LEAD PAINT and HISTORIC BUILDINGS

Training Manual

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Produced by the
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Lead and Historic Buildings

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LEAD PAINT AND HISTORIC BUILDINGS

PREFACE

This training manual is the product of a 1997 Training Grant received by the Illinois Historic Preservation Agency (IHPA) from the National Park Service's National Center for Preservation Technology and Training (NCPTT). We are all aware that lead paint has the potential to cause severe health problems. While nearly every historic building has some lead paint, there is a great deal of confusion in the building rehabilitation industry regarding safe and appropriate treatments. Building owners are frequently told "if its got lead paint on it, its gotta go!" The safest techniques, however, are fully compatible with retaining historic building components. Yet this is not the story most commonly told.

Most existing lead paint training emphasizes material removal and replacement techniques inappropriate for historic buildings. Most current lead training has been aimed at environmental and abatement professionals. This manual and curricula is instead designed to integrate lead-safe construction techniques into the existing rehabilitation, preservation, and maintenance industries. It will demonstrate how lead-safety can be both compatible with the basic principle of historic preservation—retention of significant historic materials—and also cost-effective.

In the fall of 1997 the IHPA put together a team of lead paint experts from Community Resources in Baltimore Maryland, the Building Research Council, University of Illinois, Department of Architecture (BRC) and the Architecture Section of the Preservation Services Division, IHPA. The IHPA requested and received a grant from NCPTT to develop the curricula for a training course and a training manual that would tell the lead paint story with a different outlook. In 1998 the IHPA sponsored two training classes to get feedback on the developing curriculum. Many of the comments of the attendees are incorporated in this final version. This training manual, and a Teacher's Guide that explains how to use the manual as a course curriculum, is now available for use by any organization that would like to sponsor a workshop. The manual has also been designed so that it can be useful as a "stand-alone" document even without classroom training.

The training and manual work together to clarify the lead paint regulatory, technical and safety issues. They show how working lead-safe is not only good construction practice, good for workers and building occupants, but also good preservation. This training tells 'the other side' of the lead paint story: Lead paint is a significant health and construction issue, but there are cost-effective lead-safe treatments usable by the existing rehabilitation industry that promote the retention of historic materials.

One of the benefits of the low-dust rehabilitation methods explained in this training is that they also lead to "healthier" buildings. With our growing understanding of indoor air quality issues and the importance of "healthy" homes and workplaces, the work practices that follow have benefits even beyond lead safety.

Welcome to the world of lead-safe historic rehabilitation. By combining the goals of lead safety and historic preservation, you will be in the vanguard of environmentally safe practices, both to your immediate benefit, and to the long term benefit of society.

1 INTRODUCTION

OVERALL GOALS

Preserve and Maintain Historic Buildings

The preservation of our older building stock has merit. In doing so we preserve our collective heritage, maintain the aesthetic diversity of our communities, and 'recycle' significant, high quality historic materials.

Integrate Lead-safety into Preservation Work

Lead based paint work can be completely compatible with retention of historic materials. Dealing with lead paint is not something that should be layered on top of a project through an outside industry, but integrated into rehabilitation from the planning stage through completion.

Promote Cost-effective Treatments

Older buildings are constructed with high quality materials and durable construction methods worthy of preservation. Repair programs that balance long-term value vs. short-term cost recognize the benefit of retaining vs. replacing historic materials.

Maintain The Health of Workers, Occupants and The Environment

As we better understand the problems of lead paint, indoor air quality, molds, carbon monoxide, etc., we are able to design work protocols that allow us to safely and affordably solve the problems. Performing all rehabilitation work in a lead-safe manner is appropriate and responsible. It protects the workers, occupants and the environment.

KEY PRINCIPLES IN MEETING THESE GOALS

Historic Buildings are high quality

Historic Buildings represent high quality materials and construction techniques unmatched today. Those significant materials have value and deserve preservation.

Historic Preservation Maintenance

Long-term maintenance is always better than years of deferred maintenance followed by periodic rehabilitation. This holds true from an historic, economic, health and environmental perspective.

Understand Environmental Work

Environmental building problems, including lead paint, indoor air quality, and biological molds, tend to share causes — moisture, poor circulation, inferior materials, etc. They can best be solved by a strategy that deals with the building as a system, not as separate problems. Cost-effective solutions include an understanding of the causes of environmental problems by all trades and professions from maintenance workers to carpenters and architects.

Keep Work In-House

The most appropriate people to solve environmental problems are the people already maintaining, rehabilitating and restoring buildings. They are also the best people to make design and construction decisions that affect the significant historic materials in a building. The additional cost of training and specialized equipment will be more than offset by keeping environmental work in-house. Although there will be times when specialized expertise is necessary, outside experts should be used selectively.

Protect Workers by Minimizing Exposure

When working in a potentially toxic environment:

- Generate the least amount of dust
- In the smallest space
- For the shortest time
- Exposing the fewest workers

Clean and Monitor

> To maintain the health of workers, occupants and the environment, clean up as work is done and again at the end of the job. Use dust sampling to monitor and record effectiveness.

Most historic buildings have some lead paint. These include hundreds of thousands of structures in historic districts, thousands of individual landmarks and an untold number of handsome, serviceable, older buildings. It is important for the preservation community to be informed on the subject of lead paint. This training manual and the training courses based upon it will explain the genuine public health risks presented by lead paint, as well as the techniques to manage, minimize or eliminate this risk in historic properties. It will enable preservation professionals and trades workers to understand the lead paint issue, become better stewards of their historic building, better protect both themselves and building occupants, and be in the forefront of environmentally safe practices.

AUDIENCE

This training manual is designed to appeal to two different audiences — the people designing or guiding historic building work (preservation professionals, building owners, architects, consultants, facility managers, and contractors) and the people doing historic building work (contractors, preservation craft, and maintenance workers.)

Preservation and Design Professionals and Building Owners

This group needs to know the origins and content of the regulations that apply to lead paint. These regulations have been changing in response to Title X, the 1992 federal legislation that is the basis of much of the lead-paint environmental training. They also need to know how to

specify lead-safe work and how to retain lead-painted significant historic materials in a building.

This manual clarifies safety issues, regulations, worker requirements, assessment procedures, and cost-effective techniques for lead paint work on historic buildings. Today the U.S. Department of Housing and Urban Development and most other entities recognize that the societal cost to make all buildings lead-free is not economically achievable. In response to the need for cost-effective solutions, a system of "in-place management" techniques have evolved to make a building lead-safe but not lead-free. These methods and procedures allow historic materials to be retained. It is the intent of the training manual and course to enable you to design a lead-safe rehabilitation that can safely and appropriately be done by knowledgeable general contractors and preservation craft workers with limited need for specialized abatement contractors.

Contractors, Construction and Maintenance Workers

This group needs to know how to safeguard themselves and future building tenants from lead paint hazards. This manual includes common sense construction techniques that minimize worker exposure to the environmental hazards of lead paint. This material differs from traditional lead abatement training because it targets an audience of existing rehabilitation, remodeling, preservation, and maintenance contractors and workers. The focus is on low-dust and low-hazardous waste generation. Techniques will emphasize historic fabric retention by making buildings lead-safe rather than lead-free. In-place management techniques are explored. Lead-safe practices are included for a wide audience of construction trades. The limits of these techniques, and when and why you may need to delegate work to environmental professionals, are also described.

The two major differences between this training and existing lead paint training courses are 1) it is tailored to historic resources, and 2) it promotes the use of lead-safe techniques by the existing rehabilitation industry.

It takes years to become a skilled preservation trades person. It takes only two days for an experienced trades person to learn how to do that same craft in a

In neighborhoods where deteriorated properties have low real estate values, the cost of full scale lead-paint abatement may approximate the value of the building, with the result being the demolition of the structure. Cost-effective,

Lead abatement is a strategy to permanently eliminate a lead paint hazard. HUD defines "permanent" as a treatment capable of lasting 20 years. Abatement includes: 1) complete removal of the lead paint, 2) removal and replacement of the lead painted component, 3) enclosure of the component or surface, 4) encapsulant coatings — newly developed coating systems that have long life-spans. Complete abatement of a building can be a very expensive proposition. It may also be destructive to historic features.

THE HISTORIC PRESERVATION DIFFERENCE

Most lead training emphasizes "permanent" abatement solutions of lead-paint hazards. Techniques of the abatement industry frequently result in the loss of lead-painted historic features or their wholesale covering. Replacing original wood windows or covering buildings with artificial siding are common techniques recommended by the lead-paint abatement industry. Neither of these are appropriate to historic structures. By contrast, this manual emphasizes making buildings lead-safe rather than lead-free. This distinction is key to performing cost-effective rehabilitation. The intent of this training manual is not to teach how to be a preservationist, rehabilitation contractor, or historic architect. Rather, it will show how working with lead safely can coincide with historic preservation principles.

LEAD SAFE VS. LEAD FREE: IN-PLACE MANAGEMENT VS. ABATEMENT

Over the last ten years, as the country has begun to seriously address the issue of lead based paint, one clear fact has emerged. The size and extent of the problem are vast. An attempt to perform complete "lead abatement," with the removal of all lead from the target buildings, is not practical. The cost would be simply too great.

An alternative approach has emerged. Terms such as "lead hazard control," "interim controls" and "in-place-management" are central to a discussion of lead based paint. The "lead-safe" alternative to complete abatement is simple in concept:

- Identify the lead-painted components that are causing a hazard.
- Treat those hazards, and their root causes, in the most practical way possible.
- Clean the site thoroughly.
- Maintain the rest of the lead-painted surfaces in sound condition.

The new emphasis on in-place management of lead based paint is entirely compatible with a rehabilitation project.

In fact, the concepts of "in-place management" are identical to some basic preservation principles. In-place management focuses on the retention of architectural elements, not their removal. It focuses on a high level of maintenance and cleanliness. It allows for low-cost, practical treatments. For most rehabilitation projects, it works well. Working lead-safe, protecting both the workers and occupants of a building, should improve, not impose on, a rehabilitation project. Nor does lead safety require reliance on a specialized industry and their experts. To the contrary, the most qualified people to accomplish lead-safe rehabilitation are the existing preservation professionals. The preservation community has decades of experience working with older painted surfaces compared with the lead abatement industry. The existing professionals and tradespeople, those people who deal closely with lead paint every day, need to know how to perform their work in a lead-safe manner. This manual will help provide that knowledge.

Interim controls are a strategy designed to make buildings lead-safe by temporarily controlling lead paint hazards. Implicit in the name is the suggestions that interim controls are only a temporary, second choice, and that the ultimate goal was always to fully abate the building.

In-place management is a more useful term for the same methods as interim controls. Its name acknowledges that this is more than a stopgap solution prior to full abatement. It's a cost-effective method of making buildings lead-safe. The concept is relatively new to the field. The controls include specialized cleaning and dust removal, paint film stabilization, and the treatment of friction and impact surfaces.

TRAINING MANUAL ORGANIZATION

This manual is designed to stand alone as a resource for preservationists, but it will also serve as a training manual and curriculum for classroom instruction. The topics follow the chronological order of a rehabilitation project. Additional resources and information are referenced and contained in the Appendices. A teacher's guide is also available for use by instructors.

2 LEAD, LEAD HAZARDS, AND LEAD REGULATION - A PRIMER

Goals

- Summarize the harmful effects of lead.
- Describe the physical pathways that can result in lead poisoning.
- Differentiate between the presence of lead in paint and lead hazards.
- Review the current regulatory environment.

The increasing national focus on lead paint problems in the 1990's has created some confusion, particularly among those whose work involves the rehabilitation of older buildings. The purpose of this chapter is to clear up some of the prevailing misunderstandings. The chapter is divided into two sections:

A. Lead and Lead Hazards

B. Lead Rules, Regulations, and Guidelines

A LEAD AND LEAD HAZARDS

In 1786 **Benjamin Franklin** wrote to Ben Vaughn, regarding an ailment called the "Dry Bellyach" and "a loss of use of...limbs"

"When I was in Paris with Sir John Pringle in 1767, we visited La Charité, a hospital particularly famous for the cure of that malady, and brought from thence a pamphlet, containing a list of the names of persons, specifying their professions or trades, who had been cured there. I had the curiosity to examine that list, and found that all the patients were of trades that in some way or the other use or work in lead; such as plumbers, glaziers, and painters...You will see by it, that the opinion of this mischievous effect from lead, is at least above sixty years old; and you will observe with concern how long a useful truth may be known, and exist, before it is generally reciev'd and practis'd on."

Principles

- Lead was a common ingredient in paint until the 1950s.
- Lead is toxic, and affects virtually every important system in the body. Children under the age of six are particularly vulnerable.
- **LEAD IN DUST** is the principle lead hazard. This understanding is critical to performing lead-safe rehabilitation.
- Two types of poisoning are of the greatest concern:
  - Children under the age of six – ingestion of lead dust from a contaminated environment.
  - Construction Workers – inhalation of lead dust from uncontrolled work activities.
- The mere presence of lead in paint in an old building is not hazardous. Lead paint becomes hazardous when:
  - It is chipping or peeling.
  - It is subject to friction or impact.
  - It contaminates soil around the exterior of a building, particularly where children play.

What is Lead

Lead is a chemical element (Pb). Its physical properties, being a heavy, soft, malleable metal, have made it a desirable

building material for thousands of years. Lead has been a valued ingredient in paint for nearly as long. Lead served as both a pigment and as a drying agent in paints. Lead-based paints were good paints, known for their durability and moisture resistance. When paint was beginning to be mass-produced in the 19th century, lead content was considered positive. Some paints were manufactured with as much as 50% lead content.

Lead is also a toxic substance. This fact was recognized more than 200 years ago, and countries around the world started phasing out lead paint: France in the 1840's, Germany in the 1870's, and many other countries in the early 20th century. In the United States, lead paint in residential construction wasn't completely phased out until 1978, though manufacturers began to rely less on lead ingredients in the 1950's. Any building constructed prior to 1978 may have lead paint. For buildings constructed prior to 1940, there is a greater than 90% probability that some lead based paint is present. Lead paint is still used in certain non-residential applications such as marine paint.

The current definition of "lead paint" is a paint that contains 0.5% lead by weight. This is the same as 5000 parts per million (ppm).

Lead as a Toxin

Lead has no biological value. As a toxin it affects virtually every system in the human body. Chronic lead exposures may damage the nervous system, blood, kidneys, heart, and reproductive system. In acute doses, lead poisoning can lead to seizures, coma, and even death. The human body "thinks" lead is calcium and absorbs it into bone tissue.

Because lead can affect so many body systems, the symptoms are varied.

Symptoms of lead poisoning can include:

- headache
- dizziness
- poor appetite
- irritability, anxiety, or depression

- insomnia
- constipation
- excessive tiredness or fatigue
- loss of sex drive or sexual impotence
- fine tremors
- muscle and joint pain
- inability to keep hand fully extended ("wrist drop" - weakness of extensor muscles)

Although symptoms may not appear until blood lead levels are very high (40 to 50 μg/dl, micrograms of lead per deciliter of blood), health effects may occur at much lower levels. For example, damage to reproductive systems can occur just above 10 μg/dl.

Assessing the extent of lead poisoning involves taking a blood test. The results are measured in micrograms of lead per deciliter of blood (μg/dl). In many states, children are screened to identify those who are at risk. The CDC (Center for Disease Control) considers a level above 10 μg/dl to be of concern. Unfortunately, most states do not instigate environmental solutions until a child's blood is as much as double that level. Workers who are regularly exposed to high lead dust levels should also be screened by OSHA regulation. Although OSHA does not require a worker to be removed from a job site until their level reaches 50 μg/dl, there is evidence to suggest that damage may occur at far lower levels.

While children will have similar symptoms from lead poisoning, concerns about childhood lead poisoning begin at levels below the point when visible symptoms can occur. Recent research has raised concerns about the neurotoxic effects of lead in children and developing fetuses. From conception to age six, the brain and central nervous system are in a period of critical and rapid development. There is evidence that lead can damage the central nervous system and impair brain development during this critical formative period.

Lead poisoning in young children has been linked to:

- learning disabilities
- impaired IQ
- lowered attention span
- Hyperactivity, and
- behavioral problems

Based on this evidence, in 1991 the Center for Disease Control lowered its recommended "intervention level" for children to 10 μg/dl. Those who are most at risk from low level exposure are the youngest: fetuses, infants, and children under age six.

It is estimated that one out of 23 U.S. children is being robbed of their his or her full potential because of exposure to lead. The recent national focus on lead based paint is being driven by well-founded concerns regarding childhood lead poisoning.

Pathways to the Body

Lead can enter the human body in two ways: ingestion and inhalation. Lead is introduced to the body through the digestive system with ingestion. With inhalation, airborne lead particles are introduced through the respiratory system, or the lungs.

Inhalation - The Concern With Construction Workers

For lead to be breathed in, the lead particles must be very fine and they must be airborne. Unlike asbestos, lead is quite heavy ("heavy as lead") and does not stay in the air for long periods of time. For this reason, lead poisoning from inhaling lead dust is primarily a concern for workers, those who generate lead when renovating older buildings.

Diet and Hygiene

Proper diet and attention to hygiene help protect a child from lead poisoning.

Diet: Foods high in calcium and iron help to keep a child's body from absorbing lead. Foods to favor:

- Low-fat dairy products.
- Green vegetables
- Whole grains
- Lean meats and fish
- Beans, legumes

Foods to avoid:

- Fatty foods such as potato chips and greasy snacks
- Deep fat fried foods like donuts, french fries, etc.

Hygiene: Children's hands should be kept clean. Washing hands before meals or snacks is particularly important, as most lead ingestion occurs from hand-to-mouth activity. Children's toys, pacifiers, bottles, and anything that might be put in their mouth should be kept clean. Cloth toys and clothing should be laundered regularly.

Ingestion – The Concern With Children

Ingestion of lead is the primary concern for children and residents. As with inhalation, the culprit is lead dust. The popular conception that children get lead poisoning from eating lead paint chips represents rare cases. (Children who actually eat lead paint are acutely poisoned). Lead dust is the more frequent cause. In a house that has high levels of lead dust, children are at risk. Dust settles on the floor, and small children's lives occur close to the floor. Much of a toddler's world, when they are not in someone's lap, happens on the floor. Children's instinctive hand-to-mouth activity results in the ingestion of unseen lead dust. Over time, this activity can substantially raise a child's lead level. Unfortunately, blood tests may not indicate the severity of long term lead poisoning as substantial amounts of lead are absorbed into the bone, brain, and other organs.

One thing is common to both the inhalation and ingestion pathways: LEAD DUST. This cannot be overemphasized. Lead-safe renovation is all about minimizing, containing, controlling, and cleaning up lead dust throughout the construction process.

Myth: Children are poisoned by eating paint chips.

Sometimes, but this is the rather rare exception, not the rule. The most common source of lead ingested by children is lead dust, not actual paint chips. Houses that are poorly maintained, where old lead paint has been flaking and peeling, will become contaminated with high levels of lead in the household dust. Lead in household dust is the principle source of childhood poisoning.

Lead Hazards

There is a distinction between lead based paint and a lead based paint hazard. The simple presence of lead based paint in a building does not constitute a hazard. Lead does not mysteriously migrate out of paint and into the environment. Lead based paint that is maintained in sound condition is safe. For this reason, our existing and historic building stock can

continue to serve us safely when the painted surfaces are well-maintained.

A lead paint hazard is defined as:

- Lead-contaminated dust, and
- Any condition that can result in lead-contaminated dust, namely:
- Chipping, peeling, or deteriorated paint.
- Paint on a friction or impact surface.
- Bare, lead-contaminated soil.

Myth: Only poor children get lead poisoned.

Low-income families are more likely to live in poorly maintained, older housing. Because of this, childhood lead poisoning is most common in inner-city, low-income neighborhoods. However, any child can be poisoned if exposed to lead dust, regardless of income. Careless rehabilitation in residences can be a cause of lead poisoning in children of all income levels.

Paint Deterioration

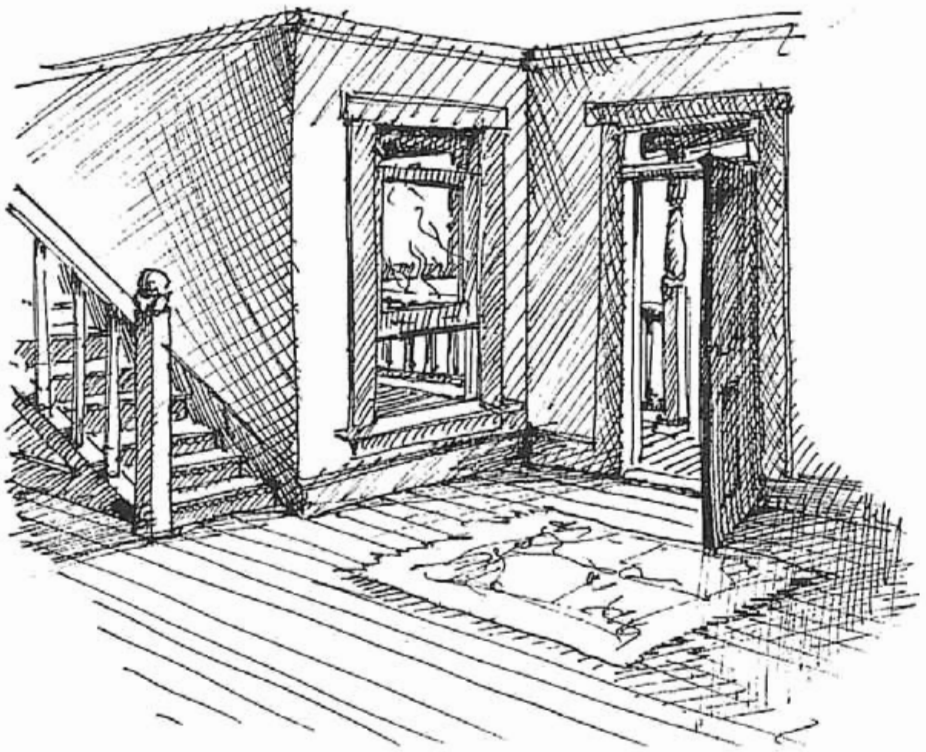
Deteriorated paint is the obvious, and well-understood, lead hazard condition. The residue from chipping and peeling interior lead based paint ends up on the floor. Once there, it breaks down from traffic and quickly converts into lead dust.

Myth: All lead paint is hazardous to children.

Not true. Paint that is deteriorating, or paint that is being rubbed or scraped off, can contaminate a building with lead dust and present a hazard to children. **Lead paint that is maintained in sound condition, and is not subject to friction or impact, is not hazardous.**

Friction and impact surfaces

Lead dust can also be generated through friction and impact of painted surfaces. Painted stair treads and floors are an example of friction surfaces. Wood painted windows can have friction surfaces, although the edge of the sash is usually unpainted. Doors and door jambs can also have friction surfaces if the door rubs against the jamb, or binds on the hinge side. Impact surfaces are any painted surface subject to abuse: chair rails and wainscoting, railings and balustrades, outside corners of woodwork and walls.



Friction surfaces can include: windows, doors, stair treads and risers, balustrades and railings, floors, protruding trim, and exposed, outside corners. The nose of window stools and stair treads as well as porch railings are easily accessible to children's chewing.

Lead In Soil

On the exterior of a building, deteriorating paint can elevate the lead content of soil at the base of the building. In urban and high traffic areas, the soil may have a high lead content from the deposits of years of leaded gasoline exhaust. Outdoor areas around large, painted structures (such as water towers and bridges) may also have high lead levels in the soil as a result of deterioration, paint removal, and paint preparation. Lead contaminated soil is a direct hazard if children play in the area. Exterior soil also is tracked into a building to become a component of household dust.

Myth: Chewable surfaces

The idea that children are lead poisoned by chewing on building components has been overstated. Nevertheless, surfaces that are horizontal, round and at children's mouth height, can be a hazard for young children. Examples are porch railings and window stools (inside sills). Both are areas that children like to frequent.

Conclusion

Throughout this section there has been a focus on lead dust. The implications on building renovation are obvious. Renovating older buildings is a dirty business; great quantities of dust can be generated. A renovated building can end up with far worse lead dust contamination than if the surfaces were left alone.

B LEAD RULES, REGULATIONS, AND GUIDELINES

For many people working in rehabilitation and historic preservation, there is an impression that lead paint brings with it stacks of confusing federal regulation. While a number of federal regulations have recently been enacted, these regulations were developed primarily to govern the emerging lead paint abatement field. Relatively few regulations apply to building rehabilitation, renovation, or remodeling work. The following discussion provides an overview of the federal laws, regulations and guidelines that affect lead hazard reduction.

Title X

The Residential Lead Paint Hazard Reduction Act of 1992, otherwise known as "Title X ," (commonly referred to as "title ten") was enacted by Congress in 1992. It is this law that initiated the development of most of the recent regulations. Title X instructs numerous federal agencies to take specific actions on the lead paint problem. Some of the requirements of Title X are still in progress. Two aspects of Title X are significant to this discussion:

- Title X established a framework for sensible and effective lead hazard control programs. The goal of these programs is to ensure that housing became lead-safe, not necessarily lead-free. The current EPA and HUD regulations reflect that change in approach.
- Title X seeks to regulate the development of a new industry to perform lead hazard abatement, not to regulate existing rehabilitation work. The regulations make more sense when viewed in this light.

Relevant regulations and guidelines are summarized below and in the chart on page 2-19. The chart indicates when specific regulations apply according to the type of project.

HUD Guidelines

In June of 1995, HUD published the Guidelines for the Evaluation and Control of lead Paint Hazards in Housing (HUD Guidelines). Pursuant to Title X, the HUD Guidelines' primary purpose is to provide guidance for lead work in target housing that is associated with the Federal Government. (Target housing is defined as pre-1978 housing, not including housing for the elderly.)

Four points need to be made about the HUD Guidelines:

- Outside federally assisted housing projects, the HUD Guidelines are not regulations; they do not impose requirements on private projects. They are, however, an outstanding reference document, covering all aspects of lead hazard reduction work in detail.
- As indicated by the title, the HUD Guidelines focus on target housing, recognizing that homes with pregnant women and children under the age of six are the most critical buildings to be concerned with. There is, however, no similar document for commercial or institutional buildings, and the information in the HUD Guidelines suffices as "state-of-the-art" for other buildings, as well.
- The 1995 HUD Guidelines have a much greater emphasis on hazard reduction and less costly interim control measures, as compared to full-scale abatement, than earlier guidelines. This recognizes that making housing lead safe may be a more realistic goal than making it lead-free.
- HUD Guidelines address primarily abatement and lead hazard reduction projects as compared to renovation projects. The Guidelines do contain some guidance on

renovation, historic preservation, and maintenance procedures.

HUD Rule for Federal Housing

Title X treats federally owned and assisted housing distinctly from private housing. On September 15, 1999, the United States Department of Housing and Urban Development (HUD) published its final regulation overhauling lead safety requirements for HUD-funded projects. (Federal Register number 24 CFR Part 35). The spirit of these modifications support the content of this curriculum. Six important changes in the final regulations are:

- Formal inspections can be skipped by property owners who institute standard treatments.
- Emphasis is placed on *failing* paint rather than the mere presence of lead paint.
- Dust clearance levels have been lowered to be more health-based. They are 40 $\mu g/ft^2$ and 250 $\mu g/ft^2$ window stool. The 800 $\mu g/ft^2$ for troughs remains the same.
- Clearance tests are encouraged for all renovation or painting that breaks lead surfaces.
- A one-day training is has been developed by HUD and the EPA for a "sampling technician" who will be certified to take dust samples. It can be obtained by calling 1-800-242-LEAD.
- Vacuums with "equivalent efficiency" may replace HEPA vacs.

The HUD Rule takes effect in September of 2000. The point to realize is that any residential project that receives federal funding falls under distinct regulations, which may differ depending on the federal funding program. These rules do not require compliance for non-HUD-funded project or projects not under local health department orders. When working on

target housing that receives federal assistance, one should check with HUD to determine the lead paint requirements.

Disclosure Rule

The Disclosure Rule went into effect December 6, 1996. This regulation does apply to all private target housing built before 1978. Developed jointly by HUD and EPA as required by Title X, the Disclosure Rule dictates actions that should occur whenever pre-1978 housing is sold or leased. It requires the disclosure of all known lead paint or lead paint hazards, the opportunity for a buyer to conduct an inspection, and the distribution of educational materials. It does not require any abatement or hazard control actions by either party, and has no relationship to rehabilitation projects that are not associated with the transfer of property.

