LEAD SUPERVISOR CERTIFICATION

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ACCREDITED LEAD TRAINING PROVIDER

STUDENT MANUAL

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LEAD ABATEMENT TRAINING FOR SUPERVISORS & CONTRACTORS

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LEAD ABATEMENT TRAINING FOR SUPERVISORS AND CONTRACTORS

PREFACE

This course manual consists of twenty-one chapters including a review section, a glossary, and a reference section. An additional reference manual provides details on several important state, local, and federal abatement regulations and guidelines.

A number of slides, overhead transparencies, and classroom activities are included in the instructor's manual accompanying this manual. Some of these activities are small-group projects. Others involve demonstration-type activities which the supervisor-trainees perform on a "Lead House of Horrors"--a four-sided housing structure assembled in an area close to the classroom. This "Lead House of Horrors" is based on a similar structure which has been used effectively in lead abatement courses offered by Mr. John Pesce of Melrose, Massachusetts.

After the first course day, it is suggested that each day begin with a review. This review can take the form of a "Lead Jeopardy" game, an idea also obtained from Mr. Pesce's experience. Brief rules for this game--played by two teams of trainees--are outlined in the Instructor Manual section “U.” The course includes a brief pre-test during the first session and a two-hour written exam at its conclusion.

The manual has evolved from the presentation of a five-day course, "Lead Abatement in the Residential Environment," offered by the Continuing Education (CE) program of the University of Cincinnati National Institute for Occupational Safety and Health Education and Research Center. Judy L. Jarrell, Ed.D., is Director of the CE program. The course content draws on extensive research and other experience of the University's Department of Environmental Health in the areas of childhood lead poisoning -- particularly lead-exposure measurement and pathways -- and soil and dust lead abatement. The lead-based paint abatement activities in the Commonwealth of Massachusetts and the State of Maryland, and dust and soil lead abatement experiences in Toronto, Canada also provided substantial input to the course content.

The course co-directors were Scott Clark, PhD, PE, CIH and William Menrath, M.S. Dr. Clark is Director of the Environmental & Industrial Hygiene Training Programs at the University. He was a Co-Principal Investigator of the U.S.EPA-supported Cincinnati Soil Lead Abatement Demonstration Project. He is currently Director of the University of Cincinnati Evaluation of the HUD Lead Hazard Control in Private Housing grant program through the National Center for Lead-Safe Housing. Mr. Menrath was Associate Director for Environmental Monitoring and Abatement of the Cincinnati Soil Lead Abatement Project. He held similar positions with many lead exposure studies in mining communities. He is also involved in the HUD Evaluation Project.

Many other individuals were involved in the preparation and instruction of the content of the original version of this manual. These include Mr. Richard Boehnke, then with the Toronto (Canada) Department of Public Health, Mr. Richard Humpstone of South Woodstock, Vermont, Mr. James McCabe then with the Baltimore, Maryland Department of Housing and Community Development, and Mr. John Pesce of Star Enterprises of Melrose, Massachusetts. Constructive comments and suggestions on style and format were received from worker training course curriculum development experts, Dr. Phil Berger, and the late Mr. Sam Gunto, of the University of Kentucky, Behavioral Research Aspects of Safety and Health (BRASH) group in Lexington, Kentucky. Contributions by way of feedback from course attendees is also acknowledged.

External review of the original manual was provided by a number of individuals from government, labor, education, and private sector organizations. Extensive revisions were made based on the many helpful suggestions received from reviewers. As experience is gained using these course materials, other materials/information may be added as is deemed necessary.

This 1996-97 revision has been made under the direction of the U.S. EPA, by the Continuing Education Office of the Education and Research Center at the University of Cincinnati. Changes, updates, and corrections were solicited from directors of the six EPA-Sponsored Regional Lead Training Centers (RLTCs), their member institutions, and RLTC instructors, along with individuals from government, labor, education, and

private sector organizations. Instructional technology review was provided by Judy L. Jarrell, Ed.D., of the University of Cincinnati, and by an outside environmental curriculum consultant, Susan Marie Viet, CIH, CET.

A. Objectives and Overview

OBJECTIVES AND OVERVIEW

The purpose of this course is to train individuals supervising residential lead abatement projects concerning safe effective abatement methods and procedures. In addition to the techniques used for carrying out lead-based paint, soil, and dust lead hazard control activities, emphasis will also be placed on:

- worker protection and safety,
- occupant protection,
- clean-up and clearance,
- waste disposal,
- resident and community relations,
- regulatory aspects,
- sampling techniques, and
- legal and insurance issues.

Lead has long been known to be a poison. Recent research has shown that the levels of exposure causing adverse health effects are lower than formerly thought. A primary source of lead in the residential environment is lead-based paint which was widely used in household paints before 1978. The exposure to lead-based paint in residential environments can be directly from painted surfaces or, more commonly, from dusts and soils that have been contaminated by lead-based paint. Other sources of lead will be discussed in more detail in the “Lead and Its Uses” section of this manual.

Lead hazard control activities are sometimes divided into two categories:

1) Long-term or permanent activities called **abatement**, and
2) Activities with shorter periods of effectiveness, called **interim controls**.

Activities which have some lead in place, such as wet scraping of loose paint and repainting, or activities which must be repeated periodically, such as dust removal (interior or exterior), are sometimes referred to as interim controls. In reality, most lead hazard reduction activities, except those that involve complete removal of lead from a dwelling (e.g., window replacement) are less than "permanent." "Permanent" is generally considered more than 20 years. Studies are now underway to find out which control methods are effective long-term (for up to three years after the hazard control activity occurred).

This course covers essential responsibilities of the supervisor during the abatement or interim control process:

- Pre-planning,
- Community relations,
- Site preparation,
- Contract planning and development,
- Worker and supervisor training,
- Project management,
- Abatement implementation,
- Clearance procedures, and
- Record keeping.

Residential lead abatement and interim controls protect children, in particular, from hazardous lead exposure. Because of this it is important to understand the ways in which children become exposed to lead.

A number of studies have shown the main source of lead exposure for most children is ingestion (eating) of lead-contaminated dust, which occurs through hand-to-mouth activity. A simplified model illustrating the exposure of children is shown in Figure A-1 (page A-7. Lead-based paint can be from both interior and exterior paint. The lead paint hazard could be in the child's residence, or from adjacent houses as well as elsewhere in the neighborhood. It could also include a build-up of fall-out from leaded gasoline and, in some cases, from nearby mining, smelting, and industrial sources.

The contamination of dust and soil from the deterioration of surfaces painted with lead-based paint generally occurs gradually over long periods of time. It is dependent on many factors, and is increased from time-to time by deliberate efforts (careless demolition and/or renovation) and by freezing/thawing cycles, etc. Other sources of contaminated soil and dust exist and vary from location to location. Among these other sources are:

- Primary and secondary smelters,
- Mining and milling operations,
- Industries re-processing lead-containing materials,
- Soil near major roadways or in urban areas, via emissions from vehicles formerly using leaded fuels,
- Coal-fired power plants and municipal incinerators, and
- Other industrial and hobby sources.

It is generally accepted that a child's exposure to lead frequently involves a soil and/or dust ingestion pathway. Therefore a comprehensive and effective residential lead hazard control program should include all lead hazards. The lead hazard reduction efforts should be planned as an appropriate blend of efforts aimed at all significant sources of lead in the environment. Thus, residential lead hazard reduction can be made up of lead-paint, interior lead-dust, exterior lead-dust, and soil-lead hazard reduction. In some special situations, it also may involve improvements in the plumbing system and/or fixtures.

<u>Dust Control</u>

Efforts are also necessary to make sure that abatement workers, building occupants, and workers' families are not adversely affected by lead exposure. It is extremely important that abatement is carried out in such a way that:

- Lead-contaminated dust does not become a hazard to occupants during or after abatement;

- Lead-contaminated dust is not spread to adjacent housing areas; and
- Lead-contaminated dust is not taken home by the workers on their clothing and shoes, or in their vehicles.

One of the earliest reports of "worker take-home" of lead contamination (Rice, et al, 1978) involved a situation with workers in secondary lead smelters. The take-home happened even though workers generally showered before going home and their work clothing was laundered by the employer. More recently, in Baltimore, a worker's child sued a lead abatement company over health effects linked to take-home lead.

Worker Protection

In addition to dust control, worker protection safeguards are needed to protect workers from:

- Physical Hazards (slips trips, falls, cuts, equipment, traffic, ladders, etc.)
- Electrical Hazards
- Chemical Hazards (solvents and other chemicals used for paint removal, and combustion products, such as fuels used in generators and portable heaters)
- Airborne Lead
- Lead-Contaminated Dusts

Each of these and other hazards will be discussed in detail in the course manual.

The worker's respiratory protection needed will vary depending on the type of abatement work being done and the resulting concentration of lead in the air. If the various hazard reduction tasks can be separated in time and/or location it may sometimes be possible to vary the level or type of respiratory protection needed. For example, respirators will be required for activities creating high concentrations of airborne lead-contaminated dust and fumes (e.g., work on lead-based paint items and in areas containing large amounts of lead-contaminated dust). If the housing has already undergone a thorough initial clean-up after such removal has occurred, subsequent activities (such as re-installation of doors lead-abated off-site, new windows, and other new carpentry and painting) usually do not produce air lead levels calling for respiratory protection. Appropriate scheduling and completion of activities will enable the use of respirators to be restricted to only those times when they are necessary. OSHA regulations will have to be followed in the design of such worker safety and health plans. Other worker protection measures including rules against "eating, drinking and smoking" should always be practiced throughout all phases of hazard reduction activities.

It should be remembered that respirators are uncomfortable use, can restrict communication and vision, and thus can cause safety and health problems themselves. In good industrial hygiene practice respirators are considered to be a measure of last resort, to be used only if other controls (ventilation, alternative abatement techniques, work practice controls, etc.) are not effective.

Carpet and Furniture Lead Hazard Reduction

Several studies have shown that it may be practically impossible to remove even one-half of the lead-contaminated dust that has accumulated over an extended period of time in carpets and upholstered furniture. In some cases, it may be more economical to replace such items rather than undertake exhaustive and expensive cleaning efforts that have only limited value in reducing lead exposure. Consideration should be given to furniture and carpet replacement. Most current guidelines, including those of HUD, call for protecting furniture and carpets from the dust generated during lead hazard reduction. They do not, at this time, address the issue of replacing or cleaning these items. Thus, if carpet and furniture are not replaced, an important source of exposure may remain in the housing after the "abatement" has been completed. (Contamination of curtains and draperies will be assessed in research now underway, as well as ductwork used for heating and cooling.)

Comprehensive Lead Hazard Reduction

As will be discussed in the next section, lead can be present many areas of the residential environment (paint, dust, soil, and water) and can come from many sources (paint, formally used gasoline-additives, mining operations, primary and secondary smelters, hobbies, folk medicines, and household plumbing). Some lead hazard control projects may focus on only one of these sources. However, the immediate pathway of exposure for most children is lead-contaminated dust, usually from paint. However, from a child's health point-of-view it is important to consider other major sources of lead when designing and conducting a hazard reduction project.

At present, a number of programs (at a cost of over $300 million) are underway at the Federal and State levels to remove residential lead-based paint hazards such as deteriorated paint and lead-contaminated dust. The largest effort is the U.S. Department of Housing and Urban Development Lead-Based Paint Hazard Reduction Program in Private Housing. In just the first four rounds of funding under this yearly program, HUD awarded a total of 84 grants totaling $335 million to numerous states, counties, and cities across the country.

Another group of efforts is directed toward reducing mining, smelting, and other industrial sources of lead through the Superfund program. Some activities near Superfund sites are now receiving HUD funds for control of lead hazards in housing.

B. History: Lead- Its Uses and Environmental Impact

LEAD - ITS USES AND ENVIRONMENTAL IMPACT

OBJECTIVE:

To describe: 1) the major historical uses of lead and the major changes in these uses over the past 100 years, and 2) the impact of these uses on the need for and nature of residential lead abatement.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Describe how children are typically exposed to lead.
- Give several examples of “lead-based paint” hazards.
- List possible locations in a residential environment where lead may exist based on an analysis of scenarios presented.
- Describe the use of lead as white-lead pigment in comparison to lead used as a gasoline additive over the past 100 years.
- Indicate white-lead pigment’s importance to the lead hazard reduction plans.
- Estimate the relative amounts of lead in the paint, soil, and dust in various locations in and around a house.

As a supervisor/contractor of a lead hazard control project, knowledge of lead and its uses is important because it will help you identify the many areas inside and outside the house where lead can be present. It will also aid you in understanding why certain areas of the residential environment are the focus of a particular lead hazard control effort.

History

LEAD ORE

Lead is one of the seven metals of antiquity. Its discovery has been traced to the development of processes for metal refining. The finding of the precious metal (silver) as an "impurity" in lead ore resulted in a surge in the mining of lead ore.

LEAD PIGMENTS

Archaeologists have found lead pigments on buildings built around 3000 B.C. The color is still easy to see after 5,000 years. This quality of lead pigments helps explain one of the reasons it was used as an additive in paint for centuries. Lead-based paint was also durable and could resist the effects of moisture and weather changes. High-lead paint was valued as high-quality paint and, although used on all surfaces, was particularly used in high-use and moisture-prone areas of housing, such as kitchens, bathrooms, floors, and exteriors. However, even in the l9th century when harmful health effects were observed in the manufacture and use of lead, increasing amounts of lead were mined, smelted, and used as pigments in paint and in many other products. The peak use of lead for household paints did not occur in the U.S. until the mid-1930s.

LEAD PIGMENT SUBSTITUTES

That trend was reversed earlier in other countries. For example, in 1840, France made it a policy to discourage the use of lead as a pigment in paint. Zinc oxide was used to replace white lead as the white pigment. In 1870 Germany banned the manufacture of lead paint pigments after concluding that it was too dangerous. Titanium dioxide and zinc oxide were used instead of the lead pigments. In 1904, lead was banned as a pigment for paint in Queensland, Australia. In spite of all this, the United States and the United Kingdom continued to allow the use of lead in paint.

LEAD PROPERTIES

Lead has many properties which have found great favor with plumbers for centuries. Among these are that it:

- is durable and very workable,
- does not corrode,
- does not readily crack due to building settling, and
- does not readily burst with freezing and thawing. When it does burst, the fractures could usually be temporarily repaired by mashing the leaking area.

These properties led to the first major use of lead as the base material for the many miles of aqueducts built during the Roman Empire. It is estimated that about 12,000 tons of lead were used in making just a single siphon unit in the Lyons (France) aqueduct. The first peak in the annual world-wide production of lead was during the Roman Empire in about 20 B.C. This level of production was not reached again until about 1700, during the early stage of the Industrial Revolution (see Figure B-1, page B-17).

Major increases in lead production occurred:

- when it was introduced for coins,
- when production of silver increased (since lead is often found with silver), and
- at the start of the industrial revolution.

LEAD USES:

PAINT

<u>Lead-Based Paint</u>

Lead-based paint is the major ultimate source of lead exposure to most children in the U.S. Most of the lead-based paint was made with white lead, a chemical form of lead produced by the fermentation of elemental lead. This old Dutch process was a commonly used method for producing white lead.

The process dates back to the Middle Ages. The French found that if they put sour wine into lead pots, a white powder was formed, which made the wine poisonous but was an excellent paint [Hamilton, Alice, Exploring the Dangerous Trades, Little Brown and Company, Boston, 1947].

By 1884 there were already reported to be about 31 white-lead works for paint production in the United States. The states with the largest number of these plants were Pennsylvania (9), New York (6) and Ohio (5) (Table B-2, page B-15). When these white-lead plants were operating, the pioneering occupational health physician, Alice Hamilton, inspected them in her classic occupational hazards survey. For one plant she observed that "this is much the worst white-lead factory I have ever seen. It was built in 1843 and is crowded, dilapidated, dark and ill-ventilated....a worker with one years' experience had lead colic [stomach pain] five times and that was no unusual record....They were smeared with white lead dust and their hair was full of it." [Hamilton, Alice, Exploring the Dangerous Trades].

WHITE LEAD

Lead-based paint that has weathered, chipped, peeled, or been removed from painted surfaces is a potential hazard when it contaminates:

- soil in residential yards and other play areas,
- dust inside houses, especially when the dust is accessible to children; and
- dust on paved areas around the house, such as sidewalks, alleys, streets and parking lots.

LEAD-BASED PAINT AD
Dutch Boy ad from Oil, Paint and Drug Reporter Magazine, 12/6/37

Other pigments, such as red lead and litharge, were also used in some household paint. Most of these other pigments produced were, and still are, used in industrial paints and ceramics.

Gasoline Additives

GASOLINE ADDITIVES

Soil and dust contamination from atmospheric fallout, particularly that which occurred before the phase-out of leaded gasoline, can still be an exposure source. Although tetraethyl lead was not used as a gasoline additive until the early 1920s (Table B-1, page B-14), by the time of its phase-out, which began in the 1980s, the cumulative total quantity used was similar to that used for white-lead pigment during the most recent one-hundred year period! (see Figure B-2, page B-18). About seven million metric tons of lead were used during that period for each of these two uses.

BATTERIES

Throughout this period the highest use of lead was for storage batteries -- ranging from about 24% to 78% of the annual usage. Note that at the start of this period, use of white lead was almost three times that of red lead and litharge, while by 1950 the reverse was true. During later years, the quantity used for white lead was so small that it was no longer reported separately. Similarly, usage of lead additives for gasoline also is no longer reported separately.

Other Uses of Lead

Besides its use in paint, lead has found uses in many other areas of the home which can lead to human exposure. Among these other household uses are:

- food and beverage containers
- folk remedies
- pesticides

- plumbing
- roof and other paints
- gutters, spouts, flashing and ornamental lead-work such as cornices and moldings.

Hobbies and Sports

Lead is a component of some materials used in hobbies. Probably the most common use of lead in hobbies is in stained glass. A variety of objects such as windows, panels, lamp shades and decorative boxes can be made from stained glass. Some artists' paints may also contain lead. People engaging in these hobbies should be extremely careful not to contaminate their homes.

Some sporting activities may also present added risk of lead exposure. Making ammunition and fishing weights can leave residues of lead in the work area. Additionally, the person engaged in the activity should wash his/her hands prior to eating, drinking, smoking, or preparing food. Persons who practice shooting at target ranges have the potential to inhale fine dust while at the range and may also bring that dust home on clothing or shoes. Fish and water fowl taken from water contaminated with lead may have measurable levels of lead in their meat.

Food and Beverage Containers

FOOD & BEVERAGE CONTAINERS

Lead pewter, and leaded bronze vessels and utensils were in use for centuries dating back to remote antiquity. The period 1220 to 1800 A.D. has been suggested as being the "Pewter Era" because the most common manufactured goods were those made of pewter. In colonial America, acquiring a full set of pewter platters, plates, etc. was a very desirable achievement. Before the introduction of lead-free pewter, around 1656, all manufactured pewter had between 10-50% lead.

While pewter is no longer commonly used for food service, other utensils containing lead are still produced. Lead crystal is still purchased by those seeking high-quality glassware. Some lead glazes are still used for dishes. This practice is not permitted in the United States but some tableware produced in other countries (e.g., Mexico and other Latin American countries) is still imported and finds its way into American homes. Cases of lead poisoning from lead glazes in food and beverage containers still occur in the U.S.

The metal food can (the "tin can") was patented in the U.S. in 1810. Solder used for the side seam, contained 63% lead and 37% tin. A tin shortage during World War II led to an increase in the lead content to 98%! In 1984 it was estimated that 15% of dietary lead came from the lead solder in food cans. This has decreased a lot with the removal of solder from domestically-produced food cans. Some imported canned foods still may contain lead solder.

<u>Lead in Folk Remedies</u>

FOLK REMEDIES

Lead is a component of some folk medicines. This is especially true for some of the southeast Asian countries and Latin America. These substances are given internally to some young children with persistent stomach aches and/or diarrhea. Among the commonly used substances are **azarcon** and **greta**. Azarcon (lead tetraoxide) is a bright orange powder which is sometimes used as an external skin preparation. Greta, another lead oxide, is a yellow powder also used as a glaze for low-fired ceramics. The lead content of these compounds can be over 90%!

PESTICIDES

Lead in Pesticides

Lead has been used as an ingredient of pesticides until the past several years. High amounts of lead can be found in the soils of many orchards where pesticides were used for long periods of time.

PLUMBING & DRINKING WATER

Lead in Plumbing and Drinking Water

Until recently the solder used to seal the joints in copper piping, commonly used in household water lines, contained 50% lead. In most water systems the current major source of lead at the tap is from the plumbing system itself:

- lead pipe usually from the street (known as service lines) to the house and sometimes even within the house.
- lead solder used in making connections in copper piping.
- lead from alloys such as brass and bronze used for faucets, fittings, fixtures and valves, water meters and other devices.

In 1986, Congress amended the Safe Drinking Water Act (SDWA) to prohibit the use of lead in plumbing in public water systems. However, millions of homes nationwide contain lead solder, or are serviced by lead connections to the water main. In addition, brass fixtures may contain up to 8% lead under the law. (In 1996 another amendment to the SDWA mandated all new plumbing fixtures must have no lead content after February, 1999.) Water which is more acidic has the potential to leach lead from plumbing. Even mildly acidic or aggressive water is capable of dissolving lead from brass faucets, valves and fittings (especially within the first few months of use) and from lead solder and lead pipes. Regulations under the SDWA (see section on Regulatory Review and the separate volume on Selected Regulations and Guidelines) require public water systems to optimize their corrosion control treatment.

If that doesn't work, they must then replace lead service lines to lower lead levels in drinking water below 15 parts per billion.

Sources of Lead Exposure

SOURCES

Some of the sources and pathways for lead are shown in Figure B-3 (page B-19). The basic exposure pathway involves contamination of household floor dust by exterior sources (paint, soil, and dust) and interior paint. These sources result in lead dust on children's hands and then elevated blood lead.

In some areas residues from:

MINING

- mining,
- milling, and
- smelting operations,

both past and present, are major sources of lead in dusts and soils. The dust may be present in all areas of a house, including basements, floors, upholstered furniture, carpets, and even in attics. (Attic dusts as high as 20,000 parts per million, (ppm) lead have been found in Butte, Montana and Kellogg, Idaho, areas of previously extensive mining and smelting.) Some former battery plants and battery crushing operations are on the Superfund National Priorities List because of high lead amounts in nearby soils.

Lead in Urban Dust and Soil

DUST & SOIL

Residues from leaded paints and atmospheric fallout from combustion of leaded gasoline also represent major sources of lead-contamination of soil and dusts. In a study done for the U.S.EPA, an inner city area contaminated by lead-based paint and fallout of lead additives to gasoline, lead concentrations in soil and exterior and interior dusts was monitored for a number of years. The housing ranged from those built during the 19th century to post-World War II housing. Some of the 19th century housing was previously lead-abated through an extensive "gut" rehabilitation effort. Lead levels in the following areas were measured:

- soil cores
- exterior dust (on paved surfaces and hard-packed soil areas)
- interior surface dust on floors and window sills
- interior dustfall (A dustfall sample is a collection device, generally an open container, in which dust is allowed to accumulate and later measured and analyzed.)

Soil and dust levels are shown in Table B-3 (page B-16) according to housing type. Lead in dust can be expressed as both a mass concentration and as a surface loading. The highest concentrations of lead in <u>dust</u> were found in the older housing which were in deteriorated and dilapidated condition. For four of the five housing categories, lead concentrations were lower in interior dustfall samples than on floors in the housing. This indicates that the source of lead-contaminated dust on the floors of most homes is not airborne dust.

Multiple Source Environments

MULTIPLE SOURCES

In some areas a number of sources (Figure B-4, page B-2) can be major contributors to lead contamination of soils and dust. These situations are very likely to exist in older communities where various mining and ore processing operations existed side-by-side. In these areas lead contamination can be due to:

- interior and exterior lead-based paint,
- residual gasoline emission fallout,

- mining wastes,
- milling wastes, and
- smelter wastes.

The dust from many of these sources can be tracked into living and play spaces by people and pets as well as blown in by winds. Where smelters existed, or still exist, lead-contaminated fallout can be from from stack and waste pile emissions. Movement of vehicles across lead-dust contaminated areas is another way lead can be transported.

For all types of occupations involving lead it is possible to have lead-contaminated dusts carried home by workers on their shoes and clothing. This is referred to as worker “take home.” It can be avoided by showering and changing from work clothes prior to leaving the work site.

Not long ago, the use of lead in the manufacturing of gift "pewter-like" ornamental ashtrays in a large midwestern city resulted in many cases of clinical lead poisoning among employees, **and** family members.

OCCUPATIONAL
“TAKE HOME”

The family members were exposed by contact with lead-dust contaminated clothing and shoes worn home by the workers and by lead-dust in automobiles. The lead dust being carried home also got into upholstered furniture and carpets in the workers' homes.

WORKER "TAKE-HOME" OF LEAD-CONTAMINATED DUST IS A RISK TO FAMILY MEMBERS. LEAD ABATEMENT WORKERS MUST TRY TO PREVENT THIS PROBLEM BY THE USE OF GOOD WORK PRACTICES.

The supervisor must ensure that workers do not leave for home or enter their private vehicles wearing lead-dust contaminated clothing.

Estimating Relative Amounts of Lead In and Around the House

HOW MUCH CAN THERE BE?

In order to gain some insight into the relative amounts of lead in various areas in and near a housing unit we will estimate the quantities and relative amounts of lead in the paint, interior floor dust, and exterior dust and soil. Assume that the two-story house has six rooms, each with floor dimensions of 3m x 4m and 3m ceiling height and the horizontal dimension of the house is 12m long by 3m wide. The floor area is about $72m^2$ (ignoring halls, closets, etc.) and the total surface area (inside and outside floors, ceilings, and walls) is about $576m^2$. [$648m^2 = 648 \times 10^4\ cm^2$, since $1m^2 = 10^4\ cm^2$.]

<u>Paint Lead</u>. For simplicity, we will assume that all surfaces are coated with identical paint films. the paint films have a lead level of 2 mg lead/cm^2. This is a conservative loading for an old, urban house. If the average lead level on the surfaces of the house is 2mg Pb/cm^2 the total amount of the lead in the paint is $648 \times 10^4\ cm^2 \times$ 2mg Pb/cm^2 = $648 \times 10^4 \times$ 2mg Pb = $1,296 \times 10^4$ mg = 1.296×10^4 grams or 12,960 grams lead.

<u>Interior Dust Lead</u>. If the floor dust lead loading in the house is 1 mg/m^2 (about the same as the HUD clearance level), the amount of dust in interior floor dust is 1mg lead/$m^2 \times 72m^2$ = 72mg lead or 0.072 grams lead.

<u>Exterior Dust Lead</u>. If there is a 1 meter-wide paved sidewalk

along all four sides of the house (a total of 34 meters in length), and the exterior dust loading is 200mg lead per square meter, the amount of lead on this sidewalk area (200 mg/m^2 x 34 m^2) is 6,800mg lead or 6.80 grams lead.

Soil Lead. Another area where lead may be present is in soil around the house. Assume the soil area is twice the size of the paved area, or 68m^2, and the soil lead concentration is 500 ppm. The total weight of the top six inches (15.24cm or 0.1524m) soil is: 68m^2 x 0.1524m x 10^6 cm^3/m^3 x 1.5g/cm^3 (density of soil) = 15.5 x 10^6 grams. The amount of lead in this soil is: 500g lead divided by 10^6 g soil x 15.5 x 10^{6}g soil = 7,772g lead.

Total Lead. The total amount of lead in this property is:

paint	12,960.000 grams (60.690%)
floor dust	0.072 grams (0.001%)
exterior dust	6.800 grams (0.034%)
soil	7,772.000 grams (39.294%)
	20,738.872 grams

Even though 99.963% of the lead in the property is in the soil and paint, the children's exposure occurs mostly from the small percentage of lead in the dust.

In the lead paint removal/enclosure process, even if only 0.002% of the paint lead (0.26 grams) is not cleaned up but ends up in floor dust, the clearance level will be exceeded! This exercise shows how it is very important to carefully clean up areas of the house after abatement. In order to do this, the abatement crew must be careful all through the abatement process. This means cleaning up daily and ending up with surfaces that are able to be thoroughly cleaned.

Thinking of it in another way, if a total of about 15 square inches of paint chips ($100cm^2$) from anywhere in the house is left in the form of dust evenly spread over the entire floor area, the clearance level will still be exceeded. Similarly, if soil abatement is not carried out carefully and 0.003% of the soil lead is allowed to enter the house, the floor dust lead loading will be exceeded.

For additional information regarding the prevalence of lead in housing see the Report on the National Survey of Lead-Based Paint in Housing, Base Report in your "Regulations & Guidelines" notebook.

Summary

A rational approach is needed for reducing lead exposures in homes. This approach must consider the condition of lead-based paint on surfaces in the house and dust and chips from lead-based paint and lead dust from other lead sources. These residues from lead sources may be present in the dusts inside the house (on floors, furniture and carpets as well as in attics and basements) and in dusts and soil outside of the house. Lead in the plumbing system and other neighborhood sources, if they exist, also must be considered if they are above regulatory levels.

TABLE B-1

MAJOR USES OF LEAD IN UNITED STATES

(percentage of total used)

Use	1930	1940	1950	1960	1970	1980	1988
White Lead	10.0	8.4	2.9	0.8	0.4	7.3*	5.1*
Red Lead/ Litharge	4.2	7.6	8.2	7.3	6.7		
Gasoline Additive	0.6	4**	9.2	16.0	20.5	12.0	2.3**
Storage Batteries	21.2	28.2	32.2	34.6	43.6	60.3	77.6
Cable Covering	27.1	13.7	10.7	5.9	3.7	1.3	1.3
Ammunition	4.3	7.2	3.1	4.3	5.3	4.5	4.3
Solder	3.5	3.1	7.6	5.9	5.1	3.9	1.5
Caulking	2.7	2.5	4.3	6.5	2.6	0.5	0.1
Other	26.4	25.3	21.8	18.7	12.1	10.2	7.8
TOTAL USE (in 1000's metric tons)	697	782	1123	926	1234	1073	1231

* data not available separately ** estimated (Source: U.S. Mineral Yearbooks, U.S. Dept. of Interior, Washington, D.C.)

TABLE B-2

LOCATION OF WHITE-LEAD WORKS IN U.S.

(1884)

PENNSYLVANIA		OTHER CITIES	
Philadelphia	3	BALTIMORE, MD.	1
Pittsburgh	6		
NEW YORK		CHICAGO, IL.	2
Buffalo	1	LOUISVILLE, KY.	2
New York	5	SAN FRANCISCO, CA.	1
		ST. LOUIS, MO.	3
OHIO			
Cincinnati	3		
Cleveland	1		
Dayton	1		

(Source: Mineral Resources of the United States 1883-84, Washington, D.C., 1885)

TABLE B-3

CONCENTRATIONS OF LEAD IN DUST AND SOIL IN AND NEAR URBAN CINCINNATI, OHIO HOUSING

(geometric mean values)

	19th Century Housing Poor Condition	19th Century Housing Satisfactory Condition	19th Century Housing Rehabilitated[a]	Public Housing	Post WWII Private Housing
Soil Lead[b] ppm	910	690	220	140	100
Exterior Dust[c] ppm	4600	5000	1800	230	330
Interior Dust[d] ppm	2400	1700	620	490	330
Interior Dust[d] mg/m^2	2.1	0.77	0.25	0.25	0.13
Interior Dustfall ppm	560	460	220	180	180

[a] These houses previously had most lead-painted surfaces removed or enclosed as a result of the HUD-supported gut-rehabilitation process used.

[b] Top one-inch core.

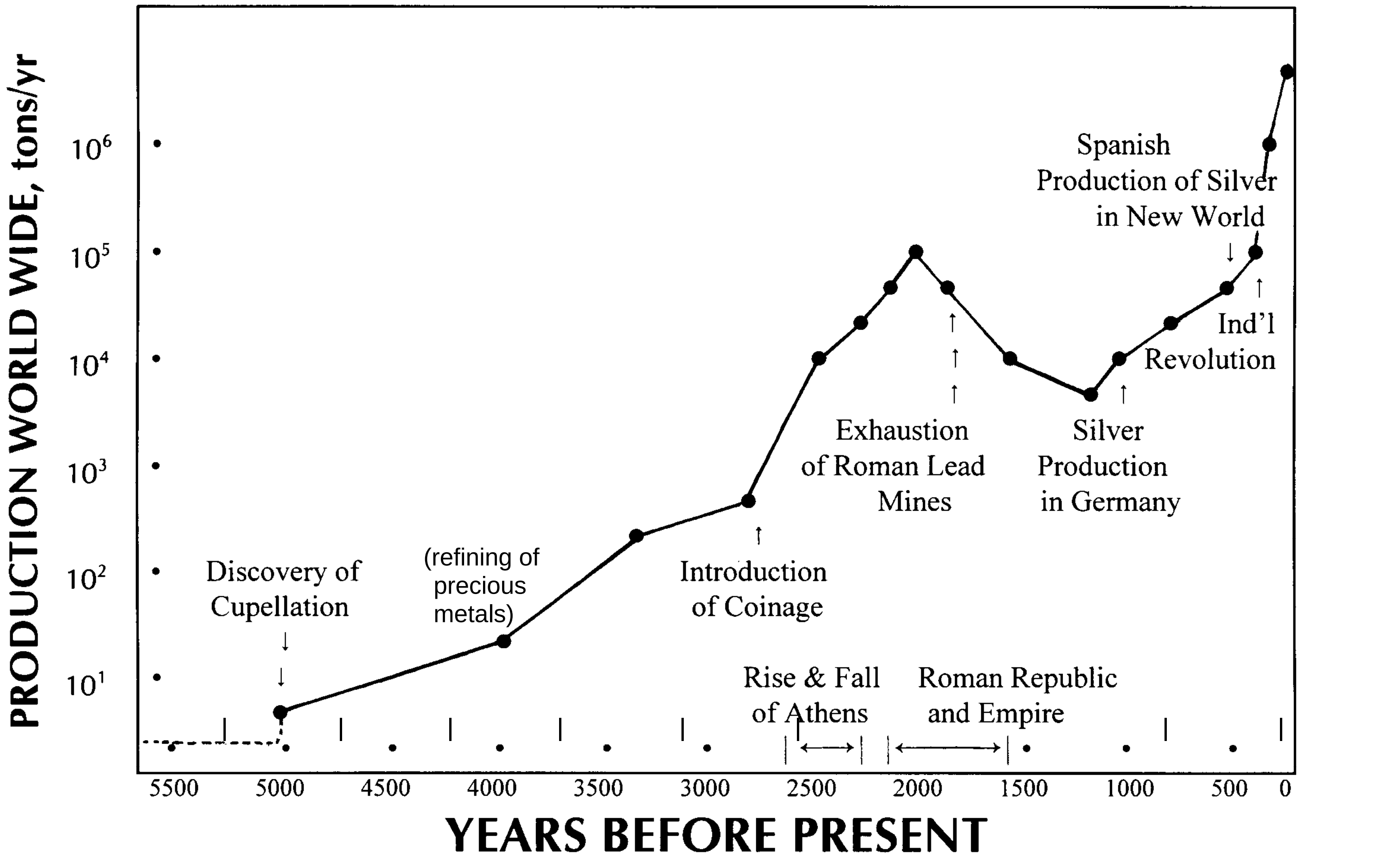
[c] Surface scraping.

[d] Vacuum-collection method.

Adopted from Clark, S., Bornschein, R., Succop, Roda, S. and Peace, B., "Urban Lead Exposures in Cincinnati", Chemical Speciation and Bioavailability. S.T. Nash (Ed.), Lonsdale Press Ltd., London, 1992.

FIGURE B-1

WORLD LEAD PRODUCTION



U.S.EPA Air Quality Criteria for Lead, 1986

Source: Adapted from Settle and Patterson (1980)

FIGURE B-2

UNITED STATES LEAD CONSUMPTION

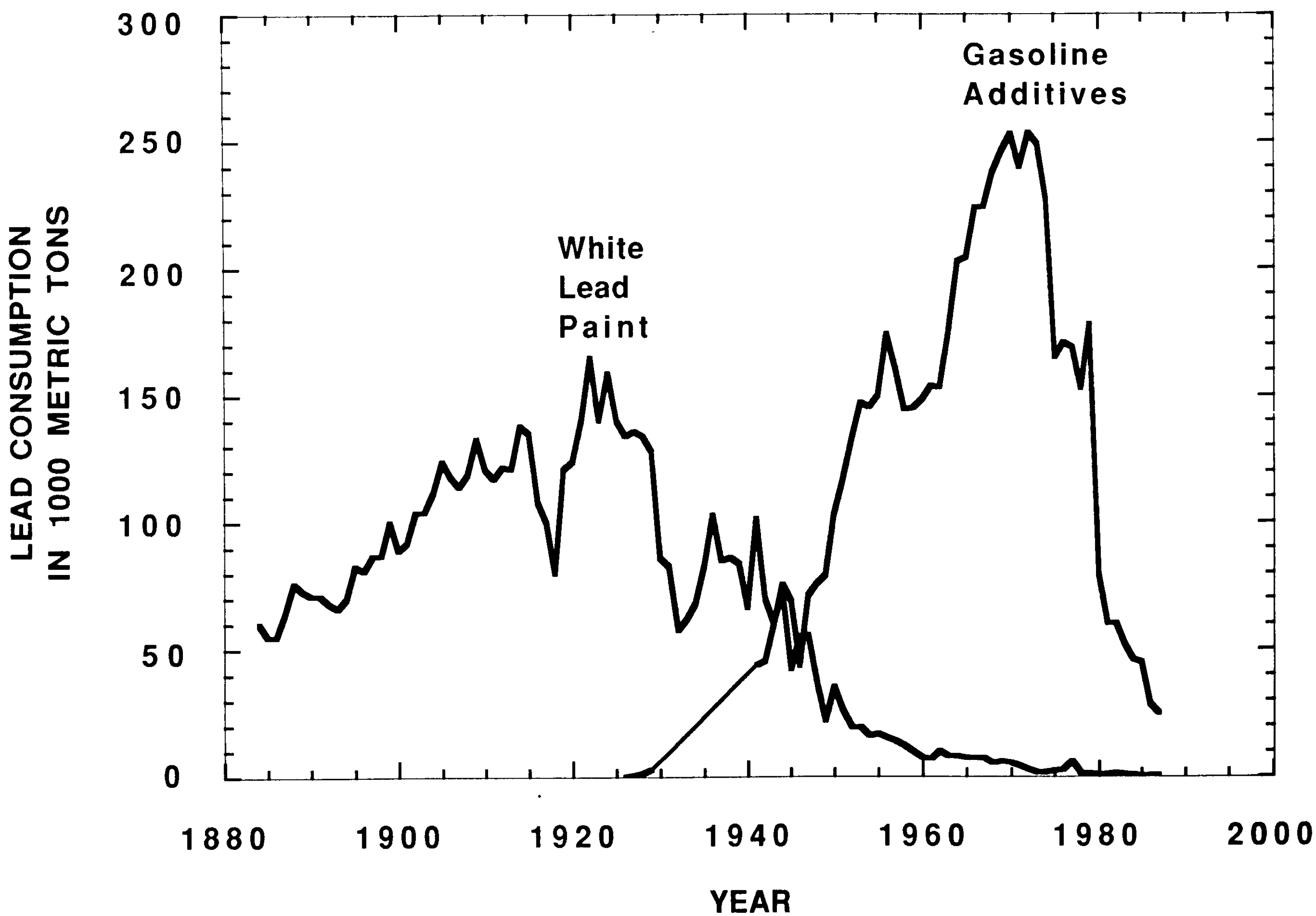
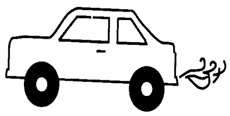
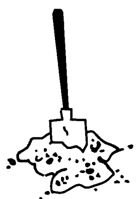


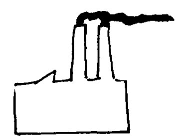
FIGURE B-3

SOURCES OF LEAD

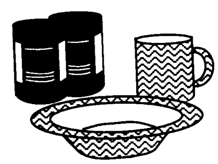


- PAINT
- GASOLINE
- DUST





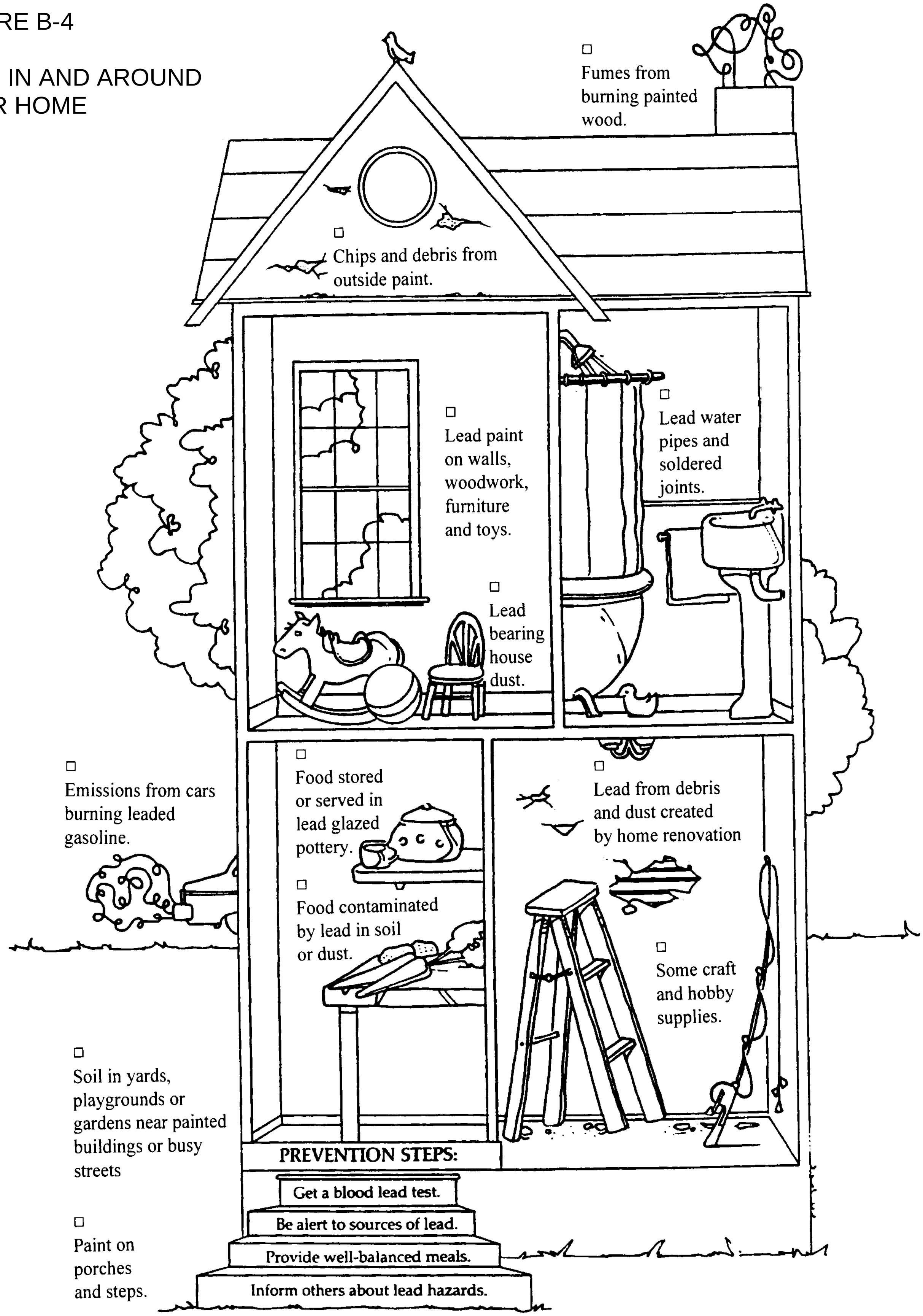
- SOIL
- AIR
- SOLDER
- STATIONARY SOURCES, LIKE SMELTERS
- WATER
- FOOD



Adapted from "Strategic Plan for the Elimination of Childhood Lead Poisoning," February 1991, U.S. Public Health Service.

FIGURE B-4

LEAD IN AND AROUND YOUR HOME



1996-9?

C. Regulatory Review

REGULATORY REVIEW

OBJECTIVE:

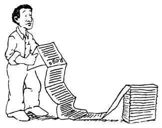
To summarize Title X Legislation, HUD regulations and Guidelines, the OSHA Standards, (General Industry, Lead in Construction, and Hazard Communication), U.S.EPA regulations and guidelines, and other applicable federal and local regulations for lead paint hazard reduction activities.

LEARNING TASKS:

Supervisors/contractors should be able to:

- List the major provisions (including purpose and focus) of the federal OSHA and HUD regulations and guidelines in regard to lead exposure and lead paint abatement.
- Describe a "competent person for health and safety" as defined by OSHA (29CFR1926.62).
- Describe the applicability of the federal OSHA and HUD regulations.
- Explain why it is important to check that worker licenses and certificates are current.
- Identify the OSHA action level and permissible exposure limit for workers engaged in lead abatement.
- Describe actions which must be taken if the OSHA action level for exposure is exceeded.
- Describe actions which must be taken if the OSHA permissible exposure limit for exposure is exceeded.
- List the major provisions of the federal EPA regulations in regard to training and certification requirements for lead abatement personnel.
- Recognize the units used to express lead levels in air and paint.

As a supervisor/contractor on a lead-abatement project, this chapter is important to you because these regulations constitute regulatory requirements which may directly impact the project on which you are working. As a supervisor, you are responsible to assure that the health and safety requirements are met and to implement other applicable elements of the regulations.



REGULATORY REVIEW

Introduction

Since the early 1970s the Federal government has taken a number of regulatory actions to reduce risks connected with human exposures to lead. The use of lead in house paint and in the solder and pipes used in drinking water systems has been banned. The phase-out of lead solder in food cans also has been encouraged. The Environmental Protection Agency (EPA) has taken action to remove lead additives from gasoline and set new standards for drinking water.

Historically, like many hazardous materials, lead has been regulated by several Federal agencies. Each agency has focused on different aspects of the lead hazard. In the early 1990's a number of Federal agencies formed a lead task force to coordinate their efforts in order to produce a unified and sensible approach to lead pollution problems. Agencies represented in this task force are the:

FEDERAL AGENCY LEAD TASK FORCE

- Occupational Safety & Health Administration (OSHA),
- Environmental Protection Agency (EPA),
- Department of Housing and Urban Development (HUD),
- Agency for Toxic Substances & Disease Registry (ATSDR),
- National Institutes of Health (NIH),
- National Institute for Occupational Safety & Health (NIOSH),
- Consumer Product Safety Commission (CPSC),
- National Institute of Standards and Technology (NIST),
- Food & Drug Administration (FDA),
- Maternal Child Health Bureau (MCHB) of the Health Resources Services Administration (HRSA),

- National Institute for Environmental Health Sciences (NIEHS),
- Farmers Home Administration (FHA),
- Department of Veteran's Affairs (DVA),
- Resolution Trust Corporation (RTC),
- Department of Defense (DOD),
- Council on Environmental Quality (CEQ), President's Office, and
- National Aeronautics and Space Administration (NASA).

Regulatory History of Lead

1950 - 1976

1950's	U.S. Public Health officials begin to trace cases of lead poisoning to lead-based paint
1950-70	Some larger cities banned the use of interior lead-based paint
1955	Paint industry adopted voluntary standard limiting use of lead in interior paints to 1% by weight
1970	Occupational Safety & Health Act (OSHA)
1971	Federal government enacted Lead-Based Paint Poisoning Prevention Act (LBPPPA) Public Law 91-695 - amended in 1973, 1976, 1987, and 1988 (McKinney Act)
1972	HUD issued regulations prohibiting use of lead-based paint in Federally-funded housing
1978	CPSC set a maximum allowable amount of lead at 0.06% for residential paints, furniture, and toys, as well as paints used in public places
1978	OSHA promulgated 29 CFR 1910.1025 - Lead in General Industry Standard

1978 - 1996

1990	HUD Interim Guidelines for Indian & Public Housing
1992	Title X of the 1992 Housing and Community Development Act (The Residential LBP Hazard Reduction Act)
1993	OSHA promulgated 29 CFR 1926.62 - Interim Final Lead in Construction Industry Standard
1994	EPA Guidance on Residential LBP, Lead-Contaminated Dust, and Lead-Contaminated Soil
1995 (June)	Revised HUD Guidelines: "Guidelines for the Evaluation & Control of Lead-Based Paint Hazards in Housing"
1996	HUD/EPA Disclosure Rule
1996	EPA Requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities

As you can see from the foregoing regulatory history, the "major players" in the regulation of lead exposure on the Federal level, have been HUD, EPA, and OSHA. Title X and EPA requirements include encouraging the states to set up their own programs. In the past few years, some states, cities, and towns have designed their own lead hazard programs which call for the screening of children, inspections of paint and water, abatement, public education, inspector, supervisor, and worker training and certification/ licensure, and/or waste disposal regulations/guidelines.

MAJOR PLAYERS:
HUD
EPA

NOTE:
Because of the variety of lead regulations, anyone engaged in activities involving lead must look into local and State regulations. When there is more than one regulation governing an act or procedure, the most stringent requirements from each of the

DON'T FORGET STATE REG'S!!

regulations must be followed unless the law states otherwise.

The following summaries of regulations are supplied in this manual as quick references. Some of these regulations will be covered in more detail in other sections of the course, and most of them can be found in your "Lead Abatement Guidelines & Regulations Notebook" (Volume II). You are encouraged to read the full text of the regulations.

TITLE X - THE RESIDENTIAL LEAD-BASED PAINT HAZARD REDUCTION ACT OF 1992

TITLE X
10/28/92

On October 28, 1992 the Housing and Community Development Act of 1992 (P.L. 102-550) which includes Title X (The Residential Lead-Based Paint Hazard Reduction Act of 1992) was signed into law. Title X provides for a comprehensive national approach to dealing with lead-based paint in the nation's housing stock.