Lead Paint Hazard Task Force

Title X directed the Secretary of HUD, in consultation with the Administrator of EPA, to create a task force to make recommendations on lead paint hazard reduction and financing. The report of the task force, *Putting the Pieces Together: Controlling Lead Hazards in the Nation's Housing*, was published in July of 1995. The report provides an analysis of the existing state of the lead hazard reduction problem, and proposes national directions to address existing inadequacies. The report provides recommendations aimed at financing, liability, insurance, and educational needs. The work of the task force was not regulatory. Two sections developed in the report, "Standard Treatments" and "Essential Maintenance Practices," are referenced in this manual and contained in Appendix D – Relevant Documents.

Toxic Substance Control Act; Title IV

Title X gave EPA the jurisdiction for establishing regulations for lead abatement under the Toxic Substances Control Act (TSCA). Several sections of this act are noteworthy.

MYTH: Since there is lead paint in my building, I need a certified lead abatement contractor to do my rehabilitation work.

This is usually not true. A certified lead abatement contractor is required whenever the stated goal of the rehabilitation project is lead abatement. This is usually only the case when a project is initiated because a child has been identified as lead poisoned. Virtually all rehabilitation and historic preservation projects are initiated for other purposes. In these cases, a certified lead abatement contractor is not required. (The exception may be renovation projects associated with federally-assisted target housing or projects receiving HUD subsidies.)

This does not mean that all contractors should be considered qualified to work on a building with lead paint. Building contractors performing rehabilitation should have a good knowledge of the problem of lead paint. They should specialize in the treatments and methods that reduce exposure, contain lead dust, and leave a clean and safe building following rehabilitation work.

Sections 402 and 404

These sections establish the lead paint training and certification programs. Specified training programs are required for lead inspectors, risk assessors, contractor/supervisors, and lead workers. The training programs are administered at the state level. **Note:** These regulations specifically exempt renovation and remodeling work. Training is only required for lead abatement and lead hazard reduction work. Title X provides EPA with the authority to regulate renovation work in the future. EPA is studying the issue, but has yet to publish a proposal.

Section 403

This directed EPA to establish criteria for identifying lead paint hazards, including lead-contaminated household dust and lead-contaminated residential soils. On June 3, 1998 EPA proposed these new standards. The agency has yet to publish the final recommendation. It is possible that HUD will adopt the new standards. The federal lead standards can be found on page 4-3 in Chapter 4, "Evaluating a Building for Lead."

The Marketing Advantage

It is quite possible that renovation contractors who know and practice lead safety will have a marketing advantage in the future. The national attention given to lead paint issues is not likely to go away soon. Indeed, the federal government has recognized that the current low level of consumer demand for lead safety has been an obstacle to making progress against lead hazards, and will be focusing effort on raising that demand. EPA's Remodeling Disclosure Rule, which took effect on June 1, 1999, will raise public awareness at the point of sale for residential renovation. As public awareness of lead hazards spread, there may be a significant marketing advantage to the contractor who can say,

> "We will do a good job on your project. Furthermore, we will leave your home cleaner than when we started work. We know how to protect your family from lead hazards in the process, and we will have the building tested at the completion of the project to guarantee its safety."

This training manual provides remodelers with the basic information for taking this approach.

Section 406

This is the Remodeling Disclosure Rule. This rule, which took effect in June 1, 1999, requires remodelers and renovators to distribute the pamphlet, Protect Your Family From Lead in Your Home, prior to renovation work. This rule will likely raise consumer awareness on the lead paint issue. Rehabilitation contractors with a sound knowledge in environmentally-safe work practices can use this awareness as a competitive edge.

OSHA Lead Exposure in Construction Rule

In June of 1993 OSHA issued 29 CFR Part 1926, Lead Exposure in Construction, Interim Final Rule. These regulations base levels of worker protection on exposure to airborne lead dust, and are targeted to workers in the construction industry. While clearly focusing on abatement contractors, this regulation applies to all persons working with lead paint.

The requirements of OSHA 1926 are based on dust lead levels, measured in micrograms per cubic meter (mg/m^3). In establishing an action level of 30 mg/m^3, and a permissible exposure level (PEL) of 50 mg/m^3, OSHA is particularly concerned about protecting workers from abatement activities that generate large amounts of dust. When airborne dust exceeds these levels, specific worker protection efforts and compliance programs are required.

OSHA 1926 was designed to protect all lead workers, particularly those who may be subject to acute exposures on larger, prolonged industrial abatement projects. For this reason, the OSHA regulations can appear awkward when applied to smaller scale, rehabilitation projects. Chapter 6 contains a more detailed discussion of OSHA regulations.

Resource Conservation and Recovery Act

The primary Federal statute governing waste management is the Resource Conservation and Recovery Act (RCRA). Solid waste generated by construction, maintenance activities, lead paint hazard reduction, and abatement projects are all currently governed by RCRA.

What determines if waste is classified as hazardous? In the case of lead, determination of how to classify waste is done through a test called Toxicity Characteristic Leaching Procedure (TCLP, pronounced "Tee-clip"). This test measures how likely the waste is to leach (and contaminate soil and water), and leads to the categorization of waste. Generally, the only type of lead debris from rehab projects that will classify as hazardous waste are paint stripper waste products, concentrated lead paint chips, and lead dust.

There are two important exclusions in RCRA to the full requirements (and high cost) of hazardous waste disposal: (1) The household waste exclusion exempts solid waste generated as part of routine residential maintenance by a homeowner, resident or contractor. (2) Small quantity generators who produce less than 100 kg/month (approximately 220 pounds/month) of hazardous waste are conditionally exempt and may handle such waste as non hazardous. These exemptions cover a large sector of renovation activities. If a contractor can limit the production of these types of waste to less than 220 lbs/month, lead paint waste disposal should not present any problem to rehabilitation projects.

MYTH: I have lead paint in my building, so I am going to have to abate.

Probably not true. Regulations rarely require full lead paint abatement. When a child is identified as lead poisoned and lead hazards are found in the child's residence, a state may require lead hazard reduction or lead abatement to address the identified hazards. Childcare facilities may also be required to address lead hazards. There are federal requirements that compel full lead abatement. These cases are: public housing, HUD funded multifamily mortgage insurance conversions, and HUD funded major rehabs.

These cases aside, there is no legal requirement to perform full lead abatement in a building. Virtually all historic preservation and rehabilitation projects are outside these requirements. While the presence of lead paint in a building may not demand abatement, it does demand knowledge and careful, clean, work practices. That is the purpose of this manual.

Having to test and treat architectural components as hazardous waste can be costly, and it has proven to be a significant obstacle to the financing of lead paint abatement activities. On December 18, 1998, the Agency published a proposed rule under the Toxic Substances Control Act (TSCA) for the management and disposal of lead paint (LBP) debris generated by individuals or firms. This proposal would take lead debris disposal out of RCRA jurisdiction and would be generally less burdensome, allowing architectural elements to be disposed of in nonhazardous landfills without requiring hazardous waste determination. This proposal has not been finalized.

The state agency charged with waste management is the best source of information for questions relating to a renovation project.

State and Local Ordinances

States have the authority to regulate lead paint removal, disposal, and worker training and licensing. Most state requirements are aimed at mitigation in the case of a lead poisoned child. Local agencies may also have laws dealing with lead paint safety. Rarely are owners required to remove lead paint. It is important to determine which laws are in place, whether a project is defined as an abatement, and whether special contractors or permits are required.

3 CAUSES OF BUILDING DETERIORATION

Principles

- Paint deterioration, and the issues surrounding lead paint, are inseparable from the causes of all building deterioration.
- Addressing major building deterioration is not only good preservation practice, good stewardship of historic resources, but also cost effective building management.
- The root causes of building deterioration, and thus lead paint degradation, should be identified and addressed as part of lead-safe rehabilitation.
- **Moisture** is the principal cause of building deterioration.
- Other causes of deterioration include:
    - Foundation settling
    - Structural failures
    - Use and abuse (abrasion and impact)

Craftspeople and design professionals who are regularly involved in historic preservation and building rehabilitation have tremendous experience with the causes and consequences of building deterioration. It is not the purpose of this section to provide a course in building diagnostics. It is the purpose to provide an overview of building deterioration, and to emphasize that lead paint problems are directly related to the root causes of deterioration.

Paint is just one component of a building system. Failure at any point in the system can lead to paint deterioration and lead hazards. Because paint is the outside layer of a building system, it often serves as an "early detection system" for related building problems. A renovation or lead hazard reduction project that takes care of the cosmetic paint problems without determining and addressing the sources of deterioration makes little sense.

MOISTURE

Water is the most prevalent cause of building and paint deterioration. Deteriorating paint and mold growth are often the first signs of water damage. Water damage can result from a variety of sources. Locating the source and fixing a water problem is both a renovation and lead safety activity. Sources of water damage include:

Roof leaks

A functioning roof system is the first line of defense in any building. Flashing around chimneys, vents, skylights, and at roof junctions are particularly vulnerable, and the cause of most roofing failures. Ice damming (caused primarily by warm interior air leaking into the attic in winter) can do considerable damage to walls and ceilings around the perimeter of a building.

Holes in exterior cladding

While less frequent than roof problems, water will enter a building through holes in the exterior walls, particularly in wind-blown conditions. Windows and doors, by definition, are holes in the exterior, and blown-in rain can damage sills, walls, and ceilings. Caps over doors and windows should be flashed to minimize water infiltration. What water enters the wall cavity must be allowed to drain and dry out.

Gutters and down spouts

Clogged or defective gutters and down spouts can spill rain water directly onto exterior surfaces, and occasionally directly into a wall cavity. Proper drainage at the base of a down spout is essential to keeping the foundation, basement, or crawl space dry. Splash blocks and/or leaders should be employed to divert water at least six feet away from a building.

Exterior Grading

Soil around a building should be pitched to divert rainwater away from the foundation. Decks, sills, and driveways that connect with a building should also be pitched away.

Wet basements and crawl spaces

Defective down spouts and exterior grading, as mentioned above, are a leading source of below grade moisture. Wet basements and crawl spaces can result in excessive humidity in a building. Crawl spaces should always be covered with a polyethylene vapor barrier.

Plumbing leaks

Leaking plumbing, including drainage and bath and shower enclosures, is a frequent cause of deterioration. Kitchen and bathroom sink cabinets should be checked for deterioration at the floor level.

Household moisture

Cooking, cleaning, and showering are all manmade sources of moisture. Bathrooms (particularly those with showers) and kitchens should be vented to the outside, as should all clothes dryers. Bathroom floors should have a water-resistant floor covering. Clothes dryers should vent to the exterior.

Condensation

Wet basements and crawl spaces, along with man-made sources of moisture, can create a high moisture load in a building. An excessive moisture load can result in condensation problems. The potential for condensation is a factor of climate, construction detail and building use. In cold climates, a potential cause of damage is warm moist air entering wall cavities and condensing as it contacts cold

exterior surfaces. Window condensation from high humidity can damage the paint on wood sash and other window components. In hot climates, warm moist air can condense on cooler interior surfaces, such as vinyl wallpaper, during air conditioning season. The first priority in addressing condensation problems is to identify and reduce the moisture sources that are causing the excessive humidity in the building.

Moisture Caused Problems

Paint degradation and the resultant lead hazards are not the only environmental impacts that can result from moisture sources. Other moisture problems include:

- Wood rot
- Mold growth
- Insulation degradation
- Structural damage
- Surface degradation
- Sickness (lead poisoning, allergies, asthma)
- Vector infestation (dust mites, roaches, rats, etc.)
- Low air quality
- Secondary insect attack

B FURTHER CAUSE OF DETERIORATION

Other causes of deterioration can be divided into four general categories.

Foundation problems

Foundation settling can result in water infiltration, shifting walls, ceilings and floors, and ultimately to damage of substrates (plaster and wood) and failing paint.

Structural problems

Structural problems can develop for a variety of reasons:

- An original undersized structural design
- Water damage from exterior or interior sources
- Improper modification of framing members to accommodate mechanical systems (addition of duct work)
- Fire damage from the building's past
- Seismic damage
- Insect attack

Like foundation problems, structural problems can lead to shifting, cracking, and failure of painted substrate. **Note:** Serious structural displacement can in turn affect the integrity of exterior cladding and roofs, in which case water infiltration becomes a secondary attack.

Use and abuse

People use buildings, often intensively. Physical abuse and normal wear and tear always takes a toll on a building over time. If maintenance is infrequent, deterioration and paint degradation from use and abuse can become severe. Areas of a building that are particularly vulnerable to impact and abrasion include:

Windows

- Chipping, peeling or abraded paint where sash rubs against parting bead, stops, or jamb
- Flaking paint from weather and condensation

Doors

- Signs of abrasion on latch edge or head jamb

- Signs of crushing on hinge edge, particularly at bottom
- Loose hinges

Outside corners

- Chipping on outside corners of walls, chair rails, base board shoe, cap molding, balustrades, jamb edges of doorways or passages

Floors

- Where floors are painted with lead paint or leaded varnish, they become a hazardous friction area.

Stairs

- Risers or treads painted or varnished with lead are high impact areas.

Case goods

- Cabinet doors sticking, crushing
- Drawers sticking, abrading

Other failures of multiple paint layers

Paint failure can occur for reasons other than moisture.

On older buildings, multiple repainting jobs can result in an excessively thick paint surface. Over time, this surface loses its elasticity and has difficulty responding to seasonal movement in the substrate. This can result in cracking and scaling of the thick paint surface. Also, thick layers of paint can have trouble responding to moisture transmission through the substrate.

Improper or incomplete paint preparation can result in paint failure. In many cases, inadequate cleaning of the dirt film from surfaces prior to repainting can lead to premature paint failure.

Incompatibilities of paint layers is another cause of paint failure. In particular, oil-based paints can fail when applied over latex paints. Many paint failures are due to the old paint not being primed or de-glossed.

Conclusion

While rehabilitation projects naturally focus on improvements and modernization of spaces to serve contemporary use, rehabilitation should always include, first and foremost, actions necessary to halt deteriorating conditions, particularly conditions which may threaten the health of occupants. When planning rehabilitation work, a visual inspection for signs of deterioration should be central to the planning process. This is key to preventing lead based paint failure and the long-term maintenance of lead painted surfaces.

4 EVALUATING A BUILDING FOR LEAD

Knowing which painted surfaces contain lead can be of significant value in performing environmentally-safe rehabilitation. Inspecting buildings for lead abatement projects has grown into a profession with mandated training requirements, and specific environmental testing procedures. The purpose of this chapter is to introduce the techniques and services of this profession, and explore how they can help in planning and performing a rehabilitation project.

Goals

- Understand the various types of environmental sampling and lead testing procedures, and understand what the results mean.
- Understand the professional lead evaluation business, and the types of services that are available.
- Provide guidance on choosing a lead evaluation strategy for rehabilitation projects.

A ENVIRONMENTAL SAMPLING AND TESTING PROCEDURES

There are six testing methods to determine the amount of environmental lead in and around a building:

XRF Testing

Paint Chip Sampling

Chemical Testing

Dust Wipe Sampling

Soil Sampling

Water Sampling

With the exception of the first method, XRF testing, environmental samples can be gathered by anyone associated with a rehabilitation project. Appendix A contains detailed instructions and laboratory forms to use when taking environmental samples.

XRF Testing

Within the lead evaluation profession, the primary method for measuring lead level in paint is with a portable XRF instrument. Proper use of an XRF machine requires detailed training and a licensed professional; the technology cannot be applied by an untrained person. XRF stands for X-Ray Fluorescence. XRF instruments expose the painted surface to high-energy radiation (it contains a radioactive source) which

causes the lead to emit X-rays with a characteristic frequency. Using an XRF instrument is preferred within the profession because:

- The reading is immediately available without waiting for lab results.
- It is less costly, with no laboratory fees. (The instruments themselves, however, are extremely expensive.)

What the Numbers Mean: Federal Lead Standards

The following table provides federal EPA and HUD standards as of 6/1/99.

1. Paint		
	Current and Proposed EPA Standards	
XRF Tests:	1.0 mg/cm^2 (milligrams per square centimeter)	
Paint Chip Samples:	5000 ppm (parts per million), or 0.5%	
2. Dust Levels - Assessment and clearance		
	Current HUD Standards	
Dust Wipe Samples: (micrograms per sq. ft.)	40 μg/ft^2 (HUD as of 9/2000) 50 μg/ft^2 (EPA Proposal)	
	250 μg/ft^2	
	window troughs (also called window wells) - 800 μg/ft^2	
3. Bare Soil		
Soil Samples:	**Hud Guidance**	**Proposed EPA Standard**
(micrograms per gram)	"High contact areas", such as play areas for children - 400 μg/g	building perimeter and yard - 2,000 μg/g

- It is nondestructive. There are no surfaces that will require repair after testing.

XRF testing determines how much lead is present in all of the paint layers, but does not indicate which paint layer(s) contains the lead. Additionally, while XRF testing reveals where lead paint exists, it does not indicate where there is a risk. Remember, lead paint that is present several layers down, when left intact and undisturbed, does not represent a risk. A risk will occur when lead levels are over the federal standard **and** there is chipping, flaking, or abrasion. A risk will also occur if the architectural element is removed, sanded, scraped, or demolished during renovation work.

Paint Chip Sampling

Paint chip sampling involves removing paint from a building component and sending the sample to a laboratory for analysis. Paint chip sampling can be a valuable test prior to rehab work. When a building component will be disturbed during the course of the work (removed, sanded, scraped, or demolished), a paint chip sample will confirm the lead content. Paint chips taken from a flaking, peeling surface can determine a lead hazard as well as the presence of lead paint. Instructions on taking paint chip samples can be found in Appendix A.

Chemical Testing

Over-the-counter chemical tests are inexpensive and available at most hardware stores. The purpose of chemical testing is the same as a paint chip test. Unlike a paint chip test, a chemical test will not quantify the lead content, but only indicate the presence of lead on the paint layers tested. Concerns have been raised over the accuracy of these tests (both false negatives and false positives), and HUD has not approved their use in the HUD Guidelines. Paint chip

sampling provides the surest indication of lead in paint, and is the current recommendation for testing an individual surface.

Myth: Only a certified professional can test for lead, such as taking dust wipe samples.

Not true. Anyone can take samples and send them to a lab for analysis.

It is true that if one wants to serve in a professional capacity in the field of lead evaluation, then special training and certification is required. To perform a lead inspection or risk assessment in preparation of an abatement project, one is required to complete certified training and be licensed by the state. Certainly, using an XRF machine, which is useful for lead inspections, requires specific training. One must also be certified to do a clearance exam. HUD and the EPA have developed a certification course for people who can take dust samples and do risk screens but will not be inspectors or risk assessors. This is a one day certification training.

This does not mean that someone can't take samples for informational purposes on a rehabilitation project. Dust wipe sampling, in particular, can be a very valuable tool, helping to ensure a safe project. This chapter presents several times when dust wipe sampling is encouraged as part of a rehabilitation project.

Dust wipe sampling

Lead in dust is the principal cause of lead poisoning. As we shall see in upcoming chapters, controlling, minimizing, containing, and thoroughly cleaning up dust are the central themes to doing environmentally-safe rehabilitation work. For this reason, dust wipe sampling can be very helpful in the course of a rehabilitation project. There are four times when dust wipe sampling may be valuable:

Prior to any construction to determine the level of risk.

A rehab project may use dust wipe sampling to monitor the effectiveness of lead-safe practices. In this case, a contractor may want to document lead dust levels prior to construction to establish baseline levels. This helps establish a comparison before and after the work is completed. Additionally, a risk

assessment should include dust wipe sampling, particularly if a building will be occupied by young children.

During construction to evaluate workers' potential exposure and cleanup strategy

There may be several points within a project when a contractor may want to take dust wipe samples.

- Following particularly dirty phases of construction to ensure that clean up was successful, that isolation can be taken down, and to avoid tracking lead dust around the rest of the building.
- Outside containment areas to ensure the containment is working.
- Before clearance testing to get an indication that it will pass.
- At any point when a contractor wants to monitor the effectiveness of lead-safe practices.

Clearance testing at the completion of the work

In the field of lead hazard control and abatement, a final examination is a mandatory and formalized process known as "Clearance." In addition to a visual inspection of the completed work to affirm the specified work is complete and that there is no flaking paint, dust wipe samples are taken from the floors, window stools, and windows troughs. These samples are called "clearance samples." A lead contractor is not released from a project until clearance testing has been passed successfully.

There is no required clearance testing for renovation projects. For a renovation project to be performed in an environmentally-safe manner, however, taking dust wipe samples at completion is highly recommended. There are very good reasons for this:

- For the property owner and design professional, it assures that the goal of performing the renovation work without creating a lead hazard was realized.

- It assures the building is safe for occupancy and use, whether the occupants are young or old.
- For the contractor, it provides valuable feedback on the crew's performance in accomplishing the work in a lead-safe manner. It is a valuable learning tool in developing lead-safe renovation practices.
- It provides legal protection for all parties in the renovation project.

The last reason is in everybody's interest. Testing at project completion provides essential documentation that a renovation project was performed safely. Formal clearance testing establishes this fact through a procedure that is recognized as the industry standard. In those cases where the legal standing of the test may be important, a true "clearance test" is advisable and should be performed by an independent third party. A licensed risk assessor, lead inspector, industrial hygienist, or other trained third party should provide this service. This avoids any conflict of interest, or even the appearance of a conflict of interest, and assures that the tests will have full legal standing. "Clearance testing" should be performed in accordance with HUD Guidelines, Chapter 15. Whether formal "clearance testing" or not, it is highly recommended that some type of dust wipe sampling be performed at project completion for all of the above reasons.

A couple of months after occupancy to monitor conditions over the long term as part of a maintenance program.

A property owner may want to do some dust wipe sampling two or three months after renovation. This should not be confused with clearance testing. Rather, it is intended to answer the following questions: Has the building remained in a lead-safe condition? Is the maintenance and cleaning program working? With the relatively modest cost of dust wipe sampling (+/- $5 a sample), such testing is a good way of documenting efforts to maintain a lead-safe building.

Detailed instructions for taking dust wipe samples are included in Appendix A, Lead Testing

Soil sampling

If there is bare soil on the property of a lead-poisoned child, a risk assessor will probably test the soil for lead content. Children playing outside are in direct contact with the soil, and soil from the exterior can be tracked into the building and become part of the interior household dust. High levels can be associated with deteriorating paint conditions on old wood frame buildings. Leaded paint chips collect at the base of the building and become part of the composition of the soil. A building that has undergone exterior renovation, including sandblasting, high-pressure water blasting, or paint-stripping, may have extremely dangerous lead levels. Soil can also have high lead levels as a result of nearby construction or demolition work that occurred in the past, or from being adjacent to busy streets where cars with leaded gasoline once traveled. If a renovation project involves residential buildings or other buildings that are frequented by children, it is responsible to check whether there are bare soil conditions, and whether the soil has a high lead content.

For contractors working on a renovation project that will involve exterior paint work, it is advisable to take soil samples prior to the start of the work. This testing serves the same purpose same baseline dust levels on the interior. Detailed instructions for taking soil samples are included in Appendix A, Lead Testing.

Water Sampling

Water supply systems occasionally have included lead components or lead solder, which can contaminate the water and contribute to lead poisoning. In cases of childhood lead poisoning, a professional may test the water to determine if it is a contributing source. There are "over-the-counter" water test kits available for homeowners. Unlike the other tests, water sampling need not be a component of a rehabilitation project.

B THE LEAD EVALUATION PROFESSION

There are two types of certified lead evaluations: a lead paint inspection, and a lead risk assessment. By federal regulation, both lead inspectors and lead risk assessors must receive special training. The regulations require the training programs to be established at the state level; the federal EPA then approves the state programs. Many, but not all, states have set up these programs in the last six years. States without training programs may still have certified specialists who received their certification in other states.

Lead Paint Inspection

A lead paint inspection is a surface-by-surface investigation of all painted surfaces, interior and exterior. The goal of a paint inspection is to identify all the surfaces that contain lead paint. A lead paint inspection is not intended to differentiate between the potential hazards posed by the lead based paint that is found, but to simply identify and catalog the surfaces with lead. A lead inspection is performed principally with a portable XRF machine.

An Inspector – Has successfully taken a two- to three-day course in how to use an XRF machine and paint sampling techniques to determine the amount of lead on painted surfaces.

Lead Risk Assessment

A risk assessment is an on-site investigation for lead paint hazards. The focus is not on finding all the lead paint (as in a lead inspection), but in identifying the areas that could be causing or contributing to the creation of lead dust and resulting in a hazard.

The first step is a visual examination of a property. An assessment focuses on the condition of the painted surfaces, on identifying surfaces that are subject to friction or impact, and on identifying areas of visible dust accumulation. A risk assessor should be knowledgeable of the causes of paint deterioration. When particular paint problems are found, a risk assessor will perform limited environmental sampling (XRF or paint chip sampling) in order to determine whether the problem area involves lead paint. This is a principal difference between a lead paint inspection and risk assessment: the inspection documents all painted surfaces, while risk assessment documents those surfaces which could be contributing to a lead hazard.

A risk assessment may also include dust wipe sampling, lead testing of exterior soil, and testing of the water supply. When a poisoned child is involved, the assessment will include an interview with the family to determine other possible sources of lead (occupational or hobbies), cleaning and maintenance practices, and recent renovation activity. A risk assessor should also provide a property owner with acceptable options for controlling lead hazards that have been identified. A good risk assessor should be able to help prioritize the work within a limited budget.

A Risk Assessor – Has successfully taken the inspector course plus two days additional training as a risk assessor, which includes training on interviews, additional sampling, visual investigation to ascertain causes of damage and recommendations of remediation solutions.

Combined Lead Inspection/Risk Assessment

Risk assessment is about identifying and developing a plan to control lead hazards. Lead paint inspection is about documenting the lead content of the painted surfaces. It is possible for a risk assessor (who is trained in both specialties) to combine both approaches into one evaluation. Existing lead hazards are identified, while at the same time, prevention of future lead hazards is facilitated through the documentation of all lead-painted surfaces. This level of investigation will be the most expensive. Risk assessment is the best solution for housing where children reside.

Sampling Technician

The new sampling technician course will prepare participants to:

- Understand the Federal, State, and Indian Tribe regulatory requirements for lead clearance;
- Conduct a visual evaluation and correctly identify gross dust, debris, and deteriorated paint;
- Collect dust samples in accordance with standard acceptable procedures;
- Interpret results of a laboratory analysis accurately;
- Collect soil samples in accordance with standard acceptable procedures;
- Write a complete, accurate, and understandable clearance report; and
- Explain the results to the client.

Choosing a Lead Evaluation Specialist

When considering professional lead inspectors or risk assessors, be sure that they have been trained through an EPA-certified course. You should also expect them to have at least a few years of experience in the lead trade. (Rarely will a specialist have a decade or more of experience – the lead field is too new.) A risk assessor without years of experience in renovation or a building inspection trade may not be well qualified to analyze building problems, or develop useful specifications for historic buildings. It is appropriate to ask for references; good professionals should be comfortable providing a list of satisfied customers. Keep in mind that these professionals are trained in the field of lead abatement, not historic preservation. Apprise a lead evaluation specialist of your goals for saving historic material and features prior to their risk assessment. Be aware that may not be their prevalent outlook, and in fact, may be contrary to their normal recommendations.

If your state has an EPA training program in place, the state agency running that program (often the state health department) will maintain a list of the trained lead inspectors and risk assessors licensed in the state. The U.S. Department of Housing and Urban Development has created a listing service to provide consumers with the means to locate lead inspectors and risk assessors across the country. It is called the National Lead Service Providers Listing System. This service can be reached at 888-LEAD-LIST.

Note – The only required training to become a risk assessor is four to five days of training. If a technician does not understand how a building works as a system including infiltration, condensation, relative humidity, ventilation, moisture, etc., they cannot be effective in developing solutions to many of the most severe paint failure problems. Furthermore, they may not be able to provide solutions that are compatible with protecting historic materials. Virtually no state certification requires this advanced building knowledge

beforehand. For this reason a building design professional or contractor with a lifetime of "building as a system" experience may be far more qualified to identify and focus on the critical causes of deterioration and the resultant lead hazards.

Historic preservation organizations, developers, architects and contractors need to encourage individuals who already know building dynamics and historic rehabilitation to obtain a risk assessor's certification.

OPTION	ACTION	WHO	TESTING COST	WHEN	COMMENTS
1. Assume all paint has lead.	None		$0	Whenever testing is not done.	While avoiding evaluation costs up front, may spend more on unnecessary precautions later.
2. Take selective samples yourself.	Self-performed paint chip sampling.	Rehabilitation specialist	$5 to $15 per sample.	To inform rehab process by identifying lead on selected, critical, surfaces.	Can identify lead paint on surfaces to be disturbed. Results may be poorly interpreted without training.
3. Hire a Risk Assessor	Visual Inspection, environmental sampling.	Certified Professional	$100 to $200 (residential-size project)	To identify hazards, particularly in all child-occupied housing.	Will identify lead hazards and suggest design alternatives. Does not document all painted surfaces. Can provide additional lead paint documentation upon request.
4. Hire a Lead Inspector	Comprehensive XRF testing of painted surfaces.	Certified Professional	$200 to $300 (residential-size project)	Whenever comprehensive documentation of painted surfaces is preferred.	Does not identify lead hazards. Documents locations with lead paint throughout a building. Does not make work recommendations.
5. Hire a Sampling Technician	Dust Sampling	Certified Professional	$50 to $75 (residential-size project)	To identify lead levels in dust where child is present or for clearance	Only determines presence of lead in dust

CHOOSING AN EVALUATION STRATEGY

The following table presents four options for choosing a lead evaluation strategy.

Strategy #1. Assume all paint has lead

Not every rehabilitation project will receive a professional lead evaluation as part as the planning process. At the present time, very few rehabilitation projects see this level of investigation. While evaluating a building for lead prior to rehabilitation is recommended, it is unrealistic to think that this will occur in every case.

If a rehabilitation project does not include any sort of testing or lead evaluation, it can still be executed in a lead-safe manner provided:

It is assumed all painted surfaces contain lead paint. Pre-1940 structures have a 90% chance of having some lead-base paint, and the implications for worker and occupant safety is significant. In making this assumption, precautions need to be taken whenever painted surfaces are disturbed in the course of the work.

The obvious advantage to this strategy is that the up-front costs of testing and evaluation are eliminated. The disadvantage to this strategy is that unnecessary precautions may be taken when disturbing surfaces that do not contain lead paint. This is, however, a one-way street: in the absence to testing, the only safe course of action is to assume the paint is lead.

Making this assumption should not be viewed as overly burdensome. As we will explore in following chapters, lead-safe renovation is about working smart and working clean. It is about minimizing the generation of dust and debris, keeping it from spreading around a building, and doing thorough cleaning afterward. These practices make good policy, and good business sense, in any case. In the absence of lead testing, environmentally-safe methods and work practices should always be followed.

Strategy # 2. Take selective samples yourself

The second approach is for the person preparing the scope of work, be it the designer or contractor, to "screen" the painted surfaces as part of the planning process. To "screen" means to determine the risk and lead content of paint that is damaged, or that will be disturbed in the course of the work. A lead screen involves collecting paint chip samples from the painted surfaces for laboratory analysis.

Having the person writing the scope of work trained to include a risk screen will bring down the cost and may better integrate the lead specific work into other work. The disadvantage to this strategy is that testing results could be misinterpreted without proper training. The person performing the risk screen should have a firm knowledge of lead hazards, paint chip sampling, and causes of building deterioration.

A person can take the risk assessor course (1 or 1 ½ days) without going through the inspectors course but they will not be certified.

A Cautionary Note: A large painted surface may test just below the defined limit for lead (5000 ppm or 0.5%). Any technique that converts a substantial amount of that paint to

dust, such as belt sanding, may still create an unacceptable lead hazard. Activities that generate large quantities of dust should always be approached with caution.

Strategy # 3. Hire a Risk Assessor

A professional risk assessment is recommended whenever a rehabilitation project involves residential buildings, particularly buildings that presently, or may in the future, house young children. The same is true for daycare centers or any other building where young children spend considerable time. When these buildings are being rehabilitated, it is responsible and efficient to include lead hazard identification and hazard reduction in the course of the rehab work.

In these cases, the advantages of using a certified risk assessor over performing limited testing yourself include:

- A risk assessor has received 5 days of training on how to conduct a risk inspection and risk assessment.
- Their documents have more legal standing because the risk assessor has received certified training.
- Those responsible for the rehabilitation should want the extra protection that a professional risk assessment offers.

Also, some jobs may require a certified risk assessor:

- Where a child has been poisoned
- Federally owned housing

Remember, a risk assessor identifies lead hazards, but does not need to identify the lead content of all painted surfaces. When a risk assessor is hired, it may be necessary to identify the surfaces that, while not presently posing a risk, will be disturbed in the course of the work. The risk assessor may not test or sample these surfaces without that knowledge. In a rehabilitation project, it will be necessary to work closely with the risk assessor to identify all building components that will

require testing. It will be important to advise the risk assessor regarding the significant historic features or finishes that must be retained.

Strategy # 4. Hire a Lead Inspector

A lead inspection will document the lead content of painted surfaces, but it will not identify which components present a lead risk to the occupants. A lead inspection can be valuable if a property owner would like to have permanent documentation of the painted surfaces in the building. This can be helpful for informing ongoing maintenance practices. If a lead inspection is chosen prior to rehabilitation on child-occupied buildings, it should be combined with a risk assessment to ensure that all existing lead hazards are identified for inclusion in the rehabilitation project.

In general, whether a building receives a professional lead inspection or risk assessment may often be a question of scale. On larger commercial or institutional projects, sufficient budgets may provide the resources to allow for professional evaluation. Larger projects are more complex to plan and execute, and specific knowledge on the location of lead paint can greatly assist the planning and scheduling process that has lead safety as a goal. On smaller projects, professional evaluation may be less likely to occur, and a lead screening by a rehabilitation specialist may be more practical. In many of these cases the project is a more informal affair.

Strategy #5. Hire a Risk Assessor

If all you want to determine is the amount of lead in dust, you can hire a sampling technician.Sampling technicians can take dust samples under these circumstances:

- In a residence where a child or prenant woman resides (or is moving in).
- When a contractor wishes to know baseline lead dust levels before a project begins.
- At the end of a project to determine if the work-site was left "clean".
- To make sure that a site remains "clean" after a rehabilitation.

A Concluding Note

For the most part, lead inspectors and risk assessors have been responding to the health concerns in the emerging lead field, often working on projects where lead poisonings have already occurred. This is reactive, not proactive. Lead-safe renovation is designed to be proactive. The field has not typically been serving those performing renovation work (except in cases where careless renovation leads to a health problem). Ideally, the specialist should be informed of your goals for the planned renovation, particularly historic material retention, and should perform the evaluation work with the renovation in mind. As lead-safe renovation becomes a more integrated part of preservation practice, inspectors and risk assessors will become more experienced in adapting their knowledge to proactive, lead-safe renovation. Preservationists in local communities should encourage such a trend. Preservationists should also consider becoming trained risk assessors, or at least sampling technicians, in EPA certified courses.

5 PLANNING FOR SAFE REHABILITATION

Goals

- Review the range of criteria that go into making design decisions on historic rehabilitation projects.
- Understand how to integrate lead safety into the planning process.
- Combine lead safety with the retention of historic material.
- Present an overview of the Secretary of the Interior's Standards for Rehabilitation.

A CRITERIA FOR DESIGN DECISIONS

There are many factors to consider when planning a rehabilitation project. This is nothing new to the design professionals and craftspeople who work on older buildings professionally. These professionals are experienced in integrating many factors in the development of a scope of work. Even without considering lead paint, the criteria involved in making specific design decisions are complex. Lead paint should not be considered an overriding issue in the planning process, but rather just one more factor to weigh in

the development of a rehabilitation plan. Some important categories to consider are listed below.

Function and Occupant Use

The most valuable protection for historic buildings is that they remain useful and functional. Virtually all rehabilitation projects, be they commercial adaptive reuse or residential projects, are designed to enhance the "use" value of the building. Ensuring that a building will serve its intended function is the foremost criteria in the planning process. Considerations include:

- Alterations and/or additions to fulfill building function.
- Aesthetic preferences and values of owner.

Historic Significance

Although only a small subset of all historic buildings are actually designated as "landmarks" or are listed on the National Register of Historic Places, a large portion of our built environment consists of historic buildings. These buildings were usually built with high quality craftsmanship and materials. They also provide meaning to a neighborhoods or community's sense of place. All decisions regarding historic buildings should take into account the:

- High quality and durability of historic materials
- Significance of historic materials and craftsmanship
- Effect on the overall historic design of the building
- Local, state or federal design review when applicable

Condition Assessment

While the retention of significant historic features is always preferred, clearly not every deteriorated historic building element can be repaired or preserved. The condition of building components plays a role in design decisions. The principal considerations include:

- Extent of building component deterioration.
- Methods for repair.
- Availability of skilled preservation craftsmen.

Life Cycle Cost Issues

Cost is an issue in every rehabilitation project. All too often, however, only the initial cost of treatment is considered. The overall, long-term cost of a treatment may be different, and should be factored in the cost consideration. "Life Cycle Costing" is a method that calculates the up-front cost of an intervention spread over the time the intervention or installation survives. Elements of life cycle costing include:

- Initial cost versus the years of use
- Maintenance costs during this period
- Cumulative energy cost increase or decrease
- Effect on the value of the building
- Discount rates, inflation, etc.

Health and Comfort

Providing for the health and comfort of occupants is central to a successful rehabilitation project. Energy use, along with the effectiveness and efficiency of the HVAC system, are the principal comfort issues. Lead paint is just one of the health concerns related to rehabilitation. Health and comfort criteria include:

- Energy conservation effects including temperature, humidity and air circulation
- Acoustic properties of treatments
- Treatments affect on mold, roach and rodent infestation
- Treatments affect on air quality
- Presence and condition of lead paint

Conclusion

Most design decisions result from the combined consideration of several of these factors. For example, although plaster costs more than drywall at installation, plaster is much cheaper when life-cycle-costed, far easier to maintain, more resistant to roaches and mold, aesthetically matches original historic material, and is more effective acoustically. The preservation of historic buildings and retention of specific historic components is often preferable when evaluated over the full range of criteria and may be less costly.

B INTEGRATING LEAD ISSUES INTO REHABILITATION PLANNING

Out of the criteria detailed above, a rehabilitation project's scope of work will emerge. The scope of work will be a detailed plan of the activities that comprise the project. Lead paint issues should play a part in the development of the scope of work; in some cases, specific treatments (Chapter 7) may be chosen partially out of consideration for lead safety. However, there ARE many other criteria that go into

developing the scope of work and it is natural that lead paint will just be one of many factors considered.

Working environmentally-safe is not about what you do, but how you do it. In the initial scope of work there will be activities that will disturb lead paint. These activities should be identified prior to the initiation of work. For these activities, working safely will involve applying precautionary methods to the setup, scheduling, and performance of the project. This is the focus of the rest of this manual.

- Setting up the site for safety and efficiency. (Chapter 6)
- Minimizing the generation of dust and debris in the course of the work (Chapter 8)
- Containing the dust that is generated to protect the site. (Chapter 7)
- Understanding how to protect workers. (Chapter 7)
- Cleaning up the site to high standards. (Chapter 7)
- Scheduling the work to reduce everyone's exposure, while maximizing productivity. (Chapter 9)

C THE CASE FOR A PRESERVATION APPROACH

The retention of historic materials is a key preservation concept, yet it is often ignored in lead paint abatement projects. Why do most lead paint remediation projects recommend replacing historic materials rather than simply making them lead-safe?

- Many abatement firms and professional have come to lead work from the asbestos field. In asbestos projects, the removal of an isolated (usually non-historic) asbestos-containing material is the most common

practice. However, that "pull it out" methodology can be disastrous for a building if many significant features are painted with lead paint.

- There are tremendous market forces promoting the replacement of historic materials targeted at owners and builders. There are large industries that have evolved around the manufacturing and selling of replacement windows and artificial siding. Those industries are aggressive in their marketing and do not always tell an unbiased story about their products.
- Contractors may be more technically familiar with replacement rather than repair options. They are not immune to marketing either. They may also make a higher profit on purchasing and putting in new materials rather than repairing the old.
- There is a tremendous amount of confusion about energy savings and replacement materials, in particular windows and siding. Independent research does not always back up the claims of the replacement material industries. We dispel some common energy conservation myths in Chapter 8 regarding window treatments.

So why not simply replace your historic windows or siding when your environmental abatement firm suggests it, and your contractor says it's easier? Because historic materials have value. Historic materials are:

- High quality
- A good economic value
- Authentic

The Quality of Historic Materials

Historic building components are usually made of:

- high quality materials (.i.e., old growth wood unavailable today)

- high quality (often cabinet-grade) construction
- durable, not disposable, technologies (weight and pulley systems in old windows that will last hundred of years)
- easily maintainable and repairable materials (i.e. wood floors). A better term for "Maintenance-free" materials might be "non-repairable or non-maintainable"
- highly skilled craftsmanship (such as three coat plaster walls) that is hard to find today
- decorative and elegant components (turned wooden spindles)

Both due to historic significance and due to common sense, an abatement approach of replacing all lead painted materials should never be the first choice in a rehabilitation project. Why throw away such high quality and replace it with lesser quality?

Retaining Historic Materials is a Good Investment

When you retain and repair historic materials and make them lead-safe—rather than replace them—you are:

- Creating local jobs. Rehabilitation is labor intensive
- Investing more construction dollars in the local economy. More money is spent on local labor than on nationally or internationally produced new materials.
- Making a long-term investment in a property. The durability of high quality historic materials, properly maintained will far outlast most new materials. Replacing a high quality wood window with a vinyl window is like throwing away a Cadillac with only 50,000 miles and replacing it with a new Yugo.
- You are in the vanguard of environmentally responsible principles—practicing "sustainability." This is recycling of the largest scale.

Historic Materials are the Real Thing

They embody principals that we are all familiar with. They are genuine. Most of us understand the difference in value between an original painting or antique and a reproduction. Yet when looking at a 150 year old window we may not stop to appreciate the extremely high quality, nor question a contractor that says – "I can put in a new one that will look just like it, only it will be better, because it's brand new!"

D SECRETARY OF THE INTERIOR'S STANDARDS

The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Buildings (Standards) form a good basis for planning appropriate preservation-based treatments of historic buildings. The Standards were established in 1976 to assist in the rehabilitation of properties that are of historic significance. The Standards are the basis for design review of projects that are subject to Federal Section 106 review, or are receiving Historic Preservation Tax Credits. Most states and local design reviews are also based on the Standards.

Although the complete Standards and Guidelines are over 60 pages, the basic principles most relevant to a discussion of lead paint are summarized below:

- Find a use that is compatible with the historic building – one that requires the least destructive alterations
- Recognize and retain the significant features and finishes of a building

THE SECRETARY OF THE INTERIOR'S STANDARDS FOR REHABILITATION

(1) A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.

(2) The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.

(3) Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.

(4) Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

(5) Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property shall be preserved.

(6) Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities, and where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

(7) Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.

(8) Significant archaeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

(9) New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

(10) New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitation were written by W. Brown Morton II and Gary Hume, in 1976. The Guidelines were revised in 1983 by Gary Hume and Kay D. Weeks. The Standards were revised in 1990.

- Just because a later changer is not original doesn't mean it's not significant - it may be an important part of the history of the building
- Protect distinctive craftsmanship and significant materials
- Repair rather than replace historic features – when materials are missing or beyond repair, replace accurately
- Clean and repair materials appropriately – nondestructively
- Make alterations and additions compatible (harmonious) and recognizable
- Make alterations reversible – additive changes rather than subtractive changes

Thousands of construction projects that affect properties on (or eligible to be listed on) the National Register of Historic Places are renovated each year following the Standards. But beyond their use in a regulatory capacity, the Standard just make good construction sense – recognize what is important and high quality in your building and don't unnecessarily lose it when making changes. The Standards and Guidelines recommend identifying, retaining, and preserving those features that are important in defining the overall historic character of the building.

Example: Historic Wood Window

Peeling paint on an historic wood window can make it look like it's in much worse condition than it really is. It's often informative to carefully strip the paint of a representative window before making overall window condition decisions. A window survey is an appropriate methodology to evaluate the overall conditions of the windows on a building. For example, windows on the south and west facades may demonstrate the most deterioration. Lead paint hazard reduction treatments often present opportunities to improve the energy efficiency of historic windows with methods such as weather-stripping, reglazing, fixing closed one or both sash, storm window installation, or even retrofitting with insulated glass. All of these treatments are options that can significantly improve the energy performance of historic windows.

6 SITE SETUP

Thoughtful site setup makes the job of environmentally-safe rehabilitation much easier. The set up procedures described below are prudent for all rehabilitation jobs, particularly in occupied spaces. While these protocols focus on lead paint jobs, they are also useful on any job that creates dust.

Principles

When setting up the work site, consider the well-being of:

- The workers
- Current and future occupants
- The building
- The environment

Creating safe, clean, well-vented, and well-lit work areas, saves more money than it costs.

Careful site setup should always:

- Separate high dust from low dust areas.
- Isolate work dust from occupied spaces
- Leave work and adjacent areas cleaner than you found it.

A PRE WORK PREPARATION

There are three general categories of site conditions:

- **Abandoned Property** – which may contain rubbish and structural damage.
- **Turnover Property** – when a property is temporarily vacant between renters or sale transfer.
- **Occupied Property**

These different situations will affect setup, containment and scheduling. Each situation will have special considerations.

Abandoned Property

- Set up temporary lighting for safety
- Place dumpster
- Close off structurally damaged areas
- Put on respirators, puncture proof shoes and puncture resistant gloves and clean out all rubbish. Wall-to-wall carpet and wet upholstered furniture may be particularly unhealthy.
- Damp broom (wearing a respirator) and vacuum site.
- Brace and secure any structurally unsound floors, walls or roof structures.

Turnover Property

- Clean out all rubbish, and if possible, dispose of wall-to-wall carpet (wear respirator).
- If appliances—stoves, refrigerators, etc.—are to be saved, clean them. If they will be subject to dusty conditions during work, wrap them in poly.
- Place dumpster, if required.

Note: In rental housing, tenant turnover is the ideal time to address lead hazards and other health and maintenance concerns. Two documents in Appendix C, Standard Treatments and Essential Maintenance Practices, establish the minimum effort required to provide lead-safe housing to tenants.

Occupied Property

Occupied properties present a particular challenge. The challenge is critical in child-occupied buildings. In these cases, site setup, containment, and scheduling must work together to provide for a safe and efficient project. In most cases, the project can be "phased" to isolate work areas from occupied areas.

When setting up work in an occupied building, furniture and other objects require protection. To the greatest extent possible, rooms should be cleared prior to beginning work. Smaller items should be boxed and put into storage. Because they can hold dust, all fabrics (rugs, drapes, upholstered furniture) should be removed during construction and cleaned before being brought back into the building. If some furniture cannot be removed, they should be set in the center of the room and covered in poly. Where high dust levels are possible, the poly's perimeter should be taped to the floor.

B SECURE SITE

This is a critical step on any construction but it is particularly important on a historic site contaminated with lead.

Historic sites are particularly tempting for theft of both tools and historical architectural components. Protecting the customer's property is the contractor's responsibility.

Allowing children into any construction site, particularly a lead contaminated site, is extremely dangerous and is never recommended.

C UTILITIES

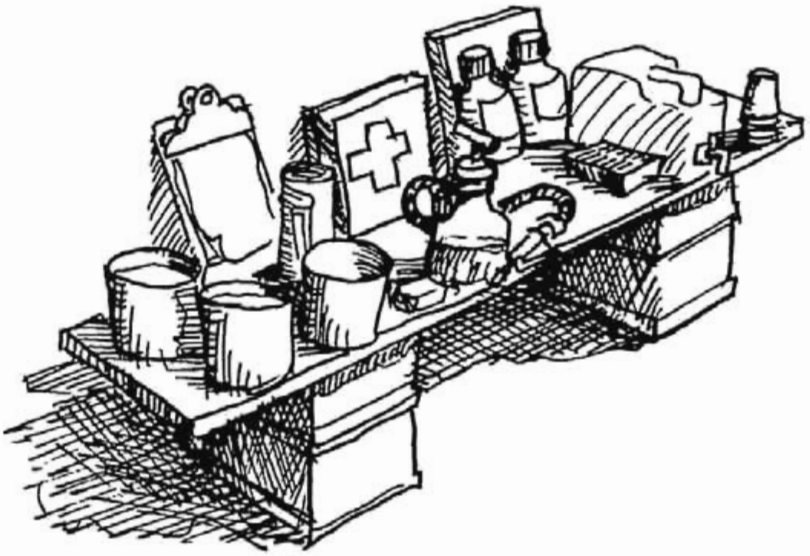
- Once rubbish is removed and the site is made safe and secure set up;
- Sanitary Facilities – Toilets kept clean, supplied and well lit.
- Heat – Sufficient for worker comfort and the curing of materials.
- Ventilation – This is particularly critical where solvents are being used or temperatures are high.
- Light – Where light is insufficient, string lights across ceiling. Low levels of light slow down work, lower work quality and cause injury.
- Water for three purposes
    - Worker clean up at "adjacent area" (see below).
    - Work site clean up and for mixing cement, plaster, etc.
    - Pure bottled drinking water.

D ADJACENT AREA

The adjacent area is set up at the point the workers enter and exit the work area. Egress should be limited to this spot. It is a transition area and should be kept as clean as practical. Material would be placed on a counter height surface about 2' wide and 6' long. A kitchen counter sink is ideal, particularly at a back door, but where no sink is available, boards on saw horses will work. Supply the station with:

- Bucket of water to rinse hands and face

- Soap and second bucket of water to wash
- Empty bucket and pump sprayer for final rinse
- Paper towels for drying and trash bag



Adjacent area with wash station, safety and first aid supplies, emergency number list, and fresh drinking water.

- Health and safety supplies including:
    - Eye wash station
    - First aid kit
    - Cleaning pads to wash respirators
    - Drinking water and cups
- A clipboard with emergency numbers and procedures

Directly before adjacent area there should be a place to remove Tyvac™ booties and Tyvac™ suits and/or a place to clean clothes and shoes with a HEPA vac. There should also be a place to hang up clothes and baggies for storing dust masks or respirators.

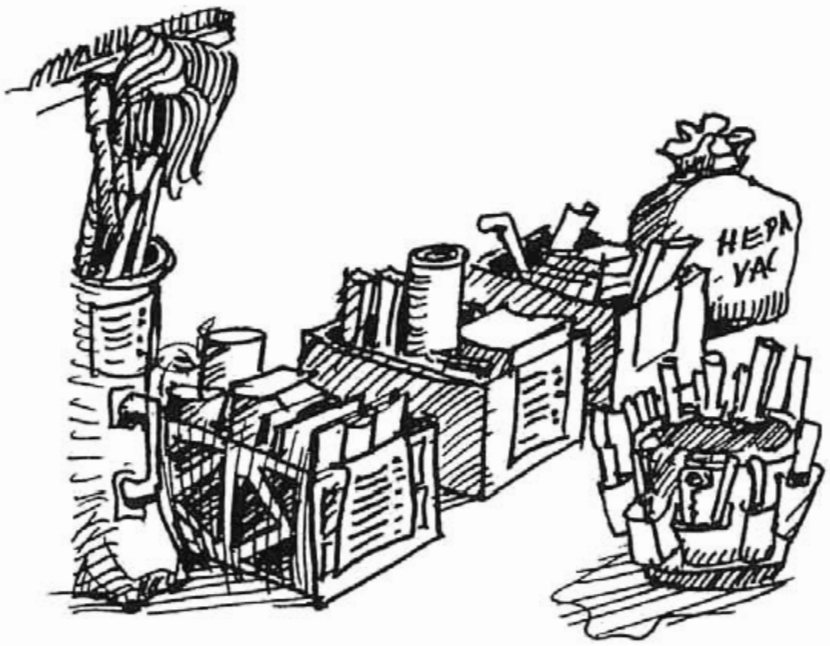
E BREAK AREA

As eating, drinking, and smoking are extremely unhealthy on a lead contaminated site, a break area that is separate from the work area is necessary. The area would include:

- Seating, heat, light and ventilation
- A place for clean clothing storage
- Drinking water and cups
- A place to store food (refrigeration desirable)
- Easy access to toilet facilities

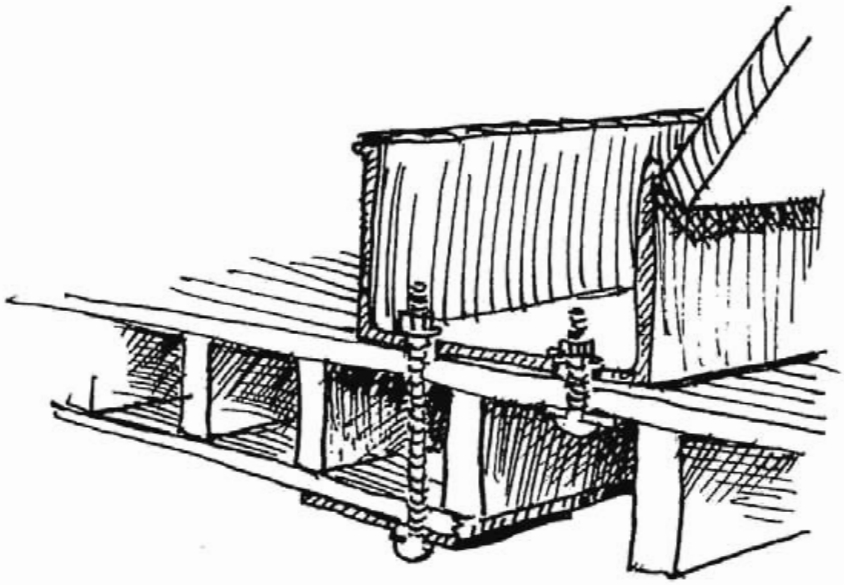
F STORAGE AREA

Supplies Inventory – The organization of, and access to this area is critical to an efficient job. Each would contain specific materials listed on an inventory sheets in plastic sleeves on the face of the containers. Containers such as "milk cartons" could be used. This will minimize purchasing trips.



Storage Area

Tools and Euipment – When security is a particular concern, a lock box bolted through the floor is a secure storage area.



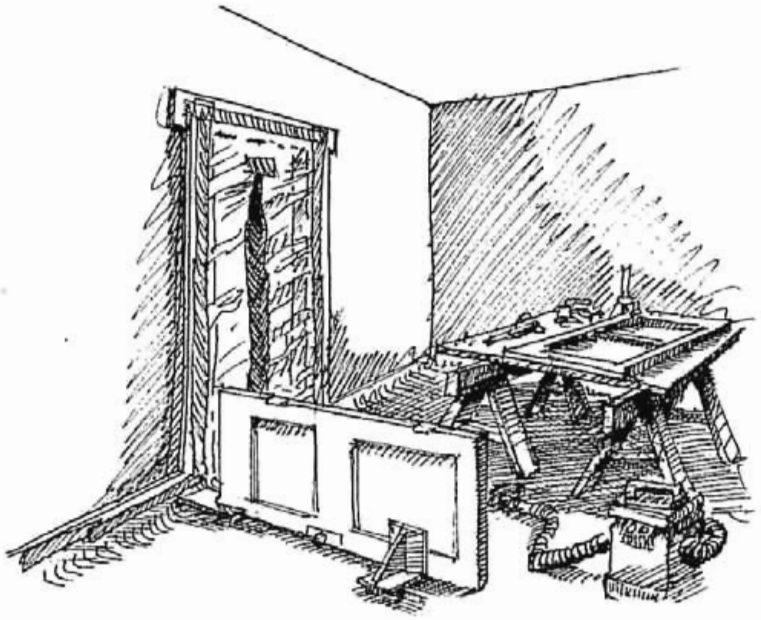
Site-built security box

G DUST ROOM

A dust room is a location where particularly dirty work can be performed in containment, separate from the rest of the building. It allows for the restoration of movable architectural elements, such as doors, window sash, and mantel pieces, to be performed without contaminating other areas. It is also an ideal place to perform on-site stripping and refinishing. Where dirty work is being done in an occupied house or an environment still containing carpeting or upholstered furniture, it's critical to isolate dirty work.

In choosing a site for a dust room select a room that is centrally located, has enough space to work, is well lit, can be easily closed off, and is not a passage to another room. Install

a slit and flap closure (Chapter 7) at the entry door. When working in an apartment building an empty apartment can be used as a dust room.