Section 403 of the Toxic Substances Control Act (amended by Title X) required the EPA to promulgate regulations which identify lead-based paint hazards, lead-contaminated dust, and lead-contaminated bare soil. It also required the final Rule be promulgated by April 28, 1994. Although EPA did not publish a final rule by this date, the Agency has issued interim guidance. (A copy of this guidance document is in Volume II - Regulations & Guidelines, and will be discussed in the "clearance" session of this course.)

DEFINITIONS

Title X also sets the following definitions:

Lead-based paint hazards: conditions causing exposure to lead from dust, soil, or paint that is deteriorated or present in accessible, friction, or impact surfaces that would result in adverse health effects, and that comes from:

- lead-contaminated dust.
- bare, lead-contaminated soil.
- lead-contaminated paint that is deteriorated or present on accessible, friction, or impact surfaces.

Lead-contaminated dust: Surface dust in residences that contain an area or mass concentration of lead above levels determined to pose a health threat to pregnant women or young children.

Lead-contaminated soil: Bare soil on residential property containing lead above levels determined to be hazardous to human health by the appropriate Federal agency.

TRAINING, CERTIFICATION & WORK PRACTICES

In addition to the foregoing, TSCA Section 402(a) required the EPA to promulgate regulations ensuring that individuals engaged in lead-based paint activities are trained, training programs are accredited, and that contractors are certified. Also, standards were to be set for performing lead-based paint activities (these regulations were promulgated August 29, 1996).

HUD RULES

Title X, Sections 1012 & 1013, mandated HUD to promulgate rules regarding the "Evaluation & Reduction of Lead-Based Paint Hazards in Federally Assisted Housing, and Disposition of Federally Owned Housing." This rule was proposed June 7, 1996. The primary purpose of this Rule is to revise requirements for hazard evaluation and reduction activities. It also adds some notification and disclosure requirements (for current tenants).

NATIONAL LEAD TASK FORCE

Section 1015 of Title X set up a task force to study lead contamination issues. The summary of the task force report ("Putting the Pieces Together: Controlling Lead Hazards in the Nation's Housing") can be ordered by calling 800/424-LEAD or 800/245-2691 (HUD website: www.hud.gov/lea/leahome.html).

DISCLOSURE RULE

Title X Section 1018 (Disclosure of Information Concerning Lead Upon Transfer of Residential Property) required EPA and HUD jointly to promulgate a rule by October 28, 1994 requiring that (for target housing):

- purchasers/lessees receive EPA's lead pamphlet
- sellers/lessors disclose all known lead hazards to purchasers/lessees
- purchasers have a 10-day period for inspection for lead-based paint hazards
- sales contracts contain a Lead Warning Statement.

TARGET HOUSING

This rule was promulgated March 6, 1996. **Target housing** includes any housing constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any child who is less than 6 years of age resides or is expected to reside in such housing) or any 0-bedroom dwelling.

LABORATORIES

Title X also required EPA to establish standards for environmental sampling laboratories (TSCA Section 405). The American Industrial Hygiene Association and the American Association of Laboratory Accreditation are serving as accrediting organizations in the "National Lead Laboratory Accreditation Program" (NLLAP). A list of NLLAP-accredited laboratories can be obtained from the National Lead Information Center (1-800/424-LEAD).

HUD
(History Before Guidelines)

Lead-Based Paint Poisoning Prevention Act (LBPPPA), 1971, amended 1973, 1987 & 1988

LBPPPA

The LBPPPA was adopted to reduce levels of lead in paint in federally financed and subsidized housing and to fund screening and research programs. It was amended in 1973 to require HUD to take steps to eliminate, as much as possible, the hazards of lead-based paint poisoning in federally financed and subsidized housing. Some important sections of the LBPPPA are:

- Section 302 requires Public Housing Agencies (PHAs) and Indian Housing Authorities (IHAs) to conduct a random sampling of pre-1978 family dwellings and common areas in all PHAs/IHAs where children live or are expected to live.

- Specifies the use of an X-ray fluorescence analyzer (XRF), and denotes a reading of 1.0 mg/cm^2 as a positive finding of lead-based paint with a backup of atomic absorption spectroscopic analysis (AAS) if necessary.*

*Please refer to the Glossary (Chapter T) and Sampling for Lead (Chapter O) for a description of the X-ray fluorescence analyzer and atomic absorption spectroscopic analysis.

Lead-Based Paint Statutory and Regulatory Requirements

In response to the 1989 HUD-Independent Agencies Appropriations Act, HUD developed comprehensive technical guidelines on testing, abatement, cleanup, and disposal of lead-based paint in public and Indian housing. Additionally, as directed by the 1990 HUD-Independent Agencies Appropriations Act, HUD issued the Interim Guidelines on April 1, 1990. An Official Revised Edition of these Guidelines was published in September, l990, followed by an extensive revision published in July, 1995 ("Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing").

MC KINNEY ACT

Stewart B. McKinney Homeless Assistance Amendments Act

(amended **LBPPPA** relative to **PHAs** and **IHAs**)
Effective as of November 7, 1988

1. Eliminated requirement to test and abate public housing units at turnover;
2. Eliminated requirement for 100% testing;
3. Extended the period for completion of testing for all PH units until 1994; and
4. Gave PHAs/IHAs the option of testing and abating to the 0.06% Pb level.

HUD GUIDELINES FOR THE EVALUATION AND CONTROL OF LEAD-BASED PAINT HAZARDS IN HOUSING

Latest Version: **July, 1995**

HUD GUIDELINES

The Guidelines provide detailed, comprehensive, technical information on how to identify lead-based paint hazards in housing and how to control such hazards safely and efficiently. The goal of this document is to help property owners, private contractors, and government agencies sharply reduce children's exposure to lead without unnecessarily increasing the cost of housing.

The Guidelines address lead hazards posed by paint, dust, and soil in the residential environment. Lead exposures from air emissions, Superfund sites, drinking water, ceramics, home (folk) remedies, cosmetics, food, or other sources are not the focus of the manual. These sources are regulated by the Environmental or Consumer Protection Agencies.

The 1995 Guidelines were issued pursuant to Section 1017 of the Residential Lead-Based Paint Hazard Reduction Act of 1992, which is often referred to as Title X ("Title Ten") because it was enacted as Title X of the Housing and Community Development Act of 1992 (Public Law 102-550). The Guidelines are based on the concepts, definitions, and requirements set forth by Congress in Title X.

PURPOSE

The primary purpose of the Guidelines is to provide guidance to people involved in identifying and controlling lead-based paint hazards in housing associated with the Federal Government. The Guidelines also may be useful to individuals in housing that has no connection with the Federal government, as well as day-care centers and public buildings that exhibit conditions similar to those in residential structures.

LEAD-BASED PAINT DEFINITION

The Guidelines define “lead-based paint” as any paint, varnish, stain, or other applied coating that has 1 mg/cm^2 (or 5,000 µg/g by dry weight) or more of lead.

Even though the Guidelines are no longer titled **“interim,”** they are subject to change as new information becomes available. The Guidelines are not enforceable by law unless a Federal, State, or local statute or regulation requires adherence to certain parts of the Guidelines.

Refer to your copy of the Guidelines’ Executive Summary for a complete discussion of the lead hazard control process, including:

- planning,
- lead hazard evaluation,
- lead hazard control,
- preparation,
- cleaning and clearance, and
- reevaluation.

The Guidelines should be used <u>in conjunction with</u> the requirements of any State or local codes and regulations which may apply to the specific project under consideration. Where state or local codes are more stringent than the Federal Guidelines, the more stringent requirement prevails.

OSHA LEAD STANDARDS

(29 CFR 1910.1025 & 29 CFR 1926.62)

The General Industry and Construction Industry Lead Standards are very similar so they are summarized together in the following pages. However, some significant differences do exist. Where this is the case, the differences are pointed out in the text.

History

In 1971, OSHA set a Permissible Exposure limit (PEL) of 200 micrograms of lead per cubic meter of air (200 $\mu g/m^3$). In 1978, OSHA promulgated a new lead standard (29 CFR 1910.1025) for all industries except construction and agriculture. This Standard was designed to regulate workplace exposures to lead which are generally constant since conditions and work practices remain fairly constant (e.g., in a battery manufacturing plant). It became the principal source of guidance for establishing what the "standard of care" should be for the construction industry, even before the 1993 promulgation of the OSHA Interim Final Lead in Construction Industry Standard (29 CFR 1926.62). Lead abatement is considered a construction activity.

Exposure Levels

The General Industry Lead Standard (29 CFR 1910.1025), and the Lead in Construction Interim Final Standard (29 CFR 1926.62) set the following Action Level (AL), Permissible Exposure Limit (PEL), and Allowable Blood Lead Level, and medical removal criteria:

EXPOSURE LEVELS

- **Action Level** = 30 micrograms of lead per cubic meter (30 μg/m^3) of air (8-hour average)

- **Permissible Exposure Limit** = 50 μg/m^3 of air (8-hour average)*

- **Allowable Blood Lead Level** = up to 40 micrograms of lead per deciliter (40 μg Pb per dl) whole blood

- **Medical Removal Criteria** =
  General Industry Standard:
  3 tests averaging 50 micrograms of lead per deciliter (50 μg/dl) blood, or 2 tests (periodic and follow-up) of 60 μg/dl
  Construction Interim Final Rule:
  2 tests (periodic and follow-up) 50 μg Pb per dl blood

*for shifts other than 8 hours use: PEL = 400/#hours worked. [E.g., if the shift is 10 hours, the PEL would be calculated as: 400 ÷ 10 = 40 μg/m^3 (8-hour TWA).

NOTE: The Centers for Disease Control (CDC) lowered its "Intervention Level" (community prevention activities) for children in October, 1991, to 10 μg/dl of whole blood.

Requirements

✓Any Occupational Exposures At or <u>Above</u> the Action Level (30 µg Pb per m^3) Require:

EXPOSURES ABOVE THE A.L.

1. Semi-annual exposure monitoring at a minimum--more frequently when workplace changes may affect exposure levels.

2. Medical Surveillance Program (General Industry: if exposure is at or above AL for 30 days/year--not necessarily consecutive days). The testing must be offered at no cost to the employee and at a reasonable time and place. Blood-lead testing frequency depends upon exposure levels and blood-lead levels, but is required before job assignment to use as a base-line. (Construction Interim Final Rule states <u>initial medical surveillance</u> must be made available to employees exposed above the action level on <u>any</u> day.)

3. Training & Education prior to initial job assignment and annually thereafter.

EXPOSURES ABOVE THE P.E.L.

✓Occupational Exposures <u>above</u> Permissible Exposure Limit (50µg Pb per m^3), without regard to respirators, *(General Industry Standard: >30 days/year; Construction Interim Final Rule: on any day)* require:

1. Exposure monitoring - quarterly (3 months) -- additional monitoring if changes may affect exposure level.
2. Engineering and work practice controls (including administrative controls)

3. Written compliance program (prior to beginning the job)
4. Protective clothing
5. Hygiene facilities
6. Respiratory protection program
7. Warning Signs

COMPETENT PERSON

✓OSHA Competent Person

In 29 CFR 1926.62, OSHA defines a "competent person" as "one who is capable of identifying existing and predictable lead hazards in the surroundings or working conditions and who has authorization to take prompt corrective measures to eliminate them." There is a similar definition in 29 CFR 1910.1025. On a lead hazard reduction project, the competent person has the responsibility to ensure the compliance program for the project is adhered to by all personnel at the project site.

COMPLIANCE PROGRAM

✓Compliance Program

The OSHA Interim Final Lead in Construction Standard (1926.62) requires a written compliance program for all jobs. The purpose is to prevent employee exposure above the PEL and address how that will be done whether that be through the use of engineering controls, respiratory protection, or by use of good work practices. The Plan must be written and implemented prior to beginning a lead abatement job. It must be reviewed and updated every six months for the duration of the lead abatement job. This written program includes at least:

1. A description of each operation in which lead is emitted; e.g., machinery used, material processed, controls in place, crew size, employee job responsibilities, operating procedures, and

maintenance practices;

2. A description of the specific means to be employed to achieve compliance, including engineering plans and studies used to determine methods selected for controlling exposure to lead;
3. A report of the technology considered to prevent exposures from exceeding the PEL;
4. Air monitoring data which documents the source of lead emissions;
5. A detailed schedule for implementation of the program, including documentation such as copies of purchase orders for equipment, construction contracts, etc.;
6. A work practice program which includes protective work clothing and equipment, housekeeping requirements, and hygiene facilities and practices;
7. An administrative control schedule (a job rotation schedule, if administrative controls are used to reduce employee TWA exposure to lead, is to be established and implemented);
8. Other relevant information.

(See the HUD Guidelines in Volume II for an example.)

The compliance program shall provide for frequent and regular inspections of job sites, materials, and equipment to be made by a competent person. Written programs shall be submitted upon request to any affected employee or authorized employee representatives, to the Assistant Secretary and the Director, and shall be available at the worksite for examination and copying by the Assistant Secretary of OSHA and the Director of NIOSH. Written programs shall be revised and updated at least every six (6) months to reflect the current status of the program (*Construction Industry Standard*).

✓**Hygiene Facilities**

HYGIENE FACILITIES

The following hygiene facilities are required when the PEL is exceeded:

1. **Change Rooms** with separate storage facilities for work and street clothing. The change room (clean side) is one of only two jobsite locations where eating, drinking, smoking, or use of cosmetics is permitted--the lunchroom is the other. (Locations for removing protective clothing will often have to be improvised at lead-abatement sites.)

2. **Showers** must be provided, where feasible, and, if available, all workers must shower at the end of the work shift.

3. **Lunchrooms:**

   General Industry Standard -- have temperature controlled, positive-pressure, filtered air supply.
   Construction Industry Standard -- facilities or eating areas are as free as practicable from lead contamination and are readily accessible. Employees must wash their faces and hands before eating or smoking and not enter the eating area wearing uncleaned protective clothing.

4. An adequate number of **Lavatories** (*General Industry Standard*).

RESPIRATORY PROTECTION PROGRAM

✓Respiratory Protection Program

The OSHA Lead Standard stipulates that when engineering and work practice controls do not reduce employee exposure to or below the PEL, the employer shall supplement these controls with a written respiratory protection program (see OSHA Respiratory Protection Standard on page C-34 and Chapter L, Respiratory Protection).

EMPLOYEE TRAINING

✓Employee Training

The employer shall institute a training program for and assure the participation of all employees who are subject to exposure to lead at or above the action level on any day or for whom the possibility of skin or eye irritation exists. (Training to be prior to the time of initial job assignment.) The following elements must be in the training program:

1) content of lead standard
2) specific nature of operations
3) respirator use, fitting, etc.
4) descriptions of medical surveillance program, medical removal protection program, and adverse health effects
5) engineering controls and work practices (site/job-specific)
6) contents of any compliance plan in effect
7) prohibition of chelating agents
8) employee’s right of access to records

And the employer "shall assure that each employee is informed" of the OSHA 29 CFR 1926.62 regulation.

✓Signs

SIGNS

The employer shall post the following warning signs at all access points to each work area where the PEL is exceeded:

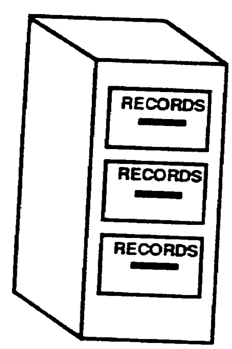
WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

RECORD KEEPING

✓Record Keeping

Subpart C of 29 CFR 1910.1020 (d)(1)(i) requires:

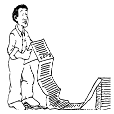
1. Exposure monitoring records
   - preserved and maintained for at least 30 years (except for background data and MSDSs),
2. Medical surveillance records
   - preserved and maintained for at least term of employment plus 30 years; records can be given to short-term employees (less than one year) at termination and need not be retained.



Subpart C, 29 CFR 1910.1020 (d)(1)(i) applies to construction employers as well as general industry and maritime employers, and is referenced in 29 CFR 1926.62. In addition, 1926.62 requires:

3. Medical removal records
   - preserved and maintained for duration of employment.

These records are to be available upon request of the Assistant Secretary of Labor or the Director of NIOSH for examination and copying. If the employer goes out of business and there is no successor, records are transferred to the Director, or the Director can be notified at least three months prior to their disposal.



MAJOR DIFFERENCES BETWEEN
OSHA GENERAL INDUSTRY LEAD STANDARD
(29 CFR 1910.1025)
and
OSHA LEAD IN CONSTRUCTION INTERIM FINAL RULE (29 CFR 1926.62)

1910.1025 vs 1926.62

The Lead in Construction Interim Final Rule determines the kind of respirator initially required by the kind of task involved (see Chapter L, Respiratory Protection). It sets up **"High Exposure Tasks"** which trigger certain protections prior to air-lead monitoring:

HIGH EXPOSURE TASKS

1. Tasks which commonly produce exposures above the 50 µg/m^3 PEL, but less than 10 times the PEL:

    - manual demolition of structures (e.g., dry wall)
    - manual scraping
    - manual sanding
    - heat gun applications
    - spray painting with lead-based paint
    - power tool cleaning with dust collection system

    And any other tasks when the employer has reason to believe exposure may exceed the PEL.

2. Tasks which result in exposures 10 times to 50 times the PEL (from 500 µg/m^3 to 2,500 µg/m^3):

    - using lead-containing mortar or lead burning
    - cleanup of dry expendable abrasives
    - rivet busting, power tool cleaning without dust collection systems
    - movement and removal of abrasive blasting

enclosures

3. <u>Tasks which produce > 2,500 μg/m³ (>50 times the PEL)</u>:
   - abrasive blasting
   - welding
   - cutting
   - torch burning on steel structures

MEDICAL SURVEILLANCE

Medical Surveillance:

Initial medical surveillance (which consists of biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels) must be made available by the employer to **construction** workers exposed to airborne concentrations of lead on <u>any day</u> at or above the action level (30 μg/m³). **General Industry** workers are not provided initial medical surveillance until exposure above the action level occurs on more than 30 days per year.

MEDICAL REMOVAL

Medical Removal Provision:

Standard	*Provision*
General Industry	Remove (to exposures < AL) based on the average of three blood tests of 50 μg/dl, or one test of ≥ 60 μg/dl.
Construction Industry	Remove (to exposures < AL) any worker who has been exposed to lead at or above the action level on each occasion that a periodic <u>and</u> follow-up blood sampling test indicate blood-lead levels ≥ 50 μg/dl. Workers retain their pay status (as long as the job continues, or up to 18 months).

OSHA 2207
CONSTRUCTION INDUSTRY STANDARD
(29 CFR 1926)

NOTE: GENERAL PROVISIONS OF 1926 THAT APPLY TO YOU!!

Subpart B - General Interpretations (1926.10)

Scope: No contractor or subcontractor shall require any laborer or mechanic employed in the performance of a contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his/her health or safety, as determined under construction safety and health standards promulgated by the Secretary of Labor.

Application: For this Standard to apply, contracts must be ones which:

1. are entered into under a statute subject to Reorganization Plan No. 14 of 1950 (64 Stat. 1267) which includes 57 different construction acts [refer to 29 CFR 1926.12(b)]; and

2. are for construction, alteration, and/or repair, including painting and decorating.

Subpart C - General Safety and Health Provisions (1926.20 & .21)

Accident prevention responsibilities: The employer must initiate and maintain programs to ensure working conditions do not become unsanitary, hazardous, or dangerous to the workers' health or safety. These programs must include frequent and regular inspections of the job sites, materials, and equipment by competent persons designated by the employer.

Safety training and education: The employer shall instruct each employee in the recognition and avoidance of unsafe conditions. Employees must also receive training on the regulations which apply to their work for the control or elimination of any hazards or other exposures to illness or injury. Hazards can include:

- materials handling equipment, other powered equipment
- poisons and caustics
- flammable liquids, gases, or toxic materials
- confined or enclosed spaces
- harmful plants or animals

Subpart D - Occupational Health and Environmental Controls (1926.50)

Medical services and first aid: The employer shall ensure that a medical person be available for advice and consultation on matters of occupational health. If no infirmary, clinic, hospital, or physician is reasonably near (time and distance) the worksite, someone with a valid certificate in first aid must be at the worksite to give first aid. This section also:

- defines what is necessary in the on-site first-aid kit,
- requires proper equipment for prompt transportation of injured persons, and
- requires that telephone numbers of the physicians, hospitals, or ambulances be conspicuously posted.

The foregoing are just some of the general provisions of the Construction Industry Standard (29 CFR 1926). The full Standard plus appendices is almost 600 pages in length. A copy of the Index for the Construction Standard is included in your GUIDELINES & REGULATIONS NOTEBOOK (Volume II); you may obtain a full copy of the Construction Industry Standard for approximately $33 from the Superintendent of Documents of the U.S. Government Printing Office (202/783-3238).

OSHA
HAZARD COMMUNICATION STANDARD
(HAZCOM)
(29 CFR 1926.59)

COMPLIANCE TO HAZCOM 1926.59 IS MANDATORY!

Because the HUD Guidelines emphasize the HazCom regulation, it will be covered in detail in the "Hazardous Material Identification" chapter of this manual. This summary is provided as a quick reference for the lead abatement supervisor/contractor.

Background

The HazCom (or right-to-know) Standard is one of OSHA's most significant workplace regulations. It has two broad requirements:

1. **Chemical manufacturers must:**
   - Evaluate their products.
   - Label those which are hazardous.
   - Provide detailed hazard information to their commercial customers (MSDS).

2. **Employers who use hazardous materials must:**
   - Inform their employees of hazards.
   - Train them to work safely with the toxic substances they encounter on their jobs.
   - Train them for emergency situations.

PURPOSE

The purpose of the HazCom is to inform workers and others exposed to certain toxic substances of the health risks associated with them. The Standard is not intended to limit production, use, or distribution of the chemicals.

Who/What Is Covered?

The Standard applies to almost every organization--those who actually produce chemicals and those who use them. Unlike the OSHA Lead Standard, which only deals with lead and is triggered by exposure, the hazard communication requirements must be met whenever hazardous chemicals are used.

In general, the HazCom covers any chemical, including those in mixtures known to be in the workplace where workers would be exposed to them under normal conditions. Lead paint and chemicals used as paint strippers, for example, would be covered.

COMPLIANCE

Compliance

The employer must develop a compliance program which includes these key elements:

- Hazard Determination
- Written Hazard Communication Program
- Warning Labels
- Material Safety Data Sheets
- Employee Training

1. Hazard Determination

HAZARD DETERMINATION

A key step in the development of a Material Safety Data Sheet (MSDS) and the labels for containers, is a determination of which chemicals are hazardous and why they are hazardous. Three sources list hazardous chemicals:

- OSHA 29 CFR 1910, Subpart 2, Toxic and Hazardous Substances
- American Conference of Governmental Industrial Hygienists (ACGIH)--Threshold Limit Values
- NIOSH Pocket Guide to Chemical Hazards

If a chemical is listed in any of these sources, it is considered hazardous. Also, if a chemical is known to possibly cause cancer, that fact must be included on the MSDS.

WRITTEN HAZARD COMMUNICA-TION

2. <u>Written Hazard Communication Program</u>

The written hazard communication program will be part of your overall worker training plan. It should be easy to implement and easy to describe to an OSHA inspector. It should include:

- Program introduction
- Program management (including the role of the supervisor)
- Participating personnel
- Hazardous locations
- Hazardous chemical listing
- Hazard labeling
- MSDSs (use same names as on container labels)
- Training programs
- Trade secret access
- Documentation
- Program evaluation/quality assurance
- Methods for controlling exposure

WARNING LABELS

3. <u>Warning Labels</u>

Hazardous chemical containers must have the following information labeled, tagged or marked on them before they are put into use. You also must label "secondary" containers which hold substances that have been taken out of their original manufacturer's container:

- Identity of hazardous chemicals.
- Appropriate hazard warnings.
- Name and address of chemical manufacturer, importer, distributor, or other responsible party.

OSHA accepts other systems for in-plant labeling (e.g., using numbers or other methods to categorize hazards). However, if such systems are used, worker training must stress the target organ effects of the chemicals.

4. <u>Material Safety Data Sheets (MSDS)</u>

MSDSs

MSDSs must be available at the worksite for all hazardous chemicals present. MSDSs are covered in detail in the Hazardous Material Identification section of this manual.

5. <u>Employee Information and Training</u>

EMPLOYEE INFORMATION & TRAINING

OSHA's requirements for employee training are specific, but flexible, to allow a company to have a program tailored to its operation. Basic training should cover:

- HazCom explanation
- Training requirements of the law
- Company training program
- Company HazCom explanation and location
- Where to find the hazardous chemical list
- Locations of hazardous chemicals
- Description of labeling systems
- MSDS descriptions and their location (examples of MSDSs of particular relevance to lead abatement are presented in the “Hazardous Material Identification” section of this manual.

- How to control exposures

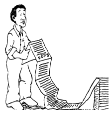
NOTE FROM "OSHA Instruction CPL 2-2.58":

1926.62(1) Employee Information and Training

"Although 29 CFR 1926.62(1) references 29 CFR 1926.59 and requires that all employees covered by the "Lead Exposure in Construction" standard receive hazard communication training, the Hazard Communication standard, 29 CFR 1926.59, would not normally cover employees subject to lead exposure generated from lead-containing materials (LCM) already in place on the job. Employees exposed to such hazards are covered by 29 CFR 1926.21(b)(2) which requires that the employer instruct each employee in the recognition and avoidance of unsafe conditions and in the regulations applicable to his or her work environment in order to control or eliminate any hazards or other exposure to illness or injury.

- Under this provision, the employer is required to instruct employees exposed to lead in the hazards of lead and in the requirements of the "Lead Exposure in Construction" standard **even if the exposure does not exceed the action level**. This instruction need not be as comprehensive as any of the training provided under 29 CFR 1926.62(1)(2).

- An effective employee training program provided under 29 CFR 1926.62(1) must include the elements listed in 29 CFR 1926.62 (1)(2)(i)-(viii) and be specific as to the job conditions. A generic training program can be used but must be modified to address site-specific issues such as what operations have exposures greater than the AL, engineering controls, work practices, PPE associated with specific job assignments, and the medical surveillance program."



OSHA
RESPIRATORY PROTECTION STANDARD
(29 CFR 1910.134)

Background

OSHA regulations require employers to determine what types of respiratory equipment are needed for their workers, and to make sure that workers know how to use, and do use, the equipment available.

The two basic objectives of any respiratory protection program are: (1) to protect the wearer from safety and health inhalation hazards, and (2) to prevent the wearers from being injured if there is a malfunction or they do not use the equipment correctly.

TWO BASIC TYPES

There are two basic types of respiratory devices:

- Atmosphere-supplying or supplied-air respirator (SAR)
- Air-purifying or filtering respirator (APR)

Atmosphere (air)-supplying respirators must be worn in situations immediately dangerous to life and health:

- When the oxygen available to breathe is 19.5 percent or less, or
- there are dangerous concentrations of hazardous gas, vapor, or particles in the air that may not be filtered out safely.

These respirators provide air through a hose from a tank or compressor through a hose. There are two types:

- The self-contained breathing apparatus (SCBA) allows freedom of movement, but only a limited amount of air.

- Air-line respirators supply air from a compressor or a large tank of compressed air. They have a large air supply, but their hoses may get tangled or limit movement.

Note: These types of respirators are not usually used in lead-based paint work except when conducting abrasive blasting on bridges or other steel structures.

<u>Air-purifying respirators</u> are used when the air has enough oxygen, but contains potentially harmful gas, vapor, or particulates. This type of respirator utilizes cartridges which filter or absorb the contaminants as existing air is breathed. These respirators are available in full or half facepieces with disposable filters. Which type the employer chooses depends on the type and concentration of the contaminant to be removed from the air, the efficiency of the respirator against the contaminant, and the warning properties of the contaminant. These respirators also have an end-of-service life and eventually lose their ability to filter or absorb the contaminant they were designed to protect against.

Most lead-abatement projects use a half-face HEPA respirator.

GENERAL REQUIREMENTS

General Requirements

1. Personal protective equipment must protect employees from all hazards and potential hazards identified during the site

characterization and analysis.

2. When there is an immediate danger to life or health (IDLH) condition, positive pressure SCBA, or positive pressure air-line respirators equipped with an escape air supply must be used. (These conditions are usually not present on lead-abatement projects.)

3. The level of respiratory protection must be increased when additional information or site conditions show that it is necessary to reduce exposures below established PEL's.

MINIMALLY ACCEPTABLE PROGRAM

OSHA requires that respirators be supplied "when such equipment is necessary to protect the health of an employee." This requirement includes an on-going respiratory protection program. The requirements for a minimally acceptable program are:

1. Written standard operating procedures regarding the selection and use of respirators.

2. Respirators selected on the basis of hazards workers are exposed to.

3. A training program in the proper use of respirators and their limitations.

4. Workers should be assigned individual respirators when possible.

5. Respirators that are cleaned and disinfected on a regular basis. If more than one worker uses the same

respirator, it must be cleaned after each use.

6. Respirators stored in a convenient location in a clean, sanitary, sealed container.

7. Routine inspection during cleaning of respirators.

8. Appropriate surveillance of work area conditions and degree of worker exposure or stress maintained.

9. Regular inspection and evaluation to determine the continued effectiveness of the program.

10. Workers assigned to tasks requiring respirators must be physically able to perform the work and use the equipment. A local physician shall determine what health and physical conditions are pertinent. OSHA recommends an annual review of a respirator worker's medical status.

11. Respirators must provide adequate respiratory protection against the particular hazard they are designed for according to standards set by "competent authorities." Authorities recognized by OSHA include the U.S. Department of the Interior, Bureau of Mines, and the U.S. Department of Agriculture.

WORKER TRAINING

To safely use the respiratory protection equipment, both supervisors and workers must be instructed by competent personnel. Training must allow the worker to:

- handle the respirator to know how to put it on and take it

off properly and how to clean and store it,
- have it fitted properly to the individual’s face,
- test its facepiece-to-face seal,
- wear it in normal air long enough to get used to it, and
- then use a test atmosphere to determine its effectiveness.

POTENTIAL FITTING PROBLEMS

Every respirator wearer must receive fitting instructions, including how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Problems to watch out for include workers who have beards, sideburns, eyeglasses, dentures, or anything that might change the respirator's proper fit. Except for PAPR’s, beards cannot be worn if they extend into facial areas where the respirator seals to the skin. Eyeglasses pose special problems. Because a proper seal cannot be established if the temple bars of eyeglasses extend through the sealing edge of the full facepiece, special full-face respirator facepieces have been developed to accommodate eyeglasses.

EPA
DRINKING WATER REGULATIONS FOR LEAD

Goal:
Water systems should try to supply water which is free of lead.

ACTION LEVEL: 15µg

Action Level:
The treatment requirements of the regulation are triggered if the action level of 15 µg (or 15 ppb) Pb per liter of water is reached in at least ten percent of the homes where samples were collected.

Legislative Basis:
Safe Drinking Water Act

Regulation:
National Primary Drinking Water Regulations for Lead and Copper (June 1991 Fact Sheets and brochure on "The Lead Ban" are included in Volume II: Guidelines & Regulations Notebook.)

SOURCES

Sources of Lead in Drinking Water:
- Lead in solder and in brass faucets and fixtures and pipe
- Lead Service Lines (20% of Public Water Systems)
- Source Water (1% of Systems)

REQUIREMENTS

Requirements of Regulation to Reduce Lead in Drinking Water:
- Optimal corrosion control treatment
- Source Water Treatment
- Public Education
- Lead Service Line Replacement (if corrosion control not effective in meeting goal)

In August, 1996, the U.S. EPA, in a revision of the Safe Drinking Water Act, mandated that all new plumbing fixtures must have no lead content by February, 1999.

Relevance to Residential Lead Abatement:

RELEVANCE

A comprehensive residential lead abatement effort should consider all significant lead sources in the home. In addition, replacement of pipes with lead solder, brass faucets and fixtures, and lead water lines found within partitions in the house will probably be more economical to do at the same time as the walls are being disturbed for paint abatement.

TREATMENT, STORAGE & DISPOSAL OF HAZARDOUS WASTE

EPA
RESOURCE CONSERVATION & RECOVERY ACT
(RCRA)
(42 USCA 6901 et seq. and 40 CFR 240-281)

RCRA was enacted in 1976 as an amendment to the Solid Waste Disposal Act (SWDA) and reauthorized with several amendments by Congress in 1980 and 1984. Originally, RCRA requirements covered waste identification, waste characterization, permitting, recordkeeping, manifesting, and recycling, disposal, treatment, and storage standards. When RCRA was reauthorized in 1984 EPA was authorized by Congress to issue additional hazardous waste management rules. (The reauthorized RCRA is often referred to as the Hazardous & Solid Waste Amendments [HSWA] of 1984.)

Part of the reauthorized RCRA are the rules concerning small quantity generators, underground storage tanks, secondary containment for tanks holding hazardous waste, double liners, leachate collection systems, and leak detection systems for landfills, land treatment facilities, and surface impoundments, and restrictions on land disposal of hazardous waste. RCRA amendments focus on interstate transportation of solid waste, solid waste recycling and packaging standards, disposal of municipal ash, hazardous waste recycling, and waste reduction.

RCRA gives the states primary responsibility for management of nonhazardous solid waste. However, it directs the EPA to adopt regulations setting minimum standards for the states to meet. It also directs EPA to establish, administer, and enforce regulatory systems governing the management of solid waste, including hazardous waste.

Lead abatement contractors/supervisors must be aware of RCRA requirements because lead abatement activities often generate hazardous waste. The generator of hazardous wastes has certain responsibilities under RCRA. These responsibilities are covered in detail in the “Waste Disposal” section of this training manual.

Contractors should remember to contact the states they are working in for other specific requirements.

EPA

Requirements for Lead-Based Paint Activities In Target Housing and Child-Occupied Facilities 40 CFR Part 745 Subpart L - Lead-Based Paint Activities (TSCA 402-404) August 29, 1996

WHO/WHAT IS COVERED?

One of the requirements of Title X for EPA was to promulgate regulations for training and certification (or licensing) of individuals and firms involved with lead hazard reduction and accreditation of training programs. Another requirement was the establishment of work practice standards.

This regulation applies to:

- all individuals & firms engaged in LBP activities;
- all states and tribes without authorized state or tribal programs;
  and
- all federal agencies having jurisdiction over properties or facilities.

EFFECTIVE 8/29/96

The effective date of the 40 CFR 745 regulation is August 29, 1996. However, all provisions of the regulation have deferred applicability dates:

① All states and tribes are to have authorized programs in place by August 31, 1998. They can apply for authorization of their programs on or after October 28, 1996.

For training providers and/or individuals and firms operating in states or tribes <u>without</u> authorized programs, the following dates apply:

② Training courses must be approved by March 1, 1999. Training providers may apply for approval on or after August 31, 1998.

③ Individuals and firms engaged in LBP activities must be certified by August 30, 1999. They may apply for certification after March 1, 1999.

④ All work practices must be followed after August 30, 1999.

Following are some important definitions found in the 402-404 rules:

SOME DEFINITIONS

<u>Abatement</u> means any measure or set of measures designed to permanently eliminate lead-based paint hazards. Abatement includes, but is not limited to:

(1) The removal of LBP and lead-contaminated dust, the permanent enclosure or encapsulation of lead-based paint, the replacement of lead-painted surfaces or fixtures, and the removal or covering of lead-contaminated soil; and

(2) All preparation, clean-up, disposal, and post-abatement clearance testing associated with such measures.

(3) Specifically, abatement includes, but is not limited to: (i) projects for which there is a written contract or other documentation, which provides that an individual or firm will be conducting activities in or to a residential dwelling or child-occupied facility that: (A) Shall result in the permanent elimination of LBP hazards; or (B) Are designed to permanently eliminate LBP hazards and are described in paragraphs (1) and (2) of this definition. (ii) Projects resulting in the permanent elimination of LBP hazards, conducted by firms or individuals certified in accordance with Sec. 745.226, unless such projects are covered by paragraph (4) of this definition; (iii) Projects resulting in the permanent elimination of LBP hazards, conducted by firms or individuals who, through their company name or promotional literature, represent, advertise, or hold themselves out to be in the business of performing LBP activities as identified and defined by this section, unless such projects are covered by paragraph (4) of this definition; or (iv) Projects resulting in the permanent elimination of LBP hazards, that are conducted in response to State or local abatement orders.

EXCEPTIONS: Abatement does **not** include**:**

- Renovation
- Remodeling
- Interim controls
- Operations & Maintenance activities
- Other activities which are not purposely designed to permanently eliminate LBP hazards

Lead-Based Paint Activities means, in the case of target housing and child-occupied facilities:

- inspection

- risk assessment
- abatement

Target housing means any housing constructed prior to 1978, **except:**

- Housing for the elderly or persons with disabilities (unless one or more children ≤ 6 years of age resides or is expected to reside in such housing); or
- any 0-bedroom dwelling.

Child-occupied facility means a building or portion of a building, constructed prior to 1978, visited regularly by the same child, ≤ 6 years, on at least **two different days** within any week (Sunday - Saturday), **provided:**

- that day's visit lasts at least 3 hours, and
- the combined weekly visit lasts at least 6 hours, and
- the combined annual visits last at least 60 hours.

This includes:

- day-care centers
- pre-schools
- kindergarten classrooms

Certification of Individuals

CERTIFICATION OF INDIVIDUALS

To apply for certification of an individual, the applicant must either submit an application demonstrating requirements have been met for the discipline sought, or submit an application with a copy of a valid LBP activities certification (or equivalent) from an authorized state or tribal program.

The chart on page C-45 gives the minimum number of training hours, the number of hands-on hours within the training course, requirement for the third-party certification examination, any prerequisite education or experience required, and number of refresher training hours required for each discipline.

GRAND-FATHERING

This regulation also has a “grandfathering” provision for persons who successfully completed training between October 1, 1990 and March 1, 1999. These persons would submit an application which includes:

1. proof of successfully completing the training course, or on-the-job training;
2. proof of meeting or exceeding education and/or experience requirements; and
3. proof of successfully completing an accredited refresher training course within the required time period.

Inspectors, Risk Assessors, and Supervisors must also pass a third-party certification examination.

EPA has 90 days to approve or disapprove the request for certification. The course certificate serves as interim certification until certification notification is received from the EPA. (Inspector, Risk Assessor, and Supervisor trainees are allowed three [3] chances within six [6] months to pass the EPA examination.)

Table C-1EPA Lead Hazard Control Training Requirements

Discipline	Total #Trng Hours	#Hds-on Hours	EPA/State Exam	Pre-Requisite Education and/or Experience	Refresher Training Hours
Inspector	24	8	yes	none	8
Risk Assessor	16	4	yes	inspector training and bachelor's degree and 1 yr exp. in related field*; or associate's degree and 2 yrs exp. in related field; or CIH, PE, RA and/or certification in related field**; or high school diploma/equivalent and at least 3 yrs exp. in related field.	8
Supervisor	32	8	yes	one year exp. as certified LBP abatement worker, or at least 2 yrs exp. in related field or in building trades.	8
Project Designer	8	0	no	supervisor training, and either 1)bachelor's degree in engineering, architecture, or related profession; and 1 year experience in building construction & design or related field; or 2) 4 yrs exp. in building construction & design or related field.	4
Worker	16	8	no	none	8

* e.g., lead, asbestos, environmental remediation work, or construction.
** e.g., safety professional or environmental scientist.

RE-CERTIFI-
CATION

Re-certification of Individuals

There is a re-certification requirement for Inspectors, Risk Assessors, and Supervisors of:

- ✓ every three (3) years if the applicant completed an initial course which used a course test and hands-on assessment, or
- ✓ every five (5) years if the applicant completed an initial course which used a proficiency test

Recertification can be obtained by successfully completing a refresher course.

CERTIFICATION
OF FIRMS

Certification of Firms

A firm can become certified by submitting a letter to EPA attesting that:

- ✓ it shall only employ appropriately certified employees to conduct LBP activities; and
- ✓ it and its employees shall follow 745.227 work standards for conducting LBP activities.

EPA will have 90 days to approve or disapprove the request for certification.

Work Practice Standards

Section 745.227 of 40 CFR Part 745 deals with standards of work practice. These standards are covered in more detail in appropriate course/manual sections.

The first provision of this section is that all LBP activities must be performed by certified individuals.

> EXCEPTION:
> No certification is necessary for persons performing LBP activities within buildings they own and live in, unless a child residing in the building has been identified with an elevated blood-lead level.

SAMPLING METHOD-OLOGIES

For inspectors and risk assessors, sampling methodologies to be used are documented in:

- ⇨ The U.S. Department of Housing and Urban Development (HUD) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing;

- ⇨ The EPA Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust, and Lead-Contaminated Soil;

- ⇨ The EPA Residential Sampling for Lead; Protocols for Dust and Soil Sampling (EPA report #7474-R-95-001);

- ⇨ Regulations, guidance, methods or protocols issued by States and Indian Tribes that have been authorized by

EPA; and

⇨ Other equivalent methods and guidelines.

Other Provisions

OTHER RE-QUIREMENTS FOR SUPERVISORS

Other general provisions of these standards for abatements are:

1. Certified supervisors are required on-site during all worksite preparations and during post-abatement cleanup of every project. At other times, they must be on-site or available by telephone, pager, or answering service, and be able to be present at the work site in no more than 2 hours.

2. The certified supervisor and the certified firm are responsible for ensuring all abatement activities are conducted according to the EPA Work Practice Standards and all other Federal, State, and local requirements.

3. Notification is required prior to commencement of abatement activities (procedure for notification will be in place by August 31, 1998).

4. A written Occupant Protection Plan (unique to each facility/residence) which describes protective measures for occupants, must be prepared by a certified supervisor or project designer for each project.

5. Some practices are explicitly restricted:

RESTRICTED PRACTICES!

   ☞ open-flame burning or torching are prohibited.

☞ machine-sanding and grinding or abrasive blasting and sandblasting without HEPA exhaust control is prohibited.

☞ dry-scraping is prohibited unless:

- in conjunction with heat gun or around electrical outlets;
- if LBP area is ≤ 2 square feet in rooms, hallways & stairways;
- if LBP area is ≤ 20 square feet on exterior surfaces.

☞ heat guns are prohibited to be used ≥ 1100°F.

These restrictions will be covered in more detail in appropriate sessions of the course and the “Lead Hazard Reduction Strategies” section of this manual.

SOIL ABATEMENT

7. Soil abatement procedures are also described in the regulation. Contaminated soil should be:

   * removed and replaced with soil uncontaminated with lead; or
   * covered with a permanent covering.

8. In addition, the regulation requires that post-abatement clearance must be performed <u>only</u> by certified inspectors or risk assessors.

ABATEMENT REPORTS

9. Abatement Reports are required and must be prepared

by a certified supervisor or project designer. The abatement report shall include the following information:

* start and completion dates of abatement;

* name and address of each certified firm conducting the abatement and the name of each supervisor assigned to the abatement project;

* the occupant protection plan prepared by the certified supervisor;

* name, address, and signature of each certified risk assessor or inspector conducting clearance sampling and the date of clearance testing;

* results of clearance testing and all soil analyses (if applicable) and the name of each recognized laboratory that conducted the analyses; and

* a detailed written description of the abatement, including abatement methods used, locations of rooms and/or components where abatement occurred, reason for selecting particular abatement methods for each component, and any suggested monitoring of encapsulants or enclosures.

STATE & TRIBAL PROGRAMS

10. States and tribal units are to promulgate/institute regulatory requirements for certification or licensure of lead hazard reduction personnel. These regulations must be “as protective as” the Federal regulations in order for

the State or tribal program to be approved by the U.S.EPA under these rules. Several states have regulations in place, however, they must apply for approval of their programs by August 31, 1998 to be in compliance with 402/404.

GOVERNMENT AGENCIES/CONTACT PERSONS
FOR LEAD ABATEMENT REGULATIONS

1. Environmental Protection Agency
   National Program Chemicals Division
   Office of Pollution Prevention & Toxics (7404)
   401 M Street, S.W.
   Washington, DC 20460

   EPA Regional Lead Contacts (see map in "Reference" section of this manual for states in each region):

Region I Lead Contact:	617/565-3836
Region II Lead Contact:	908/321-6671
Region III Lead Contact:	215/566-2084
Region IV Lead Contact:	404/562-8998
Region V Lead Contact:	312/886-7836
Region VI Lead Contact:	214/665-7577
Region VII Lead Contact:	913/551-7518
Region VIII Lead Contact:	303/312-6021
Region IX Lead Contact:	(fax) 415/744-1073
Region X Lead Contact:	206/553-1985

2. EPA Hotline 202/554-1404 or 800/368-5888 or 800/LEAD-FYI
   Hotline FAX 202/554-5603.
   Lead Clearinghouse: 800/424-LEAD
   Web site: www.epa.gov/opptintr/lead/index.html

3. U.S. Department of Housing and Urban Development
Office of Lead Hazard Control
451 Seventh Street, S.W., Room B-133
Washington, DC 20410

202/755-1785 Fax: 202/755-1000

Publications:	HUD User Line:	Web sites: www.leadlisting.org and
202/708-4510	800/245-2691	www.hud.gov/lea/leahome.html

4. U.S. Occupational Safety and Health Administration
200 Constitution Avenue, N.W.
Washington, DC 22010

202/523-8148

5. State Contacts - Call the Lead Information Center Hotline: 800/LEAD-FYI, or National Conference of State Legislatures, 303/830-2200.

D. LEGAL AND INSURANCE ISSUES

Laws

LEGAL AND INSURANCE ISSUES

OBJECTIVE:

To present:

- Lead abatement supervisors/contractors with background knowledge of potential liabilities associated with lead abatement to help avoid or reduce such liabilities;
- Sufficient information on insurance to identify and evaluate risks to lead abatement contractors associated with lead abatement.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Identify the rules governing contract and tort liability.
- Explain the relationship between the standard of reasonable care and applicable regulatory standards.
- Describe the nature of vicarious liability and the circumstances under which it may arise in lead abatement.
- Identify the elements or property damage and personal injury awards and their potential amounts.
- Compare/contrast the types of insurance applicable to lead abatement.

As a supervisor/contractor of a lead abatement project, this section is important to you because you should understand:

- **The dangers associated with a lead abatement project and the legal liability resulting from improper abatement;**
- **The importance of the contract documents as a guide to the conduct of a safe abatement project; and**
- **The kinds of insurance coverage available to you if you contract to do lead abatement.**

LEGAL LIABILITY

This section introduces lead abatement contractors and consultants to the potential for legal liability when carrying out abatement operations. It also suggests some precautions that may help reduce that potential.

Types of Potential Liability

"Liability" may refer to any of three different kinds:

- Criminal liability,
- Regulatory liability, or
- Civil liability.

CRIMINAL LIABILITY

Criminal liability would arise from violation of a statute, such as the National Emission Standards for Hazardous Air Pollutants **(NESHAPS)** standards of the Clean Air Act. Statutes impose criminal punishments for actions that disobey its provisions, such as intentionally discharging visible quantities of lead particulates into the atmosphere. Such statutes may pose fines or imprisonment or both. Public prosecutors enforce them through trials, usually involving juries, in which the guilt of the defendant must be proven beyond a reasonable doubt.

REGULATORY LIABILITY

Regulatory liability is imposed through governmental regulatory agencies. Some regulatory agencies have very limited powers. Their authority may extend only to suspending or revoking a license they have previously granted. Others, such as EPA and OSHA, have broader powers and made be authorized to impose monetary penalties for violation of their regulations. They can charge an offender with violation of administrative regulations, hold a hearing before an agency hearing officer, and impose an administrative fine directly. TSCA also allows criminal sanction (call 202/564-4282 for more information).

CIVIL LIABILITY & COMMON LAW

Civil liability differs from the other two in that it, most of the time, arises out of controversies between private parties and is imposed through lawsuits brought by private parties. Most of the rules that govern civil liability do not come from statutes passed by legislatures. Instead, they come from the opinions of judges in previous cases- judicial precedents-that we call "The Common Law," a body of customs (some very ancient) that govern most of our interactions with one another. Sometimes, as we will see, a legislature will enact a statute that will modify an existing Common Law rule.

Civil liability arising of lead abatement is most likely to arise under two sets of Common Law rules, those governing contracts and torts.

Contract Liability

CONTRACT LIABILITY

A **contract** is a legally enforceable agreement. Usually, a contract involves a promise by one party to provide goods or services and a promise by the other to pay a specified amount of money for them. If either party fails to live up to the promise, the other is entitled to recover the sum of money that will put him/her where he/she would have been if the defaulter had lived up to the promise. In the lead abatement context, that means if an abatement contractor fails to perform at the contract price, the building owner is entitled to hire another contractor of comparable skills at the lowest price reasonably obtainable (presumably higher than the contract price or there wouldn't be any controversy) and sue the non-performing contractor for the difference between the contract price and the price actually paid.

The cost of the work may not be the only consequence of the first contractor's failure to perform. The contract may have been specified when the work was to be done and failure to do it on time may cause problems. For example, a tenant might not be able to use rented space at a critical time. The defaulting contractor also would be liable for such consequential damages as the cost of renting other space for the tenant or the loss of profits from business interruption.

Losses resulting from delays in completion are sometimes hard to prove with any precision. As a result, building owners sometimes require provisions in their lead abatement contracts specifying that the contractor who fails to meet a contractual deadline will pay a sum of money for each day of delay – so called "liquidated damages." If the sum is a reasonable approximation of the actual losses the default would cause the building owner, the courts will enforce it. However, if the amount named is grossly disproportionate to potential losses from the delay, the courts will deem it a "penalty" provision and refuse to enforce it.

Some contract controversies result from outright, intentional failure to perform. Most, however, result from disagreements between the parties about what the contract's terms mean. Such disputes arise either because the contract's words can be read to have two or more different meanings or because an important term has been left out.