A dust room with 6 mil poly taped to baseboard, containment over door (see page 7-4), work bench, door hold, and high efficiency vacuum system for use with power tools.

To Set up a Dust Room:

- All horizontal surfaces that can be impregnated with dust and are not smooth and easily cleaned should be masked.
- Cover floor with 6 mil poly taped to base board.
- Cover all vents. Do not run furnace if return vent is covered.
- Seal any cloth that cannot be removed such as upholstered furniture with poly (4 or 6 mil) taped to floor. Never choose a room with wall-to-wall carpet.
- Be sure room is sufficiently ventilated for workers' safety. As power tools will be attached to a high efficiency vacuum, very little airborne dust will be created so a window may be left open.

- Try to stock room with all needed tools and supplies to minimize traffic in and out. Minimize the time any one worker must be in the room. For example four hours with two breaks, then replace with another worker.
- In most cases workers in this room should wear tyvec suits, shoe covers and respirators.
- Materials to be treated are handed in, worked on, cleaned off, then handed back out.
- Do only dust-creating work in this room – once a component is ready for other work such as gluing, filling, priming, glazing, etc., clean it then hand it out.
- As soon as possible, clean up the room and break down containment.

H DISPOSAL

Debris Storage – Proper storage of lead contaminated debris is critical. Where possible, dumpsters with lids that can be locked should be used. Where a dumpster cannot be used, lead debris should be wrapped in 6 mil poly and stored in a secured area or closed truck.

Generally, disposal in a lined landfill is sufficient for most rehabilitation projects. Unless a general contractor consistently produces large amounts of concentrated lead waste, such as sludge from paint stripping, concentrated paint chips and lead dust, or large amounts of liquid waste from an operation like water blasting, they should avoid becoming a "hazardous waste generator."

Becoming a hazardous waste generator can add significant expense to both a particular job and overall overhead. Once a contractor does a job where they are deemed to be a hazardous waste generator they must conform to significant (RCRA – page 2-16) EPA regulations that include:

- Maintaining a manifest (log) that tracks each step of disposal
- The contractor ("generator") remains responsible for the disposal
- Special insurance may be necessary
- Waste management systems must be set up

There are three situations that may relieve a contractor from these hazardous waste requirements, and allows for simplified procedures:

- **Maintenance waste** – If the waste is from routine maintenance, it is excluded from RCRA rules
- **Conditionally exempt small generator** – If a contractor produces less than 100kg (220lbs) of hazardous waste per month, it is excluded from RCRA rules. For most rehabilitation projects, particularly small commercial or residential jobs, it is unlikely that a contractor will produce more than 220lbs of hazardous waste. Therefore, for most rehabilitation projects, this exclusion will apply. If a phase of the project is going to generate more than this amount of hazardous waste, consideration should be given to hiring a hazardous waste contractor to deal with the removal and disposal during this phase.
- **Residential Exclusion** – Residential owners are excluded from the rule. If a homeowner orders a dumpster, the contractor fills it, and the owner has the dumpster removed, the building owner becomes the "generator" who qualifies under the residential exclusion.

The EPA has recently proposed exempting lead painted components from RCRA jurisdiction, which could greatly simplify disposal issues. However, this proposal has not been finalized at the time of this writing. For most renovation projects, qualifying as a conditionally exempt small generator should be a realizable goal.

For most projects, the following procedures, summarized from the HUD Guidelines, should be sufficient:

- Wrap up waste in plastic to bring to dumpster or truck and bring to a lined landfill. If the landfill will not take the waste wrapped in plastic, keep the truck or dumpster covered until dumping.
- Store the waste in a designated area. The area should be secured.
- Dumpsters should have lids that can be locked if accessible.
- Dump liquid waste from cleaning into toilet after filtering it through a fine screen (like a window screen). Never dump contaminated water into a storm drain.

Note: State or local environmental agencies usually have jurisdiction. It may be necessary to negotiate with state officials to establish specific protocol for a project. Some municipalities have transfer stations that will receive waste making the municipality the "generator."

7 DUST CONTROL- PROTECTING WORKERS AND THE WORK SITE

The key to working environmentally-safe is dust control. This chapter focuses on the three areas directly related to dust control.

Goals

- **Containment**-Confining and preventing the spread of dust on a job site.
- **Worker Protection**-Engineering controls to minimize airborne dust, and respiratory protection for those times when airborne dust is unavoidable.
- **Cleaning-**Removing construction dust and debris frequently and to a high standard.

The protocols focus on jobs where it is known or assumed there is lead paint present that will be disturbed. However, dust control is not just a lead issue. **All Demolition Dust is Unhealthy.**

Construction dust in older buildings, particularly dust that has accumulated in wall cavities, may contain:

- Lead and other heavy metals
- Molds, some of which are toxic
- Vector (rats, roaches, dust mite) contaminants
- Asbestos, horsehair, fiberglass, and other fibers
- Plaster, coal and other accumulated dust

A high level of construction dust is bad for workers and occupants regardless of whether the dust contains lead. Workers must protect themselves and occupants (current or future) from exposure.

Principles

- Create as little dust as possible
- Don't breathe dust
- Don't spread dust
- Clean up and clean up again

A CONTAINMENT

Unnecessary containment adds unnecessary expense. If dust is kept to a minimum and confined, safety becomes affordable. Methods to minimize dust with engineering controls will be covered later in this chapter. When dust is created, however, it is both healthy and cost-effective to contain it.

There are four convenient categories of confining dust:

- Masking
- Containment - interior
- Containment - exterior
- Isolation

Masking – (Low Dust)

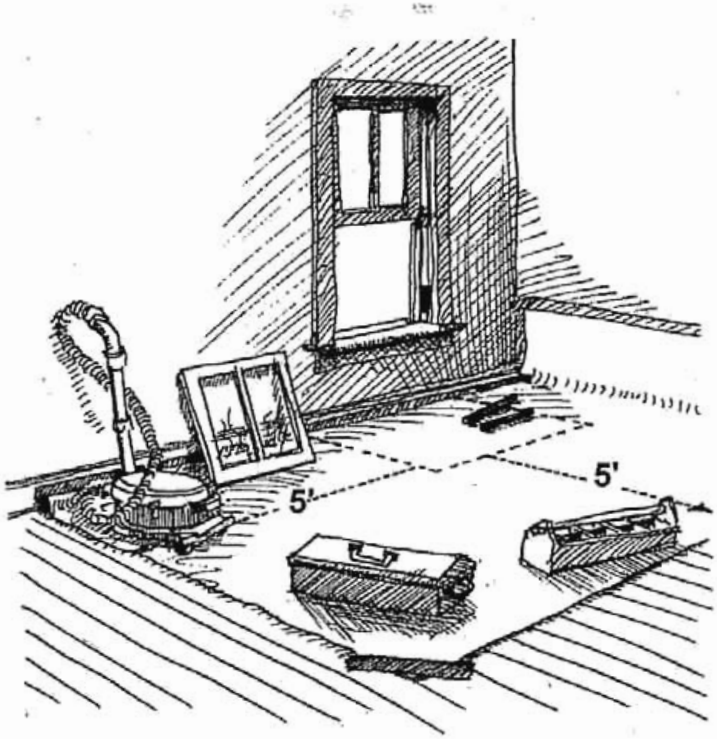
For most small jobs that produce some paint chips, but very little dust, masking is sufficient.

Examples

- Repairing or restoring a window but not removing the jamb and casing.
- Repairing or wet scraping a section of a wall but not all the walls or ceiling of a room.

Procedures

- Place 6 mil poly 5' in each direction from the work area. Tape it to baseboard with painters' tape (use high quality duct-tape if painters' tape does not stick).
- Move furniture approximately 8' from work area. If some furniture is too heavy, cover with 4 or 6 mil poly.



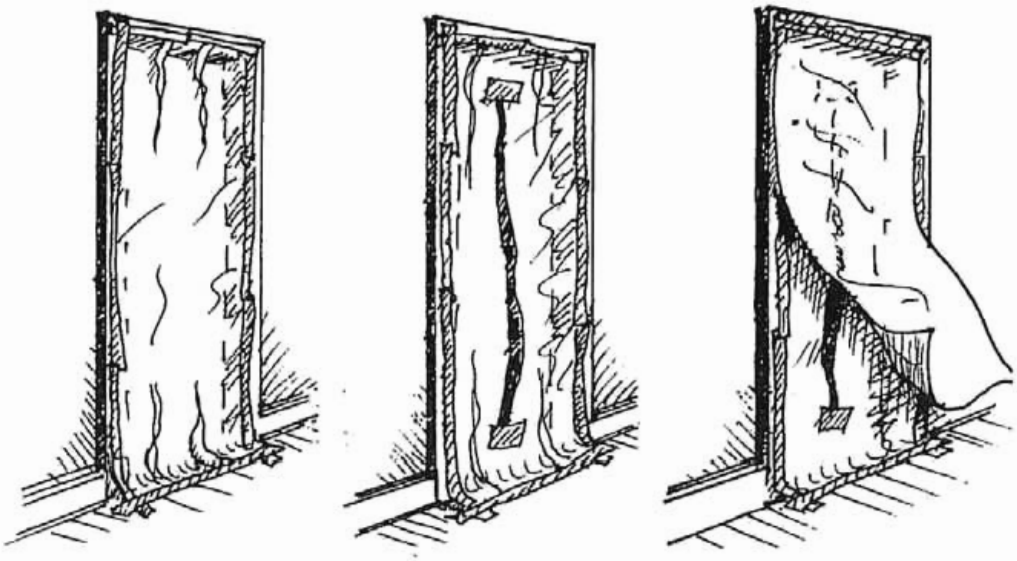
Place 6 mil poly to cover floor 5 feet in each direction from work area. If against the wall or furniture that can't be moved, go up a couple of feet. Using painter's tape (duct tape if painter's tape doesn't stick), tape to baseboard. Stapling through a square of duct tape at the corners helps secure it. The corners away from the wall may be taped to prevent tripping. When the job is complete at this spot, vacuum poly, fold dirty side to dirty side and move to next work area.

- Shoe covers – Try to have all tools and cleaning equipment on poly before work starts, always wear shoe covers on poly and always remove them before stepping off to avoid tracking dust, paint, caulk, etc. If there is a wind and work is being done in room with a door, keep door closed to avoid dust from blowing off poly.
- Clean up as you work.

- When wet scraping, a vacuum nozzle can be held next to the scraper blade.
- Pick up chips and dust from a poly with wet paper towels, wet sweep them or vacuum (use brush and lower level suction if vacuum is adjustable).
- Remove poly by folding dirty side to dirty side. Move the poly to the next work area and reuse.

Containment – Interior (Moderate Dust)

Containment is used where there is only moderate dust created or to protect a high dust area from the rest of the work site. Containment includes masking furniture, vents and covering porous floors and wall-to-wall carpeting with 6 mil plastic taped at the perimeter. The exit door, if out of the work site, would consist of a slit and flap door (see illustration). An adjacent area for workers should be set up close to this door.



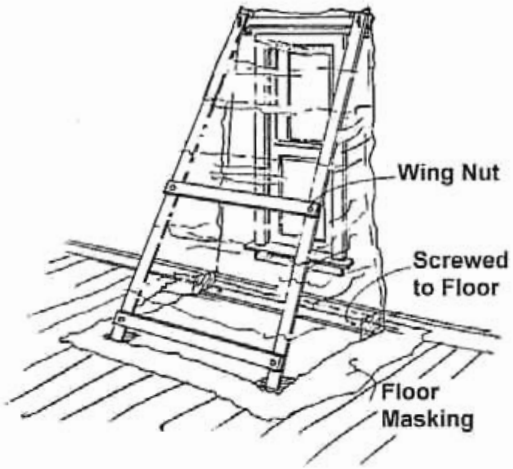
Tape all 4 sides. Corners may be stapled if necessary.

Slit about 6" from floor to 6" from head jamb.

Tape a second sheet to head jamb.

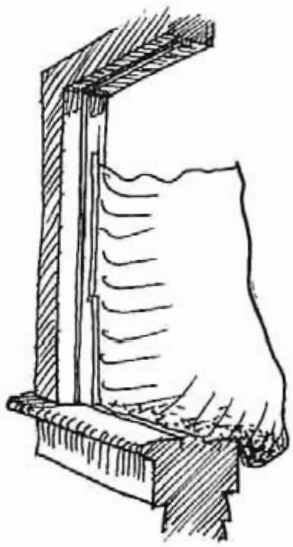
Where containment is set up between high dust areas and low to moderate dust areas its purpose is to eliminate the need of workers who are in the lower dust areas to wear respirators.

Containment can also be set up in a portable unit that is placed on poly and leaned against the wall. This design is joined at cross braces with wing nuts so it closes down to about 8' x 4" x 4"



Portable Containment Setup for Window Work

When working on windows from the inside, poly can be stapled and taped to outside edge of sill, then 3' up on outside nose of jamb or exterior casing. Leave slack so it acts as a scoop to catch chips.



Exterior Containment for Window Work

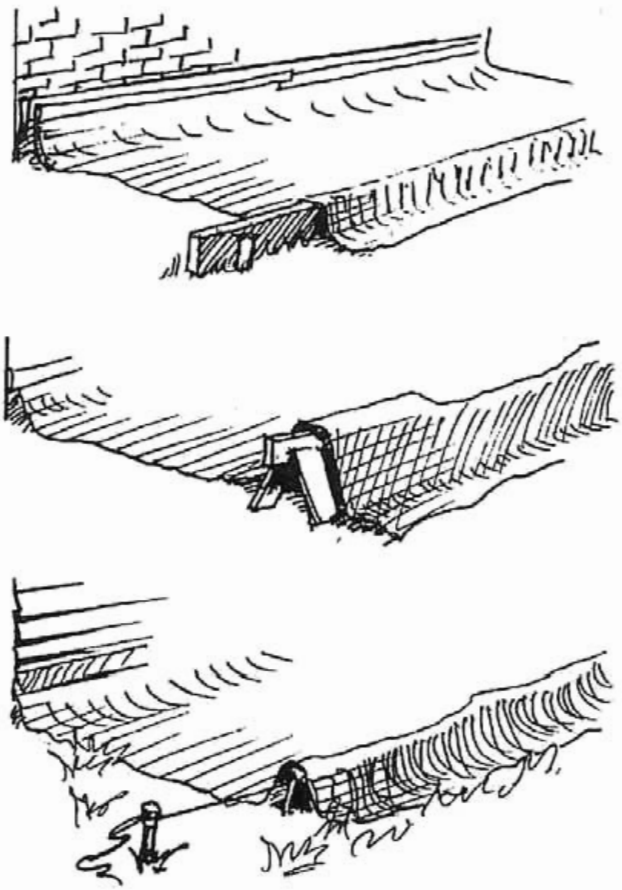
Containment – Exterior

Ground cover

When working on the exterior of a house virtually all dust and paint chips should be captured by a ground cover and cleaned up on a daily basis.

Wet Scraping

- Use 6 mil poly taped to base of house extending 10' out from wall when working on first floor. If space permits add 5' for each additional story.
- Turn up edges of poly at perimeter to prevent wind from blowing or rain washing chips off plastic.
- Plastic on grass may need to be rolled up nightly to avoid killing the grass.

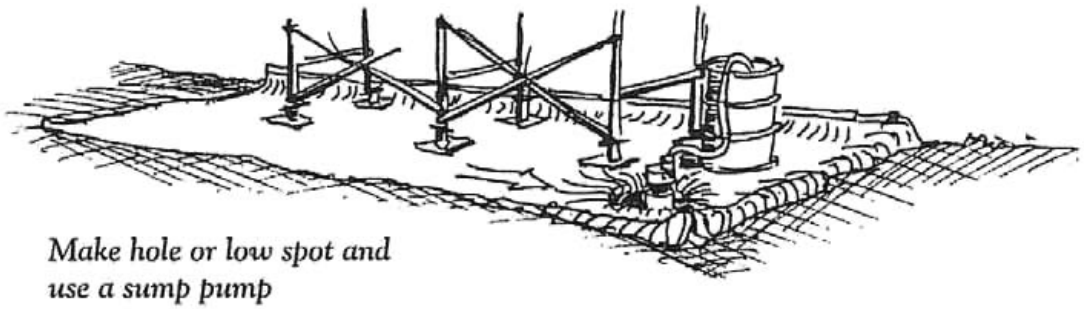


Exterior Containment for Wet Scraping

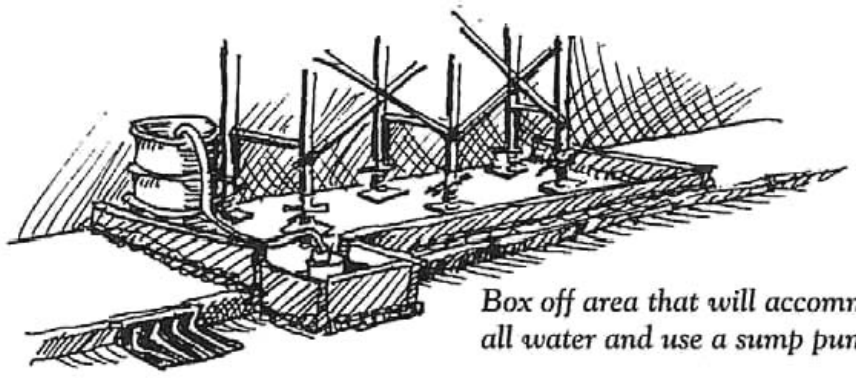
- Where a sidewalk or a passage size makes extending plastic out from the wall impossible, and a scaffold is being used, drop a mesh or rip-stop poly shroud around scaffold. Mesh will contain chips but not dust.

High Pressure "Washing"

- High-powered pressure washing (over 400 psi) is basically power stripping. The run off needs to be either collected and strained, or tested and disposed of as per local regulation. Disposing of liquid waste is expensive so collecting and straining the liquid is recommended. When using a high pressure washing technique, the plastic drop cloth should contain the liquid and be pitched to a sump pump from where it can be pumped into a barrel. It is critical that no lead contaminated water is allowed to flow into a storm drain. (see Illustration)



Make hole or low spot and use a sump pump



Box off area that will accommodate all water and use a sump pump

Water Collection for High Pressure Washing

Low Pressure Washing

- Low pressure washing should be done after wet-scraping has removed virtually all the loose paint. Gathering the water and straining it should not be necessary.

Shrouded, HEPA Power Tools

- Where power tools (abrasive blasting, grinding, planing, and sanding) are properly shrouded and connected to a high efficiency vacuum, and the vacuum suction is sufficient, additional containment of the work area should not be necessary. Some planers and orbital sanders are designed to be attached to a high efficiency vacuum. The ground should still be covered and respiratory protection is still needed.

Exterior Containment Guidelines

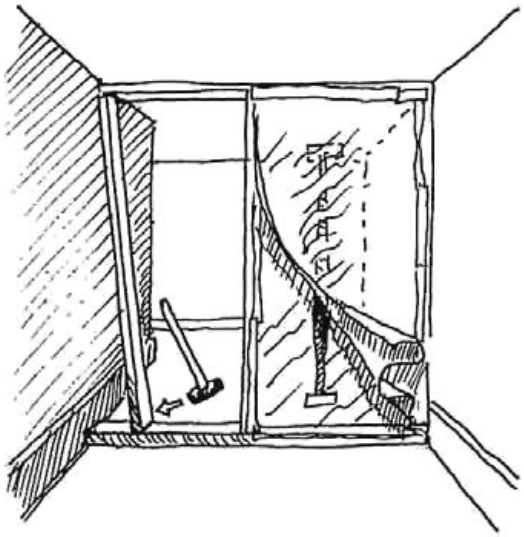
- Any window within 20' of a dust-producing exterior work area should be closed and have a warning on inside not to open.
- Entrances to the building should be no closer than 20 feet. If this is not possible, a protective tunnel of poly should be constructed.
- If the wind is over 20-mph HUD guidelines call for a cessation of work. However, winds at half that speed will blow chips and dust off the ground cover. Working wet and turning up the edge of the poly (see page 7-6) helps retain chips as does dropping a shroud on the windward side of the scaffold.
- Clean up should take place at the end of each day, particularly if there is public access to the work area. This clean up does not need to achieve clearance levels.

Isolation

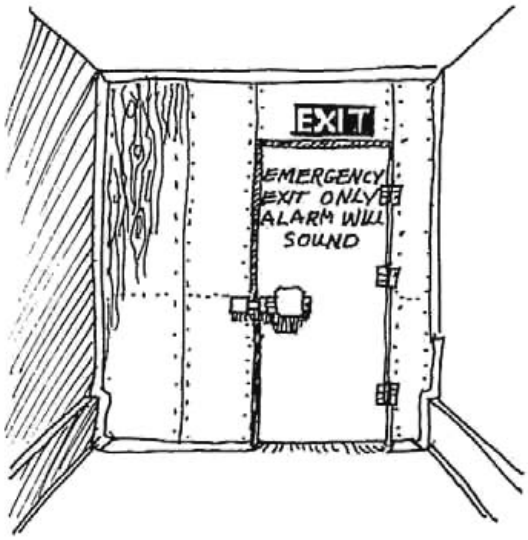
Isolation is used to separate high dust areas from occupied spaces, particularly spaces occupied by children, or spaces

with upholstery, carpets and other furnishings that cannot be completely cleaned.

One method is to seal off the work area from occupied areas and have workers leave and enter from a second exit. This could be an exterior doorway, fire escape, or ladder if the work space is three stories or less. When a separate entrance is used, that is also the second egress from an occupied space, it must be accessible in a fire emergency. In a multi-family building or commercial space this can be done by installing a panic-bar system with an alarm on the barrier door. If the



Build a pressure-fit stud wall and cover with poly, slit one side and add flap over slit.



Where security is important but a fire exit must be preserved, install plywood over a pressure-fit stud wall. Hang a plywood door with an alarmed "panic pad."

Isolation barriers where there is no door to shut

barrier is a plywood wall rather than an existing door, a plywood door can be cut and hinged into the barrier wall.

In all cases, the perimeter of the opening should be sealed with weather stripping that will seal the clean area from dust but not prevent the door form being opened in an emergency.

This barrier is **never** broken until the isolated side is cleaned and cleared. If such isolation is impossible, a double slit and flap system on both ends of a cleanup space would work. It is essential that return vents and registers of forced air systems in the isolated area are completely sealed. If the return is sealed, do not run the furnace.

When containment or isolation is between a work and a living space, it is advisable to take pre and post dust tests just outside of the work area as a record of the containment's effectiveness. One method of assuring the area outside containment never has an increased level of contamination is to do a pre-work cleaning, which allows for a low baseline level.

Examples

A single family home can be occupied in the evenings while part of the unit is contaminated and isolated if: (1) the bathroom is accessible, (2) there is enough space to sleep, and (3) the entrance and entrance hall remain accessible. If the kitchen is in the isolation area, the refrigerator, a set of dishes, and a hot plate can be set up in the dinning room so the passage can be sealed. Most areas in a residence can be worked on in complete isolation using doors or windows as separate exits.

In a commercial setting a barrier wall can be constructed at various different places and times during work. For example, an exit staircase, an elevator, and half the office space can be isolated, giving workers and occupants separate exits from the building. Fire exit doors can be built into the barriers. Where the workers have no option but to exit through occupied space, they can exit through a decontamination unit. This consists of three spaces each about 4' by 4'. The first is where dirty clothing is removed, the second is for wash up or shower, and the third contains clean clothing. Each space is separated by a slit-and-flap door.

B WORKER PROTECTION

GOALS

- Make the work site safe and healthy for workers
- Make safe work practices a part of all rehabilitation and maintenance work
- And achieve these goals at a minimum of extra cost

Protecting the crew is the responsibility of every rehabilitation contractor. In this section, worker protection is divided into two categories:

Engineering Controls

Respiratory Protection

Engineering Controls – Techniques for Minimizing Exposure

Engineering controls are safe work techniques and practices, other than respiratory protection, that reduce a worker's potential exposure to toxic dust and fumes.

The goal of engineering controls is to minimize the need for worker respiratory protection Respirators are uncomfortable, put a strain on the wearer's lungs and slow down work. On the other hand it is crucial that workers be protected from toxic dust and fumes. In fact, experience suggests workers should wear respirators at half the level that OSHA has set for respiratory protection (see next section.) On a

construction job where both dust and fumes may be present, engineering controls are critical. Engineering controls include:

- **Work wet** – As you scrape, sweep, or demolish, mist the materials with water to minimize dust. Where large areas will be wet scraped or demolished, wear a pressurized water pump container with a hose in a knapsack so use is convenient. Mist materials frequently during work.

Pump sprayer in a backpack for misting areas to be scraped.

- **Disassemble** rather than demolish
- **Use hand tools** – For small area work such as cutting of the bottom of a door or planing the nose of a window stool, sharp well-adjusted hand tools can do virtually the same job as a power tool, but with a fraction of the dust and with less setup time.
- **Scrape Kerf** – Where a lead painted material is to be cut with a power tool, remove the paint from the kerf area. Examples:
    - Cutting off the bottom of a door
    - Cutting a steel beam with a cutting torch
- **Use power tools attached to high efficiency vacuums** – This is crucial for tools like sanders, grinders or abrasive blasting equipment. When the tool is shrouded, the shroud should make full contact with the surface and the suction should be sufficient to draw virtually all the dust through the

filtration system. Regardless of the composition of the paint or the apparent effectiveness of the vacuum, respiratory protection should be worn. The respirator must be at least an N100 respirator. Be extremely careful with this equipment as it can badly damage historic materials. It is never advisable to recommend sandblasting exterior brick or wood. For example, sandblasting brick removes its protective patina, which can make it porous, absorb water, freeze and delaminate the face brick. **Never use this equipment without training for the specific tool.**

- Provide onsite washing facilities and enforce good hygiene practices (Chapter 8: Site setup).
- Clean as you work

Respiratory Protection

Levels of Exposure

The need for respiratory protection is based on the level of airborne lead dust exposure. Where tools and techniques described in the previous section are not sufficient to protect workers from toxic exposure, respiratory protection is necessary. Experience has shown that these levels will occur during:

- Demolition
- Tearing up wall-to-wall carpets
- Removing water-damaged or dusty rubbish
- Wet-scraping whole rooms
- Removing chemical strippers
- Vacuum-assisted power tools
- Using a cutting torch
- And of course, using any product or solvent that demands respiratory protection

Prohibited Practices

Some activities can generate such high levels of lead dust that they should be avoided. Practices that are so hazardous that they are prohibited by HUD guidelines include:

- Dry-scraping
- Using an open-flame torch
- Using a heat gun over 1100°
- Power sanding or grinding without an effective vacuum attachment
- Uncontained abrasive blasting
- Using a chemical stripper containing methylene chloride (specially trained tradespeople working in well ventilated spaces may need to use methylene chloride for specialized historic restoration work.

It is extremely important to know that methylene chloride will penetrate organic filters, only supplied-air respirators will work.

Brief OSHA Review

The OSHA Lead in Construction rule (OSHA 1926) is extensive. The following description provides a brief summary of this regulation.

OSHA requirements are directly based on exposure levels.

Determining Level of Exposure

Levels of exposure for various operations are determined by taking samples of airborne dust generated by a particular crew doing a specific set of work practices.

The measurements need to be done by a "competent person" as defined by OSHA.

The device to take the measurement is a battery-powered air-sampling pump that a worker wears on her or his hip. A

tube attaches it to a filter cassette, which is then attached to the worker within a foot of their face. The goal is to collect about the same amount of dust as would have entered the workers lungs had they not been wearing a respirator.

The collection is measured in micrograms per cubic meter, the symbol for this is: $\mu g/m^3$. Samples are either taken or calculated for an 8-hour period (or 8-hour "time weighted average").

There are two thresholds relevant to the levels of work discussed in this manual:

OSHA Category I

$30\mu g/m^3$ and under which requires:

- Employees to be trained
- Exposure to be characterized
- Records maintained

OSHA Category II

$30\mu g/m^3$ to $50\mu g/m^3$, $30\mu g/m^3$ is the action level. Exposure above this level requires the same as Category I plus:

- Provide the employees with respirators which they have an option of using
- Conduct exposure monitoring every 3 months
- Conduct blood lead monitoring

OSHA Category III

$50\mu g/m^3$ and over. $50\mu g/m^3$ is the permissible exposure limit. Exposures above this limit require the same coverage as Category II. Plus, at this exposure level, employers need to:

- Enforce respiratory use
- Enforce use of protective clothing
- Monitor blood lead every 6 months
- Enforce housekeeping
- Provide hygiene facilities and enforce washing

Simple Compliance Strategy

It is of course impractical to have people monitoring each practice and determining which workers are working at which level at a particular time. These protocols were developed for large industrial jobs where a specific crew implemented one measure, for a month or more at a time. This is neither possible nor practical for smaller rehabilitation projects.