Such problems can be reduced by careful reading and written clarification of the proposed contract before signing. Contractors should also include a standard set of clarifying "standard terms and conditions" in their bid proposals to eliminate the causes of the most common ambiguities. Arbitration clauses, binding the contract parties to accept quick, informal procedures for settling any contract disputes can greatly reduce the cost of resolving them.

Tort Liability

TORT LIABILITY

"**Tort**" comes from the French word meaning "wrong." In English it is defined as a "civil wrong for which the law provides a remedy of money damages." A tort consists of three elements, **all of which**

must be present before there is a tort:

1. The courts must previously have defined a “duty” or rule of conduct;
2. There must have been a breach of the duty; and
3. The breach must have caused an injury or damage to the person bringing the complaint.

The duty that underlies tort liability in connection with lead abatement is called the “duty of reasonable care” or of “due care.” The courts say that each of us owes others a duty to conduct himself or herself as a reasonable person would, under the circumstances, to avoid accidental injury to others. Breach of that duty is called “negligence.”

The important words are “reasonable” and “under the circumstances.” Remember that the first test is what a reasonable person would do, not what an average person or the majority of all people would do. And, second, remember that as the circumstances change, the duty changes.

So, as a pedestrian walks down the sidewalk, he or she is under a legal duty to exercise the care a reasonable pedestrian, so as not to heedlessly knock others down. At the end of the block, when that pedestrian gets into an automobile and drives away, the same person comes under a new set of obligations to exercise the care of a reasonable automobile driver knowing and obeying all the rules of the road and using the skills necessary to operate the controls.

As the foregoing suggests, different categories of people, such as building owners, lead abatement contractors, and lead abatement consultants, will be held to different standards of care under the Common Law. Normally we would expect the Common Law to impose the lowest standard on the building owner (a layman); a higher standard on the contractor because he/she sells advice based on his/her specialized knowledge. This is an area, however, where a legislature has modified the Common Law.

STRICT LIABILITY

For example, in Massachusetts, a statute (Massachusetts General Laws, Chapter 11, section 199) provides that building owners will be held liable for injuries resulting from lead paint in buildings where young children reside whether or not they are aware that lead is present. This a form of strict liability, that is, liability imposed even though the building owner's conduct may have been reasonable under the circumstances. The Massachusetts law goes even further. It provides that if the building owner did know that lead paint was present and failed to take the required remedial action, that owner will be liable for three times the amount of any compensatory damages awarded.

Regulatory Standards and the Standard of Due Care

STANDARD OF DUE CARE

Consider the relationship between the standard of behavior that is imposed by the standard of reasonable care and the standards that are mandated by applicable administrative regulations. Ask the question: when a contractor or inspector has lived up to all the regulations imposed on lead abatement by federal, state, and municipal regulations, has he/she, by doing so, automatically exercised reasonable care?

The answer to that question is a disappointing "usually." The Common Law rule is that compliance with a regulatory standard equals reasonable care under normal circumstances. When there are unusual circumstances, the standard of care may require behavior that is more restrictive, more careful, than what the regulation would normally require. For example, a motorist driving along an uncongested highway under normal conditions of dry road and unrestricted visibility, who complies with the posted speed limit "the regulatory standard", is exercising reasonable care. Unusual conditions, such as bad weather, or an accident blocking the road, may require the motorist exercising reasonable care to go at a much lower speed.

State-of-the-art Defense

STATE-OF-THE-ART DEFENSE

Whether an action was reasonable under particular circumstances is normally a question of fact to be decided by the jury. However, once a defendant has proven that he relied on a particular precaution based on the most advanced technical knowledge available at a given time or used the most advanced technology available at that time to create a safe condition, the defendant can assert as a matter of law, outside the jury's consideration, that he was not negligent. This is called the “state-of-the-art defense.”

In some circumstances different levels of precaution may be permissible under the regulations (as when air samples indicate a low enough level of air-borne contamination to allow a choice among alternative types of respirators), even though there is a threat of higher levels to come. However, there is some chance reasonable people might differ about which level of protection was appropriate under those circumstances. The possibility of being able to use the state-of-the-art defense in future litigation may be a strong argument in favor of using more extensive protection than the regulations might otherwise require.

Anticipatory Injury

ANTICIPATORY INJURY

Recall that the third necessary element of a tort is that failure to exercise reasonable care must cause injury. Differences have developed among the states as to what constitutes injury when a slow-acting toxic or hazardous material is involved. Some of the states that have considered the question take the position that there is no “injury” until there are sufficient symptoms to enable a physician to diagnose damage or disease. In those states, there is, therefore, no tort until the diagnosis can be made.

In some states, the courts have taken the position that the injury and the tort take place at the moment the human cell is exposed to the harmful substance (even though it may take a while for the symptoms to appear) if there is a high probability persons exposed will eventually become sick (especially where the exposed person suffers mental distress from fear of the high probability of the impending illness).

Vicarious Liability

VICARIOUS LIABILITY

Our discussion, up to this point, has concerned the individual's liability for his own torts. Next, consider the circumstances in which a person or organization that has done nothing wrong may be liable for someone else's torts because of the nature of the relationship with the wrongdoer. This liability for the actions of others is called "vicarious liability."

In its simplest form it is expressed in two parts. The first is: "The master is liable for the torts of the servants provided these torts take place in the course of the servants' duties." Notice two things about this part. The master is liable no matter how careful he/she has been in the selection, training, and supervision of the servant, for torts in the line of duty. However, the master is not liable for actions taken by the servant when the servant was off-duty, engaged in his/her own amusements.

The second part of the rule is: "The master is not liable for torts of his/her independent contractors provided that the master has exercised reasonable care in the selection of those contractors." Notice that the two parts of the rule are not symmetrical. Reasonable care in choosing whose services to use protects the master against liability for the independent contractor's tort but not for the servant's.

Subcontractors and other suppliers of services to a lead abatement contractor or consultant (such as test laboratories) normally would be considered independent contractors within the meaning of this rule. For that reason, before deciding to use the services of a possible subcontractor or supplier, ask others about the company's reputation and check out references, emphasizing the issue of safety. Keep records of whom you speak to and what was said so that at some time in the remote future you will be able to show that you used reasonable care in the selection process.

Damages

DAMAGES

"Damages" is the legal term for the amount of money the plaintiff is seeking to recover. They may be awarded for damage to property or for personal injury. They may be "compensatory" or "punitive." Consider first compensatory damages.

PROPERTY

Property damage during lead abatement may be the result of such traditional problems as a breakage or water damage caused by the work. The damage is unique to lead abatement will be those for contamination of property by the abatement process itself because of accidental failure of containment enclosures, decontamination procedures, or the like.

The measure of damages for property damage claims is the difference in value of the property before and after the damage. Usually the court will consider the cost of repairing or cleaning up contamination as the best indication of the loss in value.

PERSONAL

Damages for personal injury consist of payments for medical bills, lost earnings, and an amount representing the dollar value of pain and suffering. The claimant must collect all damages for a single tort from a single wrongdoer at one time. Therefore, the recovery will include not only damages up to the time of trial, but also damages for the estimated future duration of the injury.

Punitive damages are allowed under the Common Law of most states when damages have resulted not from an accidental failure to exercise reasonable care but from conduct that was grossly negligent, wanton, or reckless. Massachusetts has been foremost among the states that have not allowed punitive damages (but review the earlier discussion of the Massachusetts statutory provision imposing treble (triple) damages on property owners who are aware of the presence of lead to fail to abate it).

Punitive damage awards are supposed to punish the wrongdoer for egregious behavior and deter him/her or others from repeating such conduct. As of the writing of these materials, the United States Supreme Court was considering whether punitive damages should be prohibited as an unconstitutional taking of property.

Persons badly injured, resulting in total disability and severe pain and suffering, routinely recover between $6 million and $10 million. (A recent suit was brought against a Baltimore contractor for $6 million.) Punitive damage awards against major corporations have reached $100 million several times.

Likely Sources of Liability

SOURCES OF LIABILITY

Building owners, seeking to recover the cost of lead removal, have sued lead pigment manufacturers for failure to warn of the products' hazards. Tenants, alleging injury, have sued building owners for negligent failure to remove lead. The following are a few of the circumstances most likely to give rise to future litigation involving them.

Contractor:

- allowing workers to leave the work space without decontaminating themselves;
- failure to maintain containment enclosure integrity;
- inadequate attention to completion-of-work criteria on jobs

where building owners do not have professional representatives to supervise work;

- worker misconduct arising out of abuse of alcohol or drugs on the job.

Consultants:

- failing to identify lead paint during inspection;
- failing to inspect portions of the building because of misunderstanding or inaccessibility at time of inspection;
- failure to maintain state-of-the-art knowledge of changing scientific information, testing technology or regulatory standards;
- failure to exercise due care in assisting the building owner to select deleading contractors;
- failure to exercise stop-work authority in the presence of defective contractor performance when serving as building owners representative.

INSURANCE CONSIDERATIONS

Liability insurance is typically a job requirement for performance of lead abatement work on federal, state, municipal, and public school projects. Also, in nearly every state, the law requires virtually all employers to carry Workers' Compensation insurance to cover possible injury claims by their employees. Even in the absence of these requirements, prudent business judgment suggest that liability insurance is an important safeguard for any business in which there is a significant risk of very large personal injury claims.

The material that follows is intended as a guide to help understand the forms of liability insurance that are available for contractors and consultants engaged in lead abatement, to help obtain such insurance and to help understand the language of insurance requirements as they appear in abatement project specifications

Disclaimer

The information about insurers and insurance that follows is provided subject to three qualifications. First, by describing these insurance programs and the considerations to bear in mind when evaluating them, the author and the sponsors of any training program in which these course materials may be used do not mean to endorse the insurers or brokers named or to recommend any one of them over the others. Different insurers will present different advantages and disadvantages, including different levels of financial reliability, and choosing among them will be a business decision in which the buyer must exercise an independent judgment. Second, these programs are in the process of evolving. Their conditions, prices and organizational framework are likely to change from those summarized in these materials. Third, the information is presented as it was furnished by the insurance programs themselves and has not been independently verified.

Types of Liability Insurance

Contractors must carry workers' compensation insurance and need to consider comprehensive general liability insurance. Consultants will have these same concerns as well as an interest in professional errors and omissions liability insurance. Contractors carrying out very large-scale deleading projects may be asked to provide "Builders Risk" insurance. Each type is discussed below.

a) **Workers Compensation Insurance**

WORKERS' COMPENSATION

Every state now has some form of statutory administrative compensation system replacing the tort-based liability system previously discussed. These systems provide no-fault compensation to employees injured in the course of their work without requiring them to prove that they were hurt as a result of their employer's negligence. Typically, they pay for medical expenses and lost wages but do not provide compensation for pain and suffering. They are designed to provide faster and more certain payments than the tort system. In many states the remedy they provide is exclusive. In others, employees may be allowed to elect a tort recovery under pre-described circumstances.

In all states, employers are required to take part in the system by carrying workers' compensation insurance. Generally the policy wording and the amount of coverage to be carried are prescribed by regulation. Premiums are set by a quasi-regulatory process. In addition, all insurance companies wishing to sell workers' compensation to employers are obliged to take part in an insurance pool that will make workers' compensation insurance available to every employee or at a regulated price.

b) Comprehensive General Liability Insurance

COMPREHENSIVE GENERAL LIABILITY

This insurance may also be called "commercial general liability" or just "general liability" insurance or even by the initials "CGL." It is the standard insurance for protecting the policyholder-company against any claims against it for personal injury or property damage caused, by accident, to persons outside the company. Typically it will defend the policyholder from claims by "third-parties" (persons other than the policyholder or the policyholder's employees) and pay any judgment in favor of a third party subject to the terms and conditions of the policy and its deductible. The maximum amount the insurer will pay is governed by the "limits" set forth in the policy.

Since 1973, nearly all CGL policies have contained **exclusions for liability from gradually released pollution were contamination**. Since 1983, the pollution exclusion has typically included **all** coverage for pollution-related claims. Lead particulates released in the course of lead abatement would come within this pollution exclusion and therefore not be covered by a standard CGL policy. (A recent New York decision disallows the pollution exclusion for lead abatement).

Persons engaged in lead abatement share a concern that they may become liable to claims arising out of negligence resulting in the release of lead-containing materials that later cause injury to building occupants. They have sought insurance that would protect against this risk. The appendix of this section titled "Insurance Carriers for the Lead Abatement Industry" identifies a number of insurance programs that currently provide specialized CGL policies that are designed to meet this need. They extend coverage to include a pollution-related claims resulting from lead abatement activities by partially or totally eliminating the pollution exclusion.

Nearly all CGL policies contain another standard exclusion for liability for claims arising out of air orders or omissions in providing "professional services" --- the so-called "E & O" exclusion. Professional services are those services provided by specialists who are qualified to provide them by extensive training-- usually, but not always, academic training. Doctors, lawyers, architects, and engineers are examples of persons whose services are considered "professional" within the meaning of the E & O exclusion. Lead abatement consultants, such as industrial hygienists, inspectors, designers, and project monitors, also come within it.

Note that E & O exclusion is narrow. It only excludes the professional act itself, usually the giving of advice or the preparation of the designs. It means that although an inspector who drops a flashlight on a passing tenant will be covered by the CGL policy, the inspector who fails to identify lead-containing materials or the architect who designs the defective containment scaffold collapses will not be. From the viewpoint of the lead abatement contractor, the important thing to remember is that the CGL policy will protect from accidents that arise during the performance of the contract but will not protect from claims that result from his/her giving advice on lead abatement.

c) Professional Liability Errors and Omissions Insurance

PROFESSIONAL LIBILITY

ERRORS & OMISSIONS

Tort law imposes a higher standard of care on experts than it does on Laymen. Insurance companies, therefore treat expert professionals as a separate category for insurance purposes. Persons who make a profession of giving advice based on specialized knowledge are insured under policies called "professional liability errors and omissions insurance." Such coverage exists in more or less specialized forms for physicians, lawyers, architects and engineers, and consultants carrying out inspection, design, and project monitoring on lead abatement projects.

d) Builders' Risk Insurance

BUILDERS' RISK

Builders Risk insurance is described here because, very rarely, it will be required of lead abatement contractors by building owners.

It is a specialized form of property insurance designed for ensuring large buildings while they are under construction and under the control of the general contractor. It is intended to cover such risks as loss by fire before the building owner takes possession. Once the building owner takes possession, the owner normally insurers the building against damage through conventional property insurance.

In some cases the basic Builders' Risk policy is augmented by a very narrow additional coverage. This is specialized liability insurance covering only damage to other property caused by the insured building. An example is damage to automobiles parked on neighbor's parking lot caused by collapsing structure. In such cases the augmented insurance is called "All Builders Risk" insurance.

It is not well adapted for lead abatement applications because in most lead abatement projects the building owner never gives up over-all control of the building to the contractor and the building owner's property insurance stays in effect. Requiring the contractor to carry Builders' Risk insurance under such circumstances is only paying twice for the same coverage. Furthermore, if the lead abatement activity accidentally causes damage to either the structure or adjacent property, in nearly every case the contractor's CGL insurance would cover such damage. Finally, standard Builders' Risk and All Builders' Risk policies include pollution exclusions that would eliminate coverage for damage caused by lead particulates. Obtaining a one-of-a-kind, custom-built policy that includes lead pollution coverage, if possible, would be extremely expensive.

Considerations When Purchasing Insurance

-Policy Form: Occurrence-Based or Claims-Made?

OCCURANCE-BASED OR CLAIMS-MADE?

Liability insurance is written in two different ways, using so-called "occurrence-based" or "claims-made" forms. Recent insurance practices have blurred some of the differences between the two standard forms. We will consider them first in their pure states and then discuss the ways in which the distinctions are being blurred.

In modern insurance terminology an accident is called an "occurrence." An occurrence-based policy is one that covers claims resulting from an occurrence that happens during the term of the policy (the usual policy term is one year) regardless of how long it takes for the claims to be made. On a pure occurrence-based policy it does not matter that the policy may have expired decades before the claim finally arises so long is the accident or exposure on which the claim is based happened during the policy term.

A claims-made policy covers a claim for an accident as long as the occurrence and the claim both take place while a policy is in force. Its main drawback is that the policyholder must have a claims-made policy in effect when the claim arrives in order to have coverage. If the policy has been canceled or been allowed to expire sometime after the accident but before the claim comes in, the policyholder has no insurance.

As suggested above, current trends have blurred the differences between the two traditional forms. Many, but not all, occurrence-based forms today include “sunset” clauses. Sunset clause says that the policy will respond only if the claim is made within a specified time after the policies expiration date (usually five years but sometimes shorter). A corresponding provision on nearly all claims made policies, called a "retroactive" or "retro-date," says that the policy will not cover claims resulting from occurrences that happened more than a specified number of years before the inception date of the policy or even before the inception date itself.

Persons buying insurance should be aware that insurance companies may be willing to modify policy wording to make a sale. Don't be afraid to negotiate. Some occurrence-based insurers have dropped sunset clauses when pushed. Similarly, claims-made insurers will usually be willing to push a policy’s retro-date back to a date before the policyholder started lead abatement work so as to make sure there will be coverage for all claims arising out of the insured’s lead abatement activities.

One recent change is helpful to policyholders. Some claims-made insurers now offer so-called "extended discovery periods." These allow the policyholder who is retiring or ceasing to do lead abatement work to purchase, for a modest additional premium, an extension of time in which to file claims that would have been covered by the expiring policy but for the fact that they came in after it had expired. Extended discovery periods of one year Carmen; five-year and even 10-year periods have been offered but are not common. These extended discovery periods are frequently called "tales."

- **Financial Reliability of Insurers**

FINANCIAL RELIABILITY

Purchasers of insurance need to take into account the possibility that the company offering to sell insurance might go out of business or be unable to pay a future claim because of insolvency. In evaluating the financial reliability of an insurance company, consider three major classifications:

1) companies closely regulated by state insurance commissioners,
2) companies unregulated but annually evaluated by commercial financial evaluation services, and
3) unregulated organizations offering forms of collective self-insurance that are not evaluated by the commercial services.

A closely regulated insurance company that:

- submits its policy wording and price schedules for approval by the state's insurance commissioner,
- maintains the high financial reserves specified by the insurance Commissioner, and
- allows the insurance Commissioner to audit the company's financial records to confirm that the reserves meet the standard,

ADMITTED INSURANCE COMPANY

is called and "admitted" insurance company. Most states have laws providing that, if any admitted company cannot pay its policyholders for lack of funds, the other admitted insurance companies have to help pay the policyholders of the insolvent company.

APPROVED BUT NOT ADMITTED

Most of the companies offering lead abatement liability insurance are in a second category known as "approved but not admitted" or "excess and surplus lines" insurance companies. They are essentially unregulated. Companies in this category range from very large (larger than most admitted companies) to very small, new undercapitalized companies with little experience with known financial troubles.

Persons considering purchasing from companies in this later category should first consult one of the various commercial evaluation services that publish annual reports on all insurance companies selling to the public and have been in business for more than five years. These services, of which:

- A.M. Best,
- Dunn & Bradstreet, and'
- Moody's

are the most widely known, are subscribed to by insurance brokers and, through them are free to potential policyholders. The services report on the balance sheet, profit and loss statement, reserves, claims history, and management of each listed company and describes the relative financial strength of listed companies through a letter code. In the case of Best's, for example, the code is A+, A, A-, B+…etc.

RISK RETENTION GROUPS

The third category of insurers are insurance programs in which the financial reserves have been provided by the policyholders themselves. Called "risk retention groups" or "group captive insurance," these are various forms of collective self-insurance in which policyholders have organized an insurance program, perhaps making capital contributions at the time of joining, and rely on these and the accumulated annual premiums to pay potential claims. Group self-insurance is encouraged under the laws of some states like Kentucky, Colorado, and Vermont. It is prohibited under the laws of others, like Connecticut. A federal law, The Federal Risk Retention Act, provides that a policyholder may participate in such a program, even if prohibited in the policyholders own state, so long as the program is legal under the laws of the state in which it is organized. Group captive insurance programs are not regulated by the states in which they operate nor are the evaluated by the commercial rating services. Applicants of such programs received information from financial data provided by the programs themselves.

As the above information indicates, potential policyholders should be aware of the distinctions among the three categories of insurers. Policyholders may reduce the likelihood of using an unreliable insurance company by buying from an admitted carrier, by checking the financial strength of an approved but not admitted carrier through one of the commercial evaluating service directories, or by themselves evaluating financial data from, and reputations of partition participants in, a risk retention group.

- **Limits**

LIMITS OF COVERAGE

Insurance policies state under the "limits" heading the amount of coverage they provide. Most defined limits in two ways: the amount to be paid for anyone claim and the total amount to be paid for multiple small the claims. Sometimes the per-claim limit and the multiple-claim limit will be the same, e.g., $1 million. Sometimes the multiple-claim limit will be two or three times greater than the per claim limit, e.g., $1 million per claim, $2 million aggregate in any one year for multiple claims. Some of the existing programs have arranged for the $5 million-$10 million of optional additional coverage to other insurance companies. This will be described as available "excess limits" or "umbrella" coverage.

If you are considering participating in a group captive program, be aware that such programs' limits may be administered in two different ways. Some are organized so that therefore stated limits are available to each member. Others, however, are set up so that the state limits apply to the group as a whole. They are administered on a first-come, first-served basis so the policyholder who does not make a claim until after an earlier claim has been paid may find the group's limits already have been exhausted before reaching his claim.

- **Price and Minimum Premium**

COMMERCIAL LIABILITY INSURANCE PREMIUMS

Commercial liability insurance premiums are usually paid at the beginning of the policy year and priced as a percentage of the insured's estimated gross annual lead abatement revenues. At the end of the year, if the insured has grossed more than originally estimated, an additional payment must be made, at the agreed rate, to cover the excess of actual, overestimated revenues. Conversely, if the actual revenues are below the estimate, the insurance company will refund the percentage of the shortfall. However, the insurer limits the extent of such a refund by specifying a minimum premium for each policyholder.

In recent years the rates for large policyholders with annual sales in excess of $1 million have been around 3%, with minimums around $27,000. Smaller firms, with sales of $200,000 or less made pate 8 to 12% but receive minimums as low as $5000. Group captive programs tend to charge lower rates but may require large initial capital contributions of their members and may make members liable for an additional assessment equal to the annual premium if the group's funds are ever inadequate to pay a member's claim.

- **Policy Term**

POLICY TERM TYPICALLY ONE YEAR

The typical policy extends for a one-year term. Companies sometimes offer longer terms of up to three years. Occasionally a company may offer a policy only for the duration of the job. This is undesirable with claims-made policies but acceptable with all currents-based ones. Other companies may ensure for one-year terms but require the insured to list all projects to be covered and to notify the insurer before adding each job.

Insurance companies typically require the insured to pay the first portion of any claim (the "deductible" or "self-insured retention") in order to motivate policyholders to operate effective loss-convention programs. The insurance company will charge the lower premiums for higher deductibles but will not wish a policyholder to assume so large a deductible that the insured would be unable to afford a loss prevention program if it had to pay its full deductible.

<u>Bonding</u>

The term "bonding" is used to describe three kinds of security procedures used in connection with the construction-related projects such as abatement:

BONDING

- **Bid bonds**
- **Payment bonds, and**
- **Performance bonds**

all three involve promises by bonding companies to pay sums of money to, or do something for, an "obligee" in the event the company buying the bond, "the obligor," fails to live up to an agreement.

A **bid bond** accompanies a promise by a bidder to pay some percentage of the cost of the job to the building owner if the low bidder decides, after winning the bid, not to accept the work.

BID BONDS

A **payment bond** accompanies a prime contractor's promise to pay the subcontractors and will pay them if he/she fails to do so after being paid by the building owner.

PAYMENT BONDS

PERFORMANCE BONDS

A **performance bond** is a promise to complete, or arrange for completion of the job, if the contractor has not performed all the terms of the contract to the satisfaction of the building owner. Most public agencies, including school districts, are required by law to buy performance bonds in order to protect themselves from the possibility that their contractors on a deleading project will be financially unable to complete the project, or that a dispute will arise whether all the terms of the contract I haven't satisfied.

Unlike insurance company, and a bonding company is not in business to assume risk. It charges a modest percentage of the value of a project for its services, 2%-3% for example. It provides an administrative convenience for the obligee. The bonding company will not issue the bond until it has satisfied itself that if the bond is called, the bonding company will be able to foreclose on easily available assets to reimburse itself for its costs. For a large contracting company, just indicating what bank handles its payroll account will be adequate security for the bonding company. For small contractors, satisfying the bonding company may be more difficult. It may be necessary to post collateral in order to obtain a bond.

Like liability insurers, bonding companies must be admitted to rates in each state by its insurance Commissioner. Most companies are admitted in some states but not in others.

<u>Brokers</u>

BROKERS

Most insurance brokers deal in standard forms of insurance coverage such as:

- life insurance,
- homeowners insurance, and
- automobile insurance.

There are several financially sound A.M. Best rated carriers writing policies will lead abatement contractors and consultants. Nearly every independent agent has access to these insurers either on a direct access basis or through a specialty wholesaler often known as a S*urplus Lines Broker*. While many agents are not comfortable working in a special risk market, those who have specialized in commercial insurance are usually well acquainted with the insurers who deal in specialized products.

Appendix D-1 is a Notice from the U.S. Department of Housing and Urban Development regarding liability insurance carriers for your use, if you so choose. It's inclusion in this manual does not imply U.S. EPA endorsement.

E. Health Effects of Exposure

HEALTH EFFECTS OF EXPOSURE TO LEAD

OBJECTIVES:
To present information about chemical and physical hazards associated with lead abatement projects which may result in injury or illness.

LEARNING TASKS:
Supervisors/contractors should be able to:

- Identify the common routes of worker lead exposure.
- Describe basic health effects of lead exposure to adults.
- Explain why children are at special risk of adverse health effects of exposure to lead.
- Identify body systems affected by exposure to lead-contaminated substances and chemicals used on lead abatement projects.

As a supervisor/contractor of a lead abatement project, this section is important to you because recognizing potential health hazards may prevent injury or hazardous material contamination to workers, their families, building occupants or the environment.

Introduction

In addition to lead exposure, some abatement sites contain a variety of chemical substances such as gasoline, paint strippers, and cleaning solvents. These substances can enter the body through inhalation (breathing) , skin absorption, or ingestion (eating). The effects of chemical and hazardous material exposure on the body depend on several factors. These include:

- the chemical or material (what),
- concentration (how much),
- route of entry (how it is taken into the body), and
- duration of exposure (how long the exposure lasts).

Personal factors such as the workers' smoking habits, alcohol consumption, medication use, age, and gender also influence effects of exposure.

There are two routes of lead exposure for lead abatement workers, ingestion and inhalation. Inhalation of lead can be reduced by engineering controls, respirators and other methods. Ingestion of lead is probably the greatest exposure danger for most abatement workers. Workers living in lead-contaminated environments are particularly vulnerable. Ingestion also can sometimes be the most difficult route to control. For example: Will the worker smoke cigarettes without washing hands? Will the worker eat a snack or lunch with dirty hands? Will the worker follow rules relative to respirators? Personal cleanliness and habits are <u>crucial</u> to reducing exposure for abatement workers.

Following is a discussion about the health effects that chemicals and hazardous material exposure, including lead, have on the body.

Acute (Short-Term) vs. Chronic (Long-Term) Effects

SHORT-TERM & LONG-TERM EFFECTS

The effects of chemical and hazardous material exposure depend upon the concentration (amount per unit of air, water, or soil) of the chemical, how long the worker remains exposed (how long the material stays in the environment), and the chemical nature of the hazardous material.

- An **acute effect** is a severe immediate reaction, usually after a single large exposure. For example, the solvent perchlorolthylene can immediately cause dizziness, nausea, and at high doses, coma and death.

- **Chronic effects** have latency periods, which may take days, months, or years to show up. For instance, asbestos causes lung disease over a period of many years.

Burning eyes or throat are examples of acute effects; cancer is a chronic effect. Some effects (e.g., cough, nausea, skin rash, liver disorders, kidney disorders) can be either acute or chronic effects. The combined reaction of two or more hazardous materials or hazards can produce an effect greater than that of either alone.

Routes of Entry

Toxic substances can enter the body through three exposure pathways:

ROUTES OF ENTRY

- **dermal absorption** - through the skin tissue
- **ingestion** - by swallowing
- **inhalation** - breathed in through the nose and mouth

Effects of Chemicals on the Body

The effects of a toxic substance may be **local** -- at the point of contact with the body; or **systemic** -- inside the body at various organs, after the chemicals pass through the blood system.

Target organs, tissues, and systems which may be affected by toxic substances include:

- skin
- eyes
- central and peripheral nervous systems
- liver
- kidneys
- blood
- spleen
- reproductive system

Health Effects of Lead Exposure

LEAD EXPOSURE

Although the hazard has been recognized since ancient times, lead exposures high enough to produce poisoning are still common in the United States, as well as the rest of the industrialized world. Amounts of lead high enough to produce signs and symptoms of poisoning have been found in common consumer products such as foods, beverages (especially wines), cosmetics, medicines, etc., up until the last half of the 20th century in the United States. In many other countries lead contamination of foods and beverages continues to be extremely high with numerous cases of overt poisoning identified yearly.

Throughout this century, occupational lead exposures have resulted in the most severe cases among adults. For example, in the early 1900s occupational exposures in the United States were so high that only numbers of cases of poisonings resulting in death were maintained. During the period 1900-1933 over 3,400 deaths from lead poisoning were reported in the United States. More than 1,200 deaths were reported in England and Wales.

Lead poisoning damages a number of organ systems including the

- nervous system,
- blood-forming system,
- kidney, and
- reproductive systems.

Both adults and children are affected by lead exposure. For a number of reasons, that we will discuss, the developing nervous system of the infant before birth and early in life is extremely susceptible to the effects of lead.

In this discussion of the adverse health effects of lead, we will look at:

- how people are exposed to lead;
- the types of adverse health effects produced by lead;
- which age groups are most likely to be affected by lead; and

- other factors that influence whether or not a person will become ill from exposure to lead-based paint.

The scientific literature on this topic is very extensive.

How Much Lead Exposure Do We Have?

Even very tiny amounts of lead can be dangerous to a person's health. Usually lead is measured in microgram (μg) amounts. One μg is 1/1,000,000 (one one-millionth) of a gram. The concentration[1] of lead in sources of lead exposure (such as air, food, water or paint) can be very different.

For example, the amount of food and drink a child has each day weighs about 1,500 to 2,000 grams. This amount of food and drink usually has less than 30 μg of lead. This ratio is about 1 μg lead in 1 billion μgs of diet or a ratio of 1 to 1,000,000,000. An adult takes in about 2,500 to 3,000 grams of food and drink per day with a lead intake of less than 50 μg lead per day. This ratio is about 1 μg lead in 500,000,000 μgs of diet.

By contrast, the high concentrations of lead in paint and dusts means that only tiny quantities of paint and dust exposures can result in a very high lead intake. Many old paints have over 50%, and even up to 80%, lead content. A flake of paint can have enormous amounts of lead!

Dusts can have thousands of parts per million lead by weight. Studies of children living in high-lead areas showed that when the

[1] Concentration means the amount of one substance contained in another substance.

child's hands were cleaned using "wet wipes" each cleaning removed 20 to 30 µg lead. Lead dusts are a very important exposure pathway. For children it is the most important pathway. Thus, it is very important not to leave lead-containing dust in the area being abated. It is also very important for lead not to be carried home from the worksite on clothing or shoes.

INHALATION

Inhalation

If lead-based paint removal is performed by a method that produces lead fumes (heating) or by a method that produces fine breathable lead particles (sanding or grinding), lead from these processes can be inhaled. Fume or dust control is needed for processes that generate these hazards.

When very fine particles or vapors of lead are inhaled, they get into the upper airways and the lungs. Larger particles are cleared from the upper airways, swallowed, and absorbed in the gastrointestinal tract (the stomach and intestines). Smaller particles enter the lungs and are absorbed by the lung. In normal adults 30-50% of inhaled lead is retained. The amount of lead that is absorbed depends on the size of the particle of lead. Of the very fine particles that reach the lowest part of the lungs, a very large amount is absorbed. Vapors or fumes of lead caused by heating lead (for example, with heat guns or open-flame burning) are almost entirely absorbed by the lungs.

Breathing of extremely fine particles of lead or lead vapor is typically **not** a major route of lead exposure for children or adults. However, if lead-based paint removal is being done by a method that heats the painted surface (as with a torch), lead from the surface is vaporized and can be inhaled if no respirator is worn.

This is one of the reasons why lead-removal methods that use heat to blister or torch the painted surface are either not recommended or are not allowed in some localities (HUD prohibits open-flame burning).

INGESTION

<u>Ingestion</u>

When a person is in an environment that contains lead, that person can transfer lead into body tissues through eating or breathing fine particles of lead. Eating (ingestion) is the major route of exposure of both children and adults (including abatement workers) to lead.

After lead particles from dust or chips of paint are ingested (swallowed) and dissolved by stomach acids, the gastrointestinal tract absorbs part of the lead that was ingested. Part of the lead passes through and out of the body. Lead can be taken into the blood and other body organs in the same way nutrients from foods are taken into the blood. For adults, about 5-15% of the lead that is swallowed is absorbed. Young children absorb much more of the lead they swallow, typically 40-50%. This difference in the amount of lead that is absorbed is one of several reasons why young children are harmed more by lead than are adults.

The amount of lead that is absorbed into the body also depends on the size of the particle. Generally, the smaller the particle, the higher the absorption rate. Fine dusts generated from sanding or grinding of lead-based paint are absorbed more than the same amount of lead in the form of flakes of paint. In addition, fine dust is less noticeable to a child or adult than are flakes or chips of paint, and therefore more likely to be ingested.

When people do not eat much food, or are low in some nutrients, the body absorbs even more of the ingested lead. This happens because the body is trying to absorb the "good" things it needs and mistakenly grabs the lead also.

When a person is in an environment which contains lead from chipping, powdering or peeling paint or other sources, the person can transfer lead into body tissues through eating or breathing fine particles of lead. This problem is especially severe among very young children, especially toddlers under two years of age. Among children in this age group, exploring their world by placing their hands, toys and other objects in their mouths is entirely normal. However, in a high-lead environment this normal activity can cause severe effects on the child's health, particularly the central nervous system.

If young children swallow chips or flakes of high-lead paint for several weeks, the effects can be terrible. Based on reports by their mothers or other primary care-givers, approximately 10% of children under three years-of-age swallow nonfood objects. As children get older they don't do this as much. The frequent occurrence of mouthing behavior among very young children is an additional reason why this age group is particularly likely to have lead poisoning.

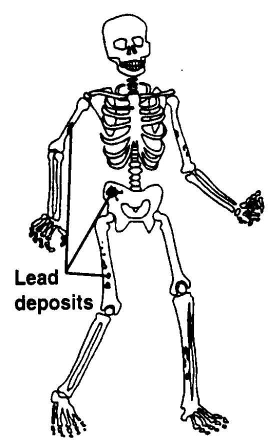
Lead ingestion is a very important exposure pathway. For children it is <u>the</u> most important pathway. Thus it is very important to occupants that abatement contractors not leave lead-containing dust in the area being abated. It is also very important for workers to avoid take-home lead.

How Lead Is Distributed In The Human Body

LEAD IN THE BODY

After lead is absorbed from the gastrointestinal tract or the lungs, it enters the blood stream. At first, lead attaches to proteins in the blood that carry it to different tissues or organ systems in the body. Blood has a fluid portion, called plasma, and a cellular portion. The cellular portion is made up of red blood cells (or erythrocytes) and white blood cells. Most of the lead present in the blood is bound to the red blood cell. Doctors can tell if a person has inhaled and/or ingested lead by measuring the amount of lead in the blood. These amounts are reported as a quantity per unit of volume. (Usually this is micrograms [μg] of lead [pb] per deciliter [dl] of blood.) Older information may also refer to micrograms per 100 grams of blood. These units of measurement are about the same.

"BODY BURDEN" OF LEAD



Lead is distributed to many tissues and organ systems of the body. It's important to remember that lead cannot be destroyed or changed to something else in the body. The amount of lead stored in the body has been described as the "body burden" of lead. Among adults over 95% of the total body stores of lead are found in bone. For children about 70% of lead is stored in bone. This lead is not simply stored away in bone forever, but moves in and out as the body functions normally. For example, as children grow and develop, their bones change form.

The amounts of lead in important organs such as the brain, the blood forming system and the kidney are signs of the damage produced by lead accumulation. Several factors must be looked at in order to find the harmful health effects produced by lead:

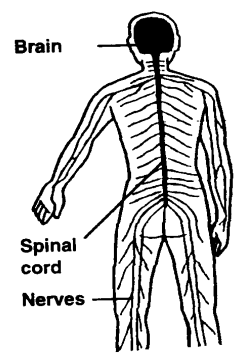
- How much lead is present in the organ system?
- How long has the lead been present?
- Is the organ system at a time in its development when it can be affected by lead?

LEAD IS A CUMULATIVE POISON

Lead is a cumulative poison. Unlike acute poisons, such as chemicals that can kill quickly by attacking the lungs, lead poisoning happens slowly. The lead that is taken in daily builds up in the tissues, especially the bones. Blood lead levels mainly show recent exposures (for example, the past few months of exposure) however, lead that has migrated from the bones is also present in the blood. It is quite possible that a person can have higher amounts of lead in his or her body than indicated by looking at the blood-lead level. It is difficult to measure lead in bones, so blood lead is typically used to measure exposure.

The body gets rid of lead in the urine and through the gastrointestinal tract. However, many people (and most occupationally exposed workers) are unable to get rid of as much lead as they take in. That is why the "body burden" of lead increases over a person’s lifetime. Until late in life, most exposed people are steadily getting more and more lead in their tissues. Only among the elderly, for example those 70 or 80 years old, does the body lead burden begin to get less.

Sometimes bone releases its lead. This may happen when the person has a disease such as osteoporosis, or during pregnancy and lactation (breast feeding). During pregnancy lead is transferred from the mother to the developing infant. Because lead freely crosses the placenta, the mother's blood lead amounts determine how much lead reaches the fetus. The infant's blood lead at birth is about 85-90% as high as the mother's blood lead level. The tissues of the developing infant, including the brain, take in lead during gestation. The lead taken in during this time has special importance because the developing brain is extremely vulnerable to the harmful effects of lead.



Damage does not occur to just one organ system (for example, the nervous system) while not harming other organs at the same time. In humans, the central nervous system, especially of developing infants and very young children, is affected by lower amounts of lead than are other organs such as the kidneys. For this reason much of the focus of recent studies on the effects of lead has been on the harmful neurological (brain function) effects of lead.

Nervous System Effects of Lead

NERVOUS SYSTEM

Early recommendations on "safe" amounts of lead in blood were dangerously close to levels now considered very likely to cause mental retardation in children. Because the past ten years has been a period of very rapid change in understanding of the toxicity of lead, much that has been written (either older pamphlets, medical articles, guidelines for occupational health, etc.) is out of date as to harmful health effects that occur at low levels of lead exposure. In the 1960's blood lead levels $\geq$ 60 µg/dl concerned medical care providers. By the 1980's this level was lowered to 25 µg/dl. In October, 1991, the Centers for Disease Control reduced the level of concern to 10 µg/dl. (See Appendix to this section.)

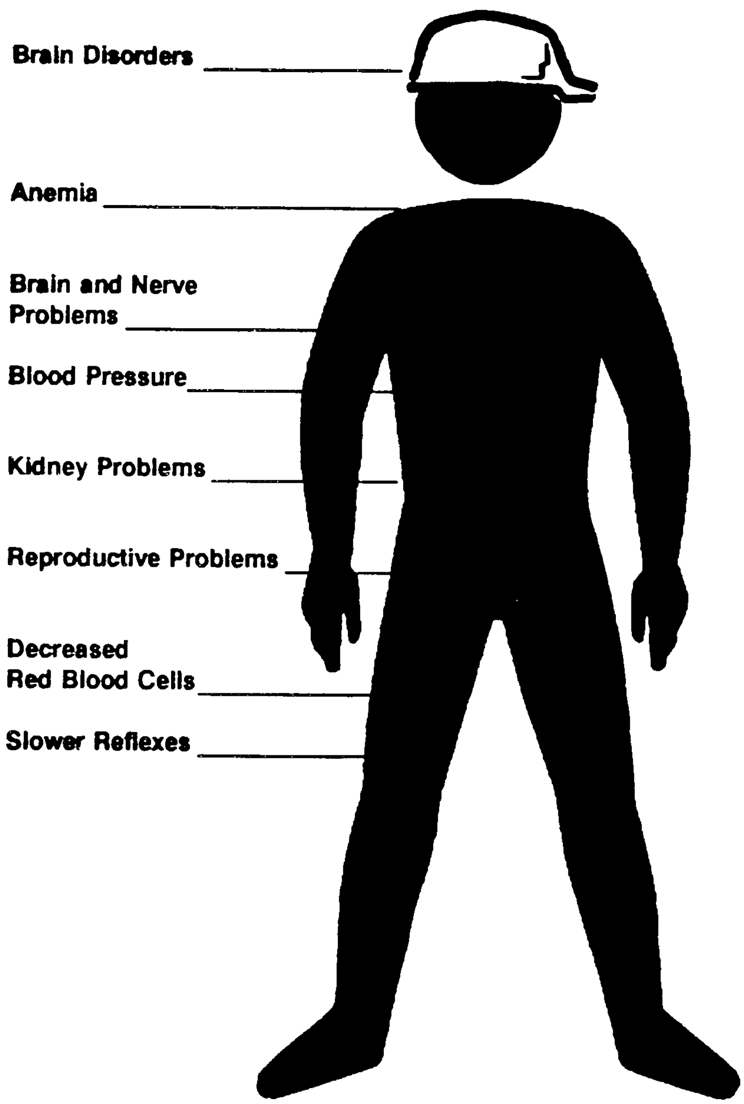
Adults:

ADULTS

At very high lead exposures adults can develop what is called "acute lead encephalopathy." This can occur suddenly. Warning signs include irritability, headaches and hallucinations, and dullness. With very high exposures the person could go into convulsions, paralysis and even die. These effects may occur when blood lead levels are at or above 150 µg/dl among adults. A more typical picture of nervous system damage in adults are harmful effects on the motor nerves. This damage, in advanced cases, results in "wrist drop" or "foot drop" (the inability to maintain the hand or foot in a normal position due to weakness of muscle tone because of nerve damage).

At lower exposures, asymptomatic (without symptoms) effects on the peripheral nerves occur. This means that changes are present that are detectable only by special diagnostic techniques. Workers having blood lead levels lower than 70 µg lead/dl have been found to have slowed movement of nerve impulses. In adults exposed to lower amounts of lead, some changes typically reported are increased occurrence of fatigue and short-term memory loss, decreased functioning of the nervous system for activities that depend on visual intelligence, and visual-motor coordination.

HEALTH EFFECTS OF LEAD IN ADULTS



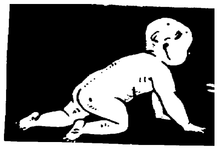
Source: U.S. Environmental Protection Agency. Air Quality Criteria for Lead. Research Triangle Park, NC:EPA, 1986.

Infants and Children:

INFANTS & CHILDREN

The effects of lead on the nervous system differ for children and adults. For children blood lead levels of about 100 to 150 µg/dl and higher are associated with severe damage (encephalopathy). When this happens there is swelling of the brain. This increased pressure severely limits the brain's functioning. Before chelation therapy (given by injection or ingestion of organic acids that bind or “chelate” lead, so that it can be eliminated from the body) was begun in the 1960s, lead poisoning this severe resulted in about a 65% rate of death for children. In current practice, these cases are rare. When properly diagnosed and appropriate chelation therapy used, the death rate is considered to be about 1- 2%. Although lead exposures this high are rare in the United States today, they do occur in industrializing countries that have not tried to control lead exposures. Children surviving an episode of lead encephalopathy frequently have permanent brain damage, including retardation and severe behavioral disorders.

Health effects of lead on children and the fetus include:



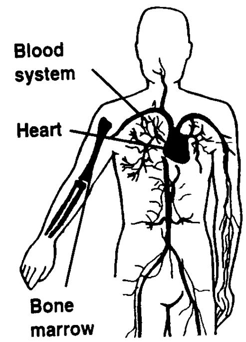
- Brain Functions:
  - Decreased intelligence
  - Developmental delays
  - Behavioral disturbances
  - Seizures (at very high levels)
  - Coma (at very high levels)
- Growth:
  - Decreased stature
- Chemical Messengers:
  - Liver dysfunction
- Blood System:
  - Anemia
- On the fetus:
  - Decreased birth weight
  - Premature Birth
  - Miscarriage and stillbirth (at very high levels)

Ref: Strategic Plan for the Elimination of Childhood Lead Poisoning, U.S. Department of Health and Human Services, Public Health Service Centers for Disease Control, February, 1991.

BLOOD-FORMING SYSTEM

Effects of Lead on the Blood-forming System

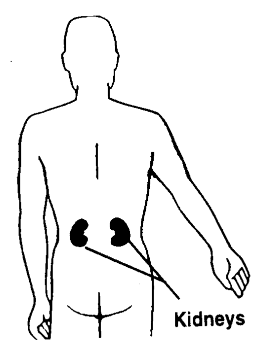
Lead impairs the synthesis (formation) of a substance called "heme" which is extremely important to human life because it carries oxygen to tissues of the body. Lead interferes with the production of this substance at several different stages. Lead-exposed persons can develop anemia. In adults, anemia is usually seen in severe chronic lead poisoning and blood lead levels of 70 µg/dl and higher are usually found.



Lead has a more severe effect on the blood-forming system in iron-deficient people. Generally young children and women of child-bearing age are much more likely to be iron deficient than are adult men. Because the combination of iron deficiency and lead exposure cause more severe effects on the blood forming system than either condition alone, women and children tend to show more severe effects. These occur at lower blood lead levels in women and children than in men.

Effects of Lead on the Kidney

KIDNEYS



High exposures to lead that produce acute lead poisoning can damage the kidney in both adults and children. One of the functions of the kidney is to absorb certain substances which are filtered through the kidney. Lead interferes with these functions by altering the metabolism of the kidney. After lead levels are reduced the kidney may regain normal function. However, if the lead exposures in childhood continue for a long time and are high amounts, children may show kidney disease later in life as adults.

Chronic nephropathy (kidney disease) in lead workers is now recognized as a separate disease. Chronically lead-poisoned workers can show elevated blood urea nitrogen. So far there is relatively little information on the renal (kidney) effects of exposure to relatively low levels of lead among either children or adults.

Other Health Effects of Lead Exposure

OTHER HEALTH EFFECTS

Hypertension

Long-term, high exposures to lead have been reported to be linked with high blood pressure and stroke. One researcher has followed two groups of workers occupationally exposed to lead (4,519 battery plant workers and 2,300 lead production workers from smelters) for a number of years. Both groups of workers have significantly more deaths than would be expected by hypertensive disease and chronic renal disease.

Some additional studies have shown that blood lead levels within the range found in the general population are associated with increased blood pressure. There are additional studies showing blood lead levels which may explain some of the differences in blood pressure. In a publication by the National Research Council (1993), J. Schwartz estimated "that a 1 µg/dL reduction in blood lead concentrations will result in approximately 3,200 fewer myocardial infarctions [heart attacks] per year, 1,300 fewer strokes per year, and 3,300 fewer deaths per year. In addition, 635,000 fewer persons will suffer from hypertension [high blood pressure]."

REPRODUCTIVE EFFECTS

Reproductive Effects

Female workers with high lead exposures and the wives of male lead workers have a higher rate of miscarriages. Male workers with elevated lead exposures (e.g., blood lead levels over 50 µg/dl) have more abnormal sperm cells and lower sperm counts.

Chemical Effects on Specific Body Systems

Brain and Nerves--The nervous system is made up of the brain, spinal cord, and nerves.

Examples of exposures which cause brain and nerve damage:

Hazard	Use or Source	Health Effects
Lead	Paints, Solder	impaired muscle coordination convulsions, coma, developmental delays, decreased intelligence, behavioral disturbances
Propane	Fuel gas, refrigerants	dizziness, nausea, vomiting
Octane	Fuel Solvent	confusion, stroke
Carbon Monoxide	By-product of incomplete combustion	headache, nausea, hallucination

Respiratory System--The main functions of the respiratory system are to filter particles and prevent soluble gases from going into the lungs, to warm inhaled air, and to exchange oxygen for carbon dioxide across lung tissue.

Examples of exposures which cause respiratory damage or disease:

Hazard	Use or Source	Health Effects
Acetone	Solvent	throat irritation
Ammonia	Cleaner	throat irritation, bronchospasm, cough, difficulty breathing
Asbestos	Insulation	asbestosis, cancers of the lung & pleura

Skin--The major functions of the skin are protection, secretion, excretion, and temperature regulation.

Examples of exposures which cause skin damage or disease:

Hazard	Use or Source	Health Effects
Octanesolvent	Fuels; heaters	itching, redness, dryness
Ultraviolet light	Sun	swelling, itching, redness

Eyes--Eyes are delicate organs which are very sensitive to toxic substances. Vapors and dusts can harm and irritate the eyes.

Examples of exposures which cause eye irritation:

Hazard	Use or Source	Health Effects
Ethyl Acetate	Solvent (Lacquers)	tearing, burning
Ammonia	Cleaner	burning sensation

Gastrointestinal System--The gastrointestinal tract includes the esophagus, stomach, and intestines. When harmful substances are swallowed these organs can become damaged.

Examples of exposures which cause signs and symptoms associated with the gastrointestinal system:

Hazard	Use or Source	Health Effects
Toluene	Solvent for Paints	nausea
Benzene	detergents, solvents, paint removers	loss of appetite in chronic poisoning, bone marrow effects
Lead	paints, solder, dye, lubricants	gastrointestinal pain (called lead colic)

Kidney and Bladder--The kidney filters waste substances from the blood and eliminates them through the urine. The bladder is where urine is stored.

Examples of exposures which cause damage to the kidney and bladder:

Hazard	Use or Source	Health Effects
Lead	paints, solder, soil, dust	hypertension, kidney damage
Toluene	solvent for paints	kidney toxicity

Blood, Bone Marrow and Heart--The heart pumps blood through the arteries to all body parts. Blood produced in the bone marrow carries oxygen throughout the body.

Examples of exposures which cause damage to blood, bone narrow and heart:

Hazard	Use or Source	Health Effects
Lead	paints, solder, lubricants, soil, dust	anemia
Benzene	solvents and paint removers	injury to bone marrow, anemia

Reproductive System--Male and female reproductive systems are affected by many toxic substances.

Examples of exposures which cause damage to the reproductive systems:

Hazard	Use or Source	Health Effects
Lead	paints, solder, soil, dust, etc.	Males: ° decreased sex drive ° decreased sperm count and motility, and altered sperm cell structure ° impotence and sterility Females: ° difficulty becoming pregnant and miscarriages (diminished fertility)

F. Medical Surveillance

MEDICAL SURVEILLANCE

OBJECTIVE:

To present information about medical surveillance programs on lead abatement projects.

LEARNING TASK:

Supervisors/contractors should be able to:

- Explain the requirements of a medical surveillance program on a lead abatement project.

As a supervisor/contractor of a lead abatement project, this section is important to you because:

- **you are responsible for implementing the Safety & Health Plan or the Site Safety Plan, which includes the Medical Surveillance Program.**

- **you need to know when workers must be medically removed.**

MEDICAL SURVEILLANCE PROGRAM

I. Introduction

The medical surveillance program, usually provided by a physician, must be spelled out in a written document designed to assess and monitor workers' health and fitness before, during, and after doing lead work. It provides for regular and emergency medical treatment, and explains how to keep accurate records that may be needed in the future.

Types of medical surveillance programs

OSHA's Lead Exposure in Construction, Interim Final Rule (29 CFR 1926.62) requires two levels of medical surveillance:

- Initial Medical Surveillance if an employee is exposed at or above the Action Level* for at least one day per year.
- Full Medical Surveillance if the employee is exposed at or above the Action Level* for more than 30 days in a year.

Initial medical surveillance

Initial Medical Surveillance consists of testing blood for lead and zinc protoporphyrin (ZPP) levels. OSHA also accepts the free erythrocyte protoporphyrin (FEP) test as equivalent to ZPP for determining lead poisoning.

Workers exposed at or above the Action Level for more than 30 days in a year must be provided with additional medical services.

*Action Level refers to the weight of lead particles in a given amount of air averaged over an 8-hour day, specifically 30

micrograms of lead per cubic meter of air (expressed as 30 μg/m^3).
Full Medical Surveillance consists of:

Full medical surveillance

- Checking blood lead levels frequently, i.e., every 2 months for the first 6 months, and twice a year after that.
- Monitoring work history, symptoms, and performing a physical examination to assess:
  - o Work practices;
  - o Personal hygiene habits;
  - o Symptoms of lead or other poisons; and
  - o Signs of adverse health effects.
- Documentation of the medical surveillance program.
- Assessing blood lead level and any effects of lead exposure when the employee was hired or placed in the current assignment.
- Monitoring changes with time. It is important to notice any trends in blood lead or ZPP levels, even if they are within acceptable limits, because these changes can be a clue to excessive exposure.
- Assessing occupational (on the job) vs. other sources of lead (e.g., in the home).

Who participates in the Full Medical Surveillance program in an abatement crew?

- All employees exposed to lead at or above the action level (30 μg/m^3> 30 days per year).

- All potentially exposed employees where the concentration of lead in the air is not known but the employer has reason to believe employees will be exposed at or above the Action Level for more than 30 days per year.

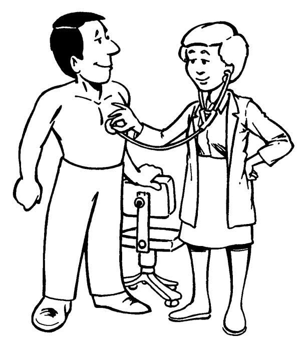
- Exposures at all LBP abatement sites can potentially be above 30 µg/m^3. Therefore, we recommend that all workers participate in Full Medical Surveillance programs.

All workers should participate in the medical surveillance program.

II. Medical Examination

Employers must provide medical examinations for all employees covered under the medical surveillance program.

Medical exams must be performed:



- as soon as the employer has reason to believe the employee will be exposed at or above the Action Level for more than 30 days per year;

- at least annually for employees exposed at or above the Action Level for more than 30 days per year, when tests within the preceding 12 months have indicated a blood lead level at or above 40 µg/dl (40 micrograms of lead per deciliter of whole blood);

- as soon as possible when an employee who is exposed at or above the Action Level for more than 30 days per year has developed signs or symptoms of lead poisoning; and

- for employees medically removed from the work area.

The medical exam consists of the following:

- ✓ A detailed work and medical history, focusing on past lead exposure (occupational and non-occupational), personal habits (smoking, hygiene), and past problems in any of these body systems: gastrointestinal (stomach/intestine), blood, kidney, cardiovascular, reproductive and neurological.
- ✓ Thorough physical examination with particular attention to teeth, gums, and gastrointestinal (stomach/intestine), blood, kidney, cardiovascular, reproductive and neurological systems. The lungs must be evaluated if respiratory protection will be used.
- ✓ Blood pressure measurement
- ✓ Blood sample and analysis which determines:
  - o Blood lead level;
  - o Hemoglobin and hematocrit determinations, red cells indices, and examination of peripheral smear morphology;
  - o Zinc protoporphyrin;
  - o Blood Urea Nitrogen (BUN); and
  - o Serum creatinine.
- ✓ Routine urinalysis; and
- ✓ Pregnancy or male fertility testing, if requested by the employee.

Employees may consult another doctor for a second opinion, to review initial results, or conduct an examination and laboratory testing.

Right to a second medical opinion

III. Information for Examining Physician

Employers and workers should not assume that physicians, especially if they are not specialists in occupational medicine, know OSHA's requirements for medical surveillance. In addition a physician may not be aware of the job health risks. Therefore, the workers' physician must be given the following items:

The physician may not be familiar with OSHA 1926.62.

- Copy of the OSHA Construction Lead Standard including appendices.
- Job description of affected employee relative to lead exposure.
- Employee's exposure level or anticipated exposure level.
- Description of any personal protective equipment to be used by the employee.
- Blood lead levels recorded in the past.
- All written medical opinions in employer's possession concerning the employee.

The employee can obtain these items from the employer and take them to the physician at the time of the exam. However, it is better to provide them ahead of time, so the physician has time to study them before the exam.

IV. Medical Opinion - Written

Contents of the medical opinion

Work-related exam results are given to the employer by the physician. Employees have a right to see all test results of their examinations within five days after the employer receives them. Work-related exam results are given to the employer by the physician. This information includes:

- Any medical conditions likely to increase risk when working on a lead abatement crew.
- Special protective measures to be provided to employee.
- Any limitations to the use of respirators.
- Results of blood tests (lead level, ZPP, etc.).

V. Medical Removal

Removing the employee from the lead work area (areas where exposure is at or above the Action Level) is designed to reduce his/her blood lead level. An employee can be removed either because of blood lead level test results, or because his/her examining physician recommends it.

Employee rights during medical removal

If an employee is medically removed, for a period of at least 18 months, that employee receives the same pay and benefits as if s/he remained on the same job. Those benefits include such things as overtime and seniority.

The employee may be assigned other duties in areas where exposure to lead is below the Action Level. These duties could include maintaining respirators, ordering or delivering materials, and/or other assignments outside the lead work area as defined above. Alternative work can be assigned until the blood lead level drops below 40 µgPb/dl (40 micrograms of lead per deciliter of blood), at which time lead work can be resumed. See the OSHA Lead Exposure in Construction; Interim Final Rule, 29 CFR 1926.62 for further information on Medical Removal Protection.

Blood lead levels requiring medical removal

*The criteria for medical removal is:

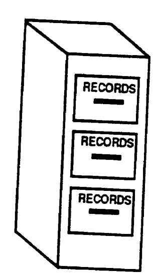
General Industry Std. - 3 blood tests averaging 50 µgPb/dl, or a single test of 60 µgPb/dl;

Construction Industry Std. - 2 blood tests at or above 50 µgPb/dl.

VI. Record Keeping

Employers must retain the following employee information for at least 30 years (OSHA Construction Industry Std. 1926.62) after the employee leaves the job:

- Name, social security number and job description.
- Copy of physician's medical opinion.
- Results of airborne exposure monitoring done for that employee and representative values provided to the physician.
- Any employee complaints related to exposure to lead.



VII. Conclusion

Medical surveillance is an important part of the employer's health and safety program. Workers are an important resource and should be protected from the dangers of lead **and other** hazards found on the job.

Safe worker blood lead levels

The medical surveillance program described above is the minimum requirement for the employer. The standard can be exceeded if the employer chooses to do so. Some health professionals believe that allowing blood lead levels up to 50 µg/dl is not healthy. They suggest a level of 25 µg/dl.

It is also possible for job conditions or work habits to change, resulting in an increase in blood lead levels. For some construction workers, especially workers engaged in the removal of lead-based paint, NIOSH recommends blood lead monitoring more frequently than called for in the Lead Standards - for example, monthly. For more details see the August 1991 NIOSH ALERT "Preventing Lead Poisoning in Construction Workers" in the Regulation and Guidelines notebook (Volume II).

G. Site Characterization

SITE CHARACTERIZATION

This section is presented in four subsections:

- **AN OVERVIEW OF SITE CHARACTERIZATION**
- **PRELIMINARY EVALUATION**
- **EXPOSURE MEASUREMENTS**
- **HAZARDOUS MATERIAL IDENTIFICATION**

OBJECTIVES AND LEARNING TASKS

are presented on separate pages at the beginning of each subsection.

AN OVERVIEW OF SITE CHARACTERIZATION

OBJECTIVE:

To present the rationale for the collection of information about the abatement site.

LEARNING TASKS:

Supervisors/contractors should be able to:

- List the elements of the site characterization process.
- Describe why it is important to inspect the work site during the planning phase of the project.

As a supervisor/contractor of a lead abatement project, this section is important to you because:

· **recognizing and controlling potential hazards can keep workers and residents from being hurt.**

AN OVERVIEW OF SITE CHARACTERIZATION

Where an abatement site is located, what shape the site is in, and the type of work to be done on the site determine how much danger the worker will be exposed to. Conditions and dangers may change as the work progresses. So, managers, project designers/planners and supervisors of lead abatement projects must study the site before work begins and know the scope of work.

Site characterization is used to identify potential hazards

Assessing an abatement work site is called **site characterization and analysis**. This analysis identifies dangers and helps select what protective equipment workers will need for the work they will be doing. Site characterization is a continuous process which includes:

- ✓ **a preliminary evaluation,**
- ✓ **hazardous material identification, and**
- ✓ **exposure measurements.**

Site characterization must be done by a qualified professional, such as an industrial hygienist, or a certified and licensed lead abatement designer/planner or contractor/supervisor. Contractors and supervisors must understand how important site characterization is. They must be able to evaluate the site for all potential hazards, and they must be able to set up and take appropriate hazard control measures for dangers or problems found on the site.

PRELIMINARY EVALUATION

OBJECTIVE:

To present information about conditions found on abatement sites which are hazardous for workers, the residents, and/or the environment.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Tell why it is important to inspect the work site during the planning part of the project.
- List several types of physical dangers at abatement work sites.

As a supervisor/contractor of a lead abatement project, this section is important to you because:

- **problems on the site may need to be fixed before you start lead-hazard control work.**

PRELIMINARY EVALUATION

The preliminary evaluation should be done at the beginning of the project to allow time to plan. One of the main reasons for doing this evaluation is to identify hazards that are already there. Otherwise, you won't know what problems to manage or what protective equipment will be needed. Planning ahead also gives you time to train workers and to let them know about the potential dangers they will be facing.

The preliminary evaluation includes a survey of the site

During the initial evaluation of the abatement site, try to get the following information:

- How much work is required by the contract or the risk assessor report.

  On large projects, a contract defines the amount and nature of work to be done. For small projects where a project planner is not required, the work may be defined by the risk assessor's report or a lead inspection report. Either way, the professional doing the site characterization should have the following information:

  - Will the work include both lead and non-lead work?
  - If non-lead work is to be done; what kind and how much, and will it be done by the lead contractor or someone else?
  - Which lead-hazard control strategy(ies) will be used?
  - Are there surfaces with lead-based paint in the work area that are not included in job? (Review available inspection and/or risk assessment reports.)
  - Has the waste stream been tested to determine if will be hazardous?

- Is the site located in a neighborhood where:

  - site security is a problem?
  - there are a lot of children because of nearby schools or playgrounds?
  - drug dealers are active?
  - heavy traffic might affect the removal of lead-contaminated soil (soil abatement)?

Get an overview of the neighborhood

- nearby buildings can be contaminated by the work being done?

- <u>What is the structural condition of the building?</u>
  - How much existing damage is there, if any?
  - Are there structural problems that might be dangerous?
  - Are there enough utilities (electricity, water, etc.) for the planned work?

Does the building have structural problems

- <u>How long will the job take and when will it be done?</u>
  - Work done when it is either very hot or very cold can cause problems such as heat stress.
  - Certain types of work can't be done during very cold weather.
  - How long the work will take may affect plans for decon units, etc.

- <u>What is the work site geography like (i.e., shape, hills, and contours)?</u>
  - This is important for soil abatement.
  - Shape of the ground may affect how you use scaffolding and ladders, where you can store garbage and debris, where you can put dumpsters, etc.

- <u>What safety and health hazards are associated with specific type of work?</u>
  - Is the building/site occupied? **by children?**
  - Will chemicals be used?
  - Are physical hazards present? broken glass? poison ivy?
  - Will enough lead dust be generated to require engineering controls such as negative air machines?

Is the site occupied by children

- Unusual hazards found on site.

Unusual hazards found on sites

  - Were any hazardous chemicals found on the work site?
    - Are there stored chemicals?
  - Have pesticides been used inside or outside of the building?
  - If unusual chemicals or materials are found on the site, they must be investigated. Information about these items can be obtained through interviews, existing records, and manufacturer's material safety data sheet (MSDS) or other documents about materials at the site.
  - Is there asbestos on the site? Will it be disturbed by the lead-hazard work?

Asbestos may be a problem

  - Is the site infested by insects?
  - Are there unsafe sanitary conditions on the site?
  - Are there broken sewage lines in the building?
  - Is there human excrement?

The information collected in this **preliminary evaluation** is used in other parts of the site characterization process. Those parts were mentioned earlier and are covered in other sections of this manual as follows:

- employee exposure measurements;
- hazardous material identification;
- safety and health plan;
- personal protective equipment; and
- employee notification.

EXPOSURE MEASUREMENTS

OBJECTIVES:

(1) To present information about worker exposure monitoring and the methods used to do this.

(2) To present information about worker exposure to poisons (toxics) on lead abatement sites.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Compare and contrast different ways of measuring exposure, and recognize the differences between them.
- Identify the main ways workers are exposed to lead on the job.
- Explain why it is better to have an independent third party monitor worker exposure.

As a supervisor/contractor of a lead abatement project, this section is important to you because:

- **you will probably be responsible for doing or coordinating worker exposure monitoring;**
- **you need to understand OSHA requirements for following rules about Action Levels and Permissible Exposure Limits on lead abatement sites.**

EXPOSURE MEASUREMENTS

I. Introduction

The process of manufacturing products almost always involves using harmful or dangerous materials. For example, home cleaning products often contain harmful materials such as irritants, or in some cases poisons. But, even though some consumer products contain harmful materials, consumers are usually not at risk because they aren't exposed to these products for long periods of time. Also, some products come with warnings such as: "Use only with adequate ventilation," "Wear gloves when using," or "Do not take internally." However, workers in factories where there are huge quantities of these materials may have much higher exposures on a daily basis. And if production problems occur, workers may be exposed to even higher levels. So, workers must have a different level of protection than consumers. Regulatory agencies try to protect workers by limiting their exposure to harmful substances.

Lead abatement workers are like factory workers. If they only had minimal exposures from one project for a few days or weeks, they probably wouldn't suffer any negative effects and the level of lead in their blood would only increase slightly. However, **lead abatement workers working in areas where there is lead dust will get higher levels of lead in their blood unless they are protected**. As they have done for workers in industry, regulatory agencies have set limits on how much lead workers can be exposed to. Federal OSHA and many State OSHAs have worker exposure standards.

Exposure monitoring for lead is necessary to insure a safe workplace

II. Airborne Exposure Measurements

How are exposure levels measured?

Breathing is the way most people are exposed to toxic substances. Toxic materials on abatement sites can be found in paint strippers, fuels for power equipment, paint thinners, and, most importantly, lead. Toxic substances found in the air are measured in the following ways:

- The quantity of the chemical substance found in a given amount of air usually is measured and described in terms of how much of it by weight is found in a certain amount of air by weight (weight of substance/weight of air ratio) - for example, parts per million of air (ppm).
- Concentration of dusts and mists are measured in micrograms per cubic meter of air (weight of substance/volume of air). For example, consider a postage stamp which weighs about 7000 µg. An air concentration of 7000 µg/m^3 is about the same as the weight of one postage stamp of dust (contaminant) in each cubic meter of air.

While breathing in a toxic substance is the way most people are exposed, that is not always true for lead. On a lead abatement site, workers can be exposed by swallowing lead particles (This can happen if lead dust on the body is transferred to food, cigarettes, or eating utensils.) For that reason, **good personal hygiene practices are an important element of worker protection**. This means that washing hands thoroughly and eating in clean environments are absolutely necessary. Water for washing and a clean lunchroom are mandatory requirements of a good safety and health plan.

Good personal hygiene is important for workers

III. Airborne Exposure Limits

Standards for airborne contaminants

The concentration of a toxic substance in the air can be measured and compared to published <u>exposure levels</u>.

- Permissible Exposure Limits (PELs) are legal exposure levels set by Occupational Safety and Health Administration (OSHA). Employers must keep workers' exposures below the PELs. PELs are legally enforceable by OSHA.
- Threshold Limit Values (TLVs) are recommendations for exposure limits which are prepared by the American Conference of Governmental Industrial Hygienists (ACGIH). TLV is the time-weighted average concentration for a normal 8-hour workday or a 40-hour work week to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. TLVs are published every year. Employers may use the more current TLVs as guidelines for exposure levels (they are probably more up-to-date) but these levels are not legally enforceable, unless they have been adopted by OSHA as PELs.
- Short-Term Exposure Limits (STEL) are set by ACGIH and OSHA. The STEL is a maximum average concentration a person may be exposed to over a short period of time, usually 15 minutes. It is only legally enforceable if set by OSHA.
- Threshold Limit Value - Ceiling (TLV-C) is a concentration that should <u>never</u> be exceeded.

PELs (the first item on the previous list) are the most important way of measuring workers exposure to lead. TLVs, STELs, and TLV-Cs are only important when organic solvents (such as paint thinner) are used on the abatement site.

IV. Time-Weighted Averages (TWAs)

Measuring contaminants during a work day

Most PELs and TLVs are measured as time-weighted averages (TWAs). Instead of measuring exposure at one particular moment, measurements are taken throughout the day and averaged. This gives you the average exposure over a typical 8-hour work shift.

Specifically, you take the amount of lead found in an air sample and multiply it by the amount of time the worker is exposed. You do the same steps for samples taken at different times during the day, add those totals, and then divide them by 480 minutes (an eight-hour day). This gives you the average.

If you showed the calculation in an equation, it would look like this:

$$TWA = \frac{(C_1 x T_1) + (C_2 x T_2) + ...C_n x T_n)}{480 \text{ minutes}}$$

Where: C_n = airborne concentration for sample n
T_n = time the worker is exposed to C_n

V. Airborne Lead Exposure Limits

The OSHA Lead in Construction Interim Final Rule (29 CFR 1926.62) for construction industry employees exposed to lead was published in 1993. Since lead abatement is a construction activity, this rule includes lead abatement workers. That standard sets a PEL of fifty micrograms of lead per cubic meter (50 $\mu g/m^3$) of air averaged over an 8-hour workday. The employer must keep work place exposures to lead below this PEL.

The Lead in Construction standard also specifies a lower "action level". The Action Level is a lower limit. If a worker is exposed above the Action Level, the employer must take special precautions. The employer must:

- monitor exposures more frequently;
- give workers medical surveillance and training.

Permissible Exposure Limit & Action Level for Lead

The Action Level for lead is thirty micrograms of lead per cubic meter (30$\mu g/m^3$) of air averaged over an 8-hour workday.

Permissible Exposure Limit (PEL) for Lead:	**50 $\mu g/m^3$***
Action Level for Lead:	**30 $\mu g/m^3$**

*Current research has indicated that this level may be too high to protect against negative affects on the reproductive system.

VI. Biological (Blood) Lead Exposure Limits

The construction lead standard also sets limits for employee <u>blood lead</u> (PbB) levels. Measuring blood lead levels gives useful information about how much lead the body has absorbed. Blood lead measurements show how much lead is circulating in the blood, but tells you less about how much lead is stored in the tissues and bones. Blood lead levels indicate how likely it is that a person may suffer some kind of damage from lead. The standard requires that blood lead levels of all employees be kept at less than 50 µg/dl. For people who plan to have children, many health professionals recommend blood lead levels no higher than 30 µg/dl. In fact, there are some worker advocates and doctors who believe that **all worker blood lead levels should be kept below 30 µg/dl.** The current construction standard set in 1993, uses the following levels:

Worker blood lead maximum levels

- PbB >= 40µg/dl requires more frequent monitoring (e.g., blood test, physical exams, etc.)
- PbB >=50µg/dl (single test followed by a repeat test to confirm the results) requires that the worker be removed from the lead work area (areas where exposures are at or above the Action Level).

(a) Unlike the general industry standard for lead, the lead in construction standard requires that if a worker has a result of 50µg/dl or more on two blood lead tests in a row, the worker must be removed temporarily from the lead work area (if exposures are at or above the Action Level), while continuing to be paid and given medical removal benefits. Employers cannot average blood lead test results to determine whether an employee is eligible for medical removal. (Employees who are medically removed must have two monthly blood lead tests in a row with results below 40µg/dl before they can return to a work area where they might be exposed to lead.)

(b) Employees can be eligible for protection benefits if they are medically removed, either because they have a high blood-lead level, or because they have a medical condition that increases their risk of being physically damaged by exposure to lead.

Note: Healthy People 2000, which has been adopted by the Centers for Disease Control and has been referenced by NIOSH in several recent documents, uses 25 µg/dl as the medical removal protection limit. This limit is specified in Maryland and has been used in many HUD specifications.

HAZARDOUS MATERIAL IDENTIFICATION

OBJECTIVES:

(1) To present information about the requirements for labeling materials used on the abatement site.

(2) To present requirements for employee training about hazardous materials.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Describe the parts of a Hazard Communication (HAZ-COM) Program.

- Describe the sections of a Material Safety Data Sheet (MSDS).

As a supervisor/contractor of a lead abatement project, this section is important to you because:

- **recognizing chemical hazards and telling workers about them may prevent injuries;**

- **there are legal requirements (see Chapter C, page C-26 for a Hazard Communication Program and penalties if you do not meet those requirements**.

HAZARDOUS MATERIAL IDENTIFICATION

I. Introduction

The Occupational Safety and Health Administration's (OSHA's) Hazard Communication Regulation (29 CFR 1926.59) requires employers to tell employees and outside contractors about the hazardous chemicals and non-chemical hazards which they may be exposed to at the work site. At a lead abatement site, workers may be exposed to hazardous chemicals when stripping paint, as well as other hazards such as lead dust.

II. Hazard Communication Program Requirements

Components of a HAZ-COM program

A written hazard communication (HAZ-COM) program must include:

- List of all hazardous chemicals at the work site.
- Labeling of all containers.

  (**EXCEPTION**: Portable containers for immediate use do not have to be labeled.)
- Preparation and distribution of Material Safety Data Sheets to all employees.
- Setting up an employee training program about chemical hazards and actions to take to protect against these hazards.

A. <u>Material Safety Data Sheets (MSDS)</u>

Information found on MSDS's

The dangers of using specific hazardous materials on a site can be found on the Material Safety Data Sheets (MSDS's). MSDS's are sent with products when they are shipped. The MSDS gives valuable information about the substance, including required information such as:

- the chemical name,
- the date the sheet was prepared,
- OSHA's Permissible Exposure Limit,
- what the mixture consists of,
- the American Conference of Government Industrial Hygienists (ACGIH's) Threshold Limit Value,
- health effects,
- physical/chemical hazards,
- fire and explosion hazards,
- reactivity hazard data (dangers due to its reactions with other materials), and
- emergency and first aid procedures related to the chemicals in the product.

Figure G-1 is an example of an MSDS. Although MSDS's have different formats, writers' of MSDS's must comply with OSHA's Hazard Communication Standard 20 CFR 1926.59 for specific requirements.

The information available on a MSDS can be divided into the following categories:

- <u>Identification of the product and the manufacturer.</u> Since many similar products are available in the marketplace, you must know what specific chemical is on the work site. The name and phone number of the manufacturer are also important if there is an accident.

- Composition and ingredients and their relative percentages. If exposure limits have been set, they are also included in this section. This section is important in establishing the risk associated with the product.

- Appearance and hazard identification. This section describes what the material looks like and what hazards are associated with it. For example, the MSDS might describe the material as an acid and indicate that it has the potential to react with other chemicals and materials. This section also describes what happens if someone inhales or swallows (ingests) the chemical, and what happens if it comes in contact with skin or eyes.
- First aid measures. This section lists specific first aid measures for spills of the chemical on the skin, splashes in the eyes, and inhaling or swallowing it.
- Fire fighting measures. This section list specific fire fighting measures for fires involving the chemical, including what materials can be used to suppress the fire, type of fire extinguisher required, and unusual hazards when the chemical is present in a fire.

- Accidental release measures. Information about things to do in case of a spill helps train workers who would be required to respond to such a spill.
- Handling and storage. Knowing how to handle and safely store material protects workers and the environment.
- Exposure controls and personal protection. This information helps safety professionals such as industrial hygienists minimize hazards in the workplace.

- Physical and chemical properties. To handle a material safely requires knowing about its properties, such as vapor pressure, flash point, boiling point, reactivity with other materials, etc.
- Stability and reactivity. Safe storage and handling require that you know how stable the product is and how it reacts with other chemicals. If a product is unstable at high or low temperatures, you will have to take special precautions when storing it.
- Toxicological information. It is important to know how poisonous a chemical is when evaluating the health risks associated with it.
- Ecological information. This information is important in evaluating the effect the product may have if released into the environment.
- Disposal considerations. Proper disposal is necessary in order to conform to environmental laws.
- Transport information. Certain Department of Transportation requirements may apply if the material is to be shipped. Failure to comply may result in fines and/or jail.
- Regulatory information. This information is necessary in order to comply with various Federal, state, local, and international requirements.
- Other information. This section contains important information that is not covered in other sections of the MSDS.

B. Labeling Containers

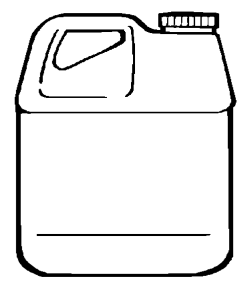
Labeling containers of chemicals

All employers must make sure that all containers are labeled, marked, or tagged with the name of the hazardous material and a hazard warning. Tags or labels must contain the name and address of a responsible party, written in English.

Two exceptions to the labeling rule are:

1. If there are many containers of the same hazardous material all over the job site, a sign or label that describes the hazards can be posted in the work area.

2. When transporting hazardous chemicals throughout a work area, as long as the hazardous chemical(s) is(are) being taken from a properly labeled container, and only one employee will immediately use the material, the portable container does not need to be individually labeled.



C. Training

Training requirements for employees and contractors

The hazard communication regulation requires that all employees working with hazardous chemicals be taught about the requirements of the standard. This training must take place when the person is hired and when a new chemical hazard is introduced into the work site. Information given to the employee includes:

1. All operations that involve hazardous chemicals;
2. Physical and health hazards of the chemicals;
3. What can be done to protect against exposure:

a) Work practices

b) Personal protective equipment

c) Emergency procedures

4. Explanation of the MSDS and labeling.

Establishing a Hazard Communication program takes a lot of time, but, it can minimize painful and costly injuries and costly OSHA citations. Job-related injuries and OSHA citations can cost an employer large sums of money and can cause serious and long-term human health effects.

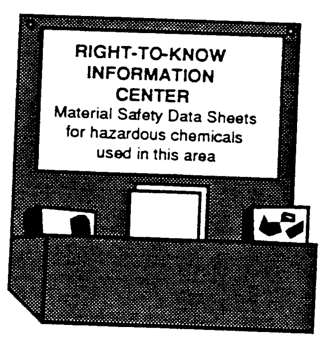


FIGURE G-1

MATERIAL SAFETY DATA SHEET

May be used to comply with OSHA's Hazard Communication Standard 29 CFR 1926.59 Standard must be consulted for specific requirements.

U.S. Department of Labor Occupational Safety and Health Administration (Non-Mandatory Form)

IDENTITY (as used on label and list) **ABC Solvent**	**NOTE: Blank spaces are not permitted. If any item is not applicable or no information is available, the space must be marked.**

SECTION I

Manufacturer's Name	**Emergency Telephone Number**
ABC Company, Inc.	**1-800-555-1234**
Address	**Telephone Number for Information**
1225 William Street	**1-900-333-4445**
Somewhere, USA 12345	**Date Prepared**
	May 1, 1990
	Signature of Preparer (Optional)

SECTION II - Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name)	**OSHA PEL (STEL)**	**ACGIH**	**<u>Other</u> NIOSH (REL)**	**%**
Methylene Chloride	500 ppm	50 ppm		
	c* 100 ppm			
	200 ppm (5 min max peak in any 2 hours)	**PEL/ STEL**		

***c = ceiling limit**

SECTION III - Physical/Chemical Characteristics

Boiling Point 104°F	**Specific Gravity (H_2O = 1)** 1.33
Vapor Pressure 350 **mmHg.**	**Melting Point**
Vapor Density	**Evaporation Rate**
(Air = 1)	**(Butyl Acetate = 1)**

Solubility in Water 2%
Appearance and Odor Colorless Liquid with a Chloroform odor

SECTION IV - Fire and Explosion Hazard Data

Flash Point (Method Used)	2^{o}F
Flammable Limits	**LEL** 14% **UEL** 22%
Extinguishing Media	**NFPA Class B Extinguishers**
Special Fire-Fighting Procedures	Small fires - Dry chemical, CO_2 Large fires - Water spray, fog or standard foam
Unusual Fire/Explosion Hazards	**Closed container may explode if exposed to heat**

SECTION V - Reactivity Data

Stationary	Unstable	Stable	Conditions to Avoid
			Heat, Open Flames, Electrical Equip

Incompatibility (Materials to Avoid) Strong oxidizers; caustics
Hazardous Decomposition/Byproducts
Hazardous Polymerization
May Occur
May Not Occur

SECTION VI - Health and Hazard Data **Hazard Rating : DANGER**

Routes of Entry	**Inhalation X**	**Skin X**	**Ingestion X**

Health Hazards (Acute and Chronic)
Target Organs Skin, CVS, Eyes, CNS
Carcinogenicity: OSHA regulated
Signs & Symptoms of Exposure fatigue, weak, light headed, nausea, irritable to eyes and skin
Medical Conditions Aggravated by Exposure
Emergency & First Aid Procedures eye splash - wash with water for 15 minutes; skin splash - wash with soap and water; swallow - seek attention immediately

SECTION VII - Precautions for Safe Handling and Use

Procedures for Material Release or Spill Small spills: take up with sand or earth or other noncombustible absorbent materials
Waste Disposal Method Dispose in accordance with local/state/federal regulations
Handling and Storage Precautions
Other Precautions

SECTION VIII - Control Measures

Respiratory Protection (Specify Type) Demand air or SCBA		
Ventilation	**Local Exhaust**	IN USE AREA
	Mechanical (General)	AREA VENTILATION
	Special	SPILLS OR CONFINED AREAS
	Other	USE EXPLOSION PROOF ELECTRICAL
Protective Gloves		
Eye Protection	Chemical splash goggles	
Other Protective Clothing or Equipment		
Work/Hygienic Practices		

MSDS FOR TRAINING PROCESS ONLY

H. Safety and Health Plan

SAFETY & HEALTH PLAN

OBJECTIVES:

(1) To present information about controlling hazards on a lead abatement site.

(2) To present different ways of controlling those hazards.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Identify and explain at least three categories of hazard controls.
- List examples of administrative and engineering controls and work practices.

As a supervisor/contractor of a lead abatement project, this section is important to you because:

- **you act as the OSHA competent person so you must be able to identify existing and potential lead hazards and to eliminate them quickly;**
- **you must implement the Safety & Health Plan or the Site Safety Plan;**
- **you need to know when workers must be medically removed.**

SAFETY & HEALTH PLAN

I. Introduction

Hazard control measures

Hazard control measures remove, reduce, or prevent exposure to physical, biological, and/or chemical hazards. These measures are presented as a document called a Safety & Health Plan or a Site-Safety Plan. Hazard control measures can be divided into three categories: administrative controls, engineering controls, and work practice controls.

II. Administrative controls

Administrative controls are written policies prepared before abatement work begins. Examples include site safety and health plans, medical surveillance programs, worker training requirements, and work practice procedures.

✍Written Safety and Health Plan

As site conditions change, the S&H Plan should be reviewed

This written document should identify key personnel and organize standard operating procedures and work practices at the abatement site. It should be used as a planning guide before any site work begins. Once the plan is put in place, it should be reviewed and modified when there are changes in site work or work conditions.

✍Parts of a Written Safety and Health Plan*

General requirements according to the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) [29 CFR 1910.120(b)(4)(ii)] include:

- Analysis of safety and health hazards of activities at the job site*
- Employee training and certification*
- Selecting and maintaining personal protective equipment*
- Medical surveillance program*
- Environmental and personnel monitoring plan and procedures*
- Site control measures*
- Equipment and personnel decontamination procedures*
- Emergency response plan
- Confined space entry procedures
- Spill containment program
- Organizational structure for safety

*These items are discussed in the appropriate sections of this training manual.

✍Medical Surveillance Program

See "Medical Surveillance," Chapter F of this manual.

III. Engineering controls

These are devices or structures that remove or reduce an exposure before it becomes a hazard. Examples include fences around work areas, safety guards installed over moving equipment, and ventilation systems. All engineering controls used to reduce or eliminate hazards should be described in the Safety & Health Plan.

IV. Work practice controls

These are procedures used during work activities to minimize risk of injury or contamination (for example, taking frequent breaks to prevent heat exhaustion or heat stroke). The Lead In Construction Standard (29 CFR 1926.62) outlines specific work practices for minimizing lead exposure during abatement (see Appendix A of 29 CFR 1926.62).

For examples of Work Practice and Engineering Controls, see Chapter O, "Lead Hazard Reduction Strategies" and Chapter I, "Other Safety and Health Considerations."

I. Other Safety and Health Considerations

OTHER SAFETY & HEALTH CONSIDERATIONS

OBJECTIVES:

(1) To present information about hazards other than lead found on abatement sites.

(2) To present solutions for controlling these hazards.

LEARNING TASKS:

Supervisors/contractors should be able to:

- List chemical hazards, other than lead, found on abatement sites.
- List several types of physical hazards typical of abatement sites.
- List examples of administrative and engineering controls and work practices used to reduce hazards.

As a supervisor/contractor of a lead abatement project, this section is important to you because:

- **controlling potential hazards may prevent injury to workers;**
- **you are required to follow other OSHA standards to protect workers from hazards.**

OTHER SAFETY & HEALTH CONSIDERATIONS

I. Introduction

Lead abatement work raises other health and safety concerns besides lead exposure. These hazards include:

- chemical hazards
- heat stress
- cold exposure
- heavy equipment
- fire
- power tools
- electrical hazards
- work site safety hazards
- noise

Many hazards are covered by OSHA regulations

Many of these hazards are covered by existing OSHA regulations. If there is an applicable standard, we include it in the description of the hazard.

These hazards are described below, along with remedies for preventing or reducing accident or injury.

II. Chemical Hazards

These include paint strippers, paint thinners, encapsulants, solvents, cleaning agents, fuels, etc. Workers can be exposed by breathing them, swallowing them, or absorbing them through the skin. Some of these chemicals are caustic and if they come in contact with skin can cause severe burns. Contact with the eyes can cause blindness. Other chemicals are volatile organic solvents which can cause dizziness, nausea, headaches, and reduced ability to function.

Workers need to know the hazards associated with all chemicals found on abatement sites. This information can be found on the Material Safety Data Sheets (MSDS) provided by the manufacturer. The contractor must provide additional ventilation and/or protective equipment, including respirators, if they are necessary to protect the workers.

MSDS's will provide information about chemicals

III. Heat Stress

Abatement workers under the hot sun and inside buildings, especially when wearing respirators and protective clothing, could experience heat stress. Heat stress can be caused by high air temperature, direct exposure to the sun, physical exertion, the amount of moving air, and the amount of water the person drinks. Sometimes it is hard to drink enough water because food and water are usually barred from the site to prevent them from being contaminated by lead. Protective clothing can also increase the possibility of heat stress. Workers should know the signs of heat stress and what to do about it. When working in a hot environment, a worker should continuously look for:

- signs of heat stress in himself/herself;
- signs of heat stress in co-workers.

It is important to watch fellow workers because they may not be aware of their own symptoms or they may be disoriented from the effects of heat stress.

Disorders resulting from the inability of the body to cope with heat stress are described as heat cramps, heat exhaustion, and heat stroke. Heat cramps are the least serious. Heat stroke is the most serious and can result in permanent brain damage or death. The important things you should know about heat stress disorders are:

- **Heat Cramps** - muscle cramps can result from loss of too much salt from sweating.

- **Heat exhaustion** - A weak and tired feeling, which may be accompanied by dizziness, nausea, and headache. In extreme cases, a person may vomit and/or faint. The symptoms to watch out for are:
  - **cool skin**
  - **sweaty skin**
  - pale skin
  - headache
  - dizziness
  - nausea (feeling sick to the stomach)
- **Heat stroke** - Occurs when the body fails to cope with heat. The body stops sweating. The person may be confused, unconscious, or have convulsions. Unless helped quickly, the person can die or have permanent brain damage. The symptoms to watch out for are:
  - **hot skin**
  - **dry skin**
  - flushed skin
  - confusion
  - headache
  - dizziness
  - nausea
  - fainting

First Aid Measures for Heat Stress

- Move the victim to shade or cool place.
- Give the person fluids to drink.
- Soak the person with water to cool him/her down. (Do not put victim in an ice bath.)
- Seek emergency help for heat stroke (call 911).

To Prevent Heat Stress

Prevention of heat stress is the best cure

- Take more frequent breaks.
- Take breaks in a cool, shaded area.
- Use acclimatization. (When beginning jobs with extreme temperatures, workers should be exposed to these extremes gradually. This allows the body to adapt.)
- Modify work practices by doing such things as changing the work schedule to avoid working during the hottest times of day.
- Wear a hat if working in direct sun.
- Drink plenty of liquids. (Workers may only drink in the clean room after washing hands and face.)

IV. Cold Exposure

Extreme cold can cause injury

Outside abatement work and inside abatement in unheated or poorly-heated buildings can expose workers to very low temperatures during part of the year (usually winter). Cold injury, frostbite, and hypothermia are dangers when temperatures are low. Frostbite results when fingers, ears, nose and toes are not protected against low temperatures. Frostbite is present or very close when parts of your body, such as the hands, feet, nose, ears, or other areas of skin:

- may or may not feel pain,
- feel numb or cold, or
- turn white or grayish yellow.

Hypothermia (reduced body temperature) may produce:

- shivering
- numbness
- drowsiness
- weakness
- low internal body temperature

Workers with symptoms of frostbite or hypothermia should warm the exposed areas. Never rub the affected area to generate heat. This can cause further damage to the soft tissues. The area should be soaked in water no warmer than 105°F. Water of this temperature is comfortable to the touch of a person not affected by frostbite. Keep the frost-bitten area in warm water until it looks red and feels warm. Do not break blisters if any are present. Seek medical attention.

V. Heavy Equipment

Rule for working around heavy equipment

Excavation equipment such as backhoes, loaders, and graders should be equipped with roll-over protective structures (ROPS) or adequate canopy protection for the operator.

Hauling and excavation equipment should be equipped with reverse alarms that can be heard above the surrounding noise level. These alarms alert nearby workers when a piece of machinery is being operated in reverse. Workers should not rely on the operator to avoid them because he/she may not be able to see them.

OSHA regulations governing the use of material handling equipment operated on abatement sites should always be observed.

Abatement workers operating heavy equipment in older areas may encounter hidden hazards such as old cisterns or wine cellars which could collapse, creating a hazard for the operator.

VI. Fire

Fire protection

Some equipment used on a construction site requires flammable or explosive fuel. Storing and handling any flammable or explosive material can be hazardous. Fuel should be stored and transported only under the proper conditions specified in the OSHA Construction Standard (29 CFR 1926.152).

There are many potential causes of fires at abatement sites. Materials may be set on fire by:

- portable heaters;
- improper use of heat guns;
- flammable materials such as gasoline, strippers, or solvents;
- having incompatible materials stored in the same storage area; and
- poor electrical wiring (especially in old homes)

To protect against fires, all flammable materials should be labeled and stored away from heat or spark sources. Workers should follow safe work practices when performing any task with heat guns or flammable materials. Appropriate fire extinguishers must also be available in the work area. If a fire can't be put out with the appropriate fire extinguisher, workers should leave the site and call for assistance.

VII. Power Tools

Power equipment should be well maintained

A variety of hand and power tools (see OSHA Construction Standard 29 CFR 1926 Sub part I, 1926.301, and 1925.302) may be required at an abatement project. These tools can include circular saws for cutting lumber, gasoline-powered cut-off saws for cutting concrete, pneumatic hammers or electric chipping hammers for breaking concrete. Needle guns, circular saws, power miter saws, sanders and pneumatic nailers may be used on paint abatement projects. All of these tools should be kept in good operating condition, especially the safety mechanisms for protecting the workers from injury. Often, these safety devices fail before motors and switches. The safety mechanisms can easily become clogged with dirt or dust and then will not work. Make sure that all of these devices work and that workers know how to use them and what their limitations are.

Also, workers should wear protective clothing or equipment such as goggles or earplugs to prevent or reduce injury. The contractor must provide protective eye and face equipment if it is likely that this equipment will prevent injuries. (OSHA Construction Standard-29 CFR 1926.102). (See Chapter K - Personal Protective Equipment).

VIII. Electrical Hazards

Power lines, buried cables, extension cords, and outlets pose a danger of shock or electrocution. To help reduce this hazard, low voltage equipment with ground-fault interrupters, double insulated tools, and extension cords with proper ground prongs, all in good condition, should be used. Local utility companies will mark areas where wires are buried.

IX. Work Site Safety Hazards

Other safety hazards

Abatement work sites often have safety hazards such as:

- sharp objects (nails, broken glass and wood slivers);
- slippery surfaces (wet floors and steps especially when covered with poly);
- falling objects;
- possibility of slips, trips, and falls;
- uneven terrain (ground surfaces, scaffolding, and ladders); and
- unstable surfaces (weak walls, floors, scaffolding or ladders).

Accidents can directly injure workers and create additional hazards. For example, tripping over an unsecured extension cord may tip over a portable heater and set the carpet or floor on fire. Site supervisors should be alert to potential safety hazards, and should take steps to correct them.

X. Noise

Noise generated by chipping and breaking hammers, needle guns, vacuum blasters, reciprocating saws, and other abatement equipment is a safety hazard. When around these devices, workers must use hearing protections such as earplugs or earmuffs. In cases where sound levels exceed those shown in the OSHA Construction Standard (Table D-2 of 29 CFR 1926.52), a hearing conservation program should be in place.

XI. Lead Abatement Work Site Experiences

Data collected on previous lead abatement projects can help anticipate potential hazards to workers. Two demonstration projects are referenced in the following pages. Also, safety and health publications sometimes report experiences from other projects.

Paint Abatement

During the HUD Lead-Based Paint Abatement Demonstration Project, the air was monitored frequently for lead concentration. Industrial hygienists from the National Institute for Occupational Safety and Health (NIOSH) observed work practices. Excerpts from the NIOSH evaluation letter were included in the HUD Report and are reproduced on the following three pages.

Soil and Exterior Dust Abatement

Air lead data from the Cincinnati Soil-Lead Abatement Demonstration Project are shown in Table 1 (page I-12). The highest concentration observed was 7.3 $\mu g/m^3$ and would not indicate the need for respiratory protection. Blood lead data for the Soil Project workers were all 12 µg/dl and less. The average value after 12 months employment on the project was 5.0 µg/dl.

Observation of HUD Paint Abatement Sites

NIOSH view of lead abatement hazards

Excerpts from NIOSH Evaluation of Workplace Conditions at HUD Lead-Based Paint Demonstration (verbatim from August 1991 report):

With respect to work site procedures:

...The use of a two-stage decontamination entry/exit facility to the abatement site should be discontinued; this requirement does not afford any substantial increase in exposure protection to the workers, or the surrounding environment, but does present complicated access to the site by the workers. A designated area, where no abatement or lead hazard exists, should be identified and utilized to prepare to enter/exit the abatement area. This area would contain hand washing facilities, clean clothes storage, dirty clothes storage, and respirator storage space.

...Proper signage should be utilized to warn all who enter the site that lead abatement is occurring on site and that access is restricted, and that eating, drinking, and smoking within the site is not allowed.

...Strict attention to proper hygiene practices (hand washing after exiting the house, prior to eating, drinking, smoking, etc.) must be maintained. A designated clean area should be provided for these activities.

...Adequate ventilation should be provided when using the heat gun, solvent-based strippers and adhesives, or heating the house with propane or kerosene heaters. Appropriate techniques include negative air machines and/or opening the house up to provide natural ventilation (remove polyethylene from and open the windows). Effective ventilation of the abatement areas should be identified and evaluated to address the second echelon of exposure control (i.e., engineering controls to minimize exposures). The use of in-home heating and ventilation systems as an attempt to improve ventilation of abatement sites does not seem feasible and may lead to contamination of other areas (e.g., duct work and furnace).

With respect to personal protective equipment:

...Face shields, impervious aprons or clothing, and appropriate gloves should be used with the caustic strippers.

...The use of gloves for all operations and tasks is not necessary except during chemical stripping.

...Portable eye wash bottles with saline solution, or an eye wash station, should be on-site where chemical strippers are used.

...We recommend a change in the requirements for use of respiratory protection and full Tyvek suits for certain operations and tasks. During exterior preparation, chemical stripping with caustic-based strippers, encapsulation/enclosure, interior preparation, and heat gun use on the exterior, the use of half-face cartridge respirators and full Tyvek does not appear necessary.[1]

...We recommend the continued use of proper respiratory protection during heat gun use on interior areas which are small and/or not well ventilated, during the use of solvent-based strippers, when removing carpet (whether moistened or not), and during any technique which has not been shown by air monitoring to have minimal (less than 15 µg/cubic meter) to no lead exposure potential. This is a more-conservative approach than OSHA regulations require under the General Industry Standard. NIOSH has supported lower exposures in recent documents.

[1] NIOSH has indicated that subsequent review of environmental data may lead to more stringent protective clothing and respiratory protection when chemical stripping is done.

TABLE I-1

PERSONAL EXPOSURE MONITORING DATA

from the Cincinnati Soil-Lead Abatement Demonstration Project

	Worker #1	Worker #2	Worker #3
Site Inspectors	<0.2	<0.2	0.3
Exc. Equipment Operator	<0.2	<0.2	<0.2
Soil Abatement Laborer	<0.2	<0.2	
Ext. Dust Worker	<0.2	4.0	
Pavement Sweeper Oper.	<0.2	0.6	7.3

all results expressed in μgPb/m^3, 8-hour time weighted averages.

J. Respiratory Protection

RESPIRATORY PROTECTION

OBJECTIVE:

To present information on various types of respirators: how to use and maintain them, and their limitations.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Explain advantages and disadvantages of respirator use.
- Understand how and when respirators are used.
- Know what respirator to use for a specific job.
- Understand the elements of a respiratory protection program.
- Explain how and why the supervisor should make workers use respirators properly.

As a supervisor/contractor of a lead hazard control project, this section is important to you because:

- **proper respiratory protection is essential to running a safe project;**
- **there are penalties for failing to enforce the use of respirators.**

RESPIRATORY PROTECTION

I. Introduction

"A respirator is a personal device designed to protect the wearer from the inhalation of hazardous atmospheres" (ANSI Z88.2, 1992).

Respirators must be used properly

Respirators are designed to reduce workers' exposure to the hazards carried in the air to acceptable levels. Respirators are probably the least desirable type of protection because they can be uncomfortable and can make it hard for the wearer to see. Meeting the requirements of respiratory protection programs can seem time consuming and expensive. Additionally, respirators don't protect workers if they are not used properly.

All of the elements described in this chapter are necessary for safe use of respirators.

Respirators are the last option to be used to control worker exposures

OSHA requires that before using respirators, you try every other protective method possible. These include engineering controls, administrative controls, work practices, selection of alternative materials, or other methods of protection from hazards. This requirement can benefit the employer. Simply changing the way a job is done may not only decrease respiratory hazards, but also make workers more productive.

Unfortunately, respirators are often necessary. Workers must wear them when the amount of hazardous substances in the air is above the OSHA Permissible Exposure Limit (PEL). To choose correct personal protective equipment (PPE), such as respirators, people working on an abatement project must know the dangers they will be exposed to and how to protect themselves.

II. Exposure Assessments

Determining the hazards of exposure is called an exposure assessment. An exposure assessment may include a list of the hazardous substances on the site and some type of environmental sampling, such as air sampling, to test for them. A lead hazard control site may contain hazardous substances besides lead, such as chemicals for paint removal. **You must know what the hazardous substance is and how much of it is in the air before you can choose a respirator (or any other type of PPE)**.