In the real world, workers will only wear protection when they believe protection is necessary or when being watched by a supervisor. Again the objective is to **design work that keeps workers safe and thus, to the greatest degree possible, out of a respirator.**

Note: The following plan is more stringent than OSHA standards.[1]

The program has these aspects:

Test Workers Blood Levels

Lead in blood is measured in micrograms per deciliter (μg/dl). OSHA requires medical removal at a level of 50μg/dl. This level is being criticized by various authorities as too high and unsafe. (The American Conference of Industrial Hygienists has suggested a level of 20μg/dl). OSHA may actually lower this level to 25 μg/dl. While OSHA only requires blood testing when workers are exposed above the Action Level, monitoring the blood lead levels of a rehabilitation crew is an

[1]This section does not attempt to address all aspects of OSHA regulation. Ultimately, it is the responsibility of every employer in the construction trades to assure the safety of employees and to comply with federal regulations. The above suggestions do not relieve an employer from this responsibility. The authors believe, however, that the guidance provided in this section (1) are entirely consistent with the intent of OSHA 1926, and, (2) represents safe and prudent worker protection measures.

excellent program to initiate for all rehab contractors. A prudent approach is:

- **Test all workers upon hiring** – This protects the employer from being made responsible for previous poisonings. Hiring a person with a high level is OK as long as that information is recorded.
- **Re-test every 6 months** – to be sure your systems are working. Re-testing can be more frequent if projects involving significant dust generation are performed.

Characterize High and Low Level Work

We know that only a few permissible work practices bring exposure levels above 30$\mu g/m^3$ – in particular demolition, a lot of dry scraping, and use of power tools without vacuum attachments.

It is not necessary to monitor exposure levels continuously. OSHA does accept historical data that documents similar activities. It is acceptable to **characterize** one or two jobs with air monitoring including all the typical operations to create a record. With engineering controls, they will most probably register far below the action level. A goal could be 15$\mu g/m^3$, i.e.: one half of the Action Level.

If scraping and some low level demolition (i.e. deconstruction) is done with safe techniques they may also fall below one half the Action Level. This means that you are giving yourself more than a 3-fold margin (15$\mu g/m^3$ as compared to 50$\mu g/m^3$).

In fact, you may find that, when engineering controls are used, most non-demolition work will fall below 5$\mu g/m^3$. This information is copied and placed in each job folder.

Train and Fit-Test Workers for Respirators

Although the objective is to avoid creating the conditions requiring respirators, supervisors don't want their choice limited by respiratory restrictions.

Send all workers to a retail outlet that sells and fits respirators, and then give them an hour of training on the care and use of half-face respirators. Have them store their respirators in strong zipper locked plastic bags – They'll have them if they need them. Note: All workers have the right to wear respiratory whenever they choose.

Carry Protective Supplies in Inventory

If these are in a box on each truck, they'll be there when they are needed.

The list includes:

- Tyvac™ disposable suits with elastic at the ankle and wrists
- Shoe covers separate from the suit
- NIOSH approved disposable respirators (in addition to half mask respirators fitted for each worker) Look for: "For protection against toxic dust", or "Approved for 5 times the PEL" or "Protective up to 0.05$\mu g/m^3$".They are made out of HEPA filter cloth, have 2 straps, a metal nose bridge and usually an exfiltration valve.
- For low level work, an N95 disposable respirator is very effective. If there is a chance the work can go over the action level, an N100 disposable respirator is recommended as it is far more comfortable than a half face negative air respirator with canister.
- Safety glasses
- Disposable caps with brims (like painters caps)

Disposable respirator, goggles and work cap. Both the N95 and the N100 look like this.

Clean All Jobs to Clearance

We don't know how little dust on floors will poison a child. We do know anything above clearance (100mg/ft^2 for floors, with the new floor level dropping to 40mg/ft^2) can poison children. There is no reason to leave a job dirty regardless of lead content. Customers will long remember how clean a job site is left.

Always Have Workers Wash Hands Before Leaving Job Site

Clothing exposed to dust should be vacuumed or changed if disposable coveralls are not worn. This is particularly important before workers eat or smoke at the job site or go home to children (see Clean-up Station in Chapter 6)

...Then workers are safe on all the jobs.

C CLEAN UP

Clean up is a crucial aspect of site maintenance. It is always cost effective. It increases production and greatly decreases worker injury and exposure. Clean up is part of a site management operation that includes:

- A well maintained supply inventory area
- Construction materials kept out of the work area until needed, then neatly stacked
- A dry, well ventilated, well lit work area
- Out of the work area trash storage

The Nature of Lead Dust

Lead dust is very fine and may be too fine to see. Whenever there is deteriorating paint, there is probably lead dust. But even without visible paint chips, there may still be lead dust.

Lead dust is sticky. It cannot be brushed off, it needs to be rubbed off. If rags, mop heads and rinse water are not changed often, the dust will be smeared around rather than removed.

Lead dust accumulates in cracks over the life of a house. If these cracks are not cleaned out and sealed up, the dust will filter back out of the cracks and into the room after cleaning. Where there are wide spaces in tongue and groove flooring, each crack should be cleaned with a corner tool on a vacuum cleaner.

Cleaning Phases

There are four phases during the course of a project when cleaning will be important:

- pre-work, vacant and occupied
- post demolition,
- in-process cleaning, and
- clearance cleanup

Pre-work

Vacant

Before even layout work is done any accumulated rubbish should be removed and the site cleaned. Sometimes this needs to be done even before an accurate specification can be written. Pre-cleaning involves the removal of large debris and paint chips, followed by high efficiency vacuuming. This is particularly important where a building has been abandoned and/or water damaged. Worker protection during this process is critical. It includes:

- Checking the structural integrity of walls and floor before work begins
- Wearing puncture proof gloves for protection against sharp objects (particularly needles)

- Wearing at least half face negative air respirators and possibly Tyvac™ protective clothing

Two specific risks are:

- Large amounts of lead dust from delaminated lead paint due to moisture
- High mold contamination particularly where there is wet rubbish. Wall-to-wall carpet removal may be particularly toxic and requires special precautions.

Occupied

Activities included in setting up the work site (picking up rugs, moving furniture, and disturbing dust in storage areas) can create risk. Specific prep stages may include:

- Occupants may be asked to clean off and pack up objects on horizontal surfaces such as mantels, counters, shelves, bureaus, window stools, etc. Dusting is best done with tack cloths before objects are put in boxes. It is recommended the contractor supply boxes, packing tape and dispensers, tack cloths, labels and makers, etc.
- Remove furniture if possible. If not possible, move furniture away from wall areas in a cluster so it can be collectively covered with 4-mil poly. If high dust (such as demolition) will be done, tape poly to floor with duct tape.
- Pre-vacuum occupied areas so cumulative dust will remain below pre-work levels.

Principle

When working in or adjacent to an occupied area, the dust levels in the occupied space should be lower than they were at start of work, and remain lower during and after the job.

Post demolition clean up

Activities that generate a lot of dust, like demolition, should be cleaned thoroughly upon the completion of the task. Do a vacuum and wet clean-up directly after demolition so workers can remove negative air respirators as soon as possible.

- Mist area

- Shovel and/or sweep up dust. Drag dust to dust pan or shovel so dust is kept to a minimum.
- Vacuum up dust with high efficiency vacuum.
- Wet mop area (details below).

Remember, these high dust activities occur in containment or isolation. Containment and isolation should be kept in place until the cleanup is done. Dust samples can be taken where there are adjacent occupied areas to assure that the cleanup has been successful. (Many laboratories have a 24 hour turnaround.)

Wall-to-wall carpets

The weight of wall-to-wall carpets may can increase over time. The added weight is from dust and dirt including lead dust, molds, vector fecal matter, dust mites, insect exoskeletons, etc. Many of these substances can trigger or aggravate health problems.

Wall-to-wall carpeting is difficult to completely clean. In child-occupied buildings, it is recommended that wall-to-wall carpeting that is not fairly new be disposed of and replaced with area rugs for rooms, and runners for halls and staircases. Staircase runners are best secured with carpet rods so they can be removed for cleaning.

Removal procedure is as follows:

- In an occupied dwelling, isolate the room during removal and until the room is cleaned. Workers should wear at least a N95 mask.
- Lightly mist carpet surface to keep down dust
- Cut into manageable sections with carpet layers hook knife so as to not damage floor
- Roll carpet into poly sheets and tape closed. Carpet can be lowered by rope out of windows to avoid trailing it through occupied space
- Remove "tackless strips" then use a high efficiency vacuum followed by wet-mopping to clean floors
- Always seal floors to make them easily cleanable

In Process Cleaning

Cleaning should be a continuous process. Clean up each work area as work is completed. This may include wiping areas with paper towels, keeping drop cloths vacuumed, using a vacuum next to a scraper to catch chips as scraping is done. Having several small portable vacuums around a job encourages clean work. Small debris can be misted and swept up. Always clean at end of the day so dust is settled by the next morning.

Clearance clean up

Lead abatement projects must pass "clearance" testing prior to occupation. While abatement is not the focus of building rehabilitation, it is strongly recommended that the standards of clearance testing be followed, and that each project be dust-wipe tested to ensure an environmentally-safe site (Chapter 4). Final cleaning, before clearance testing, is the most critical cleaning phase. On lead abatement projects failing clearance at the end of the job can be expensive as it prolongs completion and requires the return of a cleaning crew. The job is as good as the final cleanup.

Equipment needed

- 2 cotton mop heads for each 2,000 sq. ft. (Some mop heads can be washed and used again.
- 1 mop handle for mop head.
- 2 pails, one with mop squeezer or a wringer bucket.
- 1 cleaning cloth to replace every few windows plus 2 per room (a terry cloth towel cut into 10" x 10" squares works well).
- Cleaning detergent. Most commercial cleaners work well. There are also lead-specific cleaners designed to clean up lead dust. Avoid cleaners with TSP, as it is harsh to skin, may leave a film causing future paint failure, and is banned in several states for environmental reasons. Vacuum with floor brush, corner tool, and round cap brush.
- Tack cloths finished furniture and small objects
- Paper towels

- Latex gloves
- Spray or pump bottle for detergent

Cleaning Procedures

The following procedures will work for final cleanup and other large cleaning projects. Respiratory protection is recommended for the sweeping aspect of large cleanups.

- **Clean and remove poly.** Where poly has been used and will be used again it can be misted and swept. All plastic should be carefully folded from the corners to the middle to trap any remaining dust. Plastic used to isolated work from adjacent areas should be left in place until after the cleaning. Removed plastic should be placed into plastic bags.
- **Vacuum.** Using a high efficiency vacuum, vacuum the area from one end to the other, starting at the end furthest from the exit. In most cases, only horizontal surfaces need vacuuming. The exception is in rooms where large amounts of lead dust have been generated in these cases vertical surfaces should be damp cleaned and/or vacuumed. Pay particular attention to window troughs. (Clean out trough with damp paper towels first to pick up paint chips and large pieces before vacuuming). When vacuuming the floor, use the corner tool where the floor meets the baseboard and on the cracks between the floor boards.
- **Wash trim, windows, and doors.**
  - Spread the cleaning solution on the surface using a squeeze or pump mister. (This avoids contaminating the cleaning solution).
  - Using two small buckets or a split bucket (one empty and one with rinse water) rinse out rag in bucket with rinse water then squeeze dirty water into empty bucket or side.

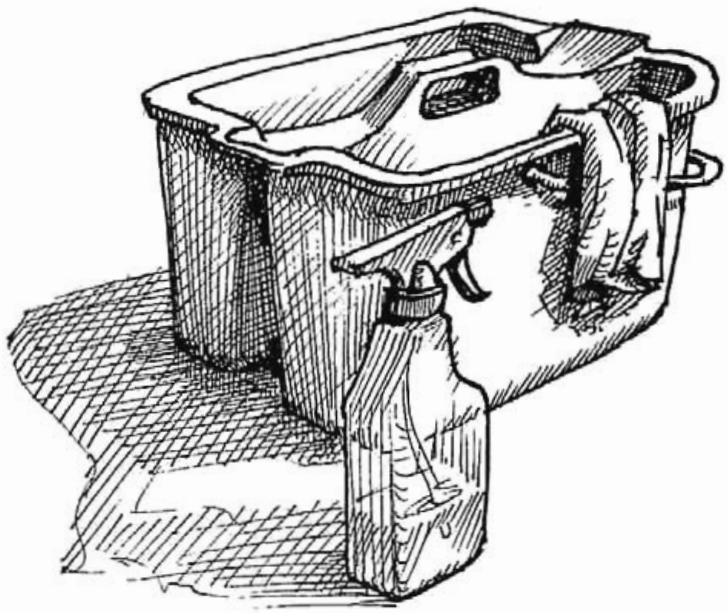
HEPA (high-efficiency particulate air) Vacuums

HEPA vacuums differ from conventional vacuums in that they contain filters that can trap extremely small particles. A regular vacuum cleaner may pick up most of what a HEPA vacuum will, but the finest dust will blow back out the exhaust port. If large amounts of paint debris are being cleaned, this can act to spread lead dust around a site rather than remove it.

There are high efficiency vacuums that are almost as effective at trapping dust but have more suction. These may be as effective.

- Change rinse water often. Throw away rag (or put in bag to be laundered) at least once in every room.
- Start from highest points and work down, cleaning windows, shelves, edges, mantels, top of moldings, etc. in each room.
- When cleaning windows, wash trough with paper towels first. **Never use the rag you used on dirty windows for other areas.**

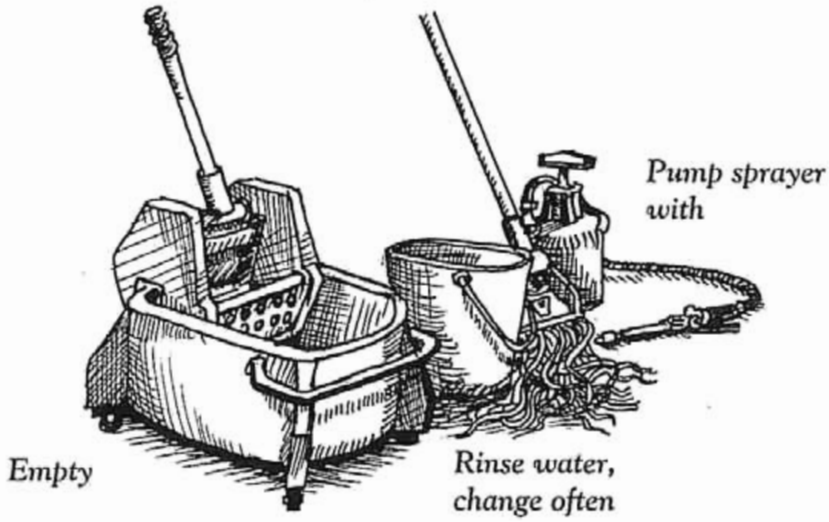
- **Wash Floors**. Put detergent water in a pump sprayer, and rinse water in a bucket. Use the following sequence:
  - Mist a small area with detergent and clean with damp mop.
  - Rinse mop out rinse bucket and squeeze out excess. Change rinse water often. Never put mop back in the squeeze bucket water.
  - Again mist with detergent, rinse, squeeze out excess, and repeat above process. By using separate rinse and detergent water, the detergent water stays cleaner. Depending on the amount of dust, a mop head will last one or two thousand square feet. At that point, throw it



Split bucket and mister with detergent good for all small surfaces, window stools, molding, etc. This bucket works well with a twist mop for small floor areas.

away or wash it out thoroughly.

- For rinsing floor, clean out buckets and repeat washing procedures but replace detergent with clean water. Use a clean mop head for the final rinse.



Three container cleaning system

8 TREATMENTS

Goals

- Introduce lead hazard control terminology, and its relationship to rehabilitation work.
- Present specific lead-safe treatments for building components.
- Discuss considerations relating to historic windows.
- Introduce the subject of deconstruction, as compared to demolition.

In the field of lead hazard control, terminology has developed that categorize specific hazard control treatments. These treatment options fall into two groups:

Interim Controls and In Place Management

Hazard Abatement and Full Abatement

Interim Controls and In Place Management

Some of these measures are temporary, designed to control lead hazards. Until other work can be done, other measures, if maintained, can last the life of the building. They include:

Paint stabilization to control lead hazards with the least intervention and dust generation. It includes wet scraping deteriorated paint followed by repainting. Because this method is relatively safe and retains historic material, it should be the first option considered in preservation projects.

Treating friction and impact surfaces addresses lead hazards that are caused by abrasion and impact. These techniques primarily refer to tuning up windows and doors. Painted floors and trim may also be subject to friction and impact. If surfaces are damaged because of moisture problems, the source of the problem must be addressed before in place management can be effective.

Hazard Abatement Procedures

Hazard abatement procedures by definition are treatments that will last at least 20 years. Full abatement is when all surfaces defined as having lead paint are abated. Hazard abatement only remediates those surfaces that present a current or eminent hazard, i.e. Not intact surfaces. There are four general categories of hazard abatement procedures.

- **Encapsulation** refers to the use of special paints (with or without a reinforcing mesh) that are brushed, rolled, sprayed, or troweled on. Their purpose is to form a tough and elastic barrier between lead paint and the environment. While tougher than paint, encapsulants are subject to some of the same types of deterioration. Durability depends on the condition of the previous paint layers, proper preparation, and protection from moisture. While encapsulants can be used on historic materials, they tend to be thick and obscure detail. There is also a risk they will form a vapor barrier thus trapping moisture resulting in deterioration of building materials. It is critical exterior cladding remain capable of "breathing." Prior to using encapsulants, adhesion tests are recommended.
- **Enclosure** refers to placing a rigid surface over a lead painted surface. When mechanically fastened, enclosures can provide an excellent barrier. In lead hazard control, enclosures are sealed with caulking, particularly at the base of a wall, to prevent lead dust from falling down and out into the room. Enclosures

are not appropriate for historically significant surfaces, as they completely obscure the historic feature. Laminating plaster veneer board or drywall over a plain deteriorated plaster wall is an option, particularly if the plaster is beyond saving. Drywall is harder to maintain than plaster and rapidly deteriorates in the presence of moisture. It also can harbor and encourage mold and roach infestations.

- **Paint removal** refers to the retention of the building component while removing all of the paint from the surface. To most people, paint stripping is what is commonly considered "lead abatement." While clearly a permanent solution, paint stripping can damage the substrate, is potentially hazardous to workers, and can be hazardous to the environment. (See Box pages 8-4 & 8-5)
- **Component replacement** removes the lead paint by removing the building component altogether. This approach is in conflict with historic preservation principles, and is only recommended on insignificant features like shoe molding. While eliminating a lead hazard, replacement can be hazardous to perform. Removing a baseboard, window, casing, or jamb, can release a great deal of dust into the environment, dust that has been accumulating in the cavity for many decades.

Lead Hazard Control Technique	Rehabilitation Technique	Example
Paint stabilization	Preparation and repainting	Scraping and repainting siding or trim.
Friction and impact surface Treatment	Window and door repair and alignment	Adjusting and rehanging a door
Enclosure	Lamination	Hanging drywall over existing plaster
Lead paint removal	Paint stripping	Stripping a decorative fireplace surround
Component replacement	Installing new components	Replacing kitchen cabinets

PAINT STRIPPING

There are a number of ways to strip lead paint from architectural components. All of the methods have disadvantages regarding the hazards they raise for the workers and the surrounding environment. In terms of performance, there is no one method that is always preferable as the location, substrate, and number of paint layers all play a role in determining the best method. Any paint stripping job should include a testing period to determine the most efficient and cost-effective method.

On-site vs. Off-site. The first decision when considering paint stripping is whether to perform the job on-site, or to send it off-site to a professional paint stripping facility. Off-site stripping is generally preferred for several reasons:

- It protects the building site from the generation of lead dust.
- It reduces the time on-site workers must spend in a hazardous environment.
- It places the job in the hands of professionals, where workers are (hopefully) well-equipped with engineering controls and respiratory protection.
- It removes hazardous waste considerations from the contractor.

Some architectural elements can be more easily removed for transportation off-site, including doors, window sash, cabinets, and sometimes fireplace surrounds. Other elements are more difficult to remove and transport. Baseboards and other trim can be difficult to remove without damage, and removal itself can release considerable harmful dust into the environment. Sending components to an on-site "dust room" (see 6-8) may be the most cost effective option. It isolates the dust without having to transport components. This space can be set up in a step-van or trailer.

Wood components that have been stripped chemically may have "raised grain" after stripping. It is common to sand these components prior to installation. This process can be hazardous, and should be performed with containment and respiratory protection. When the lead paint is dissolved in the process of stripping, the solvents will draw some of the mixture, lead included, into the dry wood. Dry sanding the surface will release this lead, and create a hazardous situation.

Chemical Stripping Methods

- Alkaline strippers are popular both for on-site and off-site stripping. On-site materials are often sold with a plastic sheet to keep the material moist and to contain the mess. This material is extremely caustic. It can burn a worker's eyes and skin. Protective rubber gloves, boots, and eye protection are required, and workers should be trained and experienced in the product's use. Alkaline strippers require neutralization with an acidic wash, or the residue will ruin the following paint job. The residue is hazardous, and should be disposed of properly.
- Methylene chloride strippers have been the industry standard for years, and most hardware stores still carry them. These strippers work powerfully fast. However, methylene chloride has been shown to be a carcinogen, and the use of these strippers is not recommended. Organic vapor filters for half-face respirators are insufficient to protect workers from this chemical.

A number of "Environmentally Safe" strippers have recently come on the market, partially in response to the growth of lead paint abatement. These strippers are not alkaline and do not contain methylene chloride. Some of them work with a citric acid. Compared to the more hazardous strippers, these products work slowly, and may require more than one application. If chemical stripping must be done, testing of these products could prove fruitful.

Mechanical Stripping Methods

- Hand Tools. If a painted surface is severely deteriorated, stripping can sometimes be performed with hand scrapers, though generally this is impractical for large areas. Maintaining a sharp edge on the scraper blade is essential for this work. Carbon blades are recommended. Hand scraping should always be performed with wet methods. On some wooden components like door edges, sharp hand planes can be a relatively safe and effective means of paint removal.
- Power tools. Lead paint can be planed, ground, or sanded off a surface. Normally, this would produce enormous levels of lead dust. In response to this, power tools are available that are shrouded and connected to a high efficiency vac system to control the lead dust. Tools that are available include grinders, sanders, needle guns, planes, and random orbital sanders. Many of these tools were developed for larger industrial jobs such as paint removal from large steel structures (i.e. bridges and water towers.) Despite the precaution of shrouding, some elevated levels of airborne lead dust can occur, and respiratory protection and interior containment are still required. Workers need to be trained and experienced. These tools may not be gentle enough for some substrates, damaging historic materials and leaving unsightly tool marks.
- Abrasive Blasting. Abrasive blasting is rarely recommended for historic buildings, and is more appropriate for large steel structures like bridges. This method can do significant damage. As with power tools, abrasive blasting can create tremendous hazards to the workers. Significant levels of respiratory protection is required.

Heat Stripping Methods

- Heat guns and heat plates. When using heat stripping tools, the temperature must be kept below 1100 degrees F. Above this temperature, lead paint becomes volatile, and lead fumes are produced. Lead fumes are extremely toxic and can cause severe lead poisoning. Below 1100 degrees F, stripping with a heat gun is a slow, laborious task. This method of stripping is incompatible with wet techniques, and therefore can produce significant lead dust. Workers require organic filter plus particular respiratory protection, and containment is crucial.
- Open flame torches. Open flame torches for paint stripping should never be employed. They present a significant fire hazard.

As the method descriptions indicate, virtually all stripping methods are hazardous for one reason or another. Safety of workers and the environment must be considered. Another consideration is waste disposal. Chemical strippers combined with lead are hazardous waste, as are concentrated lead chips. If a large amount of these materials are produced on a project, waste disposal may become a concern. For all of these reasons, large stripping projects are best accomplished by certified professionals who should be properly equipped and capable of dealing with waste disposal issues.

A close examination of this terminology reveals that there is a striking similarity between lead hazard control work and rehabilitation work. Once the names are understood, there is little in lead hazard control methods that should not be familiar to a building renovation specialist.

For most any building component, several of these categories could be the basis for a rehabilitation treatment. The discussion of work treatments presented below prioritizes lead safety and historic material retention. The following principles apply to all components:

- Paint stabilization is an option for all painted surfaces, and is the preferred method whenever possible. This technique is gentle, generates little dust and debris, and retains historic materials. Paint stabilization is basic good maintenance.
- Paint stripping is an option for all painted surfaces, but has significant drawbacks. While sometimes necessary on preservation projects, strict precautions must be taken to protect workers, occupants, and the building environment.
- Regardless of treatment method, the root cause of material degradation must be repaired before any treatment is implemented.

The methods described below are not work specifications but general treatment suggestions. They assume a trades background on the part of the worker.

A SIDING AND TRIM

Paint Stabilization - Wet Scraping

This is a standard treatment, which can be used on all woodwork. It is close to what painters already do.

- **Mist** -Misting the surface before scraping will usually lower the amount and spread of dust.
- **Scrape** - A two-handed scraper works best; the edge must be kept very sharp which can be done with a mill file as work is done. A carbon steel blade will hold an edge far longer. In most cases only the loose and unstable paint is removed. Where the adhesion to the substrate is weak, all the paint can be removed by wet-scraping.
- **Sand and Fill** - Leaving the paint that is tightly bound to the substrate will leave a rough surface. A damp abrasive sponge can be used to feather edges, as can a random orbital sander attached to a high efficiency vacuum. The sander must either draw dust through the sanding pad or be shrouded. Open sanding is prohibited.
- **Wash and Degloss** - Before painting clean, and (when necessary), degloss the surface. Power Washing can be done with water under pressure, but high-pressure washing that removes loose paint creates a problem if the paint is lead. The liquid waste must be collected and filtered before allowing it to enter the soil or storm drains. In some jurisdictions even after filtration liquid waste must be tested to determine if it is hazardous waste. Disposing of the wash water as hazardous waste can drive the cost too high to be practical as a choice. For these reasons, power washing is not recommended as a paint stripping method.

- **Caulk** - Use the best grade caulk. There are caulks on the market rated for 30 years plus. DO NOT OVER CAULK. Horizontal surfaces like the overlap edges of siding and above windows and doors, if correctly joined and flashed, should not need caulking. It is critical that buildings be allowed to dry-out, particularly in cold climates. Vertical openings such as along doors, corner trim, or against masonry may need caulking.
- **Prime** - The quality and choice of the primer is critical. Always specify the highest-grade primer. When life cycle costing, a cheap primer will never save money. If a high percentage of old wood is exposed, a linseed oil-based primer with deep penetration capacity is recommended as it will mechanically bond to the wood below the damaged surface. Strictly follow the directions for weather conditions and curing time.
- **Paint** - When selecting a topcoat, choose a topcoat paint compatible with the primer according to the manufacturer, or warranties are void. Most topcoats are latex-based.

Siding and Trim - Encapsulation

The use of encapsulant coatings on the exterior siding of an entire house may create more problems than it solves. It may trap moisture in the wall cavity and is difficult to remove for restoration purposes. Some encapsulants are so thick they obscure architectural detail. A potential advantage of some encapsulants is that, when paint is in poor condition yet difficult to remove to the substrate, the encapsulants will soften the paint layers and then bind them to the encapsulant topcoat. Encapsulants are more appropriately used on exterior trim and balustrade than siding. When encapsulation is used on siding be sure the clapboard's horizontal joints remain open enough to vent the wall cavity. Always do test patches of encapsulants to check for adhesion and appearance.

Siding and Trim - Enclosure

Enclosure of the exterior of a house with aluminum or vinyl artificial siding can increase interior and exterior lead paint deterioration and damage the structure of a house. It is always inappropriate on a primary or visible secondary facade of an historic house.