Exposure assessments must be performed

Exposure assessments of how much lead is in air are required at all lead hazard control sites according to the OSHA Lead in Construction Standard (40 CFR 1926.62). Quite often, you don’t know how much lead is concentrated in the air until after the project has begun. Or, it may vary throughout the project, depending on what job is being done. The OSHA Lead in Construction Standard specifies the minimum respiratory protection required for specific tasks, until the exposure assessment has been completed.

Exposure assessments usually include sampling the air to arrive at the amount of hazardous materials in it. Each hazardous material requires a specific air sampling method. Air sampling should be done by industrial hygienists or other qualified air sampling professionals. For more information on many known hazardous materials, recommended methods of sampling and analyzing them, and selecting PPE, consult the *NIOSH Pocket Guide to Chemical Hazards*, available from:

NIOSH Publications
Mail Stop C-13

4676 Columbia Parkway
Cincinnati, Ohio 45226-1998
Fax (513) 533-8573

NIOSH made several recommendations for respiratory protection after they evaluated worker health and safety conditions at the HUD Paint Abatement Demonstration Project (NIOSH, Feb. 1992). Several of those recommendations are included in this section.

III. Employer Responsibilities

Employers are responsible for respiratory protection

Employers must ensure that:

- employees have proper respiratory protection for the job site and task;
- employees are medically cleared to wear respirators;
- employees are properly trained in how to inspect, use, clean, store, and maintain respirators;
- employees are properly fit tested on the respirators being used; and
- all the items in this list are described in a written respiratory protection program (described in detail on pages J-20-21).

IV. Respiratory Protection Equipment Selection

Employers are responsible for selecting proper respiratory protection. Only NIOSH approved respirators may be used. Respirators must be provided to employees at no cost. Employees have a right to request respirators even if they are exposed to levels less than the PEL, as long as the respirator is appropriate and all of the requirements of the OSHA respiratory protection standard are met.

In most lead hazard control projects done in residential neighborhoods, workers wear air-purifying respirators with HEPA filters. Industrial projects may involve different types of hazards and different types of respirators. There are several things to consider when selecting a respirator, and this selection should be done with the help of qualified professionals.

You need to ask the following questions:

- Is the oxygen concentration less than 19.5% or more than 23.5%?
- What hazardous substances could the workers be exposed to?
- Is the air "immediately dangerous to life and health" (IDLH)? (See the *NIOSH Pocket Guide to Chemical Hazards* for IDLH concentrations)
- How much of the substance is in the air?
- What is the maximum Permissible Exposure Level (PEL) or Short Term Exposure Limit (STEL) for the substance?

You also need to consider:

- What you need to tell people working on the site.
- What the work space is like—is it limited or confined?
- Whether extreme temperatures are likely.
- What head, skin and eye protective equipment workers need to wear that could interfere with the respirator.

V. Types of Respirators

Respirators can be divided into two basic types: air-purifying and air-supplying. Respirators that provide air (air-supplying) include Supplied-Air Respirators (SAR) and Self Contained Breathing Apparatus (SCBA). Air supplying respirators must be used when there isn't enough oxygen in the air, when breathing the air might be immediately dangerous to life and health (IDLH), or when protection factors (discussed below) of other types of respirators can't do the job.

The following discussion applies to both air-purifying respirators and air-supplying respirators. Air-purifying respirators are used in most residential hazard control projects. Industrial projects may require supplied-air respirators. Workers may need additional training in how to use supplied-air respirators.

1. Air-Purifying Respirators

Air-purifying respirators

Air-purifying respirators (APRs) remove contaminants in dusts, fumes, gases, or vapors from the air. How effective they are depends on how well they fit and the type of filter or cartridge they use. APRs consist of a facepiece with an inhale and exhale valve. The most commonly APRs are the full-face mask and half-mask.

APRs use both particulate filters and chemical cartridges. These filters and cartridges are selected based on their ability to filter hazardous materials and prevent them from being inhaled. Filters and cartridges are color-coded to identify them by type (see **Table J-1** on page J-8).

Dust, mist and fume filters must be replaced whenever the wearer has difficulty breathing. Gas and vapor cartridges must be replaced when the user can smell or taste gas or vapor, or when service life has been exceeded (don't always rely on taste or odor).

Consult the OSHA respirator standard.

Limitations of Air Purifying Respirators (APRs)

APRs should not be used when there is less than 19.5% oxygen in the air or when breathing the air is immediately dangerous to life and health. They should not be used with gases or vapors that have no taste or odor, unless the APRs are equipped with an indicator that tells the user when the unit is not working.

Some workers may prefer to use the powered air purifying respirators (PAPR). Workers can use a PAPR if it adequately protects them.

2. Supplied-Air Respirators (SAR)

Supplied-air respirators

In abrasive blasting work, as when removing paint from steel structures, a supplied air respirator (SAR) is usually required. A self-contained breathing apparatus (SCBA) may give adequate protection, but it may be too heavy to be practical.

Supplied-air respirators provide air to the worker from a stationary tank or an air compressor and air lines. The worker must wear an escape bottle (usually containing at least five minutes of air). The escape bottle must allow the worker time to safely leave the hazardous area if the primary air supply fails.

There are three classifications of supplied air respirators:

- Hose mask with blower (Type A)
- Hose mask without blower (Type B)
- Air-line respirators

Air-line respirators provide air in either continuous-flow mode or pressure demand mode. (In this mode, air is only supplied when the pressure inside the facepiece drops below a certain level.)

Compressors supply grade D (normal, unfiltered) air. The air intakes for the air and the exhaust for the compressor power supply must be carefully placed so that the supply air does not become contaminated. The air supply is usually includes moisture filters and carbon monoxide alarms.

3. Self-Contained Breathing Apparatus (SCBA)

A Self-Contained Breathing Apparatus is used for emergency situations and/or when there are toxic chemicals in the air, or when there isn't enough oxygen. SCBAs are also used when you don't know how contaminated the air is.

SCBAs include an air tank or cylinder, a carrying assembly, an air gauge, a safety valve, and a full facepiece. They also include a warning device that signals when only 20-25% of service time or service volume remains. Because different manufacturers make different types of SCBAs, workers have to be trained on the particular SCBA they will be using, according the manufacturer's instructions.

Table J-1
Respirator Cartridge Color Codes

Atmospheric Contaminants to Be Protected Against	**Color Assigned[1]**
Acid Gases	White
Hydrocyanic acid gas	White with ½ inch green stripe completely around the canister near the bottom
Organic vapors	Black
Ammonia gas	Green
Acid gases and ammonia gas	Green with ½ inch white stripe around the canister near the bottom
Carbon monoxide	Blue
Acid gases and organic vapors	Yellow
Hydrocyanic acid gas and chloropicrin vapor	Yellow with ½ inch blue stripe completely around the canister near the bottom
Acid gases, organic vapors, and ammonia gases	Brown
Radioactive particles, asbestos, lead (High Efficiency Particulate Filter)	Purple (Magenta)
Particles (dusts, fumes, mist, fogs, or smoke) in combination with any of the above gases or vapors	Canister color for contaminant as designated above, with ½ inch gray stripe completely around the canister near the top
All of the above atmospheric contaminants	Red with ½ inch gray stripe completely around the canister near the top

[1]Gray shall not be assigned as the main color for a canister designed to remove acids or vapors.
Note: Orange shall be used as a complete body, or stripe color to represent gases not included in this table. The user will need to refer to the canister label to determine the degree of protection the canister will afford. For LEAD particles or fume the cartridge for PARTICLES is needed. It has a high-efficiency HEPA filter which is purple (magenta).

Table J-2

RESPIRATORY PROTECTION FOR LEAD AEROSOLS (OSHA)

Airborne Concentration of Lead or Condition of Use	Required Respirator[1]
Not in excess of 500 µg/m^3	-½ mask air purifying respirator with high efficiency filters[2,3].
Not in excess of 1,250 µg/m^3	-Loose fitting hood or helmet powered air purifying respirator with high efficiency filters[3]. -Hood or helmet supplied air respirator operated in a continuous-flow mode.
Not in excess of 2,500 µg/m^3	-Full facepiece air purifying respirator with high efficiency filters[3]. -Tight fitting powered air purifying respirator with high efficiency filters[3]. -½ mask or full facepiece supplied air respirator operated in a continuous-flow mode.
Not in excess of 50,000 µg/m^3	-½ mask supplied air respirator operated in pressure demand or other positive-pressure mode.
Not in excess of 100,000 µg/m^3	-Full facepiece supplied air respirator operated in pressure demand mode.
Greater than 100,000 µg/m^3 unknown concentration, or fire fighting...	-Full facepiece SCBA operated in pressure demand or other positive-pressure mode.

[1]Respirators specified for higher concentrations can be used at lower concentrations of lead.
[2]Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.
[3]A high efficiency particulate filter (HEPA) means a filter that is a 99.97 percent efficient against particles of 0.3 micron size or larger.

VI. Protection Factors

What is meant by protection factor?

The protection factor of a respirator is the ratio of the lead concentrations outside the respirator divided by the lead concentration inside the respirator.

For example, if there is a concentration of lead in the work area of 200µg/m^3, a respirator with a protection factor of 10 should keep the concentration of lead inside the respirator to below 20µg/m^3. Depending on what the worker is doing, this ratio may change.

These factors have been determined by NIOSH, who made measurements outside and inside respirators while people were working at their normal jobs. All the workers tested had been carefully fitted with respirators. NIOSH used the results of workers whose respirators gave them the least protection (because the respirator leaked, or didn't fit properly) to create the minimum protection factors for classes of workers. OSHA used these minimum protection factors in the lead standard. Workers wearing well-fitted respirators get at least the degree of protection NIOSH indicates; most get much better protection.

For example, a half-mask air-purifying respirator with high-efficiency filters has a protection factor of 10. That means that a few people, wearing the respirator for long periods, will have up to 10% leakage into the facepiece.

Most workers will have much less leakage. In fact, the average protection factor is closer to 50, or only 2% leakage.

There is almost always some leakage of the contaminant (in this case, lead) to the inside of the respirator. The lead inside the respirator must be kept below the PEL. The protection factor rating will indicate what type respirator is needed to keep the amount of lead inside the respirator below the PEL. (In other words, higher amounts of lead outside require higher protection factors.)

In quantitative fitting of respirators the worker is required to get a fit factor of at least 10 times the assigned protection factor. (The following section explains how this "fit factor" is calculated.) For technical reasons, the fit factor slightly overestimates the actual protection, but the main reason that a fit factor of 100 is required is that the fit test, when the worker is wearing the respirator under supervision, takes a very short period of time.

Two problems have been included at the end of this chapter to help you work out sample protection factors. Work these problems and check with your instructor for accuracy.

The following table shows assigned protection factors for different types of respirators.

Table J-3

Type of Respirator	APF*
½ mask air-purifying (high efficiency filters-HEPA)	10
loose-fitting hood or helmet powered air-purifying (HEF)	25
hood or helmet supplied-air - continuous flow mode	25
tight-fitting powered air-purifying (HEF)	1,000
full facepiece air-purifying (HEF)	50
½ mask supplied air in pressure-demand mode	1,000
full face SCBA in continuous positive pressure mode	10,000

*Assigned Protection Factor

Half Face Air-Purifying
Respirator
Negative Pressure

Full Face Air-Purifying
Respirator
Negative Pressure

Full Face Air-Purifying
Respirator
Positive Pressure
(PAPR)

Full Face Air-Supplied
Respirator (SCBA)

Full Face Air-Supplied
Positive Pressure
Respirator
(Airline)

VII. Respirator Fit

One respirator will not fit all faces

A respirator is only effective if there is a good seal between the facepiece and the wearer's face. Since different people have faces of different shapes and sizes, respirators are available in a variety of sizes and models. Each person who wears a respirator must be fit tested. A wearer has to be retested after weight loss or gain, changes in dentures, dental work, or facial injury. These changes affect the size or shape of the face and cause the person to need a different size or model respirator.

VIII. Fit Tests

Each person must be fit tested to get the right size and model respirator. Two types of fit testing, qualitative and quantitative, are used to determine these factors, along with how well the facepiece seals against the face. These tests must conducted initially and annually to judge whether the respirator continues to work properly. (The differences between qualitative and quantitative fit testing are explained in the following section.)
Quantitative fit testing must be used for full facepieces. Half masks can also be quantitatively fit tested. When using isoamyl acetate, the respirator must have organic vapor cartridges. Fit testing must be done every 12 months according to the Respiratory Protection Standard (1910.134). Workers must be able to choose the respirator that is most comfortable and that fits them best. They must be able to select from a variety of models.

Qualitative fit testing

1. Qualitative Fit Testing

Purpose: To check how effective a respirator is in preventing substances from entering the facepiece.

Method: An individual, while wearing a respirator, enters a space where a test substance is released (banana oil, irritant smoke, Ditrex, or saccharine mist). The wearer should not be able to detect the substance.

Requirements: The OSHA respirator standard requires fit-testing every 12 months.

Several important precautions for qualitative fit testing follow:

- All qualitative tests include normal and deep breathing, turning the head from side to side, looking up and down, talking, etc.
- Irritant smoke includes hydrochloric acid. The person being tested must have eyes closed. Coughing is induced when a significant amount of irritant gets inside the facepiece.
- The isoamyl acetate (banana oil) test must include a sensitivity test to show that the worker can smell a small amount of banana oil.
- The saccharine mist test is done with the worker breathing through the mouth. It includes a sensitivity test to show that the worker can taste a small amount of saccharine.

2. Quantitative Fit Testing

Quantitative fit testing

Purpose: To measure the effectiveness of respirator in preventing substances from entering the facepiece.

Methods: With the worker wearing a respirator, a substance in the air is measured inside and outside the respirator. In the test, "Fit Factors" for each exercise and an "Overall Fit Factor" (OFF) are measured. The fit factor is the average count outside the respirator divided by the count inside the respirator. The exercises include normal and deep breathing, turning the head from side to side, looking up and down, talking, smiling and frowning, bending to touch the floor, and running in place. The OFF must exceed 100 for a half mask and 500 for a full face respirator.

Requirements: The OSHA respirator standard requires fit-testing every six months for negative-pressure air purifying respirators. Quantitative fit tests are required for the full-face models.

Quantitative fit testing gives an objective measure of how much the facepiece leaks. Administering the test correctly requires less training than qualitative fit tests. The only disadvantage of the quantitative test is the additional cost for equipment (roughly $6,300 in 1996).

IX. User Seal Checks

User seal checks must be performed

Positive and **negative** pressure user seal checks should be done each time the worker puts on the respirator. These tests do not replace fit testing and do not indicate whether the fit is still adequate.

1. Negative Pressure User Seal Check

Purpose: To check the facepiece-to-face seal.

Method: Wearer places hand over cartridges and inhales. The wearer should not feel any air leaking into the facepiece. The facepiece should collapse slightly.

Requirements: This test must be done before each use.

2. Positive Pressure User Seal Check

Purpose: The purpose of the positive pressure test is to test the face seal. A slight positive pressure should be built up inside the facepiece and there should be no evidence of outward leakage.

Method: The wearer covers the exhalation valve with hand and blows out gently. Air should not escape from the seal around the facepiece.

Requirements: This test must be done before each use.

Positive and negative pressure tests can be done quickly and easily in the field. They do, however, rely on the wearer's ability to detect leaks.

X. Medical Fitness to Wear a Respirator

Employees shall be medically cleared before wearing a respirator. The physician or licensed health care provider should be given the OSHA standard and should understand what the worker’s job is.

Some medical conditions may prevent an individual from wearing respirators, including:

- Lung disease
- Claustrophobia
- High blood pressure
- Heart disease

XI. Facial Hair and Respiratory Protection

The OSHA Respirator Standard requires that:

> Respirators **shall not be worn** when conditions **prevent a good face seal**. Such conditions include facial hair, sideburns, temple pieces on glasses, or other items that contact the sealing surface of the respirator. To assure proper protection, the facepiece fit shall be checked by the wearer each time he/she puts on the respirator.

XII. Care and Cleaning of Respirators

Any hazard control project which requires the routine use of respirators should provide a respirator care and cleaning program. This program's purpose is to ensure that all respirators are maintained so that they work properly. In large organizations, one person is trained to inspect, clean, repair, and store respirators. In small organizations, each worker may be responsible for the care of his/her own respirator, so workers must be trained to inspect, clean, and store the respirator properly. If the respirator needs to be repaired, the worker must be able to obtain the necessary parts or bring it to someone who can do the maintenance work. Replacement parts used must be specifically for the make and model of the respirator being repaired. The low/no maintenance respirators now available from several manufacturers make this easier. Maintenance usually involves replacing cartridges.

Defective respirators are replaced. Respirators should not be shared. Respirators used by more than one worker shall be thoroughly cleaned and disinfected after each use. Respirator care and cleaning should be based on the types of respirators, working conditions, and hazards involved. In general, a respirator care program should include:

- Inspection (including a leak check)
- Cleaning and disinfection
- Repair
- Storage

XIII. Inspection

Inspect respirators before and after each use. For air-purifying respirators, thoroughly check all connections for gaskets and "O" rings and for tightness. Check the condition of the facepiece and all its parts, connecting air tube, and headbands. Inspect rubber or elastic parts for flexibility and signs of deterioration. Replacement parts should be readily available.

Keep a record of each respirator inspection, including date, name of inspector, and any unusual conditions or findings.

XIV. Cleaning and Disinfection

Respirators should be cleaned and disinfected to prevent skin irritations, worker exposure to chemical hazards, and deterioration of respirator parts. The facepiece should be wiped out daily. Regular cleaning and disinfection should be done as follows:

① Remove all cartridges, canisters, and filters, plus loose gaskets.

② Remove elastic headbands.

③ Remove exhalation valve cover.

④ Remove exhalation valve.

⑤ Remove speaking diaphragm or speaking diaphragm-exhalation valve assembly.

⑥ Remove inhalation valves.

⑦ Wash facepiece (and breathing tube) in cleaner/sanitizer powder mixed with warm water, preferably at 120^{o} or 140^{o}F. Wash components separately from the facemask. Remove heavy soil from surfaces with a hand brush.

⑧ Remove all parts from the wash water and rinse twice in clean, warm water.

⑨ Air-dry parts in a designated clean area.

⑩ Wipe facepieces, valves, and seats with a damp lint-free cloth to remove any remaining soap or other foreign materials.

NOTE: Most respirator manufacturers market their own cleaners/sanitizers as dry mixtures in one-ounce packets. Respirators **should not** be cleaned in dish washers.

XIV. Repairs

Only a trained person with proper tools and replacement parts should repair respirators. No one should ever attempt to replace respirator parts, make adjustments, or repairs not recommended by the manufacturer.

Make repairs as follows:

- Replace all faulty or questionable parts or assemblies. Only use parts specifically designed and approved for the particular respirator.
- Reassemble the entire respirator and visually inspect it when it is reassembled.
- Insert new filters, cartridges, or canisters, as needed. Make sure that gaskets or seals are in place and tightly sealed.

XV. Storage

Manufacturers provide cleaning, maintenance, and storage instructions with new respirators. The following instructions may also be helpful:

- After respirators have been inspected, cleaned, and repaired, store them in a location which will protect them against dust, excessive moisture, damaging chemicals, extreme temperatures, and direct sunlight.
- Do not store respirators in clothes lockers, bench drawers, or tool boxes. Store respirators in the original carton or carrying case when possible.

XV. Respirator Program

Respirator program must be evaluated at least annually

Employers who are required by OSHA to provide respirators must have a written respirator program. This program should be evaluated **at least once a year** or when requirements change. A respirator program **must** include the following as minimum requirements according to the Respiratory Protection Standard (29 CFR 1910.134):

- Written standard operating procedures for selecting and using respirators.
- Respirators must be certified and selected on the basis of hazards the worker is exposed to.
- The wearer must be trained in the proper use of respirators and their limitations.
- If possible, respirators should be assigned to individual workers for their exclusive use.
- Respirators must be regularly cleaned and disinfected after each use (or more often, if necessary). Those used by more than one worker must be cleaned and disinfected after each use.
- Respirators must be stored in a convenient, clean, and sanitary location.
- Respirators used routinely must be inspected during cleaning. Worn, deteriorated parts must be replaced.
- Employee work areas, conditions, and degree of employee exposures must be surveyed regularly.
- Medical review must be included.
- Evaluation of the respiratory protection program must be done at least annually or when conditions change.

NIOSH Recommendation:

NIOSH health alert

"Respiratory protection may be necessary for certain operations or methods such as paint removal by chemicals, heat gun, or abrasive techniques, and some set-up, and cleaning operations. However, respirators are the least preferred method of controlling airborne lead exposure, and **they should not be used as the only means of preventing or minimizing exposures. Respiratory protection requirements are not an acceptable substitute for adequate training, supervision, appropriate engineering controls, and environmental or medical monitoring.** Initial respiratory protection requirements for abatement work (which may be based on conservative assumptions) should be modified with appropriate job-specific requirements based on air monitoring results.

Respirator selection for each job category at every worksite should be determined by an industrial hygienist or other qualified individual, based on maximum airborne exposures measured."

RESPIRATOR FIT TEST - LAB SHEET

NAME ______________________ DATE ______________________

1. You wear (check all that apply)

☐ Prescription glasses ☐ dentures

☐ contact lenses ☐ a beard

☐ hairstyle that prohibits good face seal

	Yes	No
2. Did you do a negative-pressure fit check:	☐	☐
3. Did you do a positive-pressure fit check?	☐	☐
4. Did you go into a test chamber?	☐	☐

If yes, which type of chamber?

☐ "banana oil" ☐ irritant smoke ☐ both ☐other

5. What brand and size of air-purifying respirator did you wear?

Brand ____________________ Size ____________________

Full-face ____________________ Half-face ____________________

6. What brands and size of respirator(s) did not fit?______________________________

____

	Yes	No
7. Did you wash your respirator? If yes, check the supplies you used.	☐	☐

☐ towelette ☐ wash basin ☐ other

8. How long did you wear the respirator? ____ minutes

PRACTICE PROBLEMS

International Abatement Company began a new lead abatement project on Monday. Historical air monitoring by the safety and health officer indicated that respirators with a protection factor of 10 would be adequate for the specified abatement strategies for the project. Eight (8) new workers were hired for the project. Because of this, the health and safety officer decided to perform additional air monitoring. Personal air monitoring of workers performing different tasks revealed the following lead levels based on 8-hour time-weighted averages:

❶	wet scraping prior to encapsulation	58 $\mu g/m^3$
❷	applying encapsulants	32 $\mu g/m^3$
❸	daily clean-up	76 $\mu g/m^3$
❹	removal and replacement of interior doors and baseboards	83 $\mu g/m^3$
❺	removal and replacement of windows	782 $\mu g/m^3$

The lead abatement supervisor should be able to answer correctly the following questions based on the above description of an abatement project.

1. Are respirators with a protection factor of 10 suitable for all tasks described above?

   ❒ Yes ❒ No

2. What would the highest expected concentration of lead inside a respirator with a protection factor of 10 be for each of the tasks described above?

   ❶ _____
   ❷ _____
   ❸ _____
   ❹ _____
   ❺ _____

3. If the protection factor were 25, what would the highest expected concentration be?

   _____

K. Protective Clothing and Equipment

PERSONAL PROTECTIVE CLOTHING & EQUIPMENT

OBJECTIVE:

To present information on various types of protective equipment: how to use and maintain them, and their limitations.

LEARNING TASKS:

Supervisors/contractors should be able to:

- List and define at least six types of protective clothing used on an abatement project.

- Explain the reasons for the sequence used in dressing and undressing before entering and leaving a contaminated area.

- Select, don (put on), doff (take off), and clean protective clothing.

As a supervisor/contractor of a lead-abatement project, this section is important to you because:

- **Different abatement projects require different protective equipment.**

- **Different phases of an abatement project require different protective equipment.**

PROTECTIVE CLOTHING AND EQUIPMENT

I. Introduction

Protective clothing and equipment are necessary to protect workers against the chemical and physical hazards on the abatement site. Employers must provide appropriate protective work clothing and equipment (along with respiratory protection) at no cost to the employee and must ensure that the employee uses it.

II. Who Regulates Equipment?

NIOSH, ANSI, and OSHA

Agencies such as NIOSH (National Institute for Occupational Safety and Health) and ANSI (American National Standards Institute) perform research and make recommendations for protective clothing and equipment. However, OSHA sets and enforces standards.

Standards which address protective equipment include:

1926.62(g)	Protective work clothing and equipment
1910.132 & 1926.95	General requirements for full-body protection
1910.133 & 1926.102	Eye and face protection
1910.135 & 1926.1001	Head protection
1910.136 & 1926.96	Foot protection
1926.101 & 1926.101	Hearing protection
1910.95 (c)	Noise and hearing conservation
1910.120(g)(3), 120(g)(5)	PPE Program
1910.120 Appendix B	Levels of protection and protective gear
1910.1200	Hazard communication

Protective clothing and equipment guard against injury to the body including the head, eyes, face, and feet. Generally, lead abatement workers wear coveralls, safety glasses, and work boots or shoes while on the abatement site. At times, they may also be required to, or should wear boot covers, hard hats, hearing protection, and face shields, depending on the job conditions and requirements.

III. OSHA 1926.62 Regulation for Personal Protection

PPE for abatement workers

The Lead in Construction Standard regulates protective work clothing and equipment as follows:

- Provision and Use of PPE
  Where an employee is exposed to:
  a) lead above the PEL without regard to the use of respirators;
  b) lead compounds which may cause skin or eye irritation (e.g. lead arsenate, lead azide);
  c) and as interim protection for employees performing tasks as specified in paragraph (d)(2) of the Construction Standard,

  the employer shall provide at no cost to the employee and assure that the employee uses appropriate protective work clothing and equipment that prevents contamination of the employee and the employee's clothing.

  This protective clothing could include:

a. Coveralls or similar full-body work clothing;

b. Gloves, hats, shoes or disposable shoe coverlets; and

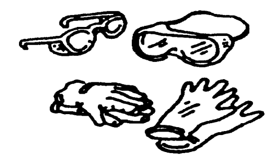
c. Face shields, vented goggles, or other appropriate PPE.

- Cleaning and Replacement of PPE

The employer shall provide the protective clothing required in a clean and dry condition at least weekly, and daily to employees whose exposure levels without regard to a respirator are over 200 ug/m^3 of lead as an 8-hour TWA.

The employer shall provide for the cleaning, laundering, and disposal of protective clothing and equipment.

The employer shall repair or replace required protective clothing and equipment as needed to maintain their effectiveness.



The employer shall assure that all protective clothing is removed at the completion of a work shift only in change areas provided for that purpose.

The employer shall assure that contaminated protective clothing which is to be cleaned, laundered, or disposed of, is placed in a closed container in the change area which prevents dispersion of lead outside the container.

The employer shall inform in writing any person who cleans or launders protective clothing or equipment of the potentially harmful effects of exposure to lead.

Labeling contaminated clothing

The employer shall assure that the containers of contaminated protective clothing and equipment are labeled as follows:

> **Caution:** Clothing contaminated with lead: do not remove dust by blowing or shaking. Dispose of lead contaminated wash water in accordance with applicable local, state, or federal regulations.

The employer shall prohibit the removal of lead from protective clothing or equipment by blowing, shaking, or any other means which disperses lead into the air.

IV. Full-Body Protection

Arms and legs may be exposed to chemicals from paint stripping agents, dusts, and other skin irritants at the work site. Disposable suits such as TYVEK^R provide little protection from chemicals but protect against dust and minor injuries such as scrapes and cuts. If they don't wear disposable suits, workers should wear long-sleeved shirts and pants, but must not take them home, and they must be cleaned by the employer. When working near heat sources, workers should not wear loose clothing. It should not be flammable, and so should not be made of polyester or other flammable material. Shirts should be tucked in and buttoned to prevent catching fire or getting caught on other objects.

V. Head Protection

Workers may wear hard hats in work areas where there is risk from falling objects or where heavy equipment is used. Generally, hard hats are less likely to be used at residential abatement sites unless the employer requires it or the employee requests it. Head coverings are available to keep hair and scalp clean.

VI. Eye Protection

The eyes and face can be protected from chemical splashes and dust by wearing face shields and eye goggles. Workers who wear prescription glasses may be more comfortable using a full-face mask.

VII. Hand Protection

Hands may be exposed to both physical and chemical hazards. In paint abatement projects, workers will be exposed to nails, wood, splinters and other sharp objects. Similarly, soil and dust abatement projects may expose workers to sharp objects. Leather gloves are recommended as protection from these hazards.

When strippers are used, workers are exposed to the chemicals in the strippers. Worker should use appropriate rubber gloves. Since the chemicals in strippers vary, the type of rubber glove may also vary. The environmental professional responsible for worker safety must make sure that the gloves are adequate protection against the chemicals being used.

VIII. Foot Protection

Abatement workers are as subject to foot injuries as workers on most construction sites. Steel-toed boots or shoes may prevent fractures from falling objects and punctures from nails or other debris. Disposable foot covers (booties) may be used to prevent the spread of lead from the work site. The booties must be removed when workers or visitors leave the abatement site. Workers can dispose of contaminated booties properly at the end of the work shift or whenever they leave the work area. However, disposable foot covers should not be worn on ladders or scaffolding because they increase the risk of slipping. Shoe/boot covers (plastic, Tyvek^{R}, rubber, etc.) also increase the risk of slips on wet surfaces. An alternative is to use work boots that never leave the job site.

IX. Hearing Protection

Long-term exposures to sound levels at or above 85 decibels results in hearing loss. Equipment such as back hoes, vacuums, and street sweepers produce noise which can damage hearing over time. Ear plugs are available in many shapes and sizes. Disposable foam ear plugs reduce noise by 15dB, conform to the ear, and are washable. Soft rubber ear plugs are available in three sizes (large, medium, and small) and reduce noise up to 13dB. These are washable and reusable. The contractor must set up a hearing conservation program when noise exposures are at or above an average of 85 dBA over an 8-hour period (29 CFR 1910.95).

X. Putting On & Taking Off Protective Clothing

Procedures for use of protective clothing

Safety professionals use the terms “donning” (for putting on) and “doffing” (for taking off) protective clothing. The donning process depends on the fit of the disposable clothing for each individual. Most experienced abatement workers use duct tape to make the clothing more comfortable and allow themselves more freedom of movement without tearing the material. You will learn how to do this during the Abatement Techniques Workshop portion of this course. Donning protective clothing should be done in a sequence that will allow the worker to remove all clothing before removing the respirator. The wearer should remove all clothing but leave the respirator in place until he/she has started the decon shower and is washing the face. Removing the respirator at this time protects the wearer from exposure to lead-dust that might occur when taking clothing off. To remove protective clothing properly, you roll the dirty side of each piece inward as you remove it. his process helps to control dust. You will learn how to doff protective clothing during the Abatement Techniques Workshop section of this course.

NIOSH Personal Hygiene Recommendations:

Health advisory from NIOSH

"Facilities for worker personal hygiene should be improved to minimize workers' exposure to lead through ingestion, and carry-home of lead contamination. Adequate washing facilities including running hot and cold water. Wherever feasible, showers, should be provided at the work site so that workers can remove lead particles from skin and hair. Contractors should arrange for collection and disposal of the wastewater in accordance with local and state requirements. Wherever feasible, contractors should supply a portable trailer to contain storage, washing facilities, and clean areas.

"All workers exposed to lead should wash their hands and faces before eating, drinking, or smoking, and they should not eat, drink, or use tobacco products in the work area, or other potentially contaminated areas on site. Tobacco and food products should never be permitted in the work area. Contaminated work clothes should be removed before eating."

L. Employee Information and Training

EMPLOYEE INFORMATION & WORKER TRAINING

OBJECTIVE:
To present information regarding required and recommended training for lead-abatement workers.

LEARNING TASKS:
Supervisors/contractors should be able to:

- List and explain required and recommended topics which must be included in a worker training program.

- Describe when and under what circumstances workers must be trained.

- Explain why the OSHA Hazard Communication Standard (HAZ COM) will apply to lead-based-paint abatement projects.

As a supervisor/contractor of a lead-abatement project, this section is important to you because:

- **You may be responsible for on-the-job worker training;**
- **You may be responsible for implementing HAZ COM on the job site;**
- **You should be aware of the training recommendations and requirements.**

Introduction

Employee information and worker training are important aspects of a lead abatement project and should not be overlooked or treated lightly. Lead abatement worker training falls into four categories:

- Training required on HUD projects;
- Training required by state and local lead regulations;
- Training required by other Federal regulations;
- Recommended training or training required as a prudent action.

"Right to Know" legislation requires employers to provide workers with information about hazards in the workplace. This could be used as part of a worker training program.

This section of the manual covers the current requirements for worker training. The regulations section of this manual includes all applicable regulations. Training regulations can change frequently, so current regulations should always be checked for changes.

HUD REQUIREMENTS

Training Requirements on Federal and Indian Housing Projects (HUD)

The "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing" (July, 1995) cites the OSHA Hazard Communication Standard for Construction (29 CFR 1926.59) and OSHA Interim Final Lead in construction Standard (29 CFR 1926.62) as containing the training requirements for lead abatement workers on HUD projects.

Training Required by State and Local Lead Regulations

STATE & LOCAL REQUIREMENTS

States and tribal units are to promulgate/institute regulatory requirements for certification or licensure of lead hazard reduction personnel. These regulations must be “as protective as” the Federal regulations in order for the State or tribal program to be approved by the U.S.EPA under their rules 402/404. Several states have regulations in place, however, they must apply for approval of their programs by August 31, 1998 to be in compliance with 402/404.

Training Required by Other Federal Agencies

OSHA REQUIREMENTS

Training Requirements Under OSHA (29 CFR 1926.62)

The OSHA Lead in Construction Interim Final Standard (29 CFR 1926.62) was promulgated May 3, 1993 and made effective as of June 3, 1993. This Standard, like the OSHA General Industry Lead Standard (29 CFR 1910.1025) requires training of workers. These training requirements are as follows.

Under OSHA's Lead Standard, worker training must be provided:

- for all employees who are subject to lead exposure at or above the action level on any day or who are subject to exposure to lead compounds which may cause skin or eye irritation...and assure employee participation.
- when the possibility of skin or eye irritation exists.
- annually.
- prior to the time of job assignment.

Worker training must include:

- the content of OSHA's Lead Standard (1926.62) including appendices A and B (and a copy of the standard and appendices must be made available to the employee).

  Appendix A covers:

- lead as a substance
- lead compounds covered by the Standard
- uses of lead
- permissible exposure limits
- action levels
- health effects related to lead exposure

  Appendix B covers key provisions of the Lead Standard with which workers should become familiar:

- Permissible Exposure Limits
- exposure monitoring
- methods of compliance
- respiratory protection
- protective work clothing and equipment
- housekeeping
- hygiene facilities and practices
- medical surveillance
- medical removal protection
- employee information & training

- signs
- record keeping
- observation of monitoring
- the specific nature of the operations that would result in lead exposure above the action level;
- the purpose, proper selection, fitting, use, and limitations of respirators;
- the purpose of medical surveillance program and medical removal protection program;
- the adverse health effects of excessive exposure to lead, especially adverse reproductive effects;
- the hazards to the fetus and precautions for pregnant employees;
- the specific engineering controls and work practices associated with job assignment;
- relevant good work practices (appendix B);
- content of any compliance plan;
- risks associated with chelating agents; and
- employees' right of access to records under OSHA's 1910.1020.

Training Requirements Under OSHA (29 CFR 1926.59)

HAZCOM REQUIREMENTS

There are other Federal regulations which apply to all lead abatement projects, including those completed outside of federally owned (HUD) housing. Since soil and paint abatement work is considered to be a construction process, the requirements of the OSHA Hazard Communication Standard (29 CFR 1926.59), HAZ COM, will apply. Lead abatement contractors are required to have a written hazard communication program. The primary components of the program are labels on products which contain hazardous chemicals used on abatement projects, a list of hazardous chemicals and material safety data sheets for products used at each project site and a training program for all employees who may be exposed.

Beyond the federal requirements, some local and state governments also have right-to-know programs that may be more stringent. Contractors should check with local and state regulatory agencies to determine the existence and applicability of additional requirements.

Haz Com training is required at the time of initial assignment and whenever a new chemical hazard is introduced into the workplace. The standard does not say how long the training must be, but it must include:

- an explanation of the requirements of the standard;
- identification of workplace operations where hazardous chemicals are present;
- an explanation of the company program for communicating chemical hazards to the employee;
- a discussion of information sources that provide lists of hazardous chemicals used at the job site, material safety data sheets, and written procedures for evaluating hazards;
- instruction on how to read and interpret the information on an MSDS and container labels, and how to use chemical hazard information;
- a presentation of specific information about chemicals used in the workplace; and

- a discussion on details about the measures employees can take to protect themselves against these hazards, including protective equipment.

Most soil and dust abatement projects would expose workers to the hazard of particulate lead. For a lead-based paint abatement project, the hazard would not only include lead but there might also be exposure to the paint strippers. Some of these strippers contain chemicals which are considered to be hazardous and would be covered by the HAZ COM standard.[1]

EPA REQUIREMENTS

Training Requirements Under U.S.EPA 402 Rules

The U.S.EPA requires training for all individuals engaged in lead-based paint activities in target housing and child-occupied facilities except persons who perform these activities within residential dwellings that they own, unless the residential dwelling is occupied by a person or persons other than the owner or the owner=s immediate family while these activities are being performed, or a child residing in the building has been identified as having an elevated blood lead level.

[1] Please see the note on Page C-30 of this manual for OSHA′s "Instruction"

The following table describes the U.S.EPA training and prerequisite requirements:

Discipline	#Trng Hours	#Hds-on Hours	EPA/State Exam	Pre-Requisite Education and/or Experience	Refresher Hours
Inspector	24	8	yes	none	8
Risk Assessor	16	4	yes	inspector training and bachelor's degree and 1 yr exp. in related field*; or associate's degree and 2 yrs exp. in related field; or CIH, PE, RA and/or certification in related field**; or high school diploma/equivalent and at least 3 yrs exp. in related field.	8
Supervisor	32	8	yes	one year exp. as certified LBP abatement worker, or at least 2 yrs exp. in related field or in building trades.	8
Project Designer	8	0	no	supervisor training, and bachelor's degree in engineering, architecture, or related profession; and 1 year exp in building construction & design or related field; or 4 yrs exp. in building construction & design or related field.	4
Worker	16	8	no	none	8

* e.g., lead, asbestos, environmental remediation work, or construction.
** e.g., safety professional or environmental scientist.

Recommended Training or Training As a Prudent Action

WHY TRAIN?

The Federal Government and some state governments have required worker training for a number of years. Worker training is an important part of any well-designed project, and contractors considering an abatement project must incorporate worker training as part of the overall abatement plan. Owners and contractors providing worker training help ensure the safe, efficient, and appropriate accomplishment of the work.

Training also provides a degree of self-protection for the owner and the contractor performing the abatement work. Failure to adequately train workers could present significant liability for the owner and contractor in the event of an injury to a worker or a member of the worker's family resulting from lead exposure from the abatement process. There is also the possibility for contamination of the environment due to the actions of a worker who did not understand the risks associated with sub-standard work practices. Any contractor who performs a lead abatement in a manner which results in injury to others would likely be considered negligent in a court of law.

The topics which should be included in a training program are: routes of exposure, worker carry home, and good work practices. Additionally, workers should be trained in:

- the proper use and maintenance of abatement tools;
- the specific abatement techniques to be used;
- the proper use, storage requirements, disposal restrictions, and hazards of any chemicals used to remove paint.

Sources for Worker Training

SOURCES FOR TRAINING

Six U.S. EPA regional training networks were established in March of 1992. A map showing the areas involved is included in the Reference section of this manual.

Until the U.S.EPA rule 402 takes effect, if licensure or certification are not required in the your area, and appropriate worker training is not available for workers on an abatement project, then you could use your own training program with the assistance of qualified personnel knowledgeable about the hazards associated with lead abatement. Qualified personnel would include:

- worker training specialists (such as labor unions),
- industrial hygienists, or
- abatement specialists.

A number of worker, university, and private organizations offer lead-abatement training courses. Check the reference section of this manual for the "State Lead Poisoning Prevention Directory" published by the National Conference of State Legislatures. This Directory is a source of names and phone numbers of state offices and officials who can supply a list of approved training providers and current state regulations.

Training information can also be obtained from:

- The United States Environmental Protection Agency
  National Program Chemicals Division
  Office of Pollution Prevention & Toxics (7404)
  401 M Street, S.W.
  Washington, DC 20460
  202/260-3790
- The National Lead Information Center (NLIC)
  1/800/424-LEAD

WORKER TRAINING TIPS

COMPETENCY-BASED TRAINING

So, how do you get started? There are many approaches to developing and delivering adult training. The approach which we will use here is "competency-based" training.

Competency-based training is centered around the answers to three questions:

1. What do you want the trainees to know/be able to do (competencies) after the training?

2. What is the best way to teach these competencies?

3. How will you determine that the trainees know/can do what you have taught them after the training session?

WHAT?

1. What do you want the trainees to know/be able to do?

If your purpose in developing and delivering the training is to meet the requirements of mandated training, the competencies (at least as far as the "what," if not the "how well" is concerned) are frequently delineated in the standard or regulation which mandates the training. The OSHA (and HUD) training requirements were listed in the first part of this section.

Once you have determined the answer to the first question of what to teach, you then need to address the second question.

2. What is the most effective way to teach these competencies?

HOW?

There are some well-researched and proven effective training techniques which you can employ to maximize the effectiveness of your training. The first of these techniques is **variety**.

USE VARIETY

Instructional variety means using different techniques during the presentation of a training program. This variety can be used in your ***training format***; for example, lectures, demonstrations, group work, and hands-on workshops. The type of format is determined by what competency you are training. If, for example, your training session is to deal with changes in regulations, you could use a lecture format or a hands-on exercise by giving the trainees a copy of the regulation and having them find the changes. If your training session is for the purpose of training the workers how to use a new procedure, you would want to use a demonstration followed by a trainee hands-on workshop so they have the opportunity to practice the new skill.

Instructional variety also can be in the type of ***visual aids*** you use. Perhaps an overhead of an old version and a new version of a regulation could point out the changes/differences in the new regulations. Or the use of a chalk/white board would serve well during the session. Props also can be useful when explaining how to operate new equipment. The point is to fit the format and visual aids to the type of training you are doing, while also helping your trainees to pay attention.

Another purpose for training variety is to account for the differing ways adults learn. Some adults are “visual.” If they can see it, they can understand it. Others need to “touch” it. They want to hold or touch the new equipment or actually complete a new kind of record-keeping form. Others seem to only need to hear an explanation of how something works and they can “go with it.”

It is important to get to know your trainees to get a sense of what works with each one of them. Of course, the best presentation technique is to appeal to several of the senses during the training process. According to J. M. Owen of the Center for Teaching Thinking, we learn:

- 10% of what we read,
- 20% of what we hear,
- 30% of what we see,
- 50% of what we see <u>and</u> hear,
- 70% of what is discussed,
- 80% of what we experience, and
- 95% of what we teach.

USE CLARITY

Another effective training technique is **clarity**. This refers to how understandable and easy it is to interpret a presentation and the training materials. Use examples that relate to what the trainees already know. This gives them a “frame of reference” to build on or compare to. Asking the trainees questions during the session will help you to determine if they are “getting it,” or if you need to use more examples, more thorough explanations, or different training materials.

WII-FM!

Right along with clarity, is the technique of **applying the learning to the trainees’ concerns**. Adult trainees are task-oriented--they want to know how the learning will help them on their jobs. So, be sure to relate what the trainees are learning to their on-the-job responsibilities.

It is always important to plan **sufficient time** for the training and practice sessions. Trainers have proven time and again that if insufficient time is spent on the in-class training and/or practice sessions, the learning just doesn't take place, or it is soon forgotten. Unfortunately, many of the regulations that mandate training also mandate the minimum amount of time the training program must last. This is unfortunate because it does not take into account the trainees who learn at a slower pace. Even though there is no "maximum" duration given, it is seldom, indeed, that a trainee (or his/her supervisor) would want or be allowed to be off the job any longer than is required by the regulation.

SUFFICIENT TIME

The next effective training technique is **success**. This simply means ensuring the trainees experience success in learning what you are teaching them. One way to ensure this success is to start of with simple or easy concepts and progress to the more difficult concepts after the trainees have mastered the easier things. Trainees who experience success early in the training are more inclined to feel they are able to master the more difficult material that comes later in the training. They are more motivated to tackle the harder material because they have seen that "yeah, I can do that." Positive trainee attitudes are important to a successful training session.

SUCCESS

Lastly, be sure to allow the trainees to **practice** what they have been learning, even if this practice consists of telling another trainee, or writing on the board, the three most important changes in the new regulations. Of course, it's easier to practice skills (doing something) than new knowledge. But be sure that the practice is **guided**. This means that the instructor must monitor the practice to be sure the trainee is practicing the new skill or knowledge correctly. Remember, "practice makes perfect," but practicing something wrong makes you perfectly wrong!

PRACTICE!

3. How will you determine that the trainees know or can do what you have taught them?

There are many ways to evaluate learning, among which are:

- trainee written examinations,
- trainee verbally answering questions, and
- observation of trainee performance.

In some cases the evaluation method is specified in the regulation mandating the training. Which evaluation method you choose could depend on requirements of the regulation, available time and resources, literacy level of the trainees, and type of training that was given. Of course, the best way to evaluate skills training outcomes is to observe the trainee once he/she is back on the job (and is unaware that he/she is being observed).

Finally, additional training tips are:

ADDITIONAL TIPS

- whenever you present safety and health training, have the workers sign an attendance sheet;
- keep a copy of your training outline or other training materials attached to, or in a folder with, the corresponding trainee attendance sheet;
- if an examination was given keep a copy of the exam and the results attached to, or in a folder with, the trainee attendance sheet.

No matter what the training session is to address, remember to consider these three questions and let them be your guide to effective training:

1. What do you want them to know or be able to do?

2. What is the best way to teach them?

3. How will you determine that they know or can do what you have taught them?

M. Project Management

PROJECT MANAGEMENT

This section is presented in five sub-sections and appendices:

- **AN OVERVIEW OF THE ABATEMENT PROCESS**
- **CONTRACT SPECIFICATIONS**
- **RECORD KEEPING**
- **SUPERVISORY SKILLS**
- **COST ESTIMATION**
- **APPENDICES**
  - **Uniform Hazardous Waste Manifest**
  - **Sanitary Landfill Disposal Record**

OBJECTIVES AND LEARNING TASKS

Objectives and learning tasks specific to each sub-section are presented on separate pages at the beginning of each sub-section.

AN OVERVIEW OF THE ABATEMENT PROCESS

OBJECTIVE:

(1) To present the responsibilities of the people involved in lead abatement and lead hazard reduction projects.

(2) To describe the steps necessary for starting and ending those projects.

LEARNING TASKS:

Supervisors/contractors should be able to:

- List and describe the responsibilities of at least six participants in a lead abatement or hazard reduction project.
- Describe the ten major steps required in the abatement and hazard reduction processes.
- Analyze an abatement or hazard reduction project to identify the area or person responsible for responding to things that are likely to happen.

As a supervisor/contractor of a lead-abatement project, it is important for you to:

- **understand the role and responsibilities of everyone on an abatement project;**
- **know the resources available to you on an abatement project;**
- **understand your responsibilities on an abatement project.**

OVERVIEW OF THE ABATEMENT PROCESS

I. Introduction

A lead-abatement or hazard control project is a complex task because toxic materials are dangerous. Because of these dangers, many federal, state, and/or local regulations may apply to the work. These projects may be done in industrial, commercial, educational, residential, or other environments. More rules may apply if the work is done on a residential property. When the abatement or hazard reduction is done within or near residences, it may:

- disrupt the lives of individuals and families;
- contaminate other parts of the environment with lead;
- raise the exposure level higher than that which existed prior to the abatement or hazard reduction activities.

Residents must be protected during abatement

The risk is a bigger problem if there are children in the area, because children are more likely to ingest lead-contaminated dust and their developing bodies are more sensitive to effects of lead. (The relative risk of children vs. adults is covered in other sections of this manual.)

Large abatement projects can expose many members of the community to contamination. Some projects, such as soil abatement, require moving a lot of material and exposing areas of contaminated soil. So, there are risks caused by heavier traffic, and by the possibility that children or pets may get onto the contaminated sites. At the very least, residents are inconvenienced by the noise and general disruption of the job. You need to tell residents about the work being done and what precautions they should take to protect themselves.

To handle lead abatement and hazard reduction safely and quickly, you have to take special precautions and plan ahead. To ensure that this process is safe and that it disrupts people's lives as little as possible, many people and organizations may be involved (depending on the size of the project). These people must be trained and knowledgeable, and they must be committed to the safety of workers and residents.

II. Participants

One person may play several of the following roles, depending on the size of the project. Lead abatement and hazard reduction on large projects may involve the following individuals and groups:

1. The Project Owner

The owner has the ultimate responsibility for the abatement or hazard reduction project. This includes the startup, the job itself, and its completion. It also includes liability that results from increased exposure to lead and other injuries that may occur during the work. Because of this responsibility, the owner must make sure that safeguards are in place to insure safety, including such things as frequent project monitoring. The owner is also responsible for the cost of the abatement and must provide the money required to complete the project.

The owner has ultimate responsibility for the project

2. The Project Manager

The project manager is responsible for the abatement or hazard reduction process. This begins with the planning of the project, continues with the abatement itself, and ends with the successful conclusion of the abatement. Because of this responsibility, the project manager must have access to everyone on the project, including the owner.The manager must have the authority to shut down the project.

3. The Project Designer, Consultant, Architect or Engineer

Lead abatement or hazard reduction project designers must be trained to handle lead hazards. Some states may also require licensing or certification for this job. If a state or locality does not have a specific training program for lead project designers, then the designer should take lead risk assessor training. The project designer, consultant, architect, or engineer is responsible for planning the details of the project, writing specifications, preparing drawings, and providing technical guidance in carrying out the abatement plan. Project designers must be familiar with all aspects of lead abatement and hazard reduction measures in order to choose the most cost-effective method(s). This person must also have the authority to shut down the project.

4. The Abatement Contractor

The abatement contractor is responsible for carrying out the abatement plan. This includes providing the material, supplies, and labor needed to successfully complete the project. The contractor must have access to enough well-trained abatement workers and equipment to complete the project on schedule.

The responsibilities of the contractor

5. The Abatement Supervisor

The abatement supervisor is responsible for the activities on the abatement site, including scheduling workers and material. This person is sometimes called the project superintendent.

The responsibilities of the supervisor

The abatement supervisor must:

- be able to read and carry out the abatement plan designed by the project designer, consultant, architect, or engineer;
- know, understand, and be able to follow applicable federal, state and local regulations; and
- have the appropriate current license or certification as a Supervisor for the state in which the work is being done.

6. The Abatement Workers

The abatement workers are responsible for doing the work assigned to them by others on the abatement site. Workers must:

- know and follow proper abatement techniques;
- know the different ways they can be exposed to lead;
- understand applicable OSHA regulations; and
- have the appropriate current license or certification for the state in which the work is being done.

7. Legal Counsel

A legal counselor is responsible for handling the legal issues of the abatement process including liability, and issues raised by the abatement contract. He/she must be familiar with issues and regulations related to lead abatement and must keep the owner informed about the legal aspects of the project. Legal counsel is often needed for cases where a child with elevated blood lead levels is involved.

8. Environmental Consultant/Inspector

The environmental consultant sometimes does the initial inspection or risk assessment of the property. During the abatement, the environmental consultant or the inspector is responsible for maintaining a safe environment for both workers and any others who have contact with the project. This person is also responsible for the inspections during the abatement and for making sure that clearance criteria have been met. Environmental consultants and inspectors belong to an environmental consulting firm or they may be employed by a public agency.

9. Regulatory Authority and OSHA

The regulatory authority is the branch of the local, state or federal government that licenses abatement contractors, abatement workers, and environmental consultants, and enforces existing lead regulations. OSHA is the legal authority responsible for worker health and safety. OSHA has the authority to levy fines and to enforce regulations.

10. The Occupational Health Facility

The occupational health facility is the health care provider responsible for worker health. Because blood lead and medical monitoring are required under the OSHA Lead in Construction Standard, the contractor must provide access to an occupational health facility that provides these medical services to employees. The physicians and staff of the occupational health facility must know about worker lead exposure issues and the OSHA Standards that apply.

11. Environmental Testing Lab

The environmental testing lab analyzes wipe samples and other environmental samples taken during the abatement project. These environmental samples (air, wipes, soil, etc.) are tested for lead content. The laboratory should be part of an environmental lead laboratory proficiency testing program.

12. The Waste Disposal Facility

The waste disposal facility is responsible for accepting the hazardous and solid waste generated during the abatement process.

13. Occupants

The residents of the neighborhood where the project is done are really participants in the abatement process. Their participation and cooperation is necessary to achieve a successful abatement. Abatement is a complex process for large multi-family projects. For single-family abatement projects, the process is much easier, but just as important. If people have to be relocated, they must remain off site while the job is being done and until the site has been cleared for their safe return.

The occupants are an important consideration

On small residential jobs, one person may play the roles of several participants. However, there are some roles that must be done by different people, because of potential conflict of interest. One person or company should not be both contractor and inspector on the same job. The quality of the inspection work may be questioned if contractors inspected their own work. Problems can also occur if one person or company is both project designer/lead risk assessor and contractor on the same project. Owners who intend to employ one company for designing and doing the lead abatement work could be paying for work that may not be necessary.

III. Abatement Steps

There are many participants and many steps required to complete the abatement process. Clearly, this depends on the size of the project (a single family dwelling vs. a multi-unit complex). The steps in the abatement process are as follows:

1. <u>The Lead Inspection and/or Lead Risk Assessment</u>

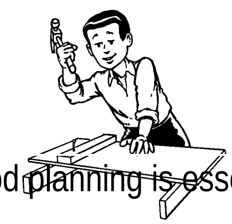
   Before doing lead abatement or hazard reduction activities, you must do either a lead inspection or a lead risk assessment (see Chapter R). An inspection determines if lead is present, and a risk assessment determines if there is a lead hazard present. If combined, the inspection and risk assessment identify the location of:

   - lead-based paint and/or lead-based paint hazards;
   - lead in soil;
   - lead in interior and possibly exterior settled dust;
   - lead in drinking water (optional); and
   - sometimes other sources of lead.

   This can be done in multi-unit buildings or single-family homes. Knowing how much lead is on surfaces in the environment allows other participants in the abatement project to do necessary planning. Occasionally, the owner will assume that an older building has lead-based paint and will go ahead with the abatement without doing an inspection or risk assessment.

2. <u>Assembling The Team</u>

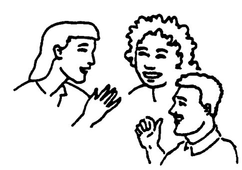
After establishing that lead and/or lead hazards exist, the owner must put together the abatement team (see previous section on Participants). The key member in the abatement process is the project manager. Because he/she must work with all the other members of the abatement team, the project manager must be brought on board early. A successful abatement project requires clear lines of authority and communication, and these lines must be understood by all participants. In a single-family dwelling abatement, it is easier to assemble the team. In this case, the owner usually hires a competent, licensed abatement contractor to manage and complete the project.



Good planning is essential

3. Preparing An Abatement Plan

The next important step in the process is to prepare the abatement plan. This step includes decisions about the bidding process, the selection of the contractor, how big the abatement job will be, the time line for abatement, the worker training needed, how the abatement will be done, and the type and quantity of waste that may be created. The abatement plan should be thorough and complete, but it should also be flexible enough to allow for change, if necessary. The abatement plan is usually included in the written contract specifications (see next section of this chapter).



4. Preparing The Community Relations Plan

Once the abatement plan has been completed and the contractor has been selected, skilled, trained staff should develop the community relations plan. This plan tells the residents in the community about the abatement and involves them in the process. (Residents and organizations in the community should be told about the project as soon as possible.) If the project involves a single-family home, the supervisor/contractor or owner may be the person who interacts with the residents and their neighbors, so it is important to understand how this process works. This part of the abatement process is covered separately in Chapter Q of this manual.

5. Critical Path Planning

People who are familiar with planning construction projects know about critical path planning. In this process, you study all the tasks in the project to decide where they fit into the overall time line. You also decide which tasks must be done before others can be started, and which ones can be done at the same time. You have to know where each category of work fits in relation to the others. The timing of the individual jobs and responsibilities determines the overall time line of a project. This is an important aspect of abatement projects because usually families are waiting to return to their homes.

Failure to plan is to plan to fail

6. Site Characterization

Before beginning the actual abatement, each site should be surveyed to:

- determine if unusual conditions exist;
- develop a clear understanding of processes that need to be done specifically for this site;

- set up requirements for security, public safety, and employee protection at the site.

7. Begin Abatement

Once the team is selected and adequately trained, the abatement plan is complete, and the workers have the required medical exams, abatement can begin. This is the time when you can begin to see how reliable the plan (and the participants) are, and when you can make changes to improve the project's chances for success. Sometimes you can assess the reliability of the abatement plan for large multi-unit projects by setting up a pilot project. In a pilot project, you try the abatement plan in a few units to judge how will it will work in the larger project.

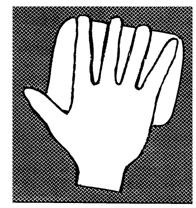
The actual lead work on the project cannot begin until after the preparation has been done. This preparatory work consists of setting up the work site boundaries and completing containment. (Work site boundaries and containment are methods for protecting workers and the environment.) Other worker safety requirements such as washing facilities, fire extinguishers, eye-wash station, first-aid kit, and MSDS should also be in place before the work starts.

Different abatement strategies and procedures are presented in Chapter N.

8. Daily Cleanup

At the end of every workday, be sure to set aside enough time for cleanup. This daily cleanup reduces risk to workers by reducing contamination. It also makes the final cleanup easier and makes it more likely that the site will pass final clearance. See Chapter N, Section VII (pages N-30-31) for details of daily cleanup.

OSHA requires a clean work place



9. <u>Final Cleanup</u>

Once the lead abatement activities have been done, you should do the final cleanup. The abatement supervisor is responsible for both the daily cleanup and the final cleanup. Final clean-up takes place just before clearance. See Chapter N, Section VIII (pages N-31-33) for details of final cleanup.

10. <u>Clearance</u>

This is the final step in the abatement process. Once abatement has been completed, either in a group of units or on a portion of a project, you can test the technical success of the project. Clearance testing consists of visually inspecting the site, followed by collecting surface wipe samples. Some localities require that you test soil for clearance after exterior paint abatement. Occupants cannot return to their homes until the project meets clearance criteria. The clearance test is an important technical evaluation of the success of the abatement project and should always be done by an independent third party. It cannot be done until at least one hour after final clean-up has been completed. See Chapter O for details on clearance testing.

11. <u>Other Work</u>

On some projects, additional work may follow the lead hazard reduction work. This work may include final painting, carpeting, or other decorative work.

In other projects, such as rehab work, the lead abatement contractor completes the lead abatement and gets clearance. Then, other contractors such as plumbers, electricians, carpenters, etc., go ahead with their work. This strategy allows the other contractors to work in an environment with fewer lead hazards. Following the rehab work, a lead inspector or lead risk assessor should collect additional surface wipe samples to ensure that dust-lead hazards do not exist.

A successful abatement project requires the participation of many people and groups. These participants must go through a series of pre-defined steps in order to complete a lead hazard reduction project.

CONTRACT SPECIFICATIONS

OBJECTIVE:

To describe fully the nature of contract specifications.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Explain the purpose of the scope of work and contract specifications.
- Name and describe at least three contract documents.
- List the types of drawings/blue lines which may be included with the contract documents.
- List three ways that a contract protects the parties involved.

As a supervisor/contractor of a lead-abatement project, this section is important to you because:

- **you may have to read and interpret specifications on the job site;**
- **you should understand the different types of specifications and how to interpret them;**
- **you should understand that specifications are part of a legal document.**

CONTRACT SPECIFICATIONS

I. Introduction

A contract is a legally enforceable agreement between two or more competent persons or parties. Contracts can be implied or expressed. Implied contracts are not written. *Implied contracts* are generally not adequate when large amounts of money or value are involved; the parties to the contract often want to be more specific about contract terms. In situations like this, the parties entering into the contract usually want to have the terms of the contract in writing. This type of contract is called an *expressed contract*.

Expressed contracts

Expressed contracts can be very complex written documents consisting of many parts. Most construction and similar contracts consist of the actual contract, along with other documents attached to it, such as bid guarantee and contract bonds, general conditions of the contract, general project specifications, and construction drawings. These items are part of a package called the contract documents, defined as follows:

The parts of a contract

1. The formal contract identifies the parties involved, the time of the contract, the time and amount of payments, the penalties for breach of contract, the items which constitute breach of contract, and other minor issues.

2. The general conditions, specifications, and drawings define the scope and performance criteria of the work. (Performance criteria are the standards used to decide if the work has been done as agreed.)

3. The bid guarantee and contract bond spell out the penalties the bidder must pay if he/she is the lowest qualified bidder and fails to enter into a contract or fails to complete the contract according to the agreed-upon terms

II. The Purpose of Contract Documents

1. Contract documents define the scope of work.

The scope of work defined in the contract spells out exactly:

Defining the work to be accomplished

- what material or components are to be removed, replaced, or otherwise abated;
- how the material or components are to be removed, replaced, or abated;
- who is responsible for each step of the work; and
- when each step of the work may be performed.

The contract documents define precisely which buildings will be treated, the apartments in the buildings, the rooms in the apartments, and the treatments to be used. They also define how extensive the treatments will be; that is, which surfaces will be treated. The contract may also specify when the work can be performed. The project manager may limit the work day in some units to certain times so that residents in the units that are not being treated are not disturbed during sleep hours, etc. Finally, the contract may specify where workers park their vehicles, store materials, access the site, etc.

The contract documents also define responsibility for the contractor, the owner, and any other parties referred to in the contract.

The contract documents define the sequence of work; that is, where the contractor will begin, at what time the contractor will begin, the work to be done during the time covered in the contract, and when the work will be completed.

The contract also defines who the workers will be, what kind of training the workers will have, and the materials that will be used in the project.

2. Contract documents define standards.

Defining the standards for materials and work

Some standards for lead abatement are set by local, state, or federal regulations. These are the minimum standards which apply. Often a project owner or architect will specify higher standards.

The contract documents also define the standards to be used in the abatement project, for example, minimum training for workers. Some construction contracts require all workers to be union workers, which implies that those workers will have completed an apprenticeship or some kind of training program and are therefore supposedly better qualified than other workers.

Standards are also important for the materials used in the project. There is a wide range of cost and quality in construction materials, and this should be under the control of the owner. The "standards" section of the contract defines the quality and quantity of materials used in a project.

Even if the contract specifications do not mention existing standards, if those standards exist (for example, regulatory standards or industry standards), the contractor must still abide by those standards.

3. Contract documents define completion.

The contract documents define when the work will end, not always with a date, but with what is required to meet the specifications of the contract.

For example, a homeowner enters into an agreement with a contractor to sand a new floor. The homeowner specifies that the work must be done “within one day.” The contractor sends one person to sand the floor for one day. What the homeowner wants is to have the floor sanded until it is ready for stain or varnish. A worker could easily sand the floor for eight hours with a 400-grit sandpaper and not meet that goal, yet fulfill the requirement of completing the work “within one day.” If the homeowner wants to have a smooth floor ready to stain or varnish, the specification in the contract might read that the floor “must be sanded until the surface is uniform and ready for stain or varnish.” It is then up to the contractor to sand the floor, first with a rough grade of sandpaper and then with a medium or fine grade, within the specified one-day time period.

4. Contract documents define costs and payments.

One of the major purposes of contract documents is to define the time and amount of the payments.

5. Contract documents are used for bidding.

Protecting the parties to a contract

For competitive bidding, all bidders on a project must have a clear understanding of the scope and nature of the proposed work.

6. <u>Contract documents are for protection.</u>

Contract documents protect the owner. They do this two ways:

1. The contract documents allow the owner to enforce the contract. Without the specifications and general conditions, it would be very difficult to enforce the contract.

2. The contract documents protect the owner from the errors, mistakes, and omissions of others.

The contract documents also protect the contractor. They do this in very important ways:

- The contract documents limit the penalties that can be imposed on the contractor and they protect the rights of the contractor.

- The limits of work expected are also included in the contract.

The contract documents protect the workers, especially if a safety and health plan is part of the contract documents.

Contract documents also provide protection for the residents and the public.

Lastly, the contract documents allow the contractor to obtain permits to accomplish the work specified in the contract.

III. The Contract as Part of The Contract Documents

The relationship between the parts of a contract

The contract drives the specifications. Without the contract, you cannot enforce the specifications. A contract could contain the most complete set of specifications in the world and yet be unenforceable because of errors and inconsistencies in the contract.

IV. Reason for Specifications in a Contract

The specifications support the contract. Without adequate specifications, no one would know when the contract was completed, or when payments were to be made, or when the contract had been violated.

Types of specifications

There are three types of specifications used in construction contracts:

1. Performance
2. Means and Methods
3. A combination of Means and Methods and Performance

Performance driven specifications usually concern the end product. For example, performance specifications in a painting contract might say that the painter must prep and coat the walls of a room with two coats of paint; that the final product must be free of sags, bare spots, and imperfections, and that the paint color must be Robin's Egg Blue.

In a performance-driven abatement contract, a contract specification might require the contractor to come in and remove trash, clean the floors, and dispose of the trash.

With performance-driven specifications, the purchaser or owner doesn’t care as much about the way the job is done as about the end result. This kind of specification works well in a construction project where the owner is not concerned about how a building is built or how a hole is dug, as long as there is no additional liability to the owner and the end product is satisfactory. Because of owner liability, performance-driven specifications are almost never appropriate for work involving hazardous substances.

The second type of specification, means-and-methods-driven, is probably more commonly used on abatement projects. his type specifies how the work is to be done, by whom, and under what conditions. Means and methods specification would be preferable on a soil abatement project, because the owner is not only very concerned about the end product, but also about how that end product is achieved. It is not enough to instruct a contractor to remove six inches of soil and replace it with clean soil. The owner certainly doesn't want to have the clean soil contaminated with whatever toxic or hazardous material is in the soil being removed. Because of this, the owner must specify precisely how the abatement process will be done.

Abatement projects are sometimes driven by combination specifications, where the method of achieving the goal is clearly spelled out and described; but some of the means of achieving the goal are left up to the contractor.

V. Worker Protection

Regulations and recommendations for protecting workers on lead abatement projects vary, so the contract specifications should include the standards to be followed on the project. This accomplishes several things:

- It defines worker safety issues.

- It levels the playing field for all contractors bidding a project. Contractors who always show concern for worker safety should not be penalized by losing jobs to contractors who bid low and save money by placing workers, their families, and the public at risk.

VI. Conclusion

The most important parts of the contract documents for the contractor are the contract specs and the general conditions. The detail specified in these sections of the contract documents either makes it a mutually-satisfactory contract or a disaster. This is true for both the owner and the contractor. If the specifications are not written clearly and concisely, the owner may not achieve his or her goal. On the other hand, if the contractor doesn’t understand the specifications, he/she could suffer major losses, either during the bidding process or while doing the work specified in the contract.

RECORD KEEPING/LOG BOOKS

OBJECTIVE:

To present the record keeping requirements of an abatement project.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Differentiate between the types of records recommended and required to be kept by abatement contractors.
- Describe the value of good record keeping.
- Describe the elements of EPA's required abatement plan.
- Explain why it is important to verify worker licensure and certification.

As a supervisor/contractor of a lead-abatement project, this section is important to you because:

- **as the agent on the job, you will have the responsibility for maintaining the appropriate records;**
- **as the person responsible for the records, you must understand the importance of those records.**

RECORD KEEPING/LOG BOOK

I. Introduction

Contractors involved in residential lead-abatement and hazard reduction projects must be aware of the extensive record keeping responsibilities. Record keeping falls into three categories:

Kinds of records you might keep

- legally mandated records;
- records to support other legal requirements;
- recommended record keeping.

Those record classifications are described in the following sections.

II. Legally Required Records

Hazardous Waste Records

You are required to keep hazardous waste records

The only abatement or hazard reduction projects which carry a legal requirement for record keeping for waste materials are those where hazardous wastes will be generated. There are minimum requirements for record keeping associated with the handling of hazardous wastes. Those requirements were established by the United States Environmental Protection Agency (U.S. EPA). The U.S. EPA regulations control the disposal of hazardous waste under the Resource Conservation and Recovery Act (RCRA).

The lead being abated or the materials used to remove lead-based paint have the potential to be hazardous waste, depending on the characteristics of the lead and its matrix. Some paint strippers contain hazardous chemicals and thus may fall into the category of hazardous waste.

Unless the generator of the hazardous waste is considered to be a *conditionally exempt small generator,* (individuals and institutions which generate no more than 100 kilograms of hazardous waste per month) all hazardous waste shipments should be accompanied by a document called the Uniform Hazardous Waste Manifest (see Appendix M-1 to this chapter). This is essentially a shipping document which is signed by the generator, the transporter, and the waste treatment and/or disposal facility. The purpose of this document is to track the hazardous waste from the point at which it is generated to the point of final destination. This is in keeping with the "cradle to the grave" philosophy instituted by the RCRA legislation and implemented by the U.S. EPA.

- When the hazardous material is transported from the abatement or storage site, this document is signed by the transporter.

- When the material is received by the disposal facility, the copy is again signed by the receiver of the material.

Hazardous waste manifest

Once the operator of the disposal facility signs the manifest, a signed copy of the manifest is returned to the generator. This copy must be received within thirty-five (35) days of the shipment of the waste. If the generator does not receive a signed copy of the document, he or she must then contact the operator of the disposal facility to determine the status of the shipment. If a copy is not received within forty-five (45) days of the shipment, the generator must contact the regional administrator of the U.S. EPA and send a copy of the signed manifest to that office with an explanation of efforts undertaken to find the lost material.

These records must be maintained by individuals and institutions generating such wastes, including any Public Housing Authority (PHA), lead-abatement contractor, or other entity generating or disposing of hazardous waste, for a minimum period of three years. It would be more prudent to retain the records for ten years. These records include copies of the manifest and any exception reports required during the course of abatement and the results of testing of wastes for hazardous status. (Records should also be maintained of shipments of waste to sanitary landfills - See Appendix M-2 for an example.)

III. Records to Support Legal Requirements

Worker Training and Safety Inspections

Document your worker training

The EPA Requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities (TSCA 402-404 rules) specify minimum training requirements. The contractor should document that this training has been completed by persons engaged in lead hazard reduction activities specified in the rule.

Worker training is mandated in both the OSHA Hazard Communication Standard (HAZ COM) and the Lead in Construction Standard. Documentation of the training is required for both Standards. The form of the record is left up to the employer but it should be sufficient to provide proof of the training at a later date. OSHA will question employees to determine if the required information was transferred during the training.

Besides providing proof that required training was completed, there are other reasons for the contractor to keep track of times and dates of worker training. If there is a record of adequate worker training, accidents resulting in injuries or environmental damage can be attributed to other factors besides poorly trained workers. Illnesses resulting from exposure to toxic materials could likewise be attributed to causes other than inadequate training.

Exposure Monitoring

Results of employee exposure monitoring must be maintained and made available to all employees. Individual results must be sent to the monitored employee within five days of receipt by the employer.

Respirator Use

If respirators are used on the project, it is important that there be a written respirator use plan and that records be maintained of worker training and respirator fit-testing. (These records may be legally required in some circumstances). Respirator use is described in detail in Chapter J "Respiratory Protection".

Clearance Testing

Records of the times and dates of clearance tests along with the environmental lab results for those tests should be maintained as a part of the permanent record for the abatement project. This is a requirement on abatement projects in Public and Indian Housing.

Keep proof of clearance

In other abatement projects, a contractor and the owner should maintain records of clearance tests because of the possibility that the property may become contaminated at a future time.

- Some state regulations do not require complete abatement. Significant amounts of lead-based paint, which may deteriorate in the future, can remain after the abatement is completed.

- Soil and dust are not adequately addressed in most areas. Lead in the soil can contaminate an abated residence.

Construction Drawings

HUD Guidelines call for as-built drawings to be completed on abatement sites where encapsulation and enclosure were used as abatement strategies. These drawings are intended to be a permanent record of where lead was left in place. This record will serve to warn contractors and others during future remodeling efforts and maintenance activities.

In single family and small multi-family private housing, it is recommended that reduced scale floor plans showing the location of leaded components be permanently mounted on the wall in the utility room or garage in such a way that they will be protected and visible.

IV. Recommended Record Keeping

Safety Inspections

Safety inspections on abatement sites may be:

- OSHA inspections;
- inspections by the local or state regulatory agency responsible for monitoring lead abatement activities; or
- inspections by the environmental consultant responsible for the project.

The reports from these inspections should be maintained as part of the record of the project.

Private Property Records

Many abatement projects require the contractor to be responsible for the moving and storage of private property or work on private property. Records describing the condition and status of that property are important. Photographs and/or video tapes are extremely useful records of the condition of private property. Access permission records for entering and working on private property should also be maintained. Communications with residents and property owners should also be handled in a methodical manner using multi-copy forms that track the message from origination to conclusion (see Appendix C).

Site Access

Records should be maintained regarding worker access to abatement sites. It is advisable for contractors to maintain these records for their own protection.

Other Testing Results

Records of other environmental testing such as the testing of replacement soil should also be maintained for future protection.

Site Log

A record of the daily activities on the abatement site should be maintained. This record would include such items as:

The site log is a history of the project

- visitors on site;
- violation of safety rules;
- equipment failures;
- workers on site;

- visits by supervisors;
- tools and equipment used;
- documentation of work accomplished;
- frequency of clean-up activities;
- unusual conditions.

This information may be very helpful for a variety of reasons such as the modification of practices for future projects, the assessment of equipment performance and for potential legal actions resulting from the abatement activities.

Material Log

This log would record the delivery of supplies and material to the abatement site.

SUPERVISORY SKILLS

OBJECTIVE:

To present skills which will be useful in supervising abatement workers.

LEARNING TASKS:

Supervisors should be able to:

- Name and explain two methods used in team building.
- Compare and contrast communication and expectations as they are used in supervision.

As a supervisor of a lead-abatement project, this section is important to you because:

- **you will be responsible for supervising other abatement workers;**
- **your success as a supervisor will depend upon your team's ability to complete an abatement project.**
- **you are responsible for ensuring safe work practices are used. This is critical in protecting the health and safety of the workers and the building occupants.**

SUPERVISORY SKILLS

I. Introduction

One of the most important responsibilities of the lead-abatement supervisor is that of supervising the activities of the abatement workers. This activity may in fact be *the* most important role of the supervisor. Effective supervision is one method of ensuring that the workers will perform all of their tasks correctly. Correct performance of tasks in a residential abatement project is important because it:

The supervisor must promote safety

- protects the children in the home being abated;
- is vital to the safety of the community;
- helps ensure the personal safety of the workers;
- protects the environment from contamination; and
- makes the abatement project successful.

If the workers are not doing their tasks correctly, they may:

- injure themselves;
- injure their co-workers;
- injure their families;
- damage property;
- injure a community resident, adult or child; and
- cause the work to have to be redone.

If the workers are not doing their jobs correctly, some parts of the project might not meet the minimum clearance criteria. This would mean additional expense for the contractor.

II. Theory of Supervision

There are two opposing views of supervision:

Ideas about how workers work

- One point of view is that workers need to be watched all the time or they will not do the job right.
- The other view is that workers will do their best with a minimum of interference or hassle. This view assumes that employees want to do their best because they want to be proud of the work they've done.

There is probably some truth in both views. It depends on the employee, and on the ability of the supervisor to work effectively with others and to motivate them. The quality of work a person does depends on his/her attitudes, values, beliefs, skills, and ability. Some workers will do well under almost any circumstances. Other workers need more supervision.

III. Aids to Effective Supervision

Communication is key to supervision

Regardless of the worker's basic attitudes, *no employee will perform well unless he/she is given the correct information and the supervisor does his/her job*. An effective supervisor provides the information by:

- communicating;
- establishing clear expectations;
- giving positive reinforcement; and

- correcting mistakes when they occur.

Supervisors who do these things will have a more efficient team.

Communicate

An effective supervisor is an effective communicator. Supervisors need to explain tasks, duties, job descriptions, etc., clearly to all workers. All employees must understand what the job is, and when and how it is to be done.

Communication is your best tool

Communication is not a one-way street. Supervisors must also listen to the other members of the team so they can be sure that the workers understand the job. The supervisor must listen to the concerns of the workers. Employees often have valid concerns about issues such as safety. They also have good ideas about how a job could be done better.

The routine safety and health meetings are good opportunities for team communication. Regular “tailgate” meetings are also effective. Regular meetings reinforce to employees that you think their safety is important. These meetings are a good time to discuss special decontamination procedures or work practices that will be used on the job.

Establish Clear Expectations

Workers need to know what is expected of them. If they do not know what they expectation is, they cannot meet that expectation. Workers need to know what you expect in terms of promptness, attention to detail on the job, performance standards, personal hygiene requirements designed to minimize lead exposure, attitudes regarding fellow employees, relations with residents, etc.

Establishing expectations of workers

Workers also have their own expectations on the job site. A supervisor should know and understand what those expectations are

Give Positive Reinforcement

When a worker has completed a task, he/she should know if that task was done correctly. If the worker does not know if the task was done correctly, will the worker do it the same way the next time? Will it be done well or badly? Also, if you tell someone a job was performed correctly, that tells the worker you noticed his or her work and that you care about how it was done.

Take Corrective Action

It is just as important to tell workers when they have made mistakes as it is to tell them when they've done the job right. They may have done it wrong because they didn't understand the job, because they were careless, or whatever. Workers should know the possible consequences of their actions. They need to know if they have risked their own safety, the safety of others, or the success of the project.

Leadership

Perhaps more important than communication is leadership. A good supervisor will be a good leader. How does a supervisor become a leader? A leader:

- Develops cooperative goals.
- Develops trust.
- Develops a team spirit.

How do you do this?

Develop Cooperative Goals

Working together

Studies show that people accomplish more when they work together than when they compete with each other. When they cooperate, people come to depend on each other and work better together. A supervisor could develop cooperative goals by showing a willingness to do whatever needs to be done to reach a common goal. The supervisor might, for example make sure that equipment and supplies are there and ready when the workers need them. Or he/she could listen to others' ideas about doing the assigned tasks or give that extra boost to workers' morale.

When workers believe in the importance of the project, they work towards a common goal. They also have to believe they can do the job and that what they are doing will make a difference. The supervisor must be able to communicate these ideas to them.

Develop Trust

People will not follow if they do not trust the leader. A supervisor must be honest if he/she wants to develop workers' trust. Part of honesty is following through on commitments.

Develop a Team Spirit

The supervisor helps develop a team spirit by interacting with other team members in a positive way.

- Say "we," not "I" or "you."

- Interact with the other team members. When you arrive on the job site, communicate the other team members, even if all you say is "Hello! How are you?" Don't just come and go.

- Be upbeat. Say positive things about what you've all accomplished.

- Do not focus on the negative. Try not to arrive on the job site complaining every day. Soon, people tune will you out before you say anything.

- If you must criticize a team member, do not do it in front of the group. Talk to the person in private.

- Meet with team members on a one-to-one basis. Do this often, and not just when you are correcting or criticizing. Meeting with team members on a one-to-one basis shows that you find the other person important enough to give him/her your time.

Lead abatement is challenging work. These challenges are in the areas of safety, working conditions, community relations, among others. The supervisor's challenge is to deal with a wide range of workers.

COST ESTIMATION

<u>OBJECTIVE</u>:

To present the major cost considerations in a lead hazard control project.

<u>LEARNING TASKS</u>:

Supervisors/contractors should be able to:

- List at least five cost considerations in lead hazard control projects.
- Compare the relative costs of waste disposal for encapsulation, on-site paint removal, and other methods.
- Judge how well the project is progressing in relation to the project budget.
- Advise risk assessors about the costs of different hazard control strategies.

As a supervisor/contractor of a lead-abatement project this section is important to you because:

- **you may be responsible for monitoring project costs for your employer;**
- **you should be aware of material and labor costs so that you can use resources wisely;**
- **you should be able to calculate costs of alternatives during an abatement project, for example, gravel instead of topsoil and sod, if the owner asks you;**
- **risk assessors depend on realistic cost information from lead abatement contractors so they can propose abatement methods that are affordable.**

COST ESTIMATION

I. Introduction

Cost estimation in an abatement project can be difficult for many reasons. The most important ones are listed below.

Unusual cost considerations

- There are unusual risks associated with the work; risks to the family that will live in the house or play on the soil, and to the workers who will do the work.
- There are potential risks to the environment.
- Lead hazard control work is often done in and around occupied dwellings. This adds complications to the job.
- Personal belongings must be protected from lead dust which is disturbed and/or created during hazard control work.
- If families do not relocate, the contractor must make sure that barriers are put up to keep residents out of the work site.
- If the families are relocated, the contractor usually must meet a strict time line or pay residents or the owner for additional relocation expenses.
- Some families are neat and tidy. Others are not. Working in cluttered environments is more costly.
- Some families have very few personal belongings while others have tons of material to be moved and stored before you can begin the abatement.

- Unexpected things occur in the course of work. Who is responsible for handling these things? Who pays for them?

All of these factors add to the cost of performing hazard control activities and the successful contractor must know about these costs. He/she must also try to anticipate unknown costs in order to make a profit at the end of the job.

II. Controlling Costs

Methods for controlling the cost of abatement

Owners often don't have a lot of money to spend on lead hazard reduction activities. Large property owners, especially those with large numbers of pre-1978 dwelling units, may not be able to pay for complete lead abatement immediately. They may use temporary controls until money becomes available for more permanent solutions. Even when they do have the money, owners want to keep hazard control costs as low as possible so they can make a profit on their investment. One way to control costs is to get realistic bids from contractors. Ways for owners to control costs and for contractors to prepare successful bids for jobs are listed below:

- Owners should use experienced architects and/or project planners who can anticipate problems and plan the project effectively.

- The project should use cost-effective strategies appropriate for the structure.

- Specifications should be as complete as possible. (See earlier section covering *performance-based* and *means and methods* specifications.) If contractors understand the requirements, their bids will be more competitive.

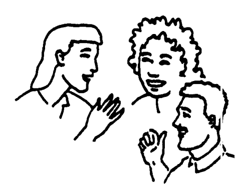
- For large projects, owners should consider a pilot project to test the process. Contractors can gain information that may be helpful in the bidding process. It will also confirm that the plan will work.

- Require a walk through the building or structure before the contractors submit bids, so that can gain a better understanding of the details of the project.

- Owners should be willing to consider acceptable alternate proposals from contractors. Contractors' experience is extremely valuable.

- For large projects, tenants should be involved through a community relations process. Tenants involved in the process are usually more helpful when asked to do things that will make the project work more smoothly (for example, packing for relocation, or storing personal belongings out of the way when they are not being relocated). Tenants can save a lot of time when they pack their own belongings. Also, their things are less likely to be damaged if they pack them themselves than if the abatement workers do it.

Following these suggestions will help the owner keep costs down, and will help the contractor assemble a realistic, profitable estimate.



III. Major Cost Categories

The important items to consider in cost estimation for an abatement project include:

Things to consider when preparing a bid

1. The unit cost of the hazard reduction strategy chosen for the job.

   Lead-based paint abatement unit costs are determined by the type of surface to be abated and the strategy(ies) to be used for the abatement, whether on-site removal, encapsulation, enclosure, or replacement of the painted component (see Chapter N, Lead-Based Paint Abatement for an explanation of these strategies). Establishing the unit costs for abatement activities is the first step in estimating the total cost of the project. Unit costs should include the cost of labor and material for each type of component scheduled for abatement.

   Unit costs for interior dust abatement, an interim control measure, can be estimated by calculating the time required to vacuum bare floors or carpeted surfaces and damp mop them. A vacuuming rate of 3 minutes per square yard is often used for interior dust abatement projects. Unit costs for sealing cracks in the flooring may also be required on projects like these.

   The unit cost used in soil abatement is generally the cost of removing and replacing one cubic yard of soil. Another unit cost helpful in estimating soil abatement projects is the per-square-yard cost of ground cover. (Planting grass or installing sod are the most commonly-used choices.)

For exterior dust suppression, the unit cost is the cost to vacuum or sweep some unit of paved surface along with the cost of removing bulk debris before cleaning. This varies depending upon the texture of the paved surface. Smoother surfaces can be usually be cleaned more easily than rough surfaces like cobble stones or pitted, broken concrete. Also, the size of the area to be cleaned can affect costs. Small, hard to access areas may require cleaning with HEPA-equipped vacuums while large areas such as streets and parking lots maybe swept with large vacuum street sweepers.

2. Disposal costs.

Disposing of the material that results from the hazard reduction activities may be a major part of the cost of a project. You can estimate this cost by calculating the amount of waste and the disposal cost of that amount of material at a disposal site. Disposal costs for material vary a lot, depending upon whether the material is solid or hazardous, the applicable tipping charges, and the transportation costs. Disposal and transportation costs may be an important factor when deciding what type of abatement to use. Hazardous waste disposal costs from the HUD Lead-Based Paint Demonstration (August 1991) are presented in Chapter P, Waste Disposal.

3. Worker training.

Worker training costs are important. Some states require abatement workers to successfully complete an approved training program and pass an exam approved by the state. After August, 1999, EPA's 40 CFR 745 will require all lead abatement workers be trained and certified.

The cost of hiring trained and licensed workers has to be figured into the cost estimate. However, training can often be a cost-effective way of addressing worker concerns. Workers not familiar with a process or a technique may not work as effectively as trained ones.

OSHA, HAZCOM, and the cost of training for specific abatement techniques should not be overlooked. Worker training has to be included in the cost estimate.

4. Safety and health costs.

You must also consider the cost of the safety and health programs when estimating the abatement project costs. Providing personal protective equipment, employee monitoring, blood-lead monitoring, and medical monitoring all contribute to overall costs.

5. Moving and other relocation costs.

Moving families and/or belongings is an important cost in an abatement project. The costs depend such things as the size and make-up of the family, how long they will have to stay in temporary housing, and the amount and type of their personal belongings that have to be moved.

6. Bonding and liability insurance.

Bonding and liability insurance are very important, and need to be included in cost estimates.

7. Clearance testing.

In addition to the cost of collecting clearance and exposure monitoring samples, the samples need to be analyzed. This adds to the cost. These processes can be expensive, so it is important to include them in the estimate. Contractors who don't meet clearance standards may be required to pay for additional testing. Contractors must also return to the job to reclean until clearance levels are met.

8. <u>Damages</u>.

Resolving disputes resulting from abatement can be expensive. You need to set up a process for resolving disputes about damage and/or losses suffered by tenants during the abatement process. This procedure must be set up before the abatement project begins. During the planning stages of the project, you need to estimate the cost of settling disputes and paying for damages, and these costs must be included in the project estimate.

9. <u>Site inspection</u>.

The cost of site inspection for an abatement project should also be calculated in the overall cost. The environmental consultant may have to provide site inspectors for an abatement project to ensure that the job meets the specifications written by the architect, engineer, or project planner.

10. <u>Time Restraints</u>

Since families have to be relocated during most abatement projects, the project planner usually sets up a completion date for the project. The contractor may have to work overtime to meet the time requirement. This cost of this "overtime" work must be included in the bid price.

The items in the above list are the major expenses you need to consider when estimating an abatement budget or calculating the bid you plan to submit for an abatement project. Some abatement projects have unique problems that have to be considered in the cost estimate. In other words, you need to be very careful when estimating the costs of a project.

IV. Cost Estimation Assistance

Sources of help when preparing a bid or cost estimate

In the construction and remodeling industry, contractors prepare cost estimates in a variety of ways.

- Some estimators review the drawings and specifications and try to estimate time and materials for each part, add overhead, contingency (unplanned, but possible events), and profit to arrive at a total cost.

- Some contractors base a final estimate on square footage with some adjustment factor for complexity or simplicity (translated as high quality or low quality).

- Some contractors use software that help them estimate costs.

Lead abatement contractors have to base their estimates on previous experience, similar experiences of others, and a detailed cost estimate for time and materials. Some software packages that are meant to help estimate costs of general construction and remodeling can provide limited help for some abatement methods. For example, removal and replacement is basically a complex carpentry project, so software that helps estimate construction costs can help with some parts of the project.

The best database of lead abatement costs that is currently available uses costs for lead abatement in Baltimore row houses in 1993-94 dollars. (Table M-1). These costs will increase or decrease depending on architectural style, area of the country, union or non-union wages, and the rate of inflation.

At present (1997), HUD is assembling a broader database, through the National Center for Lead-Safe Housing and the University of Cincinnati. This database will be available in 1998-2000.

UNIFORM HAZARDOUS WASTE MANIFEST *(Continuation Sheet)*	21.Generator is US EPA ID No. Manifest Document No.	22. Page	Information in shaded areas is not required by Federal law.

23. Generator's Name		L. State Manifest Doc. No.
		M. State Generator's ID
24. Transporter _____ Company Name	25. US EPA ID Number	N. State Transporter's ID
		O. Transporter's Phone
26. Transporter _____ Company Name	27. US EPA ID Number	P. State Transporter's ID
		Q. Transporter's Phone

28. US DOT Description *(Including Proper Shipping Name, Hazard Class, and ID Number)*	29. Containers No. Type	30. Total Quantity	31. Unit Wt. Vol.	R. Waste No.
a.				
b.				
c.				
d.				
e.				
f.				
g.				
h.				
i.				

S. Additional Descriptions for Materials Listed Above	T. Handling Codes for Wastes Listed Above
32. Special Handling Instructions and Additional Information	

33. Transporter ____ Acknowledgment of Receipt of Materials		Date
Printed/Typed Name	Signature	Mo Day Yr
34. Transporter ____ Acknowledgment of Receipt of Materials		Date
Printed/Typed Name	Signature	Mo Day Yr

35. Discrepancy Indication Space

EPA Form 8700-22A (Rev. 9-86)

Appendix B
Sanitary Landfill Disposal Record
Appendix M-2

ELDA
5701 ESTE AVENUE
CINCINNATI, OHIO 45232
513-641-3500

A Waste Management Company

SALES TICKET

CUSTOMER NAME UC | Soil

TRK. ______ DIST. ______

SIGNATURE Davis

RL FL SP STC RO MSD CD

CAR P.U. TRUCK TRAILER VAN

TYPE OF WASTE Cont. Soil

PROFILE/JOB# MER11-J96673 S.W.C.F.# 11086

CUSTOMER NO.	TICKET NO.	DATE
1005212	055989	8/18/89

TYPE	YARDS	DOLLARS	CENTS
		157	50

PLEASE GRIP FORM HERE

11086

ELDA Recycling & Disposal Facility
A Waste Management Company
5701 Este Avenue
Cincinnati, Ohio 45232

TICKET NO. 55989

SPECIAL WASTE CONTROL FORM

Date 8/18/89

Customer Name UC | Soil

Description Cont. Soil Volume (Yds/Drums) 15

Handling Instructions —Place in cell and bury immediately.

MER11-J96673

Scale Operator JT

Driver ______

Operator ______

White Copy - Office Copy, Yellow Copy - Driver, Pink Copy - Operator (Must be returned to office)

TABLE M-1
ESTIMATED LEAD-BASED PAINT HAZARD CONTROL COSTS
(Adapted from Chapter 11, EPA-Approved Curriculum for Risk Assessors)

Key for Units of Measure

A	=	Allowance	LF	=	Linear Foot
AL	=	Allowance	OP	=	Opening
CY	=	Cubic Yard	RI	=	Riser
DY	=	Day	RM	=	Room
EA	=	Each	SF	=	Square Foot
EL	=	Elevation	M	=	1,000

Note: These cost estimates have been developed for single family row homes in Baltimore. Costs in multi-family housing may be far less due to economies of scale. Costs in other areas may differ. Costs of hazard controls done as part of renovation may also be far less than shown in the following tables. Supervisors/Contractors should develop their own local cost estimates. The following estimates include the cost of labor, materials, overhead and profit. (Estimates are in 1993-94 dollars.) Owners should always obtain precise estimates from several certified contractors before proceeding with hazard control work.

Rough estimated costs for work site preparation

Task	Units	Estimate
Daily relocation	DY	$ 0-75.00
Temporary relocation	DY	0-167.00
Interior preparation--level 1*	RM	10.00-63.00
Interior preparation--level 2*	RM	20.00-120.00
Interior preparation--level 3*	RM	30.00-155.55
Interior preparation--level 4*	RM	35.00-190.00
Exterior preparation--level 1*	EL	20.00-35.00
Exterior preparation--level 2*	EL	20.00-35.00
Exterior preparation--level 3*	EL	20.00-35.00
Window site preparation	EL	40.00-69.00
Seal floor and furnace ducts	RM	5.00-23.00

Rough estimated costs for cleaning and sealing

Task	Units	Estimate
HEPA vacuum	RM	$ 5.00-32.00
Wet Clean	RM	5.00-17.25
HEPA/wet clean/HEPA	RM	10.00-52.00
Wax floor	SF	.10-.60
Seal floors	SF	.15-.90
Custom sealing	AL	0
Steam clean carpet	RM	10.00-46.00
Commercial clean curtains	RM	67.00-115.00
Furnace filter--replace	EA	7.00-23.00

Rough estimated costs for wall and ceiling treatments

Task	Units	Estimate
Clean--HEPA	SF	$.05-.09
Clean--HEPA/wet wipe	SF	.04-.14
Clean--HEPA/wet wipe/HEPA	SF	.06-.17
Stabilization--limited surface	SF	.15-.46
Stabilize and paint acrylic	SF	.20-.58
Stabilize and paint varnish	SF	.20-.58
Stabilize and paint urethane	SF	.20-.63
Stabilize and paint alkyd	SF	.20-.61

Rough estimated costs for encapsulants		
Task	Units	Estimate
Test patch encapsulant	EA	$5.00-23.00
Elastomeric encapsulant	SF	1.20-2.00
Reinforced elastomeric	SF	1.50-2.60
Epoxy encapsulant	SF	1.30-2.25
Cementitious plaster	SF	1.30-2.25

Rough estimated costs for enclosures		
Task	Units	Estimate
Fiberglass wall mat	SF	$ .60-1.05
Wall cloth/gypsum backed	SF	.70-1.15
Laminate 3/8-in. gypsum	SF	.70-1.15
Laminate 1/2-in. gypsum	SF	.70-1.15
Fur, hang, tape, finish gypsum	SF	.84-1.44
Laminate plywood	SF	.70-1.15
Paneling--fur and hang	SF	1.20-2.00
Laminate masonite	SF	1.40-2.30
Ceiling tiles--fiberglass	SF	.90-1.55
Ceiling tiles: gypsum	SF	2.30-3.90

Rough estimated costs to remove paint		
Task	Units	Estimate
Remove paint--heat gun	SF	$.50-1.15
Remove paint--caustic	SF	.55-1.30
Remove paint--organic solvents	SF	.55-1.30
Remove paint--custom chemical	SF	.55-1.30

Rough estimated costs of component disposal

Task	Units	Estimate
Dispose of lead wall/ceiling	SF	$15.00-58.00

Rough estimated costs of floor treatments

Task	Units	Estimate
Vinyl tile repair	SF	$1.70-2.90
Clean floor--HEPA/TSP		
Dispose of Carpet	SF	.50-.90
Stabilize floor--alkyd	SF	.20-.65
Stabilize floor--acrylic	SF	.20-.65
Stabilize floor--urethane	SF	.20-.65
Stabilize floor--varnish	SF	.20-.75
Encapsulate floor--epoxy	SF	1.40-2.30
Floor enclosure underlay and VCT	SF	1.90-3.30
Floor enclosure underlay/sheet GDS	SF	2.05-3.50
Floor enclosure underlay, carpet, pad	SY	14.00-24.00

Rough estimated costs for stairwell treatments

Task	Units	Estimate
Stabilize staircase--acrylic	RI	$13.00-23.00
Stabilize staircase--urethane	RI	13.00-23.00
Encapsulate staircase epoxy	RI	17.00-29.00
Enclose treads--VCT	EA	16.00-28.00
Enclose riser--plywood	RI	5.40-9.20
Enclose treads and risers--wood	EA	20.00-35.00
Enclose stairwell--rubber	EA	17.00-29.00
Enclose stairwell--carpet	RI	15.00-25.00
Enclose railing system	RI	17.00-29.00
Strip stairwell--heat gun	SF	.70-1.15
Strip stairwell--caustic	SF	.75-1.30
Strip stairwell--organic solvents	SF	.75-1.30
Strip stairwell--chemical	SF	.75-1.30

Strip stairwell--wet scrape	RI	27.00-46.00
Strip stairwell--needle gun	RI	27.00-46.00
Replace stairwell--basement	RI	2.95-5.20
Replace stairwell--main	RI	.75-1.30
Replace rail and balusters	LF	17.00-30.00
Custom stairwell treatment	RI	17.00-30.00

Rough estimated costs for window treatments

Task	Units	Estimate
Stabilize window--acrylic	EA	$ 15.00-25.00
Stabilize window--alkyd	EA	16.00-28.00
Stabilize window--urethane	EA	16.00-28.00
Stabilize window--misc.	EA	16.00-28.00
Encapsulate window--epoxy	EA	27.00-46.00
Window-fix closed/stabilize	EA	17.00-29.00
Window wrap well and stabilize	EA	30.00-115.00
Window--stool, liners, stabilize	EA	45.00-115.00
Replace lower sash, stool, liners	EA	90.00-225.00
Strip window--heat gun	EA	74.00-127.00
Strip window--caustic	EA	74.00-127.00
Strip window--organic solvents	EA	74.00-127.00
Replace sash/strip jam--historic	EA	150.00-443.00
Vinyl window with storm	EA	110.00-316.00
Vinyl DH, DG window	EA	200.00-345.00
Vinyl DH, DG, low-E window	EA	255.00-437.00
Aluminum SH--DG window	EA	150.00-345.00
Wood DH, DG low window	EA	268.00-460.00
Wood, DH, DG, window	EA	140.00-368.00
Window/replace window/dryer vent	EA	160.00-276.00
Basement window vinyl	EA	150.00-259.00
Transom--stabilize	EA	23.00-40.00
Transom--replace plywood	EA	34.00-58.00
Window--remove, patch envelope	EA	100.00-397.00

Rough estimated costs for door treatments

Task	Units	Estimate
Door--stabilize & paint acrylic	EA	$ 19.00-32.00
Door--stabilize & paint alkyd	EA	20.00-35.00
Door--stabilize & urethane	EA	20.00-35.00
Door--stabilize & misc. paint	EA	20.00-35.00
Door--stabilize plan, adjust	EA	40.00-69.00
Strip, paint, strike rail & jamb	EA	13.00-23.00
Door: reinforced elastomeric	EA	40.00-69.00
Door--strip, offsite, rehang	EA	111.00-190.00
Strip door--heat gun	EA	30.00-52.00
Door--strip--wet scrape	EA	30.00-52.00
Door strip--caustic	EA	40.00-69.00
Strip door--organic solvent	EA	40.00-69.00
Door strip--custom chemical	EA	40.00-69.00
Door replace--6 panel	EA	120.00-200.00
Door replace--hollow core	EA	40.00-69.00
Door replace--bifold	EA	44.00-75.00
Stop molding--replace	OP	10.75-18.40
Door--remove, package & dispose	EA	8.00-14.00
Remove door, close opening	EA	47.00-80.00
Laminate jamb--wood	EA	34.00-58.00
Door replace--prehung hollow core	EA	111.00-190.00
Door replace--prehung 6-panel	EA	185.00-316.00
Door ext.--replace flush	EA	84.00-144.00
Door ext.--replace paneled	EA	144.00-247.00 Door ext.-- replace prehung flush
Strip door sill	EA	20.00-35.00
Strip door jamb	EA	17.00-29.00
Laminate exterior jamb--aluminum	EA	34.00-58.00
Door--remove patch envelope	EA	232.00-397.00

Rough estimated costs for trim treatments

Task	Units	Estimate
Trim stabilize and paint acrylic	LF	$.55--.90
Trim stabilize and paint varnish	LF	.55--.90
Trim--encapsulate epoxy	LF	.95--1.60
Trim--elastomeric encapsulant	LF	.95--1.60
Trim--reinforced elastomeric	LF	1.05--1.80
Trim--enclose aluminum	LF	1.40--2.30
Trim--enclose plywood	FL	1.40--2.30
Trim--reverse	LF	.70-1.15
Trim--enclose vinyl	LF	2.55--4.40
Trim--strip off-site	LF	1.50--2.50
Trim--strip with heat gun	LF	.60--1.05
Trim--strip caustic	LF	.60--1.05
Strip trim--organic solvents	LF	.75--1.30
Trim--strip with scrapers	LF	.60--1.05
Trim--replace 1-in x 3-in	LF	.80--1.35
Trim--replace 1-in x 4-in	LF	1.70--2.90
Trim--replace historic	LF	2.70--4.60
Trim--dispose of, patch wall	LF	.17--.30

Rough estimated costs for fixtures and furnishings

Task	Units	Estimate
Skylight--enclose luan	EA	$50.00--86.00
Stabilize radiator	EA	27.00--46.00
Stabilize footed tub	EA	30.00--52.00
Stabilize cabinet	LF	17.50--30.00
Radiator-strip prime top coat	EA	40.00--69.00

Rough estimated costs for replacement

Task	Units	Estimate
Replace Play Equipment	EA	$0
Replace Furniture	EA	0

Rough estimated costs for exterior treatments

Task	Units	Estimate
Ext. stabilization --LTD surface	SF	$.55--.90
Ext. stabilize and paint acrylic	SF	.30--.60
Stabilize and paint alkyd	SF	.40--.70
Ext. stabilize & paint metal	SF	.40--.70
Ext. encap. polyamide epoxy	SF	1.00--1.75
Ext. encap. elastomeric	SF	1.00--1.75
Ext. encap cementitious plaster	SF	1.85--3.15
Ext. encapsulate custom	SF	2.55--4.35
Enclose tyvek/vinyl siding	SF	1.40--2.30
Enclose tyvek/aluminum siding	SF	1.90--3.30
Enclose sheathing/vinyl	SF	2.05--3.50
Enclose tyvek/t1-11	SF	1.40--2.30
Enclose tyvek/board std.	SF	0
Enclose siding misc.	SF	0
Enclose pipe/column	LF	4.00--6.90
Enclose trim--aluminum	LF	1.75--3.00
Enclose soffit/aluminum	LF	0
Enclose misc. trim/aluminum	AL	0
Enclose trim--wood	LF	1.40--2.40
Ext. remove paint--heat gun	SF	0
Ext. remove paint--organ. solvent	SF	94.00--160.00
Ext. remove paint--scrapers	SF	1.20--2.00
Ext. remove paint--HEPA blast	SF	1.40--2.30
Ext. remove paint--needle gun	SF	1.20--2.00
Exterior trim/replace lattice	SF	2.00--3.45
Replace exterior trim	LF	3.00--5.20
Replace railing	LF	6.70--11.50
Dispose of trim	LF	0
Dispose of exterior item	EA	0

Rough estimated costs for porches

Task	Units	Estimate
Porch-spot prep-spot paint	SF	$0
Porch--complete stabilize	SF	.95--1.60
Porch encapsulate miscellaneous	SF	1.40--2.30
Enclose porch deck--plywood	SF	0
Enclose porch deck/T & G	SF	1.85--3.15
Enclose porch ceiling--ply	SF	1.70--2.90
Enclose porch ceiling--gypsum	SF	0
Ext. replace railing system	LF	17.00--29.00
Railing with balusters 36 in.	LF	17.00--29.00
Replace column 4 in x 4 in	EA	44.00--75.00
Replace column turned	EA	180.00--310.00
Replace column--decorative	EA	74.00--127.00
Exterior: replace porch deck	SF	2.50--4.30
Replace landing	SF	4.00--6.90
Exterior: stair system	LF	37.00--63.00
Replace rear porch	EA	0
Dispose of porch	SF	2.00--3.45
Dispose of exterior item	EA	0

Rough estimated costs for outbuildings

Task	Units	Estimate
Dispose of garage/outbuildings	EA	$536.00--920.00

Rough estimated costs for soil treatments

Task	Units	Estimate
HEPA vac exterior chips	SF	$.70--1.15
Seed and tack	SF	.30--.55

Sod	SF	.70--1.15
Regrade at foundation and sod	SF	2.70--4.60
Regrade at foundation and seed	SF	1.70--2.90
Mulch 4 in	SF	.40--.70
Encapsulate playground with sand	SF	1.25--2.15
Pour concrete patio/skirt	SF	4.00--6.90
Form and pour concrete walk	SF	0
Form and pour asphalt walk	SF	0
Form and fill gravel walk	SF	0
Soil disposal--general	SF	0
Replace soil--on site	CY	34.00--58.00
Soil replacement	EA	0
Rototill topsoil/seed	SY	0
Foundation planting	EA	30.00--52.00
Foundation fence	LF	0
Install walk-off mat	EA	20.00--34.00
Soil--install	SY	0

TABLE M-2
ESTIMATED AVERAGE COSTS OF ABATEMENT PER DWELLING UNIT BY LOCATION OF PAINT AND ABATEMENT STRATEGY

Abatement Strategy	Units with Exterior LBP Only	Units with Interior LBP Only	Units with Both Exterior and Interior LBP	All Units With LBP
Encapsulation	$2,841	$1,798	$8,447	$5,453
Removal	$4,791	$1,808	$11,720	$7,704

N. Lead Hazard Reduction Strategies

LEAD HAZARD REDUCTION STRATEGIES

This chapter is presented in five sub-sections:

- **LEAD-BASED PAINT ABATEMENT**
- **INTERIOR DUST REDUCTION & CONTROL**
- **SOIL LEAD ABATEMENT**
- **EXTERIOR DUST REDUCTION & CONTROL**
- **INTERIM CONTROLS**

OBJECTIVES AND LEARNING TASKS:

These are presented on separate pages at the beginning of each section.