Wood and structural deterioration can be caused by the new artificial siding system. Any structural or wood deterioration (either caused by the artificial siding itself or by other system failures, such as leaking gutters) will develop unseen and undetected behind the artificial siding. Potentially serious problems that would otherwise be obvious at an early stage are allowed to fester and grow. The moisture trapped by artificial siding system can:

- Increase paint failure under the new siding and may cause the old wood siding to rot.
- Build up in wall cavities decreasing the insulation's effectiveness and damaging the structure.
- Maintain dampness causing the growth of molds within the wall system, particularly on the backside of drywall.
- Create damage to the inside face of the wall resulting in the failure of the paint surface.

In addition to historic and structural problems, enclosing a house with vapor resistant material can both increase the lead hazard of paint film deterioration and exasperate respiratory disease.

Conversely the artificial siding can be healthy for uninvited residents of the building. Reports from people experienced with the removal of artificial siding as part of building rehabilitation projects tell numerous stories of birds, animals, insects, and even snakes nesting behind the artificial siding. Artificial siding can also create an ideal environment for termites and roaches.

Siding and Trim - Paint Removal

There are cases where, for practical and aesthetic reasons, full paint removal becomes the preferred choice of the building owner. As many layers of paint build up on exterior siding, the paint loses its flexibility and slowly delaminates from the siding. This process is ongoing, and paint problems can develop with greater frequency. While it is acceptable to continue to deal with the paint problems on a regular basis, owners may prefer paint removal for appearance sake, and to reduce the frequency by which paint problems reoccur.

There is no one ideal solution to stripping exterior siding. Virtually all of the paint stripping techniques (Box pages 8-4 & 8-5) have been used successfully. Several types of shrouded power tools have been developed for this purpose. The best approach is always testing and experimentation, as each building may present unique conditions. Regardless of method, this is a large and expensive job that presents hazardous conditions to the workers and site. Strict attention to containment and worker protection will be critical to performing an exterior stripping job successfully.

B PORCHES

The restoration and maintenance of porches is particularly problematic. Porches are often subject to the most deterioration for a number of reasons:

- They are exposed to the weather, particularly rain and snow.
- Columns, balustrades, railings, etc. contain joinery and end grain surfaces that can trap and wick up moisture following rain, and become ideal places for rot to develop.

- Because roof leaks on porches are "outside" the house, it is more likely that leaks are not quickly corrected.

Where possible all details should be maintained, and paint stabilization techniques employed. When repainting, it is particularly important to keep the trim, balustrades and the end grain of the flooring boards sealed. Stripping and restoring badly damaged balustrades may be prohibitively expensive. This is a place where encapsulant paints may work well, particularly the products that soften and consolidate old layers. As with all encapsulants, perform tests to determine adhesion and appearance quality.

- **Porch Columns** – Hollow wood columns usually were built with vent holes at the base and cap to allow drying air to rise in the column. Make sure these vents are open. Screening may be installed to keep insects out. The base blocks of columns are designed so that they can be split out and replaced to protect the column.

Porch - Enclosure

- **Porch Ceilings** - Where porch ceilings are badly damaged and replacing the tongue and groove boards would be impractical the ceiling can be enclosed with sheets of exterior grade plywood, grooved to simulate beaded board. As with any enclosure, it's important that the perimeter edges are sealed and the boards are mechanically fastened to the structure.
- **Floors** - Where floors are lead painted and too damaged to save, and sanding or replacing is prohibitively expensive, covering the floor with exterior plywood will protect occupants if the floor is lead painted. While this technique has been used in lead hazard control work, it is a short-term solution, aesthetically unpleasing, not historically appropriate, and may cause irreversible damage to the floor. For these reasons, floor enclosure is discouraged for

preservation work. Wet scraping, or paint removal with a shrouded power tool, is preferred.

Porch - Component Replacement

Because of the possibility of severe deterioration, porches sometimes require component replacement. While virtually any component can be restored with advanced techniques (epoxy consolidants, etc.), there are times when it will be either structurally infeasible or prohibitively expensive. Where it is necessary to replace deteriorated historic materials, use reproductions that match the original. With railing systems, keeping the rail, planing the top, and replacing balustrades is an option. Given the cost of reproduction woodwork, preserving salvageable components is not only recommended for preservation reasons, but also for economic reasons.

C MASONRY

Occasionally, exterior brick and other masonry surfaces have been painted and require treatment. Sandblasting or grinding paint off brick is never recommended for two reasons: (1) large amounts of lead dust are released into the environment, and (2) it is destructive to the brick's protective kiln-hardened outer layer. This exposes the brick to water absorption leading to surface spalling and delamination. It will ultimately damage a building's appearance. Trying to reseal the damaged brick with a highly impervious sealant coating can cause further damage, as it may trap moisture in the brick and delaminate the face of the brick. Recommended treatments include:

- **Rake, Wet Scrape and Paint** – Without extreme care, using a powered grinding wheel to cut out masonry joints can damage brick and spread lead

dust. A wheeled rake is preferred for raking out brick joints. The brick can then be wet-scraped and repainted. Use the highest-grade masonry primer and paint.

- **Chemical Stripping** - Chemical stripping must be done by crews trained to capture all the liquid run off, place it in barrels and dispose of it as hazardous waste. This results in high costs.

D DOORS

Paint stabilization is the preferred treatment for doors. Because poorly fitted and maintained doors can result in friction and paint degradation, this technique should always include a tune up of the door's operation. Addressing the lead paint exposure produced by doors is virtually the same as a standard door maintenance operation.

- The door hinges should be tight.
- The latch should close without pressure or rattling.
- The door should only make wood to wood contact against the stop on the latch side (opposite the hinges).

Following are procedures aimed at restoring proper door operation.

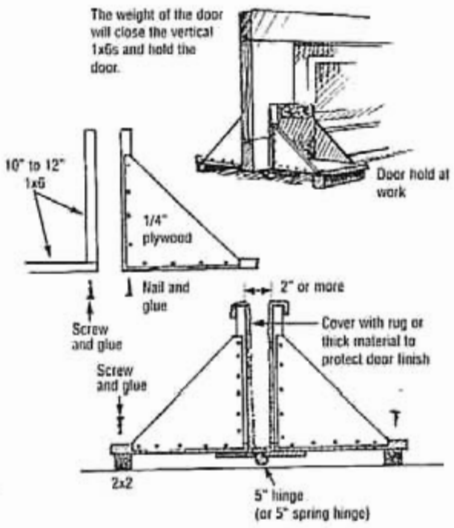
- **Hinges** - Tighten a hinge by removing the screws, inserting a dowel in the old screw holes, and then installing new Phillips head screws (which may also be longer). If door or jamb is severely damaged, hinges may need to be moved and a wooden patch, or "dutchman," installed in the old gains (the depression cut out for the hinge leaf). If the door is crushing on the hinge side, shim out hinges as necessary by sliding tin behind the hinge leaf.
- **Door Edge** - If door binds on the latch side, pull the hinge pins, remove hinge leaf from the door edge, and plane hinge edge. Use a hand plane (or power plane with vacuum attachment) to plane off paint and

chamfer corners. Once the paint is removed, a power planer can be used to complete the trimming operation.

- **Seal** - When repainting, be sure the door is well sealed. Pay particular attention to the end grain of the stiles and the edge that was planed.
- **Closure** – A properly hung door should not rub the stop molding on the hinge edge. If the stop is nailed on, the stop can always be moved. If the jamb is rabbetted rather than nailed on, the hinges can be moved or the contact edge of the jamb can be planed with a rabbet plane.

A door that is maintained should never need replacing. If the painted surface is in very poor shape the door can be wet scraped, wet sanded, power sanded with a vacuum attachment, or chemically stripped. Because doors are fairly easy to transport, it's recommended they be stripped off site. Remember, when the stripper liquefies the paint, the dry wood absorbs some of the liquified paint (including lead). It is therefore critical that any sanding, after stripping is complete, be done in full containment with respiratory protection.

A door hold makes working on doors easier and safer.



Door repair jig

E PLASTER - WALLS AND CEILINGS

Plaster is a high quality, durable material. Unfortunately, plaster is often considered disposable and sacrificed in favor of drywall to facilitate the installation of mechanical systems. We recommend avoiding this for the following reasons:

- The demolition of plaster exposes the building environment to decades of dust that has been trapped in wall cavities. Besides lead, this dust may contain rodent droppings, insect ecto-skeletons, coal dust, molds, and other elements harmful to a healthy environment.
- Drywall is a less durable material. It is less resistant to moisture and impact. Furthermore, the paper coating serves as a food source for insects and molds.
- The surface of drywall is more difficult to maintain.

Whenever possible, plaster surfaces should be retained.

Plaster - Paint Stabilization

Wet scraping and repainting is the preferred choice when treating plaster surface. Unlike drywall, plaster is remarkably moisture resistant, and misting the surface will have no harmful effect. Small cracks can be filled, or taped and filled, when necessary. If minor delamination between the plaster and the substrate has occurred, special "plaster washers" are available that can be used to help reattach plaster to lathe and framing.

Plaster - Encapsulation

Where a wall or ceiling's plaster is sound but there is substantial cracking of the surface and/or some delamination in small areas, a mesh system can save the surface. It consists of an adhesive paint into which a mesh is dry brushed, as one would apply wallpaper. A topcoat is then rolled or brushed on and can be painted. The seams of the mesh can be overlapped, cut through at the overlap, and the two scraps removed. The edges will then butt flush to produce an invisible joint. This method is considered an encapsulation technique as compared to an enclosure because the mesh is a flexible, not a rigid, material.

Plaster - Enclosure

Where ceiling plaster is delaminating, a cost effective solution is to laminate thin drywall over the plaster. When installing the drywall, it is critical to find the center of both ends of each ceiling joist. This can be done by sawing toward the joist with a dry wall dagger. Strike the centerline and screw the drywall to the centerline of the joist. The perimeter can then be taped, or even better, covered with crown or cove molding. Another approach is to install nailers fastened to the joists at 16" centers to carry the drywall.

Laminating drywall over existing plaster walls can be more troublesome, as this approach can obscure the reveal, or setback, of casing and baseboards.

Plaster - Replacement

Whenever possible, plaster should be patched and saved. If replacement is absolutely necessary, consider replastering. As discussed above, plaster discourages mold and roaches, which thrive on drywall paper. It is far easier to maintain and repair. It is also far cheaper when life cycle costed, as it can last

hundreds of years when kept dry. If replastering is prohibitively expensive, you can install a veneer board system. Veneer board is preferable to drywall as it is more dense, is finished with a real plaster topcoat, and provides a more appropriate appearance.

- **Outside Corners** - Outside corners of walls can be protected with square or turned corner guards that are attached with nails or mastic.

F FLOORING

Floors - Paint Stabilization

Where the floor is in good condition, even if it is painted with a finish containing lead, it can be cleaned and preserved or repainted. To protect it from abrasion use area rugs, hall runners and "leg coasters" under the feet of furniture to prevent scratching.

Floors - Paint Removal

Sanding floors with lead paint, shellac or varnish is so toxic it makes sense to determine if the coating contains lead. Where there is thick paint this can be done with a chip test. Where there is a thin finish, sand a few square inches of the finish and take a wipe sample of the dust. (See Appendix A for chip and wipe tests.)

Where the paint is lead it may be possible to attach a high efficiency vacuum to the exhaust port of the floor sander. Even with a vacuum attachment, however, this work must be done in complete isolation with full respiratory protection. On

a job larger than a single family home or apartment, it is recommended the first day of work be air-monitored to determine the effectiveness of worker protection.

Staircases

Where stairs are painted with lead paint, the constant friction of traffic might produce lead dust. For formal and significant stairs a stair runner in the central stair tread area will solve the problem. For commercial or non significant stairs, heavy-duty vinyl tread covers with a metal tread nose would protect the treads and prevent abrasion. This solution protects and retains the historic treads, though it covers the tread visually. A similar, low-cost (but not historically or aesthetically appropriate) solution would be to cover the risers with ¼" luan plywood.

Wall-to-Wall Carpets

Wall to wall carpeting can be highly problematic. The dirt embedded within the fibers and backing can contribute to lead poisoning, respiratory disease, and chemical sensitivity. Lead dust, molds, and organic matter accumulate in carpeting. Some wall-to-wall carpet also contains toxic chemicals from the fabric, or from carpet cleaners, as well as the mastics used for insulation. Surface cleaning does not remove the accumulated material deep within, or under the carpet. Wall-to-wall carpet should never be wet cleaned. It ruins the stretch, degrades the backing, and encourages the growth of bacteria and mold. Completely removing accumulated lead dust from carpet is impossible. Most lead remediation projects remove the carpet. Replacement with more easily cleaned surfaces (i.e., the original wood floor) is recommended.

G TRIM

Most trim can simply be wet-scraped and repainted. Leaving paint that is tightly bound to the wood may leave an uneven surface. Filling and sanding is usually the most practical solution. Wet sanding sponges, wet/dry sandpaper, or vacuum assisted orbital sanders can be used to feather edges.

- **Outside Corners** - Where outside corners are chipped from impact, they can be planed, wet-scraped and repainted or protected with corner molding.
- **Baseboards** - Where baseboards show signs of impact from furniture, traffic, vacuum cleaners, etc. they can be protected by attaching lattice strips as bumpers. This is a reversible treatment that can be valuable in buildings where young children are at risk. Sometimes all that is needed is to replace the shoe molding. When installing new shoe molding it is recommended to bed the molding in a bead of caulk. This will help keep out dust and insects, and on outside walls it will cut down on air infiltration.

H WINDOWS

Window treatments have many options in both rehabilitation and lead hazard control work. The issues surrounding design decisions—energy, lead safety, maintenance, life-cycle cost, and performance—are complicated, and often poorly understood. Because so many lead safety projects are currently specified with new replacement windows, this section of the manual has been expanded to carefully enumerate the specific window treatments that accomplish the goals of historic preservation, as well as lead-safety. They are mutually reinforcing goals. Regardless of whether a specific project is begun as a general renovation or a specific lead-safety project, the completion of a window restoration program improves the physical, aesthetic and historic qualities of a home or building.

Evaluating Window Condition and Performance

Windows have been targeted as an architectural element that requires special lead hazard treatment because of the statistically high levels of lead-dust found in window troughs and sills. These high levels result from a number of conditions, including lack of maintenance, general exterior paint degradation, high lead levels in the soil surrounding the house that is blown into and deposited in window troughs, and friction surfaces on the windows themselves.

Windows, like any other piece of movable equipment, need to be maintained to continue to perform effectively. While there are few movable parts in a window, the narrow dimensional tolerances in which windows must perform mean that very slight changes can affect their fit. The most frequent and common problem with older double-hung sash is the fact that the upper sash doesn't operate at all, and the lower sash operates with some difficulty. The second most common problem is the lack of a tight fit for the sash that does operate, which results in air leakage and cold drafts during the winter. Deferred maintenance of the painting (both interior and exterior) or too many coats of paint are issues that require the use of special paint preparation and/or paint stripping. In addition to the finish issues, the sash cords, pulleys, and weights can come undone, which limits the operability. Rotting wood sills are also a frequent complaint, as the horizontal projecting sill has the most severe weather exposure particularly where a storm window frame has trapped water. For window sash that have received very little maintenance, the actual joints in the sash can come loose, particularly at the lower rail of the bottom sash. A probe with a sharp metal object is enough to determine if the overall wood thickness shows much deterioration. The exterior glass is often installed with glazing putty, which becomes brittle over time and requires repair or replacement

The treatments needed to address these deficiencies are basically the same treatments needed to restore a window to its original integrity of design and performance. With the addition of weather-stripping and in some cases storm windows, a restored window can perform as well as a new window. It will also last longer than a new window. The typical replacement sash sold today has a twenty-year life expectancy to the operating mechanism and a thirty year life expectancy for the insulated glass. Most historic window sash have already lasted 75-100 years and once restored they will last this long again. Most old wood windows can be restored and made lead-safe with a resulting appearance, durability and operability that is equal to or better than a new window. The tools and techniques to do this work are not complicated. They are labor intensive rather than materials intensive. From a social perspective this keeps more dollars in the local economy.

Life-cycle Cost Analysis

The initial cost of any window rehabilitation treatment or replacement sash does not reveal the true cost of this work, which is a combination of initial costs and expected future costs. The future costs will include the annual energy costs, maintenance costs and the initial cost of borrowing money to pay for capital expenditures. A Vermont study provides an excellent summary of the variable energy costs for winter heat losses. Future maintenance costs are determined by quite a number of variables, but there are several tradeoffs between traditional painted sash and new pre-finished systems. Two case studies that were reviewed by the IHPA found that the long term operational costs between traditional painted wood sash and new pre-finished sash were not much different. For traditional wood windows, the painting was the most expensive maintenance cost. For new, pre-finished sash the replacement cost of slide balances, (twenty-year life expectancy) and insulated glass (thirty-year life expectancy) were the most expensive costs. In two major Illinois life-cycle window studies, the time frame for repainting a wood window was debated. A seven to ten year cycle is typical for most

existing facilities. However, if the sash is totally stripped of existing paint, an initial life expectancy of fifteen years is appropriate when high quality primers and paint are used. The use of exterior storm windows should extend the painting cycle.

Consideration of window operation should be a component of life-cycle cost analysis. The technical simplicity of the weighted balance system of sash has a proven long-term durability. In most new windows, the sash now operates on two metal "slide balances" with springs in a metal tube. The typical warranty for these systems is ten years, and their life expectancy is only twenty to thirty years. A life-cycle study of new windows with these operating systems would replace all the springs every twenty years. For extremely large window sash it is virtually impossible to use the slide balance systems, while the chain and weight system can handle any size. For sash with tilt systems that open for periodic cleaning, there is a similar twenty to thirty year life-expectancy for the operating mechanisms.

Energy conservation

Window advertising is filled with many claims, but one has achieved mythical proportions, and must be addressed. Ever since the oil crisis of the 1970s, Americans have become justifiably concerned about energy costs and the need for energy conservation. Window manufacturers have exploited this legitimate concern with substantial claims as to the energy efficiency of new windows. These claims should be analyzed critically. The reality is this: new windows will not pay for themselves in reduced energy costs if the existing wood windows are hung correctly. Windows contribute to 20% of the heat loss in a typical structure, so any claims greater than this should be carefully reviewed.

Insulated glass generally has a warrantee of only ten years. The life expectancy of this material is somewhere between twenty to fifty years. Once the insulated glass seals begin to break down, the space between the two pieces of glass begins

to fog with captured moisture. The condition is not repairable, with the prognosis of complete glass replacement. So, virtually every replacement window sold with insulated glass has a period of obsolescence that will require its replacement again.

Storm Windows

In 1996, the University of Vermont Dept. of Civil and Environmental Engineering and the Vermont Energy Investment Corp. completed a study on energy cost of various types of wood windows and energy conservation treatments. These cost comparisons were based upon a typical double-hung wood window, the kind found on most older and historic houses.

TYPE OF SASH AND ENERGY TREATMENT	ANNUAL ENERGY COST	TREATMENT COST	Payback
Historic, single glazed, double-hung wood window sash	$ 20	$0	$0
Historic, single glazed, double-hung wood window sash with weatherstripping and storm windows	$13	$150	21 yrs
New insulated glass window with integral weatherstripping	$9	$400	36 yrs

A proven and readily available system of energy conservation that is cost effective in initial cost and life-cycle cost is a storm window. For most sizes of double-hung sash, operable storm windows in metal or wood are available at a lower cost than a new primary window. Metal windows with painted finishes that match those of painted wood surfaces are readily available in a variety of colors. Storm windows with self-storing screen and sash add to their convenience. These are now available for wooden storm windows as well as metal. A new technology that is appropriate for storm windows is that of low-E glass. This special glass cost very little more than

regular glass, but greatly reduces the transfer of radiant heat energy. Storm windows do alter the exterior appearance of an historic building by adding a new layer of glass. Most preservation professionals accept this change of character to the building as a reasonable accommodation to modern functional concerns because it is easily reversible, i.e. removable without any permanent change to the building.

Glazing Option for Energy Conservation

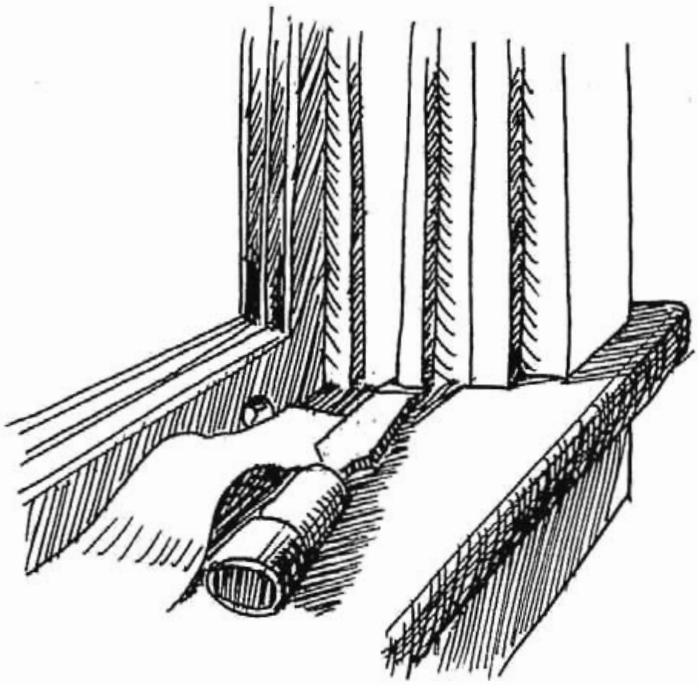
When the sash is at least an inch and three-quarters thick, the exterior side can be routed to allow the insertion of insulated glass. This is done when the sash has been removed from the frame and the paint totally removed as part of an overall restoration. The glass is generally installed with a pre-finished exterior stop that is shaped like the former putty. The other work required for these conversions is the installation of additional weight to offset the weight of double-glazing.

Treatments

The first step in window renovation/restoration is to recognize and correct any major causes of deterioration.

- **Flashing** - The exterior head trim if correctly installed functions as both flashing and drip cap. If not it needs to be flashed to prevent water from running behind or under the header.
- **Window Troughs** - A common problem is water building up in the window trough behind the frame of the storm window. To correct this condition, drill two 3/8" holes in the storm window frame flush with the sill to serve as drain holes.

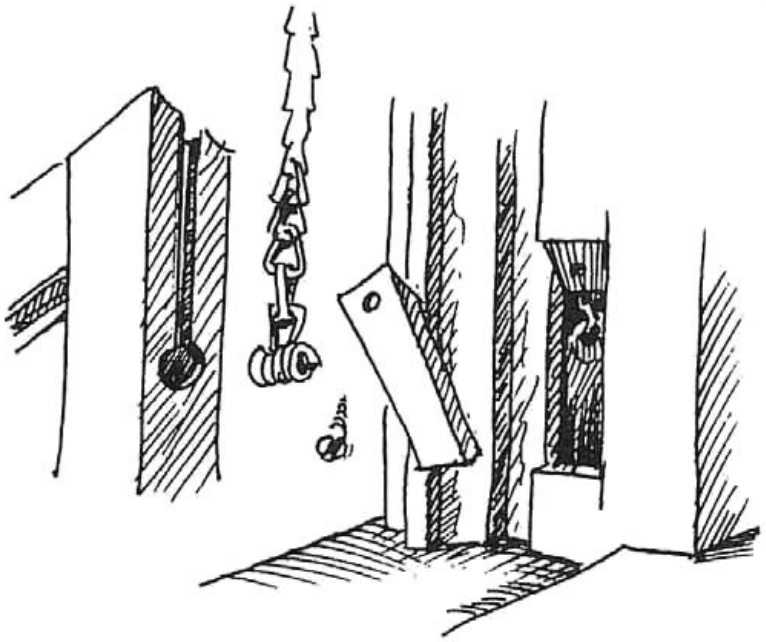
The window trough is often subject to serious paint degradation. In order to be maintainable, the window trough should be smooth and cleanable. One treatment that is cost effective is the installation of a pre-finished metal cover over the sill. The typical material is a 0.020" thick aluminum coil stock. It has no adverse effect on the window performance and little overall visual effect. The coil stock should be set in mastic caulk. A chisel driven under the parting bead and outside stop allows the flashing to slide tight to the jamb or the coil stock can be notched.



Enclosing a window trough with aluminum coil stock

- **Stool (Interior Sill) Treatment** - Where the nose of the stool is damaged, or if it is at a chewable height for resident children, the nose can be planed to maintain its silhouette. The top face can be wet-scraped and repainted.
- **Window Operation** - The typical double-hung window sash slides in two tracks with the assistance of a pair of weights hung from sash cord or chain. The sash cord should last fifty years, but ultimately, these

cords will break and need to be replaced. This task generally requires the removal of the sash from the frame to access the weight pockets. This requires the removal of the inside stop to remove the lower sash, and both the inside stop and parting bead to remove the upper sash. The inside stop, if it has value, can usually be scraped or planed and reinstalled. If the inside stop has no historic significance, replace it after wet-scraping the ridges of paint on the face of the sash and jamb along the old inside stop. Open the weight compartment and rehang the sash on sash chain. Use the spring-like fastener to attach the sash chain to the edge of the sash.



Accessing weight pockets to restore window operation

Fixing the upper sash in place is an option. The operation of the upper sash is rarely needed to meet the requirements for ventilation. Since this sash does not need to operate, fixing it in place allows the sash to be sealed to reduce air infiltration and minimize the cost of making the sash lead-safe or operable. In many cases, the upper sash is essentially fixed in

place from years of painting. Do not use caulk to seal a window shut as it is extremely difficult to remove. Hold the sash in place by screwing a block under the top sash. Do not nail or screw the top sash to the jamb.

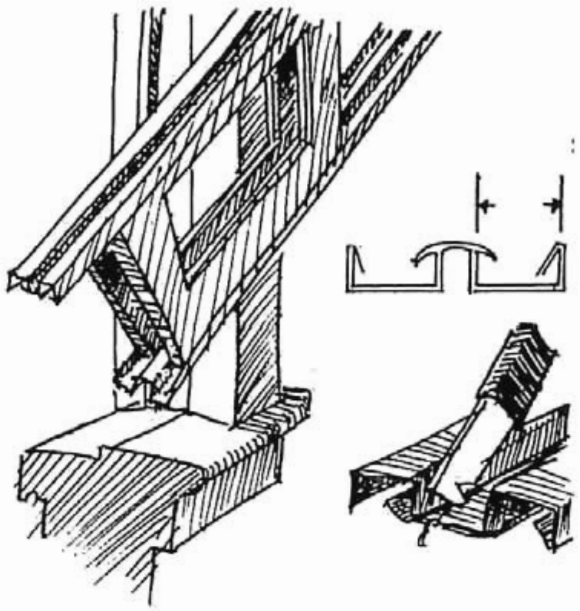
- **Sash Repair** - Older wooden sash are usually made with tight-grained old-growth wood and cabinet grade construction that, if maintained, will far outlast new replacement windows. In many cases, the only sites of degradation are at the bottom of the lower sash. In this area, the bottom rail and the end grain of the vertical stiles are most subject to water damage. Wood epoxy repair or replacement of the bottom rail can solve this problem. Where there is only minor wood rot at joints, a consolidant epoxy system works well for repair. Be sure it is a system that has strong adhesive character and remains flexible. Inflexible epoxy systems will perform poorly. A window in good condition only needs reglazing, wet scraping and repainting. Removing the inside stops and bottom sash allows access to the meeting rail and allows for easier work on the jamb. The top sash can be worked on in-place.

The sash faces can be wet-scraped, power planed or sanded to remove old paint. If power planing or sanding is done, it must be with a vacuum attachment. Sash are portable, so paint removal from sash should be performed in dust room containment.

Once the sash are out it is usually prudent to reglaze them. Old putty can be removed with a router or tool designed to remove old paint that is chucked into a power drill. Some glazing is best removed after softening with a heat gun. A half-face negative air respirator with carbon filters is recommended to protect the worker from lead fumes. Glass should be bedded in a small bead of caulk before reglazing. It is particularly important to seal the end grain of window stiles. The bottom of the bottom sash stile needs the most attention. It is an option to install integral weather-stripping routed into the sash edge, parting bead, or inside stop, a step which

greatly reduces air infiltration and helps reduce friction on painted surfaces.