LEAD-BASED PAINT ABATEMENT

OBJECTIVE:

To explain how a lead-based paint abatement project is organized and the different methods used on those projects.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Describe the procedures used to protect the workers, the public, and the environment during a paint abatement project.
- Describe the materials and techniques used to prepare a work site for paint abatement.
- List two advantages and disadvantages of the different abatement strategies (methods).
- Describe criteria for clearance at the end of a lead-based paint abatement project done for a Public Housing Authority.
- Recognize the hazards of each paint abatement method.

As a supervisor/contractor of a lead-abatement project, this section is important to you because you have to make decisions about:

- **different abatement strategies;**
- **methods for containment and when they are appropriate;**
- **daily and final clean-up;**
- **requirements for worker protection;**
- **which paint abatement method to use.**

LEAD-BASED PAINT ABATEMENT

I. Introduction

Lead-based paint abatement is the **permanent** elimination of the dangers from lead-based paint. Regulators usually consider a minimum of twenty years as permanent. Therefore, a treatment must be designed to last at least twenty years.

Occupants and lead workers can be lead poisoned

Lead-based paint usually is not dangerous when it is in good condition. However, when it is disturbed by regular household activities, such as opening and closing windows, or by an activity like abatement, people may breathe or swallow lead dust. Breathing or eating this dust can cause a high level of lead in the blood. The official term for this is elevated blood lead level (EBL) or lead poisoning. This can happen to occupants or, during an abatement project, to workers. If you don’t use good containment procedures during abatement, the lead dust can contaminate the area surrounding the site, and can cause a hazard for others. Workers can also carry lead to their own homes far from the work site. When this happens, workers' families may also be injured.

Workers must know about the dangers of removing lead-based paint. They must know what the risks are so they can protect themselves, their families, and the community. Abatement supervisors must be especially aware of the hazards. They must know about the dangers in order to protect their own health, since they are on-site during the work. More importantly, they must know about hazards and how to avoid them so they can provide direction for workers who are not as aware or who may be careless.

Abatement of lead-based paint requires a series of steps before and after removing the paint hazard. The process can fail at any of these steps and cause an immediate or future health hazard. Because of this, everyone involved in the abatement process **must** understand all of the abatement steps and risks completely. Abatement includes the following parts:

The parts of a lead hazard reduction project

- Occupant Protection
- Worker Protection (covered in Chapters I, J, and K)
- Worksite Preparation
- Containment
- Lead-based Paint Abatement Methods
- Daily Cleanup Procedures
- Controlling Off-Site Contamination
- Final Cleanup Procedures
- Clearance

This training is focused on residential projects

This training focuses on abatement in residences. Many of the elements listed above also apply to lead-based paint abatement in commercial and steel structures. However, you cannot always use the same techniques in industrial settings and in residences because there are often much higher levels of lead on commercial and steel structures. For example, abrasive blasting, which creates very high levels of lead in the air, is often used on steel structures. Unfortunately, even though uncontrolled abrasive blasting is **prohibited** on residential structures, it is sometimes used on the exterior of dwellings.

Some of the items described in this section of the manual are regulated by local or state governments. HUD has regulations that control lead-based paint abatement in federally-assisted or federally-owned housing. The policies and procedures in this section should used as a <u>minimum standard</u> on abatement projects, because they meet or exceed current regulations. Lead legislation has been recently passed in many states and is it often changed when new information becomes available. Some state governments are just beginning to pass lead abatement regulations. Because of these constant changes, individuals or groups doing abatement must be aware of local and state regulations affecting their work.

You should follow the procedures and policies presented in this section even if they are stricter than regulations in the community where you are doing the abatement because:

- Abatement workers must be concerned about protecting their own health, the health of their families, and the health of others on abatement project. State and local regulations don’t always cover these health and safety issues.
- The more people become aware of the dangers of lead poisoning, the more they will file lawsuits to pay for lead-related injuries. If a person is injured by abatement that was not done correctly, the group doing the abatement may be sued.
- Because it is the right thing to do.

II. Occupant Protection

Occupant protection is a critical element

When planning a lead abatement project, the building owner or project planner must decide whether the occupants and their belongings need to be relocated. This decision must be based on health and safety issues, not on cost or convenience. A knowledgeable professional, such as an industrial hygienist, should be consulted if there is any doubt about the safety of the residents.

Usually, if the surface of lead paint will be disturbed, occupants and their belongings must be temporarily relocated. Relocation may <u>not</u> be necessary if:

- Abatement work is very limited (for example, one room of a unit); and
- Abatement and cleanup can be done in one 8-hour day; and
- The unit is still livable in a practical sense (residents have access to kitchen and bathroom); or
- The abatement is only on the outside of a building and the interior environment can be completely sealed off with plastic or other material. The plastic or other containment material **must** prevent contamination from lead dust. If the residents stay in the building during abatement, they must be able to get in and out, and the entrance area must kept free of lead dust.

Residents who will be affected by abatement must be told about the presence of lead and its dangers before the work begins, so they can protect themselves and their families. This is especially important if young children occupy or regularly visit the residence. Residents, and especially young children, **must be kept away from the abatement work**. In addition, occupants of a unit that will be abated need to know the following things:

Adults and especially children must be kept away from abatement work

- They (the occupants) are responsible for properly packaging and sealing all their personal items in containers that are easy to handle. The contractor may be responsible for moving those personal belongings and cleaning some items, such as upholstered furniture and carpeting. (It is better to dispose of old contaminated carpeting, but sometimes it is not possible to do this.)

- If the occupants are relocated, they can only return with their belongings after the unit has passed post-abatement clearance standards. (The owner will also have to decide whether items such as rugs and upholstered furniture will be cleaned before they are returned to the unit.)

Occupants of multi-family buildings must also be notified whenever other units and/or common areas are being abated. They should be told:

- Start-up date and how long the abatement is expected to last;
- Areas to be abated and precautions to take;
- A warning to pay attention to the caution signs that will be posted around the abatement site; and
- Location of areas that may be restricted.

In a large abatement project, you should communicate this information to the residents using the community relations plan. (Community Relations is discussed in Chapter Q, Community Relations Process).

III. Work Site Preparation

A visual inspection of the property helps identify any pre-existing conditions that can slow abatement work or cause it to fail. You should do this inspection especially in projects that are abatement only and that don’t also involve modernization or rehabilitation of housing units that are in bad condition. Normal rehabilitation activities (for example, upgrading an electrical system) may not be part of the job in such projects. These inspections also help make decisions about the physical layout of the abatement tasks. Before abatement begins, you should look at site conditions and the availability of utilities needed for the job, such as:

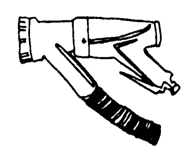
Adequate utilities should be available on an abatement site

- **Heat** - Most lead-paint abatement projects involve the containment and shut-down of heating systems on the site. You must arrange for portable heating units. If you don't have enough heat available, chemical strippers and encapsulants may not work properly. You also have to make sure that portable heating units do not cause fire or breathing hazards. You **must** provide proper ventilation for the portable heating units.

- **Electricity** - Not enough electricity on-site can slow work because of poor lighting and can limit the abatement methods you can use. With sub-standard electrical systems, you may not have enough power to run several power tools at the same time.

- **Water and Plumbing** - You need water for workers' personal cleanliness (hygiene), for clean-up during and after abatement, for cleaning, and for some abatement methods. These activities are critical for health and safety. A portable water system will ensure that workers can wash their hands and faces before breaks and after work. Change areas for workers are essential and shower areas are desirable. It's a good idea to have portable or mobile change and shower stations.

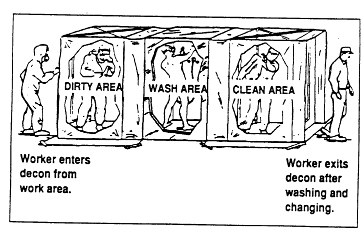
Some major parts of buildings have a direct effect on the success of a lead abatement project. Repairs to those parts of the building should be done before you start the abatement. You should consider repairing:



- Water leaks that can cause future exposures when encapsulating materials fail and when lead paint underneath deteriorates.
- Structural damage (e.g. rotted floor joists) so that workers will be safe and that work can be done.
- If a heating system doesn't work and can't be repaired, you should remove it during abatement. If you remove it afterwards, it might re-contaminate the structure because lead dust can collect in and on the ducts.

An important part of preparing the work site is the site plan. This plan includes:

- Location of storage area(s) for materials and tools.
- Location of decontamination (decon) unit and clean areas for workers.
- Location of storage area(s) for vehicles used for delivering materials and hauling waste.
- Location of barriers for controlling access to the site. This is more important for exterior abatement projects. Barriers may be necessary if you are doing abatement in very tight areas where there are a lot of pedestrians.



You need to post warning signs at all entrances and exits to the work area. Also, you should post lead hazard signs on the outside of the building before you start the abatement. OSHA specifies the wording of the warning sign:

OSHA-required warning signs

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

Warning signs must be kept clean so that they are readable.
Other things you need to consider before the abatement begins are discussed in Chapter G, Site Characterization.

IV. Containment

Good containment is essential to protect the environment

To have a successful paint abatement job, you must make sure that lead does not get into nearby areas or units and/or the outside environment. Containment systems that are not well-ventilated can increase workers' exposure to lead. Workers can also be exposed when they take the containment systems down at the end of the job. You need to take steps to prevent contamination of other parts of the building, the unit, or the environment, and to protect personal belongings from contamination.

Interior Containment

Interior containment procedures consist of the following:

- Remove all movable objects from the work area. Carpeting (including wall-to-wall) should be removed and cleaned. If renovation is being done at the same time as the abatement, the wall-to-wall carpeting is often discarded (this is the best policy). Workers should wear protective coveralls and respirators when removing wall-to-wall carpeting because ripping the carpet free can create large amounts of lead dust. Area rugs which are not fastened to the floor can be removed carefully without creating enough lead dust to require the use of a respirator. You should collect your own exposure data to satisfy OSHA regulations.

- Use 6-mil plastic secured with tape to cover exposed surfaces that would be difficult to clean. You can also use staples to keep the plastic in place. The tape should not damage finished surfaces, so you must select the right kind. You should cover any surfaces, such as grass cloth, rough wood paneling, or ornate wood work, where dust might be trapped.

- Seal the work area off from non-work areas. Openings to rooms or attached units that are not being abated must be sealed off with 6-mil plastic and tape. Make sure windows are closed during abatement activities. When a window itself is to be abated, you will have to apply stricter containment measures to protect the outside environment from contamination. You can do this by securing 6-mil plastic to the exterior window frame with fasteners and duct tape to keep lead particles or dust within the work area. An alternative method is to adequately cover the ground below the window.

- Create effective barriers at entrances between work and non-work areas by using two layers of 6-mil plastic sheeting. On one side of the door frame secure the first sheet to the top of the opening (the "header") and down along one side of the opening. Next, on the <u>other</u> side of the door frame secure the second sheet to the header and down along the opposite side.

- Cover all non-movable objects with 6-mil plastic and seal with tape. Non-movable objects include kitchen cabinets, window seats, stoves, and medicine cabinets. In limited abatements or when performing temporary (interim) control tasks, where families are not relocated, protect personal belongings and furniture from dust with 6-mil plastic.

- Cover all floors with 2 layers of 6-mil plastic (after the first layer of plastic has been secured to the floor, add a second layer to ensure that the floor surfaces are completely contained). Staples may be used to keep the plastic in place. You may want to use additional layers of 6-mil plastic in high-traffic areas or where the plastic might be broken. This allows you to easily clean up and remove debris during the abatement, and still protect the floor containment system. You may remove additional layers of plastic during the abatement process, but you should <u>never</u> remove the first layer of plastic from the floor surfaces during abatement. Otherwise, you may have to pay for more costly clean-ups.

  Covering floors protects them from contamination by lead dust. If you don't remove wall-to-wall carpeting, you must ensure that the plastic barrier remains intact during the hazard control work. If the floors are wood or deteriorated vinyl, the plastic prevents dust from getting lodged in cracks and porous surfaces and makes the final clean-up easier. If the floor is vinyl and in good condition, you can decide not to cover the floor, because the floor is cleanable. However, if the work is going to create debris that might damage the vinyl surface, you should cover the floor. Concrete floors should probably be covered, unless the concrete has been sealed. If the concrete hasn't been sealed, cleaning may not meet clearance standards because concrete is porous and absorbs other materials easily.

Whether you cover floors depends on the condition and type of floor

- Shut down forced-air heating and air conditioning (HVAC) systems and clean all air intake and exhaust points with HEPA vacuums. If you do not shut down the HVAC system, you may contaminate other parts of the building, or at a minimum, the ducts and furnace. Vents should be sealed with 6-mil plastic and duct tape before abatement begins.

- Make routine checks of the security of the containment to ensure that areas outside of the containment are not being contaminated. Immediately patch any holes you find with 6-mil plastic and tape.
- OSHA requires engineering controls to reduce worker exposures to toxic materials in the air. Because of this requirement, you may need to use:

  - HEPA filter exhaust units (negative air machines) to remove and filter lead-contaminated air from the work area; or

  - Other mechanical ventilation to reduce volatile organic vapors from the work area (for example, when using some organic strippers or encapsulants).

  The amount of mechanical ventilation required, depends on the amount of lead or other toxic chemicals in the air. If you cannot reduce airborne levels below OSHA permissible exposure limits (PELs), respirators may be required <u>in addition to</u> the ventilation.

- OSHA requires engineering controls to reduce lead exposure

If a common area like a public hallway in an apartment building is to be abated and other entrances/exits are not available, then you should create a protected passageway. You can create these by building frames and attaching 6-mil plastic to them. If a safe passageway is not practical, then:

- Only do abatement of these areas during set and posted hours.
- At the end of each work day, clean these areas with a HEPA filter-equipped vacuum until you have removed visible debris and dust from all surfaces.

- To minimize contamination, give occupants disposable shoe covers to wear when they pass through the common area. Put a waste barrel at the entry to their dwelling.

Exterior Containment

It is more difficult to provide containment for exterior lead-paint abatement. Proper exterior containment is necessary because:

- Exterior abatements can produce large amounts of liquid and/or dry waste.
- Lead in soil and dust contributes to lead poisoning in children. You must prevent additional contamination of soil and exterior dust.

Depending upon the method you use, exterior abatement can produce either liquid or dry waste. Containing liquid waste requires planning and sometimes creative solutions. To handle **liquid waste,** you need to:

Controlling liquid waste

- Place 6-mil plastic as close to the building foundation as possible and secure it.
- Extend the plastic far enough out to contain runoff. Raise the outside edge of the plastic (for example, with two-by-fours) to trap liquid waste.
- Seal all seams with tape.
- Have containers available to hold liquid waste until it can be transferred and disposed of.
- Pump, vacuum, or bail liquid waste so you can transfer it to a disposal facility.

Controlling dry waste

To contain **dry waste** from exterior abatement, you need to:

- Place 6-mil plastic as close to the building foundation as possible and secure to the building. Use duct tape to secure the plastic. Extend the plastic out from the foundation a distance of ten to twenty feet, depending on the height of the building, and secure the plastic with weights or stakes along the edge.
- Remove as much of the surface plastic as you can at the end of each work day. Equipment or structures (such as scaffolding) may make it impossible to remove all of the plastic on some jobs. If it cannot be removed it should be cleaned and barricades erected. Weather can create problems in exterior containment. For example, high winds can detach or tear the plastic, allowing lead dust to be spread over a wide area.
- Erect vertical shrouds if constant wind speed is above 15 mph. For example, erect scaffolding and attach 6-mil plastic to the building. High winds can cause big problems because the shrouds can act as sails and the scaffolds can "sail away." Don’t do abatement work when high winds make it difficult or impossible to protect both workers and the environment. If you have to do abatement work in spite of bad weather conditions, you must find other ways of securing vertical shrouds. The scaffolding must be positively anchored to the structure. You could, for example, build a containment structure independent of the scaffolding.

To have successful containment on a paint abatement site, you must provide for onsite storage of liquid and dry waste (if needed). (If the waste is hazardous, you must follow appropriate EPA and Department of Transportation regulations. See Chapter P, Waste Disposal, for further details.) For safe storage, you need to:

- Designate secure area(s) and limit access to them.
- Collect liquid waste in 55-gallon drums or smaller.
- Wrap or bag dry waste in 6-mil plastic/bags and store it in a covered dumpster.
- Separate hazardous from non-hazardous wastes.

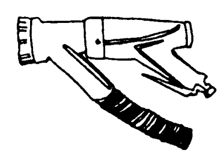
To produce the safest abatement and make clean-up easier, you have to maintain the containment system. Daily clean up should include inspections to ensure that the system is intact. Repair tears and breaks with 6-mil plastic and duct tape.

V. Lead-Based Paint Abatement Methods

There are two different methods for removing lead-based paint. The first method is to remove the lead-based paint from the surface (substrate). You can do this **removal strategy** in one of two ways:

Removal strategies

- **Replacement** - remove both the paint and its substrate (for example, wood trim) and dispose of both. After removing the materials, replace them. This completes the abatement.



NEEDLE GUN WITH HEPA FILTER

- **Removal** - separate the paint from the substrate and dispose of the removed paint. You remove it by wet scraping, scraping with a heat gun, using an abrasive, using a needle gun, stripping with chemicals on-site, or stripping with chemicals off-site.

The second strategy leaves the paint in place, but covers it. **Covering** makes lead paint inaccessible by covering or sealing painted surfaces. Covering should be considered for large surface areas such as floors, walls, and ceilings, as well as for items such as window sills and stair treads. Covering includes:

Covering strategies

- **Enclosure** - encloses the painted surface with a durable substance such as drywall, paneling, metal siding, or some other construction material designed to last a minimum of twenty years. You have to select enclosures carefully.

- **Encapsulation** - coats or seals the lead-based paint with some durable coating applied as liquid to the painted surface. Lead-free paint is not considered an encapsulant unless it passes the ASTM encapsulant test procedure. You should not use encapsulants with surfaces subject to friction or rubbing such as windows and doors.

LEAD-BASED PAINT REMOVAL STRATEGIES

Component Replacement

Replacement consists of removing the components that have lead painted surfaces and installing new components free of lead-containing paint. You should consider replacing components that can be easily removed, such as wood trim, windows, doors, etc.

To control dust during removal, mist or wet-spray the affected item and the surrounding area before you begin removal work. Be careful not to soak components, because this can damage them unnecessarily and can also spread contamination.

Remove the affected items carefully to minimize damage to the surface to which it is attached. Damaging nearby surfaces means extra repair costs. Also be careful not to damage electrical and plumbing systems.

Once you have removed the items, wrap them in 6-mil plastic and seal them with tape for proper disposal. This will minimize the chance of environmental contamination at the work site and while the items are being transported. Do an initial clean-up to remove as much dust and debris as possible. If you have been doing regular, thorough daily cleanups, this step will be much easier. Also, the rest of the abatement will be easier to do, and you may be able to use less-restrictive personal protective equipment (PPE).
Install replacement units following standard construction practices and all applicable building and fire codes. When replacing wood trim, you can reduce costs by choosing the proper replacement units. Choose one of the two following methods:

- If you are replacing wood trim in a room where you don't plan to do enclosure of plaster wall surfaces, increase the width of replacement units. This will reduce repair costs (for example, plaster work) and will produce a better looking finished product.
- If you plan to encapsulate wall surfaces, you can cut costs by eliminating trim, or reducing the size of replacement trim.

<u>Paint Removal</u>

Paint removal is the removal of lead-based paint to the bare substrate using either heat gun, chemical and/or mechanical methods. Even though the visible paint is removed, a residue can remain in some porous substrates. You can do paint removal either on-site or off-site. "On site" means that you remove the paint while the substrate remains in the building. If you take the items somewhere else to do the paint removal and then return them to the site and re-install them, this is called "off-site."

The HUD Guidelines list several things to consider when choosing off- or on-site paint removal. See the following section for some of these considerations.

Off-site Paint Removal

- The item may look better if the paint is removed off-site because there will be less chance of paint-scraper damage.
- The cost of removing, treating, and reinstalling an item is usually lower than doing a quality job on-site.
- You are more likely to damage items or nearby surfaces during removal and reinstallation of the components, and also more likely to damage the hardware left on the unit.
- Lead residue remains on the substrate, which makes items difficult to handle and clean.
- Items usually swell, which makes them difficult to reinstall.

On-site Paint Removal

- On-site paint removal methods may create a lot of lead dust and lead residue.
- On-site methods are more dangerous than other methods if not done properly.
- You should always follow the manufacturer's instructions when doing on-site paint removal.
- You do not need highly skilled labor, such as carpenters, for on-site removal work. However, workers must be trained as required by OSHA and they may have to be licensed in the locality where the work is being done.
- Some solvent-based chemical strippers are flammable, and they may contain toxic substances that are volatile and can easily create dangerous fumes and vapors.

Paint strippers can be toxic

- Caustic chemical strippers frequently used for on-site removal can cause skin and eye injuries if they are not used properly. Also, because caustic strippers have a high pH, they may have to be treated as a hazardous waste, whether or not they have lead in them.

- Heat-based removal methods involve using a heat source such as a heat gun on the surface to make the paint blister from the substrate. You can then scrape the surface with a sharpened paint scraper manufactured for that purpose, or you can use similar hand tools.
- Because of the high temperatures they run at, heat guns often cause lead to be released into the air as a fume. These fumes are dangerous. (Less lead fume will be generated if heat guns are used at their lower setting. They must only be used at their lower setting.)
- Heat guns generate poisonous organic vapors because heat causes the paint film to decompose. Recent studies by NIOSH show that when paint is heated at 700 degrees F (the typical low temperature of heat guns) organic vapors are created. As a result, you will have to consider using respirators fitted with an organic vapor cartridge as well as HEPA filters.
- Heat guns may be a fire hazard if not used carefully.
- Lead residue may remain on the substrate and may be difficult to remove.
- Dry scraping creates large amounts of dust, so that you may need more worker protection, better containment, and extra cleanup to comply with clearance standards.

Organic vapors can be produced by heat guns

Some paint removal methods are prohibited by HUD and by state regulations. Some of these methods are listed below.

- Open-flame burning or torching, including propane-fueled heat grids, should never be used under any circumstances because the high temperatures produce high levels of airborne lead and cause a serious fire hazard.
- Machine sanding or grinding without HEPA local vacuum exhaust.
- Un-contained hydro blasting or high-pressure wash.
- Abrasive blasting or sandblasting without HEPA local vacuum exhaust.
- Heat guns operating above 1100 degrees F.

Some methods are not recommended by HUD and may be prohibited in some states.

- Methylene chloride based removal products.
- Dry scraping (except for limited surface areas; e.g., around electrical devices).

LEAD-BASED PAINT COVERING STRATEGIES

Enclosure

Enclosures (sometimes referred to as rigid encapsulants) include but are not limited to, paneling, gypsum board, plywood, tile board, and aluminum and vinyl exterior siding. All enclosure products should be applied with fasteners and adhesives and installed according to the manufacturer's directions.

- **Paneling** - To prevent a bellows effect when installing paneling, you need to use panel adhesive and threaded nails. All seams and edges must be sealed or caulked to prevent dust from escaping. Because paneling is combustible, you must check building code regulations.
- **Gypsum Board/Drywall** - When encapsulating old plaster walls, gypsum board should be glued as well as screwed to the surface. Using screws rather than nails causes less damage to the underlying plaster and provides a more stable, permanent improvement.

  You may need to do additional framing or furring of the surface because of its condition. If the plaster is uneven or deteriorated, furring and shimming can make the final product look better. On exterior walls, voids created by furring should be filled with 3/4" rigid insulation. This helps to control heat loss.

When abating window jambs, you should consider aluminum or vinyl replacement guides/channels, especially when the window sashes are free of lead and only the jambs have to be replaced.

<u>Encapsulants</u>

Preparing surfaces well is important for effective encapsulation systems. If you need to prepare a surface (for example, scrape peeling paint) mist or wet-spray the area first to control dust.

You should consider encapsulation for surfaces that are difficult to remove (for example, baseboards behind pipes). These surfaces are typical in kitchens and bathrooms where plumbing and fixtures make it hard to get to them.

Flexible encapsulants usually bond to the surface underneath using glue or mastic; sometimes the material itself has adhesive in it.

These encapsulants are only as strong as the substrate (and the paints covering the substrate) they are attached to. They usually fail when:

- two layers of paint underneath don't adhere to each other;
- the paint doesn't stick to the substrate,
- the encapsulant doesn't adhere to the paint; or
- because they weren't applied properly.

Some states have created encapsulant approval programs to make sure that the encapsulant is durable, and performs as the manufacturer claims. Before selecting an encapsulant for an abatement project, be sure to check state regulations.

The primary reasons encapsulants fail are listed below:

- A layer of paint that bonded poorly and/or does not adhere to the layer under it. You usually cannot correct this problem, so you should not use flexible encapsulants in these circumstances. Some newer encapsulants penetrate the paint film and bond to the substrate. These can be used under most circumstances.
- A layer of paint over a glossy surface that was not deglossed first. (Deglossing is a technique to change a smooth, glossy painted surface to a rougher one). You usually cannot correct this problem, so you should not use flexible encapsulants in these circumstances.
- There are so many layers of paint that the weight of the paint has begun to break the bond between the paint and the substrate. You usually cannot correct this problem, so you should not use flexible encapsulants in these circumstances.

- The encapsulant was applied to a glossy surface without deglossing. Deglossers may be chemical or physical (such as wet sanding.).

- The encapsulant was applied to a dirty or greasy surface. You can usually correct this problem by cleaning, and possibly deglossing, the surface.
- The polymer paint or mastic was not applied in a thick enough layer to allow the dried film to stick together. You can usually correct this by training workers to use mil gauges to check their work.
- The surface was not prepared properly. In addition to deglossing or cleaning, you usually need to do some surface preparation before using an encapsulant. The preparation usually consists of wet scraping loose material.

Use test patches to test the suitability of an encapsulant. Because encapsulants often fail, you need to do test patches of the proposed encapsulant on each surface you plan to apply it to. The procedure for encapsulant test patches is as follows:

- Apply the encapsulant in a test area of at least one square foot on each type of surface.
- Let it cure according to the manufacturer's instructions.
- After curing, peel the edge up with a knife or other sharp instrument.
- Try to peel off the material.
- If you can peel off the material in sheets, strips, or large pieces, you should not use the encapsulant on that surface.
- If the material peels off bringing one or more layers of paint with it, you may be able to correct the problem by cleaning and/or deglossing the paint.

- If the material peels off the top layer of paint, bringing no paint with it, you may be able to correct the problem by cleaning and/or deglossing the paint.
- After cleaning and/or deglossing, you need to do another test patch.
- If you can peel off extremely small pieces or flakes of the material, it is satisfactory.

The general rule is that, after curing, the ability of the material to stick to the substrate should be greater than the cohesion within the material, that is, the material should bond to the substrate better than it bonds to itself. This means the material will "pull apart" in small pieces before it pulls from the substrate.

Another concern is that the coating or mastic (glue) may be poisonous to the workers and to the future residents of the dwelling. EPA has warned that we don't know the long-term effects that result when many "plastic type" coatings decompose. Additionally, the products themselves may be poisonous to a child who swallows them.

Screening for toxics in these products will help determine how much protection workers need when applying them. (EPA is currently looking at the health effects of encapsulants and will publish the results as soon as possible.)

The types of flexible encapsulants include:

♦ Fiberglass polymer systems

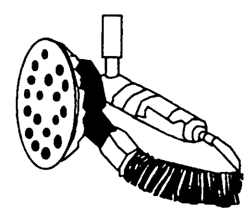
These can be used on interior walls and ceilings. Fiberglass mats generally come in rolls approximately 50" wide. A layer of mastic or adhesive is applied with a roller or brush. Do not apply fiberglass products over large gaps or holes, because the products can easily be punctured, and can re-expose the lead underneath. Do not apply the material over badly deteriorated surfaces, such as exposed brown-coat plaster, unless you repair the surface first. The mastic coating will not stick to the brown-coat. Do not wrap fiberglass around outside corners. Cut the material to fit. You need to apply an outside corner bead of wood or metal to prevent layers of the material from coming apart. Feather out metal corner bead with joint compound.

When using fiberglass materials, you usually have to apply at least two additional coats of paint to make the surface appearance acceptable.

♦ Flexible polymer coatings

Flexible polymer coatings are often latex based. These products may be less toxic both to the worker and to the future residents. However, don't assume that this is true, just because the salesperson tells you so. (The project designer or health & safety officer may have to consult with a chemist, industrial hygienist or local health authorities about the toxic nature of these coatings.)

Polymer coatings can be either one-part or two-part systems. Depending upon the product, you may be able to apply it with a brush, roller, or spray gun. Check with the manufacturer for information on how to apply it.



HEPA SANDER

You need to be very concerned about preparing the surface, applying the product properly, and the air temperature when you apply it. Humidity can also be a factor.

Surfaces must be clean, free of chipping and peeling paint, and deglossed using a chemical deglosser, if necessary. Do not use machine sanding without HEPA filtration for deglossing.

You must apply the materials to the proper thickness, according to the manufacturer's instructions. Usually, they should be applied 13-14 mils thick, and should dry to a thickness of 10 mils or more. With some two-coat systems you need to make each coat 25 mils thick. The painter must use a mil gauge frequently to check his/her work.

Usually, air the temperature must be at least 40 degrees Fahrenheit. Don't rely on this generalization, though, because it isn't always the case. Follow the manufacturer's instructions.

The polymer coating must be highly cohesive (it must hold together well), so it is almost like putting a sheet of rubber over the wall. However, when you do your test patch, and try to pull the material off the substrate, the material should pull apart in small bits and pieces, rather than coming off in the large sheets. This shows that its cohesion (how well it sticks together) is not as good as its adhesion (how well it sticks to the substrate).

You can't always use this "cohesion vs. adhesion" rule, though. You need to know more about the particular material you are dealing with. The cohesion must be strong enough so that the polymer coating does not chip and flake like ordinary paint if the material or paint underneath starts to come apart. Some materials that seem be very elastic and seem to have good cohesion don't last over long periods of time, or when they are exposed to freezing temperatures. When these products become brittle, they may chip and flake as the substrate expands and contracts.

Use only approved encapsulants

Use only encapsulation products that have been found effective by a state encapsulant approval program, or an independent authority such as ASTM; don't just go by the manufacturer's recommendations.

You can use polymer coatings on walls and ceilings, woodwork and wood trim, exterior wood or masonry surfaces, and metal pipes. However, you must use a patch test on each type of surface that you plan to coat.

You should not use polymer coating on surfaces that are abraded (rubbed or worn by friction) such as floors, window jambs or sashes, or door jambs or edges.

Because the dried film is so thick, we don't recommend applying these coatings to window jambs and sashes, or to door jambs and edges. Even when it is not too thick, don't use it for window jambs, because the wear caused by opening and closing the window can quickly wear through the material, re-expose the lead and grind it into fine dust.

Do not encapsulate worn out or deteriorated components.

You need to document all your encapsulation work because people doing maintenance, renovation, or demolition in the future may risk exposure to the lead paint underneath the coating. Also, people doing later analysis for lead paint will need to know about it because x-ray fluorescence can detect encapsulated lead.

VI. Controlling Off-Site Dispersal

You must limit and control access to the abatement work area to protect people from exposure to lead. The only people who should have access to the area are:

- Contractor and abatement workers
- Enforcement officials
- Public Housing Agency (PHA) or other inspectors
- Owner/owner's agent

Workers should always wear the appropriate protective clothing on the abatement site. (See Section K, Protective Clothing and Equipment.) Inspectors, owners, officials, and others who visit the site briefly should, at a minimum, wear disposable shoe covers. They should put on new shoe covers when they enter the site and remove them and dispose of them when they leave. (Visitors may also be required to wear other types of protective clothing, including respirators.)

A continuous cleanup program should include regular cleaning of all tools, equipment, and worker protection gear. Tools and equipment should be cleaned using a high phosphate detergent (e.g., TSP/Tri-sodium phosphate) or a lead- specific cleaner and warm water. You must also clean respirators every day. Follow OSHA Lead in Construction Interim Final Rule procedures (29 CFR 1926.62).

VII. Daily Cleanup

Daily cleanup helps assure passing clearance

HUD Guidelines say that you should do a thorough cleanup of the entire area you are abating every day. This daily cleanup should consist of:

- ✓removing large debris,
- ✓removing small debris,
- ✓HEPA vacuuming, wet cleaning, HEPA vacuuming (horizontal surfaces, only),
- ✓cleaning exterior,
- ✓patching and repairing plastic sheeting, and
- ✓securing debris and plastic.

A. Large Debris

Wrap large demolition-type debris (e.g., doors, windows, trim) in 6-mil plastic, seal it with tape, and move it to the trash storage area on the property. Since this debris can be hazardous waste, never store it outside while you are waiting for it to be removed or disposed of. You must set aside an area on the property for temporary trash storage.

B. Small Debris

Sweep up and collect small debris and dispose of it properly. Before you sweep, spray the surfaces with a fine mist of water, to keep surface dust out of the air and to keep dust from contaminating other parts of the property and exposing abatement workers. Do not dry sweep. Place the debris you have swept up in double 4-mil or single 6-mil plastic bags, seal them properly, and move them to the trash storage area. Do not overload trash bags, because they can rupture or puncture while you are handling and moving them.

C. Exterior Cleanup

Protect unabated areas from exterior abatement work with a containment system. Because weather can have a negative effect on exterior containment, remove the surface plastic of the containment system at the end of each work day. Examine the area every day and during final cleanup to be sure that no lead debris has escaped containment. If it has, rake or sweep up the debris, put it in single 6-mil or double 4-mil plastic bags, seal them, and store them along with other contaminated debris.

At the end of the abatement, do a final cleanup.You have to clean much more thoroughly at the end of the project that you do every day. If you don’t do this cleanup properly, your work will not pass post-abatement clearance.

VIII. Final Cleanup Procedures

The procedures for Preliminary and Final Cleanup are as follows:

Preliminary Final Cleanup

Before you can begin final cleanup, and before you can paint or seal abated surfaces, you must remove the plastic sheeting used for containment. Remove it and dispose of this contaminated material very carefully. Start with upper-level plastic, such as that which covers cabinets and counters. Spray or mist the plastic with water to hold down dust, and then fold it inwards to trap any remaining dust inside. Before removing floor plastic, spray it and sweep it as described earlier in this chapter. Fold it carefully from the corners/ends to the middle to trap any remaining lead dust. Put it in double 4-mil or single 6-mil plastic bags, then seal them and remove them from the premises. For both daily and final cleanup, workers must wear protective equipment, especially appropriate respirators. Leave the plastic sheets that isolate contaminated rooms from non-contaminated rooms in place until after the preliminary final cleanup is complete and then remove them carefully as described above.

After the plastic has been removed from the contaminated area, HEPA-vacuum the area as described in the HUD Guidelines. Start with the rooms farthest from the entrance so that you don't re-track dust through the areas you've already cleaned. In each room, begin vacuuming with the ceilings and move down the walls, making sure every surface is treated, including doors and door trim, windows, window sills, troughs, and trim, baseboards, etc.

Wash the entire area with either an all-purpose cleaner or a cleaner made specifically for lead, and then HEPA-vacuum it again, using the same steps as before. Do not deviate from or skip any step. If you don't follow all the procedures, dangerous levels of lead dust can be embedded in the new paint, which in turn can cause more long-term problems when the paint gets worn down or begins to deteriorate.

Painting and Sealing Surfaces

Final painting & sealing of abated surfaces

Some abatement specifications require that you paint or seal new components or existing components that have been stripped. This is to insure that no sanding is done after final cleanup. Do this step after you have inspected the site to make sure that all required surfaces have been abated. A "third party" inspector should do this visual inspection before you do repainting or sealing to confirm that the abatement was done according to specification, (that is, that all the paint was removed).

Final Cleanup

After painting/sealing is complete, do the final cleanup for the entire area, as follows:

- HEPA-vacuum it again.
- Wash it down again with TSP, an all-purpose cleaner, or a cleaner made specifically for lead.
- Finally, HEPA-vacuum it again.

You don't have to wash wall and ceiling surfaces that have been newly painted with latex paint, because this final wash could stain or damage the final painted surface. However, you should HEPA vacuum it again. You may be able to use less strict steps in final cleanup, as long as your work meets clearance. You may be able to use the results of clearance testing done during the pilot abatement to figure out how much final cleanup is required.

Clearance Testing

To make sure that you didn't leave any lead dust behind, and that you have abated all the specified surfaces, a final visual inspection and clearance dust sampling must be done. (See Chapter O, Sampling.) Do not do clearance dust sampling until one hour after final cleaning is complete.

IX. Record Keeping

You need to keep records for each abated unit. These records describe in non-technical language where the lead was found and how it was abated. Files should contain the following information:

- Identification of units abated.
- Results of all detection analysis.
- General description of abatement methods.
- Especially if you used encapsulation methods, you must keep records of what surfaces were encapsulated. Workers who do future remodeling, maintenance and/or demolition must know about the encapsulation, so they can take the necessary steps to protect themselves and the environment.
- Results of clearance tests.
- History of the abatement project from the beginning through the point at which the residents move back in.
- Relevant Federal, State, and local requirements.

The owner should keep these records. Public Housing Authorities (PHAs) and Indian Housing Authorities (IHAs) should keep these records for the life of the annual contribution contract or should contact the local HUD office if they have questions.

INTERIOR DUST REDUCTION & CONTROL

OBJECTIVE:

To present the reasoning behind the techniques currently used in the reduction and control of lead-contaminated dust inside residences, and the problems you have doing this kind of work.

LEARNING TASKS:

Supervisors/contractors should be able to:

- List the major sources of lead-contaminated dust in the interior residential environment.
- Describe the processes used to remove dust from carpeted and bare floors.

As a supervisor/contractor on a lead-contaminated dust reduction project, this section is important to you because you will be called upon to:

- **select appropriate methods for interior dust reduction and control;**
- **implement processes used to control contamination;**
- **reduce potential worker exposure to lead;**
- **protect the residents, the workers, and the environment;**
- **explain why you are cleaning dwellings.**

INTERIOR DUST REDUCTION & CONTROL

I. Introduction

Lead-contaminated dust within a dwelling can expose people living there, especially children younger than six years old. Young children are especially vulnerable to lead in dust because:

- They normally put their hands in their mouths a lot.
- They spend a lot of time on the floor.
- They have smaller bodies than adults.
- They absorb more of the lead they swallow than adults do.

Lead-contaminated dust is more dangerous for children than adults

Also, young children's nervous systems are more sensitive to small amounts lead in the blood. (For more discussion of this topic see Chapter E, Health Effects of Exposure.) To protect residents, especially young children, building owners may decide to temporarily reduce and control lead-contaminated dust until a more permanent solution is possible.

Sources of Lead in Dust

Before the Federal Government phased out leaded gas and took steps to reduce lead emissions from incinerators, smelters, and other sources, lead in the air was a problem in many areas. Because those environmental programs succeeded, dust has become the major source of lead exposure. How do fine lead particles get into dust? Here's how:

- deteriorated paint on the interior and/or exterior of the building releases fine lead particles;
- surfaces that get a lot of wear, such as stair risers, door jambs, and baseboards coated with lead-based paint;
- friction surfaces such as window tracks, sashes, and door jambs coated with lead-based paint;
- abatement of lead-based paint done incorrectly;
- maintenance, repainting and remodeling;
- lead-contaminated street dust;
- lead-contaminated soil near the building;

- removal of lead-based paint from bridges and other steel structures;
- emission sources that do not meet federal and state air emission standards;
- lead on bodies and clothing brought home accidently from hobby or work activities involving lead.

Some of these sources of lead are part of the building itself, that is there is lead paint on surfaces inside or outside the building. This happens more often in older housing. There is very little lead-based paint in housing built after 1950, but it was a very popular choice in housing built before 1950. In older houses, the worst contamination is found in attics, basements, furnace ducts, and carpets. Some of these locations are not dangerous to the residents unless the areas are visited or disturbed by remodeling or repair work. Carpets contaminated with lead are dangerous to young children who come in contact with them.

In newer dwellings and older buildings where the lead-based paint has been abated, lead dust from outside sources can reach very high levels. This happens in older urban areas where levels of lead in exterior dust are very high. Recent studies at the University of Cincinnati found that after construction work was done, lead dust levels increased in the floors of both new apartments and older units where lead-based paint had been completely abated. When the units were less than three years old, the Geometric Mean of the floor dust lead in the units sampled in the new buildings was 45ug of Pb/ft^2. In the older lead-paint-abated units the loading was 90ug of Pb/ft^2 (Pfahles-Hutchens, 1996). What this means is that even in buildings where there either is no interior source of lead or the lead has been abated, outside sources can create lead hazards.

History of Dust Reduction

The dangers of lead-based paint have been a concern of the Federal Government and some state and local governments for more than a generation. As a result, there are now many regulations and programs that attempt to reduce lead-based paint hazards, airborne lead, and lead in food and water. No one was really worried about lead-contaminated dust until recent research showed that it is more dangerous than lead found in undisturbed lead-based paint. It is a major way for lead to get into blood.

Not much research has been done on reducing and controlling lead dust, because everyone thought that all lead-based paint was dangerous and had to be abated. Few people thought that just cleaning dwellings could make them safer. Title X gave reasons for using cleaning as an interim control (temporary) measure.

We now know more about interior dust reduction and control but we still don't know enough. We are beginning to set up methods to effectively and efficiently control lead dust. The techniques for interior dust reduction and control that we discuss in this manual come mainly from two dust-lead abatement projects done between 1989 and 1991 and one dust control project now in progress. The two dust abatement projects, one in Canada and one in the United States, are:

- The South Riverdale and Niagara Lead Reduction Program

  In 1987, the City of Toronto and the Ontario Ministry of the Environment decided to do an environmental clean-up of lead pollution in South Riverdale. They thought that pollution came from a lead smelter and from automotive exhaust. They found that lead levels in the soil and the blood of school-aged children were higher than the national average.

- The Cincinnati Soil/Lead Abatement Demonstration Project

  The Cincinnati Project, conducted by the University of Cincinnati, was one of three similar projects funded by the U.S. Environmental Protection Agency (U.S. EPA) under the Superfund Amendments and Re-authorization Act (SARA). The major goal of the Cincinnati study was to determine whether three types of lead abatement, used alone or together, would reduce blood lead levels in children under five years of age. (These children lived in rehabilitated housing or in housing that had not been rehabilitated, but that was in satisfactory condition.) The three types of abatement were: soil, exterior dust, and interior dust. The study group did interior dust abatement on about 140 residences during the three-year project.

Both projects had the same objective: to reduce exposure to lead-contaminated dust, but they were done for different reasons. One was done to reduce lead exposures from a secondary lead smelter, the other was a demonstration project. So, they did abatement differently and supervised it differently. However, they both developed methods for reducing lead-contaminated dust and described reservoirs (sources) of lead in dwellings.

A third project, the Treatment of Lead-Exposed Kids, tests two different treatments of children who have high blood lead levels. The children are placed in lead-safe housing if it is available. If it is not available, the project uses dust reduction and control as a temporary measure. The results from these studies will judge how effective dust reduction is. These studies will also help decide how often buildings need to be cleaned to keep residents safe from lead.

Rationale for Dust Removal and Control

Title X emphasized lead hazards like lead dust

Before Title X, most experts thought that the only way to deal with lead-based paint was to abate it. Title X changed that by shifting attention from lead-based paint, which may not be a hazard if it is not disturbed or deteriorated, to lead hazards in general. Lead-contaminated dust is one of those hazards.