- **Jamb** – Where the face of the jamb is unpainted, sand and seal. If it is painted the jamb can be wet-planed or wet scraped with the stops and sash removed. If the paint is degrading, or additional weatherization is desired, it can be enclosed with vinyl window channel. These channels insert into the space between the side of the sash and the window frame. Their flat surfaces and angled edges separate the painted wood frame from the sash. They were initially developed to improve energy efficiency and ease the operation of loose fitting older sash, but they have the additional benefit of reducing the friction on lead-painted frames. Combined with lead paint removal on the edges of the sash, the jamb liner is a cost effective method of making window sash lead-safe. The friction on a jamb liner should not be counted on to hold the sash open. The friction-fit jamb liner can be cut off below the pulley so that the weight and chain system is still operational. This is the preferred method, and is particularly appropriate for larger size sash. When the top sash is fixed in place, and only the bottom sash will remain operable, it is possible to cut vinyl sash liner in half for this treatment.



Installation of a jamb liner

- **Replacement of Window Components** - Where the sash are beyond repair then they can be replaced with new, matching wood sash. In some cases only the bottom rail requires replacement. A local millwork shop can mill replacement pieces to order.

Windows - Conclusion

In many parts of the country, the annual expenditure on building repair and renovation exceeds that of new construction. The expenditure on windows is a major component of a facility renovation. While the marketplace promotes the purchase of new windows, for historic structures, the option of window restoration is aesthetically, historically and economically appropriate. Most historic homeowners are already pursuing this option, as the retention of historic windows and the installation of storm windows is the typical homeowner's choice. Original wood windows, with their cabinet-grade construction, environmentally irreplaceable old-growth wood and authenticity are worth preserving. Maintaining these windows also brings with it the responsibility to keep them from becoming a lead paint hazard in our homes. The goal of lead safety is another essential element in any window renovation project. Properly renovated and maintained, a hundred-year-old wood window will last another one hundred years or more. A sample specification for window repair follows.

Sample Window Work Order

Disassembly

1 Place 6 mil polyethylene extending 5 feet in all directions from the window. Tape polyethylene to the base of the wall.

2 Fix top sash in place with ¾" angle iron or wood block screwed to the jamb.

3 Score around interior stop and remove. Interior stop can be discarded.

4 Remove lower sash. Lower sash should be brought to contained dust room for restoration.

Lower Sash

1 Power plane or sand with vacuum attachment or wet scrape lower sash to remove unstable paint. Remove the paint from fiction edges (where the sash meets or rubs against other window components) at least ½" on all sides.

2 Feather edges with dampened sanding sponge or vacuum assisted orbital sander.

3 Apply a good quality primer to the lower sash.

4 Remove old glazing and reglaze sash, bedded in a thin bead of caulk with existing glass. Replace any broken glass panes as required.

Upper Sash and Trim

1 Mist all surface with water and scrape off loose paint.

2 Feather paint edges with dampened sanding sponge.

3 Provide for a smooth and cleanable window trough. Wet sand, or install aluminum coil stock to window trough.

Assembly

1 Open sash weight door and repair counter weight system as necessary.

2 Fit window channel for bottom sash with vinyl jamb liner equipped with integral weather stripping. Cut channel below pulley so sash weight pulley system can continue to be used.

3 Install lower sash and vinyl jamb liners.

Finishing

1 Apply a quality primer and top coat to all components before installation.

2 Fold polyethylene inward, remove and wet clean floor.

I ARCHITECTURAL METALS

Architectural metals are often found in commercial buildings in the form of pressed tin ceilings and cast iron exterior decoration. These metal building components were often painted. If the paint shows some signs of deterioration, the recommended treatment is the same as for most other building components – wet scraping and repainting.

In some cases, as a result of severe paint deterioration or aesthetic choice, more thorough paint removal is desired. This is a situation where developments in the lead abatement industry may be helpful. There has been considerable focus on large steel structures, such as bridges and water towers, in the lead abatement industry. Shrouded power tools specifically designed for paint removal from steel structures have been designed. These tools include needle guns, peeners, and shrouded vacuum, assisted abrasive blasters. Appendix E has a list of manufacturers of this equipment. Distributors will often lend out some equipment to contractors to test for tool performance for a particular application. A testing phase is always recommended.

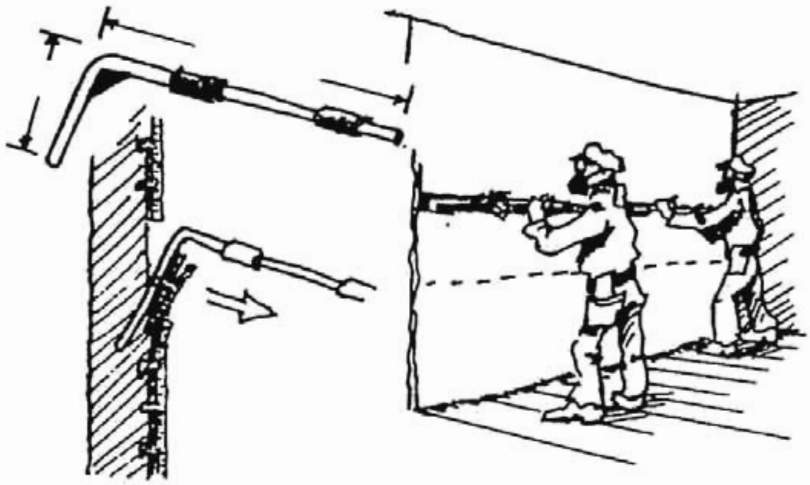
If the paint removal job is large, this is a part of a project that may benefit from hiring a specialized subcontractor. There are contractors with considerable experience in removing lead paint from painted metal surfaces.

J DEMOLITION AND DECONSTRUCTION

Demolition implies tearing a building down, usually with the most expedient method. Deconstruction is an alternative that focuses on taking a building apart. To the degree possible

demolition should be replaced with deconstruction for several reasons.

- As it is a gentler process, it creates far less environmental risk, neighborhood exposure, and ground contamination.
- The material saved can be used in other restoration, particularly historic restoration work.
- Deconstruction can generate economic opportunities in the areas of processing, manufacturing and sales as many materials have value for other uses. For example, old growth lumber found in beams can be used for furniture manufacturing.
- Again the dust created by demolition can be toxic as it may contain:
    - Lead and other heavy metals
    - Molds, some of which are toxic
    - Vector residue (roaches, dust mites, rodents) containments
    - Asbestos, horse hair and fiberglass fibers
    - Plaster, coal and other accumulated dust.
- The highest risks occur when a wall and ceiling cavity is opened – tearing out baseboards, window and door casing or plaster walls and ceilings.
- Where plaster walls must be removed, dust is kept to a minimum by channeling the wall and pulling from behind the lath, so that large sheets of wall fall face down on the floor. The lath is then gathered and bundled. The plaster is misted and shoveled up.



Deconstructing a plaster wall

- Whenever possible pull nails with a nail puller or cut with a reciprocating saw so structures come apart easily.
- Pull finish nails out of the back of moldings or cut them off with front-end nippers
- Do as much demolition work as possible in the shortest time possible then clean up so workers can take off respirators.

Where demolition is done in an occupied building it must be completely isolated from the occupied spaces.

K SPECIFICATIONS

The best guarantee for performing a lead-safe rehabilitation project is close communication between project designer and contractor. Lead-safe goals and procedures must be familiar to both parties to the project. Problems will occur if this knowledge is lacking by either party:

- If the contractor is aware of lead safety and the designer is not, the contractor will have difficulty obtaining the bid, and if the successful bidder, will regularly have to explain setup, scheduling, and occupant coordination requirements.
- If the designer is aware of lead safety and the contractor is not, it is likely that bid specifications will scare off an otherwise qualified rehabilitation contractor. Projects have ended up in the hands of lead abatement firms for this reason.

The level of understanding must go beyond written specifications; designers should not expect that preparing lead-safe specifications will ensure a properly run and designed project. Lead-safe rehabilitation demands a closer-than-usual relationship between designer and contractor.

9 PROJECT SCHEDULING

Principles

- When generating dust, expose the fewest workers to the least amount of dust for the shortest possible time.
- Combine dusty activities as much as possible.
- When working in occupied buildings, schedule work in phases. This will require cooperation with the occupants in order to isolate work space while maintaining necessary access.

Project scheduling is where the understanding of lead-safe work practices—containment, worker protection, treatments, site setup, and cleaning—comes together. Thoughtful scheduling allows for the most efficient and cost-effective rehabilitation project.

The procedures and precautions discussed in the previous chapters represent an extra investment in time and effort when performing a rehabilitation project. The extra focus on dust control and thorough cleaning that assures a lead-safe project will result in some extra cost. With careful scheduling, however, the extra cost can be marginal. When performing lead-safe building rehabilitation, the goal of scheduling is to maximize the effectiveness of lead safe procedures and productivity, while keeping costs to a minimum.

The first step in project scheduling is to identify the activities and locations in a project that will generate substantial lead dust. To the greatest extent possible, bundle dirty activities together. This accomplishes several purposes:

- It consolidates the time when workers will require respiratory protection. Remember, the goal of worker protection is to minimize the need for respiratory protection. The less time workers are in respirators, the more productive they will be.
- It consolidates the point when major cleaning will be required. This can eliminate several intensive cleaning periods, and save considerable time.
- It shortens the periods when full containment and isolation is required. This improves site access for all workers.

The second major consideration regarding project scheduling occurs when working in an occupied space. To meet the challenges of working in an occupied space, schedule the work in phases. A project can be divided spatially into two or three phases, with each phase performed in isolation from any occupied spaces. This allows dusty work, and the resultant containment procedures, to proceed without subjecting occupants to hazardous conditions. Remember, it is advisable to do dust wipe sampling following dusty work phases to ensure that the site is clean before breaking containment. This is particularly important when working in an occupied building. This is doubly important if the occupied facility includes young children.

When scheduling phases, it is important that the needs of both the workers and occupants be addressed. This will require some cooperation and communication between the contractor and the owner. In a commercial or institutional setting, occupants will need access to restrooms and means of egress must be maintained. A residential setting can be more challenging. Residents will need access to bedrooms and a bathroom each evening. If the kitchen must spend time in containment, a temporary kitchen can be set up with a refrigerator and a hot plate. For workers, the areas presented in Chapter 6, Site Setup, will need to be planned in each phase.

Lead-safe rehabilitation is a cooperative effort. This fact is demonstrated most emphatically during project scheduling.

All project participants, including design professionals, owners/occupants, and contractors need to understand project goals and safety concerns in performing the project. Because project scheduling involves the coordination of all aspects of lead safety (containment, site setup, worker protection, cleaning, etc.), project management will be enhanced with a broad knowledge of lead issues among all parties to the rehabilitation.

10 ONGOING MAINTENANCE

As we have seen, lead-safe rehabilitation is not about removing all the lead paint from a building. Rather, lead-safe rehabilitation is about fixing existing lead hazards and preventing the creation of additional hazards through careful rehabilitation techniques. This preferred approach is cost-effective, sensible, and compatible with the ideals of preservation. It is an approach, however, that requires a heightened commitment to ongoing maintenance. Whenever lead paint remains in a building, ongoing maintenance becomes an essential activity. A maintenance program designed to prevent the development or recurrence of lead hazards is commonly known as an "In-Place Management" program.

Continued, ongoing maintenance of historic buildings is central to preservation work. This principle is entirely compatible with maintaining a lead-safe building through in-place management. The emphasis on maintenance that in-place management demands should not be considered an outside imposition brought on by an environmental issue, but rather a compelling reason for emphasizing the highest form of preservation and building stewardship.

Principles

Buildings built before 1978 or that are known to contain lead based paint should be monitored regularly for signs of deteriorating paint. Dust sampling is an effective and inexpensive tool for this.

- Maintenance personnel should receive lead awareness training.
- Clean building regularly. Use high efficiency vacuums and wet cleaning techniques.
- When performing repairs minimize and contain the dust and debris. As with all rehabilitation work,
    - Work wet
    - Work clean
- Keep a good record of maintenance and cyclical cleaning activities.
- Maintaining the exterior shell, roof, flashings, gutter, and downspout systems is critical.
- Good building maintenance is good building preservation, good building stewardship and good building management.

A MONITORING BUILDING CONDITIONS

The building conditions and forms of deterioration that can result in failing paint, and subsequently create lead hazards, are detailed in Chapter 3. Whenever lead paint is present, any subsequent occurrence of these conditions can result in a lead hazard. Older buildings (pre-1978) should be inspected regularly for signs of deteriorating paint. If a building has an

existing inspection and maintenance program, it should be updated to ensure that paint condition is a regular component of the inspection process.

With leased residential property, be it single-family or multifamily, maintaining a lead-safe rental unit is a cooperative effort between owners and tenants. Tenants should be encouraged to notify property owners at the first signs of paint failure. In all rental situations, it is important for property owners to establish a regular inspection schedule. All residential units should be examined on an annual basis and at unit turnover (when the unit is unoccupied between tenants). Unit turnover is an ideal time to inspect, clean, and repair rental housing units. Implementing "Essential Maintenance Practices" and Standard Treatments" is strongly recommended (see Appendix D). Landlords have a legal obligation to inform new residents about known lead paint hazards (the Disclosure Rule), and a moral obligation to provide safe housing for their tenants.

From the perspective of childhood lead poisoning, commercial buildings are not as critical as residential buildings (with the obvious exceptions of schools and child care facilities). As with all older buildings, however, ongoing inspection and maintenance are vital to an in-place management program. Commercial properties are also more likely to have a cleaning and maintenance staff with formalized procedures. Paint inspection should be integrated into these procedures.

If the building received a comprehensive lead inspection prior to rehabilitation, knowledge of lead paint's location will prove helpful in determining the risk when paint deterioration is found. In all other cases involving older buildings, assume the presence of lead paint in the absence of specific knowledge.

We have been introduced to dust wipe sampling both in discussing risk assessments and in clearance sampling following rehabilitation work. Dust wipe sampling can also be an affordable method for monitoring the effectiveness of an ongoing maintenance program. This method can be

particularly valuable for residences with young children and child care facilities.

If the inspection indicates that painted surfaces remain intact, in-place management consists of only periodic cleaning. If deteriorating paint is found, repair activities will be required in addition to cleaning. In either case, maintenance personnel should receive lead awareness training.

B TRAINING MAINTENANCE PERSONNEL

As with rehabilitation work, maintenance work that disturbs lead paint can create a hazard for the workers and the occupants of the building. Proper training is important for maintenance workers who may break painted surfaces in the course of their work.

It is recommended that all maintenance workers have a one-day lead awareness training course. EPA and HUD recently developed the "Lead Paint Maintenance Training Program." This one-day program focuses on planning and performing lead paint maintenance jobs, and integrating lead safety into a maintenance program. While designed for maintenance of multifamily housing, the program is applicable to all older buildings. The "Lead Paint and Historic Building" curriculum also provides the necessary information for maintenance personnel.

Custodial workers who perform cleaning functions, and do not disturb painted surfaces, need to be trained in the specialized cleaning methods outlined in Chapter 10 and below. The role of cleaning in an in-place management program is paramount.

C MAINTENANCE CLEANING

When it comes to lead, a clean building is a safe building. Regular, cyclical cleaning is a key ingredient to maintaining a lead-safe building. Without regular cleaning, even a building that experiences few maintenance problems can see an increase in lead dust over time. There are a couple of reasons for this:

- Many neighborhoods have a high lead content in the soil. This is primarily the result of many years of deposits from exhaust fumes of leaded gasoline. Soils in urban neighborhoods and neighborhoods close to busy highways may be particularly lead-laden. Much of the dust that accumulates in buildings is tracked and blown in from the outside, especially in the warmer months when doors and windows are open and occupants are spending more time outside. Concentrations of lead dust can be the worst near the building's windows and doors.
- Even when a building passes clearance following rehabilitation work, there can be lead dust hidden in out-of-the-way places: cracks between floorboards, under the base shoe molding, and other crevasses. Over time, this dust can find its way into the living space.

There have been cases of residences that passed clearance following lead hazard reduction work, but failed dust tests one year later. In those cases, it is often observed that cleaning or maintenance has been seriously neglected.

Cleaning Tools and Supplies

- High efficiency vacuum
- Mops, mop buckets, one bucket wringer
- Commercial cleaner
- Pump sprayer or misting bottle
- Paper towels, disposable rags or washable rags
- Latex gloves

Cleaning procedures in a maintenance program are similar to the cleaning described in Chapter 7, if somewhat less intensive.

- **work wet and avoid spreading dust**
- Because dust enters the house from outside, placing quality walk-off **mats at the entrances** to a building is a good preventive measure.
- Floors should be vacuumed on a weekly basis, ideally with a high efficiency vacuum. Lead dust is very fine, and filters in a standard vacuum will not trap such fine particles. Manufacturers are now marketing a variety of high efficiency vacuums, including homeowner models, whose cost is not much more than traditional vacuums. This will prove to be a wise maintenance investment.
- Hard-surfaced floors should be damp mopped once a month. Use the three container technique described in chapter 7. Change mop heads frequently.
- Clean baseboards, moldings, and trim with a damp rag. Use a spray bottle with cleaning solution to dampen the rag or mist the surface, which avoids contaminating the solution. Change rags when they appear to be getting dirty. Give special attention to corners and where floors meet the baseboard. Either use disposable rags, or collect cloth rags in a plastic bag for laundering. Always launder cleaning rags separately from clothing.
- Pay special attention to cleaning windows, particularly window stools, sills, and where there is a storm window, window troughs. Whether the dust is deposited from the outdoors, or generated by the friction surfaces of

the windows, dust lead levels in window troughs are notoriously high. Use paper towels to pick up any large pieces and discard. Use rags to thoroughly clean the window well and sill as described above. Change rags often. **Do not use the rag you used on a window for other areas.**

Note: While retaining and renovating older sash with paint stabilization techniques is a perfectly acceptable option, it is an option that demands regular cleaning to guarantee effectiveness. Windows should be cleaned biweekly during the warm weather months and even weekly if the window is frequented by young children.

D MAINTENANCE REPAIR ACTIVITIES

Following rehabilitation of an historic building, one would expect fewer repair problems. Over time, however, it is inevitable that problems will arise, and repairs that disturb lead paint will be required. The keys to safely performing maintenance tasks are the same for all rehabilitation — **minimize and contain the dust and debris, work wet, and work clean**. Again, maintenance personnel should have the training to deal with situations that arise.

Planning and performing maintenance and repairs require the same process as rehabilitation work detailed in the previous chapters. The following are specific items that must be considered in planning a maintenance repair:

- Determine the root cause of the problem. Is there a moisture or structural problem that needs addressing in addition to cosmetic repair?

- Determine whether the project will disturb known or suspected lead paint.
- Determine whether the maintenance project will result in a low or high-risk situation.
- Based on the risk level, determine the level of personal protection required for the maintenance workers performing the job.
- Based on the risk level, determine the containment necessary to control the dust and debris generated by the job.
- Determine whether the occupants will be affected. If necessary, arrange with occupants for the protection of personal items. Fully explain to the occupants the nature of the work, and the safety precautions that will be taken. Schedule the project to protect the occupants.
- Determine the cleanup procedures for the project based on the risk level.

If the maintenance project creates a high-risk situation, perform dust wipe clearance sampling at the completion of the job. A visual inspection of low risk jobs will suffice.

For larger maintenance departments that have an existing work-order system, the issues above should be integrated into that system, providing documentation of lead-safe practices.

For most maintenance jobs the risk level will be low, and following the proper procedures will not significantly increase the time or cost of the work. Examples of low risk maintenance include:

- Replacing or repairing door and window hardware.
- Repairing and rehanging doors.
- Reglazing windows.
- Patching small holes in walls or ceilings (less than two square feet).

Examples of maintenance projects that can constitute a moderate or high risk include:

- Patching and repairing lead-painted surfaces greater than two square feet.
- Sanding and refinishing floors.
- Cutting into wall, floors, and ceilings to access and modify mechanical systems.
- Any other case where significant dust will be generated, or large areas of lead paint will be disturbed.

E RECORD KEEPING

Property owners should keep all records associated with maintenance activities. Logs should be kept of all routine, cyclical cleaning activities. Work orders related to repair activities that document the considerations and steps taken toward lead safety should also be kept on file. On substantial repair projects that required clearance dust wipe testing, saving the clearance test results will be valuable for both the owner and future occupants.

11 Lead Paint in Historic Buildings: Authors

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Dennis is the director and founder of Community Resources, which designs and implements projects that focus on solving urban environmental problems. The foundation for these solutions is creating community controlled, economically sustainable programs.

Dennis has served on EPA's Title X Lead Paint Hazard Reduction and Financing Task Force. He was an author and illustrator of the EPA Lead Worker and Risk Assessor Curricula and the National Institute of Building Sciences' Guide Specifications for Reducing Lead Paint Hazards.

His publication, *Maintaining a Lead Safe Home*, was chosen by HUD to be placed in all main libraries across the nation.

Dennis has developed training programs in the areas of lead prevention, historic building maintenance, healthy homes protocols, window restoration, building deconstruction and weatherization. His greatest interest is in developing community based and controlled delivery systems for restoring and maintaining healthy homes. He has been a union carpenter since 1972 and applies his hands-on knowledge of contracting and building skills to his teaching and writing. Dennis received his MFA from Ohio University in 1966.

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Jeff came to the Building Reseach Council (BRC) from a career in historic preservation, contracting, building rehabilitation, and museum work. At the BRC Jeff has worked on numerous research projects relating to building performance. Jeff has been an active contributor in the studies at the Building Research Laboratory involving thermal and moisture transmission in light frame construction and the effects of passive ventilation. He is the principal investigator in a study focusing on the prevention of freezing and bursting water pipes.

Jeff is currently involved in the issue of lead based paint hazards in housing. He works with the Illinois Department of Public Health in developing "Get the Lead Out," Illinois' Lead Based Paint Hazard Reduction Program, and does the research, analysis, and evaluation of that program. He developed and performed training on lead paint for the BRC's continuing education series for architects. Jeff is also active in local preservation issues in his community. He has a B.A. in Mathematics from Cornell College.

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Carol Dyson works in the Architecture Section of the Preservation Services Division of the Illinois Historic

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Carol also teaches part-time at the School of the Art Institute of Chicago, Historic Preservation Program. Previously she worked in Washington DC as a Deputy Regional Historic Preservation Officer for the General Services Administration and also for a private preservation architecture firm in Ohio. Carol received her Master of Architecture degree from the University of Illinois at Urbana-Champaign.

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Mike holds degrees from the University of Illinois and Columbia University. His professional experience includes work in New York City and New Orleans as well as communities across Illinois. He is a visiting professor of

architecture at the University of Illinois at Urbana-Champaign and an active lecturer on historic preservation topics.

Bibliography

Carey, Daniel and Chase, Charles. "Lead Paint. Another Preservation Roadblock?" *Historic Preservation Forum News* I, no. 6 (1995).

"Coping with Contamination: A Primer for Preservationists." *Information Booklet No. 70.* Washington, DC: National Trust for Historic Preservation.

"Get the Lead Out, Renovation, How to Safely Remove Old Paint." Springfield, Illinois: Childhood Lead Poisoning Prevention Program, Illinois Department of Public Health, 1994.

Gordon, Jeff and Dyson, Carol J. "Making Historic Windows Lead-Safe." *Window Rehabilitation Guide for Historic Buildings.* Washington DC: Historic Preservation Education Foundation. 1997.

Guidelines for the Evaluation and Control of Lead Paint in Housing. Washington, DC: U.S. Department of Housing and Urban Development, 1995.

Lead Paint Safety: A Field Guide for Painting, Home Maintenance, and Renovation Work. Washington, DC: U.S. Department of Housing and Urban Development, 1999.

Lead Paint Maintenance Training Program, National Environmental Training Program. Prepared under USEPA grant CX-824712, 1997.

Lead Paint Training Program for Remodelers and Renovators, Washington, DC: US Department of Housing and Urban Development, 2000.

Livingston, Dennis. *Maintaining a Lead Safe Home, A Do-it-Yourself Manual for Home Owners and Property Managers.* Colortone Press, Landover, MD, 1997 Call 410 727-7837.

MacDonald, Marylee. "Getting Rid of Lead," *Old House Journal* (July-August 1992).

OSHA Lead in Construction Standard (29 CFR 1926.62), Occupational Safety and Health Administration, May 4, 1993 (Federal Register).

The Painter, Gilder and Varnisher's Companion, 16th Ed. Philadelphia, Pennsylvania: Henry Carey Bard & Co., 1886.

Park, Sharon C., and Douglas Hicks. *Preservation Brief No. 37: Appropriate Methods for Reducing Lead-Paint Hazards in Historic Housing.* Washington DC: U.S. Department of the Interior, National Park Service, Interior, 1995.

Park, Sharon C. "What to Do About Lead Paint, New Guidelines Coming Soon," *CRM [Cultural Resources Management]* 17, no.4 (1994).

"Putting the Pieces Together: Controlling Lead Hazards in the Nation's Housing." *Report of the lead Paint Hazard Reduction and Financing Task Force.* Washington, D.C.: U.S. Department of Housing and Urban Development, 1995.

Radford's Cyclopedia of Construction, Carpentry Building and Architecture, Volume 10: Painting, Interior Decoration, Paperhanging. Chicago, Illinois: Radford Architectural, 1921.

The Secretary of the Interior's Standards for the Treatment of Historic Properties. Washington DC: U.S. Department of the Interior, National Park Service, 1992.

Title X (Residential Lead Paint Hazard Reduction Act of 1992) of Housing and Community Development Act of 1992 (P.L. 102-550), 28 October 1992.

Appendix A
Lead Testing

Contents:

Introduction

Chapter 4, Evaluating a Building for Lead, introduced six tests for lead content which can be used during lead inspections or risk assessments. As indicated in Chapter 4, three of these tests can be very useful when performing a rehabilitation project. All three of these tests involve taking samples for laboratory analysis. This appendix presents instructions for performing these tests. **Remember: Familiarity with these tests and instructions does not qualify anyone to perform Lead Inspections or Risk Assessments or Clearance Tests. These tests can, however, provide valuable information for performing lead-safe rehabilitation.**

A-1 DUST WIPE SAMPLING

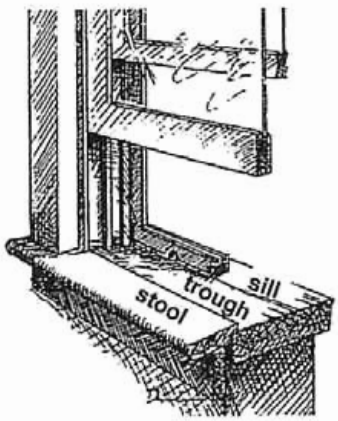
Dust wipe sampling is the most useful testing tool for performing lead-safe rehabilitation evaluation. As indicated in

Chapter 4, there are four points in a rehabilitation project when dust wipe sampling can be helpful:

- Prior to any construction. To establish baseline conditions.
- During construction. To monitor containment and in-process clean-up procedures' effectiveness.
- Testing at the completion of the work. To ensure a safe environment upon completion.
- After occupancy to monitor conditions. As part of an on-going maintenance program.

Where to take samples

Dust wipe samples are typically taken from three horizontal surfaces: floors, window stools (interior window sills), and window troughs.



Dust Wipe testing surfaces on a double-hung window

Generally, floor sampling will be the most useful. If a rehabilitation project involves the restoration of windows, the window tests will also be helpful. Third party clearance testing will typically involve all three types of surfaces. The standard place for floor sampling is under a window away from the wall.

Following are instructions for taking single-surface dust wipe samples.

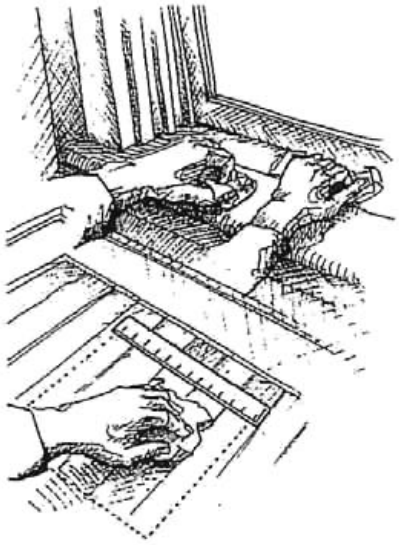
Materials you will need

- Baby Wipes- Separately packaged hand wipes are most convenient. Thin wipes that pull through a hole in the top of the container also work. Avoid baby wipes that are scented or that contain alcohol, or hand wipes.
- A centrifuge tube to hold the sample. These are available from the lab you use to analyze the samples. It is also possible to use freezer zip lock bags.
- Disposable gloves.
- A ruler, tape measure, or template.
- Fine point permanent marker.
- Masking tape.
- A form to record and identify the samples. Keeping track of the type, size, and location of the sample is critical. A sample form is included for dust wipe samples. Most labs will provide submission forms. See page A-10.

How to take a sample

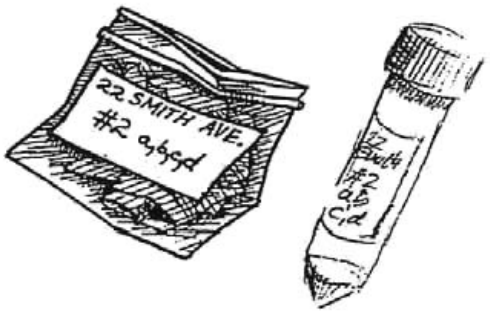
- Remove the hand wipe from its package or throw away the first wipe sticking out of the container. (It could be contaminated by previous exposure.)
- Lay template on floor or measure a one foot square area (12" x 12"). It can be marked off with masking tape. Careful measurement is important.
- Wearing disposable gloves, wipe the square in one direction. Use a side-to-side motion with an even pressure. Wipe the entire square surface.
- Fold the wipe dirty side in, and wipe the square in the same fashion but in the opposite direction.
- Place the wipe in the centrifuge tube or zip lock bag and label the sample with the forms' sample number, (see p. A-10) and the address in case it gets separated from its paperwork keeping a record of the location and type of sample.

- Mail to laboratory. The lab you use may have specific forms or transmittal sheets to help you track your sampling.



Dust wipe sampling

If you are doing more than one sample, change to a clean pair of disposable gloves and repeat the procedure. Changing gloves may not be necessary when the sample is not for clearance. When doing windowsill and window trough samples, you cannot measure a 12" x 12" square. In those cases, measure the dimensions of the area to the nearest ¼" and record it. These dimensions will be used to convert the test results.



Samples prepared for laboratory submission

Composite samples

These instructions apply to single-surface samples. Composite samples (with up to four samples in a tube) may be used as a cost saving measure. Each of the four locations in each tube must all be from the same building component; all from the floor or all from stools, etc. A composite sample will only give you an average reading among the locations. If a composite sample comes back positive for lead, the exact location of the hazard cannot be determined without additional single surface testing. For rehabilitation purposes, where specific knowledge is being sought, single surface sampling is recommended.

Where to send the sample

Samples can be sent to any NLLAP accredited laboratory. A list of accredited labs can be obtained through the National Lead Information Center clearinghouse (1-800-424-5323). Look for a lab that charges a moderate amount and has a short turnover time. There are accredited labs that charge about $5 per dust wipe sample. A list of some of the national laboratories is included in Appendix E.

Interpreting the results

Dust wipe tests are recorded in micrograms per square foot ($\mu g/ft^2$). Exactly what level of lead in dust is safe is debatable. The only recognized guidelines are the clearance levels established by HUD. They are:

- Floors: below 40 $\mu g/ft^2$
- Window stools: below 250 $\mu g/ft^2$
- Window troughs: below 800 $\mu g/ft^2$

These are the maximum acceptable levels after lead hazard reduction work has been done and a building is cleaned. Renovation work should strive to achieve these "safe levels." Levels that are above the current clearance levels are certainly dangerous for children.

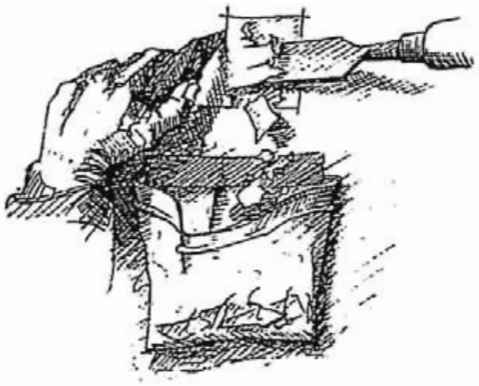
A-2 PAINT CHIP SAMPLING

Paint chip sampling is used to determine the lead content of surfaces that will be disturbed in the course of the project (i.e. removed, scraped, sanded, or demolished). If these activities take place without sampling, one should always assume the presence of lead paint. Paint chip sampling is accurate, but it does damage the surface you are testing.

Following are instructions for taking single-surface paint chip samples.

Materials you will need

- Tape measure
- Sharp utility knife
- Chisel
- Baggie
- Masking tape
- A form to record and identify the samples



Paint chip sampling

How to take a sample

- Measure an area about 2 inches square on the surface you want to test.
- Tape a baggie to the surface below the area to be sampled so to hold the bag open.
- Cut the four edges through all layers of paint with a utility knife.
- Remove all of the paint down to the substrate with a chisel. If the paint is difficult to remove, the painted area can be heated with a heat gun first. Note: do not burn or vaporize the paint.
- Close the baggie and label the sample. Keep a record of the location and type of sample.
- Clean up the dust you have created with a damp paper towel.
- Mail to laboratory. The lab you use may have specific forms or transmittal sheets to help you track your sampling.

Where to send the sample

Samples can be sent to any NLLAP accredited laboratory. A list of accredited labs can be obtained through the National

Lead Information Center clearinghouse (1-800-424-5323).

Interpreting the results

Anything over 0.5%, 5000 μg/g (micrograms per gram), or 5000 ppm (parts per million)is considered to be lead paint. Some historic paint contained up to 50% lead.

A-3 SOIL SAMPLING

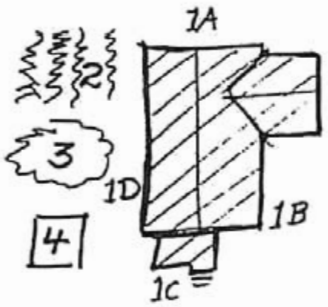
Soil sampling can be helpful whenever a rehabilitation project involves extensive exterior work, particularly paint preparation and repainting. As with dust wipe sampling, it is helpful to know the baseline conditions prior to work. Project managers should also want to test upon project completion to ensure that a hazardous condition was not created.

Following are instructions for taking soil samples.

Materials you will need

- A garden trowel
- Baggie
- A form to record and identify the samples.

Typical residential site plan for soil sampling



How to take a sample

Prepare a plan of the site, and indicate on the plan the location of the samples.

A sample can be from one location, or a composite from several locations. A composite sample will only provide you with an average reading from the various locations. (If an area is frequented by children, such as a sandbox or swing set, a sample from that single location should be tested separately.) Composites are often taken from locations around the foundation, or "drip line," around the building.

- Scoop up about two tablespoons of soil gathered from the top ½ inch of soil.
- Place the soil in a zip lock baggie.
- Label the baggie with the address of the site, and the location matched with the site plan.

Where to send a sample

Samples can be sent to any NLLAP accredited laboratory. A list of accredited labs can be obtained through the National Lead Information Center clearinghouse (1-800-424-5323).

Interpreting the results

No specific standards exist that define the lead levels that constitute a hazard in soil. EPA has recently proposed the following standard:

- bare residential soil – 2000 ppm.
- In areas frequented by children, or in other "high contact" areas like gardens, HUD recommends a level of no more than 400 ppm.

A-4 Sample Submission Form

DUST SAMPLES

Street Address / Apt. Number: _____
City, State, Zip: _____
Owner Name: _____ Owner Phone Number: _____
Occupant Name: _____ Occupant Phone Number: _____
Are there children under seven years present? _____
Is there peeling paint in the unit? _____
If yes, how much and where? _____

Fax results to: _____
Mail results to: _____

Check desired turn around time: 7 days____ 3 days____ 24 hours ____

LAB: Please enter results in this column

SAMPLE NUMBER	IF COMPOSITE	NAME OF ROOM	BUILDING COMPONENT (floor, trough, stool, etc.)	DIMENTION OF SURFACE SAMPLED	CONDITION ↙ SMOOTH	↙ ROUGH	↙ CARPET	LAB RESULT µg/ft²	ABOVE ↙ CLEARANCE
1	a b c d			" x "					
2	a b c d			" x "					
3	a b c d			" x "					
4	a b c d			" x "					
5				" x "					
6				" x "					
7				" x "					
8				" x "					
9				" x "					
10				" x "					
11				" x "					
12				" x "					

EPA Standards are: 50 µg - Floors, 250 µg - Stools, 800 µg - Troughs

As is dust test ☐ Post work dust test ☐
Total number of samples _____
Date of sample collection __/__/__ Date Shipped to Lab __/__/__
Shipped by _____ Results received by _____ Date __/__/__
Signature Signature

CHIP SAMPLES

SAMPLE NUMBER	LOCATION OF SAMPLE	SIZE	SURFACE SAMPLE	TO SUBSTRATE	PAINT CONDITION ✓ SOUND	CRACKED	FLAKING	DELAMINATION	SUBSTRATE FAILURE	STRUCTURE FAILURE	LAB RESULTS mg/cm² or %	ABOVE STANDARD ↙
1												
2												
3												
4												
5												
6												

Paint is classified as lead paint if it is over 1.0 mg/cm^2 or 0.5% (also 5,000 ppm or 5,000 ug/g).

SOIL SAMPLES

SAMPLE NUMBER	IF COMPOSITE	LOCATION (see plan)	CHILD'S AREA ↙	NEXT TO HOUSE ↙	DISTANCE FROM HOUSE (in feet)	BARE ↙	COVERED ↙	LAB RESULT ppm	ABOVE STANDARD ↙
1	a b c d								
2	a b c d								
3	a b c d								
4									
5									
6									

HUD Interim Standards: 400 for children's play area, 2,000 for building perimeter and yard.
If over 5,000 cover or remove.

The recommended treatment for elevated soil levels is to cover the bare soil with sod grass or wood chips. At very high levels (5000 ppm or greater), the recommended treatment is to completely remove the top few inches of soil, or cover the soil in a permanent manner (such as concrete).

Appendix B

Historic Preservation Regulations and Guidelines

B-1 THE STATE HISTORIC PRESERVATION OFFICER

Each State, Territory, and the District of Columbia, has a "State Historic Preservation Officer" (SHPO). The SHPO in your State can provide many important services to local governments and historic preservation commissions.

The SHPO is designated by the Governor. In some States he or she serves directly in the Governor's cabinet or executive office. In other States the SHPO may be an official in an archives and history office, a planning department, a conservation department, a parks and recreation department, a State historical society, or a State museum.

Under NPS regulations, each SHPO must be assisted by a staff of appropriate preservation professionals, in most cases historians, architectural historians, historical architects, and archaeologists. Many SHPO's are also assisted by academic institutions, historical and archaeological societies, and other preservation-oriented groups through contracts or cooperative agreements.[1]

[1] Adapted from *Local Preservation: Questions and Answers about the "SHPO"*, National Park Service, Interagency Resources Division, Washington, DC by Patricia L. Parker, May 1987.

Your SHPO's office is a good starting point for information regarding historic buildings and preservation programs. Most SHPO offices have a staff architect who is familiar with these issues.

For an up-to-date list of SHPO's, with addresses and telephone numbers, contact:

The National Conference of State
Historic Preservation Officers
Suite 342 Hall of the States
444 North Capitol Street, N.W.
Washington, DC 20001-1512
Phone: 202/624-5465
FAX: 202/624-5419

B-2 THE NATIONAL HISTORIC PRESERVATION ACT OF 1966 AS AMENDED

Section 106 of the National Historic Preservation Act of 1966 As Amended, requires that Federal agencies consider what effects their actions (and actions they may assist, permit, or license) may have on historic properties. Federal agencies are also required to give the Advisory Council on Historic Preservation a "reasonable opportunity to comment" on such actions.

Federal agencies participate in many projects and programs that affect local governments and local historic properties. Some of these are obvious: construction of highways and wastewater treatment plants, for example. Others are less so:

the Corps of Engineers issues permits to dredge and fill in waterways; the Federal Deposit Insurance Corporation approves opening branch banks and the installation of automatic teller machines; Federal Community Development Block Grant and Urban Development Action Grant funds are used by local governments to assist in rehabilitation and redevelopment. All these activities are subject to review under Section 106. The procedures to be followed in Section 106 are referred to as "the Section 106 process", and are set forth in regulations issued by the Advisory Council on Historic Preservation.

The Advisory Council is an independent Federal agency. Its role in the review of actions under Section 106 is to encourage agencies to consider, and where feasible, adopt measures that will preserve historic properties that would otherwise be damaged or destroyed. The Council's regulations, entitled "Protection of Historic Properties" (36 CFR Part 800), govern the Section 106 process. The Council does not have the authority to require agencies to halt or abandon projects that will affect historic properties; its regulations emphasize consultation among the responsible Federal agency, the State Historic Preservation Officer (SHPO), and other interested parties — including local governments — to identify and, if possible, to agree upon ways to protect the properties in question.

Section 106 applies to properties that have been listed in the National Register of Historic Places, properties that have been determined to be eligible for inclusion in the Register, and properties that may be eligible but have not yet been evaluated. If a property has not yet been nominated to the Register or determined eligible for inclusion, it is the responsibility of the Federal agency involved to ascertain its eligibility, following procedures outlined in Council and National Park Service regulations.[2]

[2] Taken from *Local Preservation: What is Section 106 Review*, by Thomas F. King, National Park Service, Interagency Resources Division, 1987.

SHPO offices, along with the Advisory Council, review many federally funded (including HUD) projects that involve lead paint. Contact your SHPO for additional guidance about the process.[2]

Appendix C
Insurance Issues

Insurance is an important consideration for those working in construction. Building contractors have general liability policies to cover their work and work-site. Design professionals have policies covering "errors and omissions."

Contractor's liability policies have a "pollution exclusion." Insurance carriers consider environmental work separate from construction, including working with lead. Rehabilitation contractors, whether they know it or not, are very much exposed to lead liability. The "pollution exclusion" gap can be closed. If a rehabilitation contractor is trained in EPA-certified courses, and follows the directives of that training, then the contractor or design professional can become, in the eyes of the insurance carriers, a qualified environmental contractor. At that point, a special policy or insurance rider can be purchased to directly cover "lead abatement" work. These policies can be costly. To date there has been no middle ground between the extremes of no coverage and costly environmental coverage. Policies developed specifically for building rehabilitation (as compared to lead abatement) to close the pollution exclusion gap at a reasonable cost are beginning to appear on the market.

The current status of insurance covering lead liability should be a strong incentive to practice lead-safe rehabilitation. Rehabilitation contractors who consider lead paint in their planning, practice responsible work habits during construction, test the building upon completion, and document their activities, clearly reduce their exposure.

A list of insurance companies and brokers that provide lead related liability coverage follows, along with some general advice on the main considerations when purchasing insurance.

LEAD-RELATED LIABILITY INSURANCE

There are five important considerations for purchasing insurance

Type

- "Occurrence" coverage covers injuries that occur during the time you have the policy.
- "Claims Made" coverage covers injuries that occur during the time you have the policy, and when the claim is made while you have the policy.
- An "Occurrence" policy is preferred, particularly when covering lead liability.

Financial Reliability

Insurance companies are rated for financial reliability. Some of the rating services that can be consulted include:

- A M Best
- D & B
- Moody's

Limits

All liability policies have limits of coverage. Some of those limits include:

- Per period, per occurrence
- Aggregate and total aggregate

- Deductible – per occurrence and per claim

Premiums

Premiums are the costs of the liability coverage. They will vary based on limits, deductible, and term of the policy.

Term

The term is the period of time covered by the policy.

THE MOST IMPORTANT THING TO DO WHEN THINKING ABOUT PURCHASING INSURANCE IS:

READ THE POLICY

INSURANCE PROVIDERS

Some insurance brokers and insurance carriers that specialize in lead liability coverage include:

American Safety
1845 The Exchange N.W.
Atlanta, GA 30339
800-388-3647

Bonding and Insurance Specialist Agency, Inc.
717 S. Wells St.
Chicago, IL 60607
312-427-2951

Commerce and Industry Insurance Company
20005 Market St., Suite 2800
Philadelphia, PA 19103
215-981-7000

Guardian Inc.
P.O. Box 152
Freehold, NJ 07728-0152
908-462-5771

Murphy Insurance Group
400 Crown Colony Dr.
Quincy, MA 02169-0932
617-773-0087

Reliance National
77 Water St.
New York, NY 10005
212-858-6569

Zurich-American Insurance Group
1 Liberty Plaza 53rd Floor
New York, NY 10006
800-382-2150

Appendix D
Relevant Documents

The following two documents, Essential Maintenance Practices and Standard Treatments, were developed by the Title X Task force. They outline the minimum guidelines for property owners to follow in order to maintain lead-safe housing.

D-1 ESSENTIAL MAINTENANCE PRACTICES

1. Use safe work practices during work that disturbs paint that may contain lead to avoid creating lead based paint hazards.

- Do not use unsafe paint removal practices, including:
  - Open flame burning;
  - Power sanding or sandblasting (unless a special vacuum attachment is used to contain dust);
  - Water blasting; and
  - Dry scraping more than a de minimis surface area (for example, more than one square foot per room).
- Use good work practices and take precautions to prevent the spread of lead dust (for example, limit access to the work area only to workers; cover the work area with six millimeter polyethylene plastic or

equivalent; protect workers, protect occupants' belongings by covering or removing from the work area; wet painted surfaces before disturbing, and wet debris before sweeping).

Perform specialized cleaning of the work area upon completion of work using methods designed to remove lead-contaminated dust.

2. Perform visual examinations for deteriorating paint (unless the paint is found not to be lead based paint):

- At unit turnover; and
- Every 12 months (unless the tenant refuses entry).

3. Promptly and safely repair deteriorated paint and the cause of the deterioration. If more than a de minimis amount of paint (for example, more than one square foot per room) has deteriorated (unless the paint is found not to be lead based paint):

- Make the surface intact by paint stabilization, enclosure, encapsulation, or removal.
- Follow Essential Maintenance Practice #1 (above) when repairing the surface.
- Diagnose and correct any physical conditions causing the paint deterioration (for example, structural and moisture problems causing substrate failure or conditions causing painted surfaces to be crushed).
- When there is extensive paint deterioration (for example, more than five square feet per room), the procedures for dust testing after Standard Treatments apply.

4. Provide generic lead based paint hazard information to tenants per Title X including the EPA-developed educational pamphlet and any information available about lead based paint or lead based paint hazards specific to the unit.

5. Post written notice to tenants asking tenants to report deteriorating paint and informing them whom to contact. Promptly respond to tenants' reports and correct deteriorating paint, with accelerated response in units occupied by a child under age six or a pregnant woman-and in no case longer than 30 days. Do not retaliate against tenants who report deteriorating paint.

6. Train maintenance staff. At a minimum, maintenance supervisors need to complete a one-day training course based on the HUD/EPA operations and maintenance/interim control activities curriculum. The maintenance supervisor must ensure that workers either take the one-day training course or have a clear understanding lead based paint hazards, unsafe practices, occupant protection, and dust cleanup methods by such means as on-the-job training and video instruction. The maintenance supervisor needs to provide adequate oversight of workers who have not taken the training course.

D-2 STANDARD TREATMENTS

1. Safely repair deteriorated paint. The standards set forth in Attachment ES-1 apply. (Note that the safe repair of deteriorating paint should have already been done under Essential Maintenance Practices. The same procedures apply to stabilizing deteriorated paint identified in the course of Standard Treatments.)

2. Provide smooth and cleanable horizontal surfaces. Rough, pitted, and porous surfaces trap lead dust and make it difficult to thoroughly clean these surfaces. Smooth horizontal surfaces will make it possible for tenants to perform regular housekeeping to reduce exposure to lead dust (for example, recoating hardwood floors with polyurethane, replacing or recovering worn out linoleum

floors, treating interior window sills). During treatment of an occupied unit, occupants and their possessions must be protected from lead exposure, but only surfaces that are accessible need to be treated.

3. Correct conditions in which painted surfaces are rubbing, binding, or being crushed that can produce lead dust (unless the paint is found not to be lead based paint). Owners shall correct conditions that cause rubbing, binding, or crushing of painted surfaces to protect the integrity of the paint and reduce the generation of lead dust (for example, rehanging binding doors, installing door stops to prevent doors from damaging painted surfaces, reworking windows).

4. Cover or restrict access to bare residential soil (unless it is found not to be lead-contaminated). Under Title X, only bare soil that is lead-contaminated is defined as a hazard. Owners shall visually check for bare soil when performing treatments on a unit and implement controls to prevent occupant exposure (for example, covering bare soil with gravel, mulch, or sod; physically restricting access to bare soil). In most cases, covering bare soil is an effective control.

5. Specialized cleaning. Lead-contaminated dust, the foremost path of childhood poisonings, may not be visible to the naked eye and is difficult to clean up. Owners shall conduct specialized cleaning of work areas upon completion of the treatments above. During treatment of an occupied unit, only surfaces that are accessible need to be cleaned.

6. Perform sufficient dust tests to ensure safety. When performing Standard Treatments in vacant units, sufficient dust tests are needed following treatment to provide a reasonable assurance of compliance (as discussed in Section 3.8). Dust tests of the work area are to be performed after completion of Standard Treatments in any unit occupied by a family with a child under age six or a pregnant woman if more than a de minimis amount of paint is disturbed.

Appendix E

Tools, Supplies, Equipment Sources

NOTE: The following lists are provided as a resource for reader. The lists do not presume to be a comprehensive survey of the categories. Listing on, or exclusion from, any of these lists does not constitute an endorsement or lack thereof by the IHPA, UIUC, CR, or NPS. No endorsement of the products and services included in the lists is implied or intended.

A. Carpentry Tools with Vacuum Attachments

1. Robert Bosch Power Tool Corp.
   701 E. Joppa Rd.
   Towson, Maryland 21286
   410-716-3900
   Power tools with vacuum attachments include drills, sanders and 3 ¼" planers.

2. Hitachi Power Tools U.S.A.
   3950 Steve Reynolds Blvd.
   Norcross, GA 30093
   404-925-1774
   Power tools with vacuum attachments include circular saw, jig saw, and orbital sander.

3. Nilfisk of America Inc.
   300 Technology Dr.
   Malvern, PA 19355
   800-645-3475
   Makes a vacuum attachment for Milwaukee Sawzall.

4. Porter Cable Corporation
   P.O. Box 2468
   Jackson, TN 38302-2468
   901-668-8600
   Power tools with vacuum attachments include circular saw and various sanders.

5. Skil Corporation
   4300 W. Peterson Avenue
   Chicago, IL 60646
   312-286-7330
   Power tools with vacuum attachments include circular saw and sander.

B. Specialty Power Tools

The following are some of the manufacturers who provide shrouded specialty tools, including needle guns, rotary peening machines, rotary planers, sanders and/or grinders.

1. Advance Environmental/Unique Systems, Inc.
   2576 Cantwell Road
   Virginia Beach, VA 23456
   800-536-7711

2. American International Tool Industries, Inc.
   1116-B Park Avenue
   Cranston, Rhode Island 02910
   800-932-5872
   Markets the "Paint Shaver" for shingles and clapboards.

3. Desco Manufacturing Company, Inc.
   30081 Comercio
   Rancho Santa Margarita, CA 92688
   800-337-2648

4. Nilfisk of America Inc.
   300 Technology Dr.
   Malvern, PA 19355
   800-645-3475
   For HEPA vacuums

5. Quest Environmental & Safety Products, Inc.
   7602 East 88th Place
   Indianapolis, IN 46256
   800-878-4872

6. Trelawny Tools
   93 Great Valley Parkway
   Malvern, PA 19355
   610-251-0477

C. Encapsulants and Enclosures

1. Dynacraft Industries, Inc.
   17 Sweetmans Lane
   Manalapan, NJ 07726
   800-922-0621

2. Fiberlock Technologies, Inc.
   630 Putnam Ave.
   P.O. Box 390432
   Cambridge, MA 02139
   800-342-3755

3. NU-WAL
   800-247-3932
   A fiberglass mat system for repairing plaster walls

4. Global Encasement, Inc
   57 West 38th St., 7th Floor
   New York, NY 10018
   800-266-3982

5. INSL-X Products Corporation
   Stony Point, NY 10980
   800-225-5554

6. International Protective Coatings Corporation
   725 Carol Ave.
   Oakhurst, NJ 07755
   800-334-8796

7. J & R Products
   Manufacturers of jamb liners for double hung windows.
   Comes in lengths of 38", 54", 70" and 80".
   800-343-4446

8. ProSoCo, Inc.
   775 Minnesota Ave.
   Box 171677
   Kansas City, KS 66117
   913-281-2700

9. Specification Chemicals, Inc.
   824 Keeler Street
   Boon, IA 50036
   800-247-3932
   Makers of Nu-Wal, a fiberglass mesh and paint system for plaster surfaces.

D. Chemical Paint Strippers

The following list includes some of the companies who provide non-methylene chloride chemical paint strippers.

1. Dynacraft Industries, Inc.
   17 Sweetmans Lane
   Manalapan, NJ 07726
   800-922-0621

2. EnviroBest Corporation
   11610 Iberia Place
   San Diego, CA 92128
   800-808-7740

3. Fiberlock Technologies, Inc.
   630 Putnam Ave.
   P.O. Box 390432
   Cambridge, MA 02139
   800-342-3755

4. Dumond Chemicals, Inc.
   1501 Broadway
   New York, NY 10036
   212-869-6350
   Note: Distributes the "Peel Away" system, a caustic paint stripper.

5. ProSoCo, Inc.
   775 Minnesota Ave.
   Box 171677
   Kansas City, KS 66117
   913-281-2700

E. Cleaning Supplies

1. Aramsco Supplies
   800-545-4372
   Offers Ledizolv and lead specific detergent wipes

2. American Institutional Supply
   800-366-3331
   Offers the "Rhino bucket", a plastic mop bucket with a mesh ringer for about $10.

3. Dynacraft Industries, Inc.
   17 Sweetmans Lane
   Manalapan, NJ 07726
   800-922-0621
   Makes lead specific cleaner (Back to Nature Lead-Clean)

4. De-Lead Technologies, A Division of Somay Products, Inc.
   4301 N.W. 35th Avenue
   Miami, FL 33142-9746
   800-274-9746
   Makes a lead specific cleaner (LeadSorb)

5. Hin-Cor Industries, Inc.
   P.O. Bos 410945
   Charlotte, NC 28241
   704-587-0744
   Makes a lead specific cleaner (Ledizolv) and lead specific detergent wipes (WipeSafe)

F. High Efficiency Vacuums

1. Desco Manufacturing Co., Inc.
   30081 Comerico
   Rancho Santa Margarita, CA 92688
   800-337-2648

2. Eagle Industries
   P.O. Box 10652
   New Orleans, LA 70181
   800-266-8246

3. Euroclean
   1151 Bryn Mawr Ave
   Itasca, IL 60143
   800-545-4372

4. Hoover Vacuum Cleaner Company
   Makers of the "Breath Easy" vacuums. Can be purchased at Sears for about $180.

5. Fortress Industries
   12451 U.S. 27
   DeWitt, MI 48820
   800-526-2569

6. Nilfisk of America Inc.
   300 Technology Dr.
   Malvern, PA 19355
   800-645-3475

7. Trelawny Tools
   93 Great Valley Parkway
   Malvern, PA 19355
   610-251-0477

G. Laboratories

Laboratories qualified to analyze lead samples are recognized by NLLAP (National Lead Laboratory Accreditation Program). A list of these labs can be obtained by calling the National Lead Information Center Clearinghouse at 1-800-424-5323. The following labs represent some of the larger national lab services providers.

1. Coltech Envirolabs
   1855 Deming Way
   Sparks, NV 89431
   702-331-3600

2. EMSL
   The Empire State Building
   Suite 1504-06
   New York, NY 10118
   800-220-3675

3. IATL
   16000 Horizon Way
   Mount Laurel, NJ 08054
   609-231-9449

4. METS Lab
   179 Smallwood Village Center
   Waldorf, MD 20602
   800-604-1995

H. Personal Protection Supplies

One can usually find local outlets for personal protection supplies such as repirators and Tyvek coveralls. Suppliers are typically listed under "Safety Equipment and Clothing" in the yellow pages.

I. Jamb Liners

1. J & R Products
   800-343-4446
   Come in 38", 54", 70", and 80".
   (54" liner costs $6.95)

J. Rhino Bucket

1. American Institutional Supply
   800-366-3331
   A plastic mop bucket with a mesh ringer for about $10