You can reduce and control lead-contaminated dust in dwellings, but this is not a permanent solution unless the source of the dust is also abated. These sources can include the main (primary) source (for example, a smelter, mine tailings, paint, etc.) and secondary sources (places where lead collects – reservoirs - such as soils, exterior dust, etc.) If these sources of lead are not abated, then reducing lead dust inside buildings will have to be repeated over and over. Research is now being done in urban housing on how quickly buildings become re-contaminated after dust reduction and control activities. The results of this research will provide guidelines on how often cleaning is necessary to keep lead levels down.

A residence can be contaminated with lead from outside sources over long periods of time (chronic) or by short-term events. Chronic or long-term contamination results from:

- long-term deterioration of paint on nearby structures;
- long-term contamination from street dust or contaminated soil;
- workers carrying lead dust home over a long period of time;
- industrial contamination over a period of years; and/or
- traffic on nearby heavily traveled streets.

The second type of dust lead contamination comes from short-term events such as:

- a nearby industrial accident;
- workers carrying-home lead dust from industrial sources;
- abatement of lead-based paint within the dwelling or nearby that was not done correctly;
- repainting and remodeling.

These two types of contamination require different treatments to reduce exposure inside the dwelling. Incidental or short-term exposure is easier to clean up. Chronic or long-term exposure creates high levels of contamination that are difficult or impossible to clean up. The lead from a long-term exposure can be found in:

- furnace ducts and other heating, ventilation and air conditioning systems;
- attics;
- basements;
- carpets;
- bare floors;
- upholstered furniture; and/or
- curtains, drapes and wall hangings.

You may not be able to remove lead from carpets and upholstered furniture.

The Scope of Interior Dust Reduction and Control

Even though there are different sources of lead in dust and different levels of contamination, all residential lead-dust reduction projects have some concerns in common. These concerns are:

- The size and extent or scope of the job
- Abatement methods

- Protecting occupants
- Protecting workers
- Controlling contamination
- Disposing of waste

You have to consider these issues when you do any kind of interior dust reduction. Planning begins early in the abatement process, but the abatement supervisor and his/her workers are responsible for dealing with all these issues.

Whether the exposure is long or short term will help decide the type of work to be done. Short-term exposure may require a simple dust abatement consisting of:

- vacuuming carpets, upholstered furniture, and other flat surfaces with a HEPA filter equipped vacuum cleaner;
- damp mopping floors and washing all flat surfaces with a detergent specially designed for lead.

This type of cleaning could remove lead-dust contamination caused by lead-based paint abatement done incorrectly or by an industrial accident.

Long-term exposure requires a more complex abatement process. This kind of long-term exposure can be caused by lead smelters nearby, or as the result of large amounts of lead-based paint and leaded gasoline in the environment. The lead-dust may have collected in large quantities in attics, basements, carpets, furniture, and on the floors. This make abatement much more difficult.

In large, complex abatement projects, you should begin with a pilot project to answer the following questions:

- Is the dust reduction and control method workable?
- Does the dust reduction and control method achieve the desired results?
- Does the equipment work properly?
- What additional problems are there?

Pilot projects are usually not practical, or necessary, in smaller projects.

You can use a pilot project to develop an appropriate cleaning method before you begin dust reduction and control. You may also have to decide whether it is more cost effective to clean carpets and furniture or to replace them.

One dust control project used a pilot project to decide on the method for cleaning wood and vinyl floors. They found homes similar to the ones that were going to be abated, and then vacuumed and mopped the wood and vinyl floors five times. They let the floors dry between washings. The wash water was saved and analyzed for lead content and the floors were sampled for lead content by the dust vacuum method. (This method is described Chapter O, Sampling). Two vacuumings at the rate of one square yard per minute, and one washing, removed at least ninety-nine percent of the lead-dust.

In another pilot study, eight homes were thoroughly cleaned and the wash water and vacuum bags were analyzed for lead content. Over eighty percent of the lead in the samples came from the furnace ducts, floors, and upholstered furniture. Another large source of lead was unfinished basements. Attics may also contain lead, but aren't always included in abatement projects because people rarely enter them and so aren't exposed to attic dust until the attic is disturbed by renovation or repair. Cleaning walls does not produce large quantities of lead so they may not need to be part of most dust-abatement projects. (However, you must clean walls in a lead-based paint abatement project. Do not confuse these two types of cleanings.)

In general, in most large abatement projects you do the following:

- Remove and replace carpets and in some cases upholstered furniture and window coverings. If you don't replace carpets and furniture, it should probably be cleaned.
- Storing contaminated material prior to shipment to disposal facility.
- Transport carpets and furniture that cannot be cleaned to a disposal facility.
- Using a HEPA filter equipped vacuum, vacuum the tops of all woodwork, including casings, baseboards, interior window sills, window wells, exterior window sills, any remaining carpeting and all floors; at the specified rate and using high phosphate detergents or lead-specific soaps. Vacuum wood and linoleum surfaces twice, at the rate of one minute per square yard, before and after wet mopping.
- Damp mop all floors and wipe top ledges of all woodwork and window sills with a damp sponge.
- Clean the furnace ducts.
- Check and clean suspended or false ceilings because they may be contaminated with lead-containing dust.
- Clean finished basements using the same method you used for the rest of the residence.
- Pay special attention to unfinished basements, because they tend to collect large amounts of dust and you will need to

clean them more thoroughly.

Abatement Methods

Techniques for effectively removing lead dust

The methods listed below have worked well in interior lead-dust reduction projects. (As we mentioned earlier, the Cincinnati project and others showed that vacuuming and/or shampooing carpets and upholstered furniture wasn't very effective.)

1. Supply enough electricity to run equipment that requires more than one single 15 amp circuit per unit.

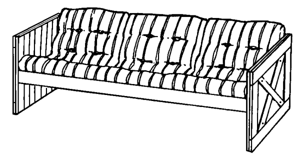
2. Send the cleaning crew to the work site. The crew follows the cleaning plan set up by the owner or project consultant. The plan says:

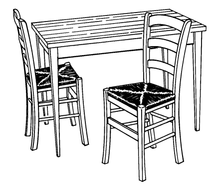
   - what order to clean the rooms in;
   - what carpets must be replaced, if any;
   - what furniture must be replaced, if any.

3. Clean a room in the following order:

   - First, HEPA vacuum all floors in the residence, then clean them again, according to the plan. This first cleaning controls dust and contamination during the cleaning process.
   - After all of the floors are vacuumed, clean all the rooms in the order stated in the work site plan. As usual, clean from top to bottom. Make sure that the plan is set up so that once a room is cleaned, the cleaning crew doesn't enter it again.

4. Clean a room in the following way:





- Before beginning any work, remove all furniture that is going to be disposed of.
- Move all other furniture and personal belongings to the nearby room(s) set up for that purpose.
- HEPA vacuum all ledges and then wash them with a high phosphate detergent solution.
- Vacuum the surface of the carpet to prevent creating dust when you fold the carpet.
- Fold the carpet in half and vacuum the bottom side, along with the floor underneath.
- Fold the carpet to the opposite side of the room and vacuum the other half of the floor and the other half of the bottom of the carpet.
- Damp-mop the floor with the detergent solution and place the carpet in its original position.
- If there is padding beneath the carpet, remove and replace it.
- Finally, vacuum the carpet for the last time. You should vacuum the carpet a total of three times at the rate of one minute per square meter each time. Workers use a stop watch to keep track of the time required. The site inspector should monitor this timing. Vacuum all carpets with an approved HEPA-equipped vacuum and an approved beater bar.

- When the vacuuming is done, put the furniture and personal belongings back in their original positions. Do cleaning in a nearby area, not in an area already abated.

5. In rooms where you are replacing the carpeting, do the steps in the same order as above except for folding the carpet. Roll the existing carpet into a tight roll and wrap it with 6 mil polyethylene plastic and tape it securely with duct or heavy strapping tape before you remove it from the room.

6. Permanently installed carpeting (for example, wall-to-wall) should be vacuumed and at the rate stated above.

7. Clean all rooms in the order described in the site plan. If there is no carpeting on the floor, clean the floor as follows:

   - Vacuum it.

   - After the first vacuuming, damp mop it with a high phosphate or lead-specific detergent solution.

   - After the damp mopping, vacuum the floor again at the rate of one minute per square yard.

8. To prevent contamination of dwelling interiors, of exterior soil, or paved areas such as sidewalks, parking areas, and streets, make sure that the vacuuming equipment consists of:

   - Vacuum cleaners equipped with a HEPA filter that removes 99.97% dust, 0.3 microns or larger.
   - A vacuum powered by exterior vehicle-mounted units that can store the dust properly. Test the exhaust for lead to make sure that it doesn't contaminate the soil and other exterior surfaces.

HEPA vacuums should be used to control contamination

9. Carpet cleaning equipment should include a beater bar attached to the cleaning head for dislodging deep dust and lead. Use this beater bar every time you dry vacuum the top of the carpet.

10. The cleaners should move all furniture that needs to be moved in order to do the cleaning effectively. The cleaners should make a note on the worksheet if any of the furniture cannot be moved, so that the owner or his/her agent knows about it. **NOTE**: People doing cleaning and moving furniture should be properly trained and given the proper equipment so that they don't injure themselves.

11. When floor areas are excessively cluttered, or when furniture tops or shelves are so cluttered that the furniture is hard to move, put the clutter in a box, move the boxes, and then do the cleaning. You should supply boxes, packing materials and staff to complete the job. After the cleaning is done, return all packed items to their original locations. Note this work on the Work Order.

12. Vacuum the following items:

    - all heating and air conditioning ducts;
    - all floors, covered or bare, including cellar or basement floors, except earth floors; and
    - all upholstered furniture, excluding bedding which should be laundered by the resident.

13. Vacuum at the rate specified in the contract. The rate may vary from the ones specified in other sections of this manual, because the rate depends on the conditions at the work site. Only an environmental professional who knows about the project should change the rate.

14. Bedding should also be cleaned. (We don't yet have any specific methods set up for this kind of cleaning.)

15. Be sure to do all cleaning activities in the order set up in the cleaning plan. This will keep cleaned areas from being re-contaminated and will make the cleaning more effective.

16. In basements, dry HEPA vacuum:

    - ceilings, finished and unfinished;
    - walls, windows and coverings;
    - floors, carpeted or bare (excluding earth floors); and
    - all upholstered furniture (excluding bedding).

17. Basement vacuuming should be done at about one minute per square meter to collect as much lead as possible. (This would mean approximately ten (10) passes at a slow pace.)

18. Dry vacuum carpeting in the same way as in the rest of the dwelling.

19. Duct cleaning equipment should use active, surface-contacting to remove as much dust as possible. If it uses some other technology, the owner or project consultant must agree that the alternate method works as well, and must approve its use. Use only HEPA-equipped duct cleaning equipment inside dwellings.

20. Supply the correct size disposable replacement filters for the heating system and install them after the ducts have been cleaned. Washable filters may be washed and reused.

21. Supply and place filtering material, such as fiberglass filters, in all duct openings. This will reduce the dust created when you run the furnace fan after the cleaning.

Duct Cleaning

22. Clean suspended ducts, pipes, wiring, etc., in the way that most effectively removes dust and lead. This may mean vacuuming, damp wiping, wiping with a dry cloth, brushing, or a combination of all of these. Clean interior <u>and</u> exterior surfaces. Often, pipes and ducts are covered with heavy loads of dust that have collected over many years. This dust may be difficult to remove and you may have to use a combination of techniques.

23. Clean the furnace ducts in the order spelled out in the plan. An environmental professional such as an industrial hygienist should set up the proper order to make sure that areas that have already been cleaned are not re-contaminated, and to make sure that the cleaning is as effective as possible.

24. At the beginning of the cleaning process, install filters in all duct openings to prevent house dust from entering the system.

25. While the HVAC system is shut down, vacuum:

    - all duct opening covers;
    - the warm air ducts starting at the top floor of the residence and working towards the basement;
    - the cold air returns starting at the highest level and working towards the lowest level;
    - the floor areas around each cold air return and warm air outlet;
    - the basement floor.

26. For all of the above, be sure that brushes are securely attached to the wands.

27. Remove the filter material installed in step 21 above so you can clean individual duct openings. Be careful to replace the filter material in each opening after you have vacuumed the duct. This keeps dust from being spread in the air if the fan is accidentally turned on, or turned on too early.

28. Wipe all heating system blades (if you can get to them) with a disposable towel, (for example, a wet wipe).

29. Replace duct system filters with new ones that are the correct size for the system. If the required filter is unavailable for a good reason, note this on the Work or Change Orders.

30. Run the air distribution fan for 10 minutes after the ducts have been cleaned. (The system should have been turned off during the cleaning.) Running the fan will trap any loosened dust, and will allow you to make sure that air flows through all the duct openings that had air flow before the abatement was done.

31. Take an inventory of all equipment, including attachments used, both before and after cleaning, to make sure that no equipment was lost or left in the duct system.

32. You will have to transport and dispose of all waste material created as a result of the cleaning process, and must follow all applicable regulations.

Occupant Protection

1. Encourage occupants to leave the premises during cleaning both to protect them and to make the cleaning easier. Develop temporary relocation plans for so that residents have a place to stay while their housing is being cleaned.

2. Workers must make sure that people living in the house, their neighbors, and others stay a safe distance from the work and equipment at all times. Don't leave equipment unattended, especially if it is connected directly to a power source.

3. Make sure that dirt is not tracked in from the outside while cleaning is being done. Do whatever is necessary to prevent dust and dirt from being carried from the area being cleaned to a clean area.

4. If you have hoses or other equipment extending from inside the building to the outdoors through doors or windows, be sure to seal window and/or door openings so that air doesn't flow in from the outside during cleaning. There are two reasons for this. First, if you have gasoline-powered equipment running outside, it can create dangerous carbon monoxide fumes that might be sucked inside the building. Second, residents may ordinarily keep the windows closed for health reasons (allergies, for example).

Worker Protection

1. Before beginning the cleaning program, workers and contractors must be trained in the work methods being used. This training program should include the following topics:

- the purpose of the program;
- a review of cleaning procedures;
- a review of work site rules;
- a review of chain of command;
- a review of health effects of lead.
- the content of the OSHA lead standard 29 CFR 1926.62 and its appendices.
- the purpose, proper selection, fitting, use and limitations of respirators.
- the purpose and a description of the medical removal protection program. This should include information about the dangers of lead poisoning, especially in relation to sexual reproduction in both males and females.
- the hazards to the fetus and additional precautions for employees who are pregnant.
- engineering controls and work practices associated with the employee's job assignment.
- the content of any compliance plan being followed.
- instructions to employees not to use chelating agents (drugs that attract lead in the blood and make it pass out of the body) unless a physician recommends this treatment.

  Workers must take this training and be certified or licensed before they can work on an abatement site.

2. You, as contractor, must provide the necessary training for your cleaning crews. This training program may have to meet local, state or federal guidelines. Have the owner review the training program also.

3. Follow a Site Safety Plan to protect workers and residents involved in the abatement project.

4. Do not permit eating, drinking, or smoking on the work site.

5. You must provide the following personal protective equipment, and make sure that workers wear it:

   - coveralls, disposable or washable, depending on what facilities are available;
   - cotton, latex or rubber gloves, (when using TSP detergents);
   - respiratory protection equipment. Environmental professionals should decide if and what type is needed before the abatement begins.

   Dispose of all disposable clothing at the end of each work day. (You should provide appropriate facilities for this disposal.)

<u>Contamination Control</u>

1. You must follow a set procedure to prevent dust from spreading to areas off the work site.
2. You must also follow a strict procedure to prevent new carpeting, new or existing furniture, and rooms from being contaminated during the cleaning process.
3. Use a load manifest system that provides an exact record of what items were disposed of, when they left the site, and when they arrived at the disposal area, so that you can guarantee that items were disposed of properly. The site inspectors, who should be on the work sites during abatement, will complete a form describing the furniture and carpeting that was removed from the residence. Someone

else must sign off on the form when the furniture and carpeting is left at the dump site. This system will assure Project Management that all furniture and carpeting got to the approved dump site. Some states may require that the furniture and carpeting be tested before it is disposed of. Some furniture and carpeting may not pass the TCLP test (see the Glossary for a definition) and may be considered hazardous waste.

4. To make sure that carpets and furniture aren't lost or stolen, do not leave them unattended (unless they are locked up securely) until they have been disposed of at the disposal site.

5. Roll carpets that are to be removed (carefully) in 6 mil polyethylene and tape them securely with duct tape so that they don't spread the dust contained in the carpet.

6. Use only vacuum cleaners with HEPA filters to remove interior dust.

7. If the vacuum cleaner bag breaks while a vacuum cleaner is operating, or if a vacuum cleaner is operated without a bag, change the second stage filter and clean the vacuum unit before it is used again.

8. Vacuum cleaners that are not equipped with an indicator that shows how much air is flowing through them should be tested by the Site Inspectors. HEPA filters should be changed as often as necessary to keep the vacuum cleaner working properly.

9. You must supply protective clothing, such as uniforms, to all workers. This helps to make sure that workers aren't contaminated by direct contact with lead. Workers should wear clean uniforms, such as lightweight coveralls, when moving new furniture and carpets. You must also make sure that dirty clothes are washed properly. And you must provide

clean gloves daily. Gloves are more likely to come in contact with contaminated material than any other clothing item. Testing has found high levels of lead inside workers' gloves. Workers usually assume that gloves protect their hands, so they should always have a supply of clean ones. Warn them that gloves reduce their exposure, but don't prevent it. Everyone must wash his/her hands before eating or smoking.

10. Before beginning the interior cleaning, prepare an instruction sheet on how to use HEPA-equipped vacuum cleaners. Give each member of the crew a copy. And each new crew member should be individually trained on using these vacuum cleaners.

11. Change wash water after each room is cleaned.

Quality Control

1. At the inspection after abatement, there should be no remaining dust on surfaces that have been abated.

2. Wipe tests may also be used to see if the cleaning meets clearance criteria on both paint and dust abatement projects.

Waste Disposal

1. Disposal of furniture and carpeting removed as part of the abatement process should be disposed of according to regulations.

2. Wastewater and vacuum cleaner bags should be disposed of according to regulations.

Interior dust abatement is basically a cleaning process, but it can become complicated because:

- It is more thorough than normal cleaning.
- The workers are handling a toxic material--lead.
- The work is usually done in housing where people are living.
- It is very difficult to remove lead dust from carpets and upholstered furniture.

These things make your job harder because you have to keep workers motivated. They may want to take the easy way out and do a superficial cleaning, and this cleaning may not pass post-abatement clearance inspection. The reason for doing abatement is to get rid of or reduce lead in a place where children may live, so not doing a good job is totally unacceptable. The abatement supervisor must be constantly aware, and must remind workers, how important this work is.

SOIL LEAD ABATEMENT

OBJECTIVE:

To present the current methods for abating lead-contaminated soil and the problems you may have doing this kind of abatement.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Describe the hazards workers have on soil abatement projects and the proper personal protective equipment required to protect workers from those hazards.
- List the soil abatement methods now available.

As a supervisor/contractor on a lead-abatement project, this section is important to you because:

- **you will be responsible for using proper abatement techniques;**
- **you will be responsible for controlling contamination;**
- **you are responsible for reducing exposure of abatement workers, their families, and the environment;**
- **you are responsible for community safety.**

SOIL LEAD ABATEMENT

I. Introduction

Lead in soil can be a hazard and should be addressed

Both HUD and U.S. EPA recognize the dangers of lead in soil. Hazardous levels of lead in soil were established by the U.S.EPA and published in the Federal Register on September 11, 1995 as interim standards (this is covered in more detail later in this chapter). A thorough paint abatement project should include abatement of soil with lead above the EPA recommended levels and dust in the area surrounding the building being abated. No one knows for sure how much of the soil and exterior dust around a lead-safe building have to be abated in order to protect the occupants of that building. Often, doing paint abatement adds lead contamination to nearby soil and exterior dust. Even though HUD tried to control and contain dust created in a paint abatement demonstration project they did in 1991, average amounts of lead in the soil increased a measurable amount (100 ppm) (HUD, 1991). This increase may have been caused by workers' tracking the dust with their shoes.

Many large soil and exterior dust-lead abatement projects have been done recently in the United States.

- Some projects have been completed in large urban cities.
- Some projects have been done in smaller communities, where mines and smelters are located. Their activities contaminated soil and exterior dust.

More abatement of lead contaminated-soil and exterior dust will probably happen in the future. People are becoming more aware and more concerned about the dangers of other sources of lead poisoning besides lead-based paint. Many government housing authorities are now dealing with soil lead issues. Sometimes soil abatement is done when large modernization projects involve regrading the soil. There are many ways to do soil abatement, such as soil removal and replacement, and the one used depends on how much lead is in the soil, and what the land is used for. Covering lead-contaminated soil with sod reduces exposure in the short-term, but this only lasts until the grass dies or is worn away.

II. Cincinnati Soil-Lead Abatement Demonstration Project

To give you some idea of how to do a safe soil abatement, we will refer to the Cincinnati Soil-Lead Abatement Demonstration Project. This project is a useful model because it is one of the few, if not the only, lead-abatement project that systematically monitored workers and the environment for lead exposure. The project found that the exposures were well below normal standards in the workplace.

The Cincinnati Project was one of three similar projects paid for by the U.S. Environmental Protection Agency (U.S. EPA) under the Superfund Amendments and Re-authorization Act (SARA). The other two projects were done in Boston and Baltimore. The major purpose of the Cincinnati study was:

- to determine whether three types of lead abatement used alone (or together) reduced blood lead levels in children. These children were under five years of age and lived in rehabilitated housing or non-rehabilitated housing that was in satisfactory condition.

The other purposes were:

- to decide whether these methods reduced the quantity of lead on the children's hands;

- to figure out how quickly the soil was recontaminated;
- to decide how cost effective the different methods of abatement were.

The three types of lead abatement used in the Cincinnati Project were:

- interior dust abatement;
- exterior dust abatement; and
- soil abatement.

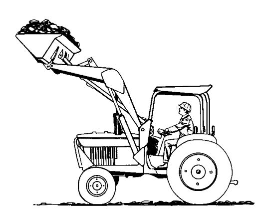
This section covers soil abatement. Exterior and interior dust abatement are considered in other parts of this chapter.

The abatement used the same steps as the ones described in Chapter M, "Project Organization - An Overview."

In most abatement projects, the environmental survey is done and the abatement team is put together before the contractor is hired. However, a contractor may be brought in to:

- test an abatement plan;
- work through or test abatement procedures;
- help develop abatement methods.

III. Soil Replacement



Normally, you don't have to develop special methods for soil replacement. When soil has been contaminated with toxic or hazardous materials, you remove the soil and replace it. Specialists are developing new methods that actually remove lead from the soil, and in the future, these methods may turn out to be more effective. Temporary (interim) methods for dealing with lead in soil, such as covering the contaminated soil with lead-free top soil and grass seed, sod, or other vegetation, can sometimes be effective. Combining these kinds of solutions with landscaping improvements can be more cost-effective.

Removing and replacing soil is a relatively simple process. The difficult part is to set up a process that:

- keeps contaminated soil away from the replacement soil;
- finds a source of lead-free top soil, as well as a place to dispose of the contaminated soil;
- protects the community;
- protects the workers;
- controls run-off of lead-contaminated soil caused by storm(s)/flooding;
- prevents contamination by lead-filled dust and soil that is blown about by the wind.

An important question is how deep do you have to go when removing contaminated soil? In projects where the soil contains extremely hazardous materials or chemicals that could contaminate the ground water, all contaminated soil is removed or isolated. Soil contaminated with less hazardous materials (such as lead) may either be removed or partly removed and covered with clean soil. You have to decide how deep to go to make sure that the clean soil provides a good protection against the contaminated soil. Depending on how contaminated the soil is, and what the purpose of the project is, soil lead abatement projects remove and replace between six and twenty-four inches of soil.

In residential abatement, you may work in both large and small sites. Some urban yards are only a few square yards in size. Other larger yards are sometimes surrounded by buildings. Because of this, residential soil abatement often means a lot of hand labor in addition to mechanical soil removal. When soil is removed by hand, it can usually be loaded into wheelbarrows. The soil in the wheelbarrows must then be off-loaded to other vehicles to be carried to the disposal site. It is probably more efficient to dump the soil into roll-off containers, instead of off-loading the wheelbarrows onto dump trucks. These containers can then be loaded onto trucks and transported to the disposal site.

IV. Mixing Soil

In most projects, you remove and replace contaminated soil. However, in some cases, you can mix soils with higher concentrations of lead and soils with lower concentrations. For example, a six or twelve inch column of soil that has a moderate level of lead (800-1000 ppm) near the surface and a lower concentration at the bottom (less than 200 ppm) may not have to be removed or replaced. You may be able to mix it so that the lead is distributed more evenly, and not so much is close to the surface where people can easily be exposed to it.

V. Alternative Soil Abatement

Current research in soil-lead-abatement may come up with new solutions. For example, it may be possible to extract lead from the soil, or encapsulate it so that people will not be exposed to it.

ELEMENTS OF SOIL ABATEMENT PROJECTS

The contractor's responsibilities in a soil abatement project are:

- Scope of Abatement Work
- Health and Safety
- Contamination Control
- Site Control

These items are discussed in the remainder of this section.

Scope of Abatement Work

1. The scope or purpose of the work is to reduce lead concentration in soil. You can do this by removing soil to a depth of from six to twenty-four inches, replace the lead-contaminated soil with top soil, take the contaminated soil to the disposal facility, cover the new soil with sod, and return the property to the condition it was in (as recorded in documentation) before the project began.

2. As the contractor, you must dispose of all waste materials that have been created by soil removal. You must follow all applicable regulations that control solid and hazardous wastes.

3. Once you have installed the sod, you may be required to maintain it until the end of the growing season. This may mean watering it regularly to keep it healthy. This is especially true for public properties such as parks and playgrounds. (Sometimes, you can plant seed, but it’s often

not practical because of how long the area will have to be protected to allow the grass to establish itself.)

4. The owner or project consultant is usually responsible for coordinating all activities in the abatement area with the people who live there. You may be asked to provide assistance.

5. If you find any personal belongings of the occupants on the property where the work is being done, contact the owner or project consultant and request that the occupants move their belongings. Never do any work when occupants' belongings are on the work site, unless the owner or project consultant tells you to go ahead.

6. Contact United Utilities Protection Service (UUPS) before you begin the job to find out the exact locations of all utilities. The UUPS is available in many communities and is usually listed in the phone book. The American Public Works Association (APWA) - (816) 472-6100, ext. 584 - can also give you local phone numbers for services that identify utility lines. If there isn't a UUPS in the community, contact the utilities directly.

7. Protect existing utilities during abatement. You are liable for any damage to existing underground and overhead utilities caused by your workers. You need to pay for any damage to these utilities as quickly as possible.

8. Be careful when removing fencing to allow workers access to the site. This fencing should be salvaged and reinstalled (if it does not contain lead-based paint) so that it is satisfactory to the owner. In some cases, you may have to

replace the fencing.

9. You are responsible for making sure that the fencing that has been removed is reinstalled correctly, in terms of position, dimensions, alignment with existing fencing, etc.

10. Abatement work near areas that have intentionally been excluded from the abatement, such as sidewalks, fences, trees, and patios, should be excavated at a 1:1 slope away from the excluded areas, because full excavation could damage them.

11. You should stop work at any time when weather or ground conditions (for example, rain or wind) keep you from having control of the operation. This decision will be made by the owner or project consultant. When this happens, you should immediately clean up the work area and stop work.

12. Before you begin the hauling operation, prepare an instruction sheet for the people operating equipment and driving the hauling vehicles. These instructions should cover such things as how to clean the vehicles, how to secure tarps and tailgates, the truck ticket system , how to unload the material, and what to do if the material is spilled.

13. Use fire hydrants only with the approval of the local water utility and follow their rules and restrictions. You are responsible for the cost of water used in your work.

14. Unless the owner or project consultant tells you otherwise, fill in the new soil two (2) inches above the previous level because the ground will settle, and you want to make sure that water drains away from existing structures.

15. Control the excavation so that you remove at least the minimum depth of soil required.

16. Tie trees and shrubs to keep them stable.

17. Scrape soil carefully from around roots within the drip line and do not undermine or damage the roots.

18. Remove soil from outside the drip line as you did within the drip line, but retain and preserve any large roots.

19. You will likely be responsible for replacing any shrubs that die as a result of the abatement work, at no extra cost to the owner.

Health and Safety

1. You must provide a workers' training program. In addition, you should also provide a set of occupational health and safety procedures to protect your workers, any one else who has access to the abatement site, and residents in the abatement areas.

2. As part of a site safety and health plan, all your employees should attend training sessions about the health hazards and dangers of lead-exposure on the job. You are responsible for the costs of having your employees attend these training sessions. All workers must receive this training before they can work on an abatement site. (You will find additional details on training in Chapter L - Employee Information and Training.)

Contamination Control

1. You must have strict rules about contamination control in place throughout the abatement to make sure that contaminated soil is excavated, handled and transported to the disposal site without being lost or spread around surrounding areas.

2. Make sure that there is no visible dust created by your operations at any time.

3. Use a load manifest system to keep an exact record of the time and location of disposal: when material leaves the site and when it arrives at the disposal area. The manifest should be a two-part ticket, provided by the owner or project consultant. One ticket is given to the abatement site inspector when the truck leaves, and the other is held by the contractor. The driver should give a copy of the disposal site ticket to the site inspector before the end of the work day on which the material was deposited in the dump site. For every truck departure ticket, there should be a corresponding dump site ticket. (The purpose of the manifest system is to ensure that the contaminated soil is not used as fill in residential areas. There are reports that this has happened in some areas.)

4. The site inspector should check all trucks, haulage vehicles and containers loaded with contaminated soil to make sure that there is no loose material sticking to the outside of the body, chassis, or tires. You should sweep up this material before the truck leaves for the disposal site.

5. To prevent work sites from contaminating each other, maintain a buffer zone at least one lot wide between soil removal and soil replacement operations.

6. Do not permit spilling or tracking of contaminated soil. To minimize this possibility, make sure that the dump trucks that remove the soil are loaded within five (5) feet of the edge of the excavation. Protect this area from contamination with 6 mil polyethylene.

7. To prevent work sites from contaminating each other, provide separate work crews and tools for the excavation and replacement operations. Or, use an effective method for decontaminating your tools. Be sure to get the owner's or project consultant's approval.

8. Make sure that all workers clean their boots thoroughly before they leave the work area. Put the soil removed from boots either in a truck used for hauling contaminated soil or leave it in the area where soil is being removed.

9. Clean all truck tires before the trucks leave the work area. Load this soil should onto the truck or return it to the lot being excavated.

10. A verification testing program should be used to monitor the contractor's performance in preventing recontamination of the replacement areas.

11. You, as the contractor, should supply and have available at all times water and water spraying equipment to control and prevent dust during soil removal. This is more important than any other work activity, and should be done

immediately whenever visible dust is generated.

12. For soil replacement , you should set up a truckload manifest system similar to the one for soil removal to make sure that only approved topsoil is used.

13. Never stockpile contaminated material onsite unless the project consultant or owner authorizes it.

14. Load soil directly into dump trucks or disposal containers. Do not handle contaminated material twice.

15. You should probably have two separate work crews and sets of equipment for soil lead-abatement projects, one for the soil removal and the other for soil replacement. Make sure that all equipment is clearly marked as removal or as replacement equipment. Never exchange workers or equipment (including trucks, earth-moving equipment, shovels, rakes, and other hand tools) between the removal and replacement work sites without decontaminating them first. The site inspector decides whether decontamination has been adequate. “Adequate” means removing all visible soil from the equipment in question.

16. Do not reassign trucks, excavation equipment, or haulage containers doing soil removal to soil replacement unless the site inspector authorizes it. When all excavation is done, the site inspector should inspect all equipment and vehicles. If they are contaminated, they must be cleaned to the site inspector’s satisfaction. All visible dirt should be removed from the vehicles.

17. Before doing soil replacement, clean all contaminated soil from walks, driveways, lanes and streets near the

excavation. Scrape, wash, and sweep all loose soil from those surfaces. No clean soil should be placed without the site inspector's approval.

18. During replacement, don't let workers or equipment come contact with contaminated soil. Workers and equipment should work on a barrier of clean soil.

19. At the end of the work day, collect all loose contaminated soil in the work area, transfer it to a dump truck, and dispose of it later. Collect as much of the loose soil as possible.

20. Clean all hard surfaces, such as sidewalks, paved driveways, and patios, at the end of each working day. Scrape, wash, and sweep all soil from those surfaces.

21. Wash the roadway and gutters and catch basins.

22. Begin clean-up early so you have enough time to do the job properly by the end the working day.

23. Put all soil that you remove from the work site in dump trucks to transport to the disposal site. Make sure that the truck has secure fitting tarps and sealed tailgates. Do not ever let soil leak from the trucks.

24. You can leave loaded trucks on the site overnight if the site inspector agrees that they are locked and secured properly. Don't leave loaded trucks onsite over the weekend. Clean any piece of equipment, including dump trucks or excavation equipment, before you remove it from the site. Decontaminate equipment by scraping soil from all surfaces and then brushing it to remove the soil. Put the soil you

remove in containers and dispose of it properly. Do this by parking the equipment on 6 mil polyethylene before you begin the decontamination.

25. On most soil abatement sites, removing the top layer of soil sometimes increases the hazard of lead exposure. This happens because the grass or other plants on the site act as a protective barrier. This is especially true if you are putting clean soil in top of contaminated soil (called “capping the site”). There may be more lead in the soil below the level you are excavating. There are two ways of being exposed to soil lead on a site:

    1. on-site
    2. off-site

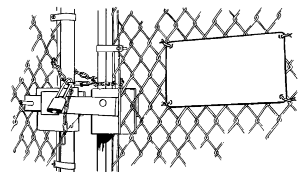
    Children playing on the soil could be exposed “on-site.” To prevent this, abatement workers must control access to the site, but they can only do this during the day. It is almost impossible after the end of the work day. You must post signs warning parents and children about the lead hazard.

    Wind or water erosion can cause “off-site” exposure by blowing or washing the soil away. Wind erosion can occur on any site. Water erosion usually happens on hilly sites. To keep this from happening, you could cover exposed sites with plastic. However, this is expensive and if the plastic is not secured properly, it could be blown off-site by a severe wind. You could dampen the site at the end of the work day to prevent wind erosion. Control water erosion with silt fences. You may have the same problems when stockpiling soil before finally disposing of it. In these cases, use a combination of plastic sheeting and silt fencing.

Site Control

1. To keep contaminated soil from being spread around, set working limits for each area of excavation. Restrict access to this area, and only let authorized personnel on site. Entry and exit should be controlled by the contractor's staff.

2. Fence the abatement work area with temporary fencing or barricades to keep unauthorized people and animals out of the work area.



3. Install yellow caution tape across doors on the property that are affected by the abatement.

4. Maintain ways for residents to get to their homes at all times. They should not have to pass through the excavation area unless the owner or project consultant approves this.

The abatement supervisor is responsible for the above tasks. To do this job, the abatement supervisor must:

- keep all abatement records;

- schedule enough trained workers to do the abatement in the time agreed to;

- obtain enough equipment to do the abatement in the time agreed to;

- make sure that replacement soil and sod are delivered on time;

- communicate with other people involved in the abatement to be sure that residents are told about the progress of the project and are prepared for the abatement.

In some abatement projects, the supervisor may have to decide which properties to abate. In others, the supervisor may be given lists and/or drawings showing what areas to abate. Because the supervisor may have to interpret sampling results, he/she should know about appropriate sampling procedures (called “protocol”). **The protocol for sampling and the action level for abatement maybe different depending on where the abatement is done.**

One of the requirements of Title X was that U. S. EPA set up standards for hazard levels of lead in soil. In July of 1994 interim standards were released. The current EPA & HUD interim standards are:

- 400 to 5000 ppm lead in bare soil which is used by children requires response (that is, at a minimum, some interim action, such a planting grass or sod on the affected area);

- 2000 to 5000 ppm lead in bare soil where contact by children is less likely requires response;

- >5000 ppm lead requires abatement.

EXTERIOR DUST REDUCTION & CONTROL

OBJECTIVE:

To present the reasoning behind exterior dust reduction & control and the problems related to doing this work.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Describe the dangers to workers on exterior dust reduction projects and the proper personal protective equipment required to protect them from those dangers.
- Describe the order of abatement in a combined paint, soil, and dust abatement project and explain why that order is important.
- List the types of cleaning equipment used for exterior dust reduction.

As a supervisor/contractor on a lead-abatement project, this section is important to you because:

- **you must use proper dust control techniques;**
- **you must control contamination;**
- **you are responsible for reducing exposure of workers, their families, and the environment;**
- **you are responsible for community safety.**

EXTERIOR DUST REDUCTION & CONTROL

I. Introduction

Exterior dust reduction and control are important because there can be a lot of lead in street dust. In fact, contaminated dust is the main way people are exposed to lead. Children can be directly exposed to soil lead, and they can also be exposed to lead in exterior dust. Exterior dust can be moved inside homes in many different ways (by children, by adults, by pets, by the wind). Once it is inside homes, children can be exposed very easily. The amount of lead in exterior dust can be more than 100,000 ppm (which means that 10% of the dust is actually lead). Levels this high have been measured in urban areas. The Cincinnati Soil Lead Abatement Demonstration Project did extensive exterior dust abatement.

II. Sequence of Abatements

In an abatement of an area that includes paint, soil, exterior dust, and interior dust, you do the abatements in the following order:

1. Abate lead-based paint on the outside of buildings first. You do this first because this process can contaminate the soil. This is likely to happen because it is hard to “contain” outsides of buildings.

2. Abate the soil next, because the soil acts like a collector (reservoir) of lead in the environment. Do this step before the exterior dust abatement because you can contaminate paved surfaces during the abatement process. During soil abatement, you will probably have to clean the streets continuously to contain dust that is escaping from the site.

3. Abate exterior dust after the soil abatement.

4. Finally, abate interior paint, then interior dust. The interior dust abatement is actually part of the interior paint abatement because it is part of the final clean-up. The interior abatements are done last because interiors can easily be contamination by outside sources of lead. If you do interior abatement properly, there isn't much chance that you will contaminate surfaces outside the building. As part of a final clean-up procedure, you may need to do some exterior dust abatement.

If you do interior <u>and</u> exterior dust and soil abatement, you would do it in the same order. Do soil first, followed by exterior dust, and finally interior dust. Occasionally, you might do exterior dust by itself. For example, you might do it in a neighborhood that was contaminated by a lead-based paint abatement that was done incorrectly. This kind of contamination could happen if a contractor or owner burned, sand blasted, or sanded lead-based paint from a structure. You might also do exterior dust abatement on a regular schedule if industrial and/or mining activities contaminate exterior dust.

III. Exterior Dust Removal Equipment

To abate exterior dust, remove as much dust and dirt as possible from all paved surfaces. Lead-contaminated dust can be found on streets, street gutters, sidewalks, alleys, patios, parking lots, etc. The paved surfaces are made of many different materials, such as asphalt, concrete, and paving bricks. Things like old brick-paved alleys are the hardest to clean.
To do this job effectively, you must use very efficient pavement sweeping equipment. This equipment can range from HEPA-

equipped vacuum cleaners, that you use in small areas, to large pavement cleaning machines used to clean streets, alleys, and parking lots.

There are at least four different types of pavement cleaning machines:

- Broom sweepers - traditional street sweeping machines. EPA research has found that these machines remove only a little bit of the dust so they shouldn't be used for lead-abatement work.

- Vacuum-assisted sweepers - a machine like the traditional broom sweeper, with a slight vacuum that helps control dust and carries dust from the broom bristles to the hopper.

- Vacuum sweepers - machines that vacuum material from paved surfaces. Some pavement vacuums have curb brushes that carry the material from the curb to the vacuum head and then into the hopper.

- Regenerative air machines - machines that move air rapidly (which creates a cyclone effect) and grab dirt from the surface of the pavement and move it into a hopper.

You can usually get the last three types of equipment, either from commercial cleaner contract services of from agencies that maintain parking garages and other paved areas.

These machines work differently because they were designed for different purposes. Some machines were designed for sweeping street curbs. Others were designed for parking lots or airport tarmacs. The machine you select for exterior dust abatement should be able to clean a wide variety of areas. Before choosing a sweeping machine for an abatement project, you should evaluate how efficient the machine is. There is a wide range in the percentage of dirt and dust picked up by different machines.

Equipment Testing

Testing the efficiency of street cleaning equipment always eliminates traditional broom-type sweepers. When you watch these machines, you can see that they leave a lot of visible dirt on the pavement and that they create a lot of dust in the air. Studies show that these machines often remove much less than half the dust in the area they area they have “cleaned.”

Other studies done at the University of Cincinnati tested several types of street cleaning equipment. The machines tested were the vacuum-assisted sweeping machine, the vacuum sweeper, and the regenerative air machine. Those tests showed that several machines were more than 90% efficient. (A machine that is ninety percent efficient picks up ninety percent of the available dirt after two passes.) UC researchers tested both large machines made for streets and parking lots and some walk-behind vacuum-assisted broom-type sweepers, made for sidewalks and other smaller areas. Several large machines were ninety percent efficient (or better). Most of the smaller walk-behind sweepers didn’t meet that standard.

For this type of abatement job, you also have to find a method for emptying the machine. Most pavement sweeping machines are not meant to control dust when they are being emptied, so you have to develop a way to do this safely. The best thing to do is to dampen the contents of the hopper and use hoses to help control the dust. Be sure to use enough water to dampen the dust that is being emptied from the hopper.

If you use water for dust control, you have to contain excess water so it doesn't run off. Do this by putting 6 mil polyethylene on the ground where the equipment is being emptied and carefully collect the water after the hopper has been emptied. Do this in a secure area away from residents and workers.

Abatement Organization

Once you have chosen the equipment for the abatement, you need to select the staff to do the following tasks:

1. the abatement work;
2. obtaining and updating permits for street closing;
3. posting temporary no-parking signs and barricades;
4. advising residents and business operators when abatement will occur;
5. coordinating movement and storage of material.

The following work activities were useful in the U.S. EPA-supported Cincinnati Soil Lead Abatement Demonstration Project (part of the Three-Cities Study).

Scope of Abatement Work

1. Clean all paved surfaces within the abatement area. These surfaces include private walks, driveways, patios, parking lots, etc., on private property (where you have gotten permission to work); and public walks, streets, gutters, and alleys. The paved surfaces should be cleaned of all sand, grit, and dust. You will also have to clean the other dirt normally found on city streets; i.e., litter, glass, weeds, etc.

2. Removing as much street dust as possible is the ultimate

goal of the exterior dust abatement process. Do not recontaminate the work site by using (or misusing) faulty equipment, or by not following required procedures.

3. Visually inspect all paved surfaces after the cleaning. If you can still see dust or dirt that has not been removed during the cleaning process, clean the area again.

4. First, remove the heavy collections of street dust and debris. You can do either by manually removing the material with scrapers, shovels or brooms, or by vacuuming if that works. As with lead-contaminated soil, dampen the street dust if you can see that dust is being created during cleaning.

5. Clean small areas, such as sidewalks and patios where you can't use large street-sweeping machines, with a HEPA filter-equipped vacuum cleaner. Vacuum surfaces over and over again until you can see that no more dust is being removed.

6. After the initial cleaning, complete the job by using the appropriate vacuum or sweeper at the specified rate.

7. Transport and dispose of all waste materials created during the dust removal process according to the contract specifications.

8. Repair any damage to the occupant's property during abatement work. Do repairs immediately, and make sure they meet the approval of the owner or project consultant.

9. Be sure that you only operate power equipment during the hours permitted by local regulations.

10. Clean catch basins if necessary.

11. Begin clean-up procedures early enough so that you can complete them before the end of the working day.

12. Make sure that fire hydrants are accessible and not blocked.

13. Use fire hydrants or an adequate portable water supply as a source of water.

14. Use fire hydrants only with the approval of the local water authority be sure to follow its rules and conditions.

15. You must provide electricity and other utilities as required.

16. You are responsible for getting all permits and approvals required by the local authority to work on or to close streets and/or sidewalks.

17. Only work on public rights of way if you have gotten the approval of the road authorities.

18. Make sure that streets have one lane open to traffic at all times.

19. Make sure that pedestrians and vehicles can get into nearby properties.

20. Put traffic signs back in their original positions and make sure that the signs are not hidden.

21. Before you start work, be sure to get agreement, signed by the property owner and the contractor, giving you permission to do the cleaning work. You should get copies of these contracts before you schedule work on the site.

Health and Safety

1. You must follow a set of occupational health and safety procedures to protect workers and residents in the abatement area.

2. Follow local regulations about noise levels.

3. Provide hearing protection to your workers if they need it.

4. Do your job in a workman-like manner, paying special attention to the safety of workers and the public.

5. Follow a Site Safety Plan that meets or exceeds the minimum needs of the workers, the OSHA Regulations that apply, and any other regulations that concern this type of work.

   You have the ultimate responsibility for the safety of workers and others.

6. Operate the equipment properly when doing the abatement work as described in the contract documents.

7. Before beginning the cleaning operation, prepare an instruction sheet for the equipment operators, telling them such things as how to use the equipment, how to clean it, and how to dispose of waste material.

8. Give copies of the instruction sheet to the owner and/or project consultant so they can approve it, and give copies to all operators before beginning the cleaning.

Contamination Control

1. Make sure that no visible dust created by your work at any time.

2. If the owner or project consultant tells you that weather conditions make it impossible to work effectively or safely, you must stop all work, and leave the site.

3. Never pile up or collect dust, sand, debris, etc., on the worksite.

4. Load dust, sand, and debris directly into containers for or disposal. Do not double handle the material.

5. You must provide water and spraying equipment to control and prevent any visible dust during the abatement. This water must be available at all times. Spraying water to stop visible dust in the air is a very important activity and should be done immediately if visible dust is present.

6. Keep the street and work area clean enough to satisfy the owner and project consultant at all times. You should not be able to see any contamination from abatement activities.

7. Clean up any oil and fuel spills from equipment immediately. Use absorbent and cleaning materials. You must make arrangements ahead of time to handle these situations.

8. Place all dust and debris removed form the worksite in dump trucks or pavement cleaners, then transport it to the disposal site. Dump trucks must have secure-fitting tarps and sealed tailgates. The dump trucks must not leak at any time.

9. You can leave loaded trucks on the site overnight if the inspector agrees that they are secured properly. Never leave loaded trucks onsite over the weekend.

X. Summary

In an exterior dust-abatement project, the abatement supervisor has basically the same responsibilities as the supervisor in a soil abatement project. Your job is to do the abatement tasks as described above. To fulfill your responsibilities, you must:

- keep all abatement records;
- schedule enough trained workers to do the abatement in the time agreed to;
- get enough equipment to do the abatement in the time agreed to;
- obtain permits for work on public streets with time to spare;
- make sure that streets are blocked off and traffic control signs are posted (you can't abate dust from gutters if cars are parked on street.);
- communicate with other people involved in the abatement process to make sure that residents and other groups in the

neighborhood (businesses, schools, religious organizations, etc.) know about the progress of the project and are ready for the abatement.

On the following pages are examples of owner and occupant agreements. You should consider similar agreements for abatement projects. Although you will not be responsible for preparing and executing these agreements, you should know about them and how you need to work with the parties involved.

APPENDIX N-1
SAMPLE AGREEMENTS

OWNER AGREEMENT (Interior Dust)

THIS AGREEMENT, made this _____ day of ___________ 19 __, by and between _____, hereinafter called ______, and ____, hereinafter called the Owner.

______ and the Owner agree as follows:

1. ______, for purposes of reducing potential lead exposure, will reduce the amount of dust in Owner's building located at: ____

2. The purpose of this abatement is to reduce the availability of lead dust to residents within the building. The goals of the research project call for the removal or abatement of lead containing dust in the environment. We presently have no knowledge of the concentration of lead in the dust in Owner's building. If permission is granted, ___, through bonded Contractors, will remove as much dust as possible consistent with project design and budgetary constraints from specified areas in and around Owner's building.

3. ______ agrees to remove dust from the exterior paved surface(s) through a combination of sweeping and/or vacuuming.

4. ______ agrees to remove dust from the common hallways and stairways through a process of vacuuming and damp mopping.

5. ______ agrees to remove dust in at least one of the apartments located in Owner's building. The resident(s) of each apartment to be cleaned or abated have previously agreed to be a part of the research project and have signed a separate Occupant Agreement granting permission for such abatement or cleaning.

6. ______ will employ a competent Contractor to perform the abatement work.

7. ______ will restore the Owner's property to the conditions as far as may be reasonable that existed prior to the commencement of the abatement except for the improvements described in this agreement. Prior to commencement of abatement work, ______ will make a photographic record of the present state of the property and will provide a copy to the Owner, along with a schedule of the proposed work, if requested. Immediately prior to the commencement of the abatement work, the Owner may require a more complete and detailed photographic record which will be retained on file and may be viewed at the discretion of the Owner and ______.

8. ______, along with its Contractors, assumes full financial responsibility for the proposed work.

9. ______ will and shall indemnify the Owner against any liens placed on behalf of the Contractor, the Subcontractors and materialmen.

The Owner understands that ______ is doing the work without acknowledging any liability for the presence of lead in the residence and ______ is not purporting to remove 100% of any lead present in the dust at the time of abatement.

SIGNED: ______________________________ DATED: __________________

SIGNED: ______________________________ DATED: ___________________

OCCUPANT AGREEMENT

THIS AGREEMENT, MADE THIS________________ day of ________________19___, by and between the _____, hereinafter called ______, and____, residing at ________ ________________________, hereinafter called the Occupant(s).___________ and the Occupant(s) agree as follows:

1. **______, for the purposes of applying techniques for reducing lead which may be present in the residence and surrounding area will reduce the amount of dust present in the residence. This abatement or cleaning will be limited to that which is practical as a result of budget and time constraints.**

2. **______, through a bonded cleaning contractor, will vacuum the floors and wood trim and damp mop all hard surface floors in the residence.**

3. **______ will replace one sofa and one chair owned by the Occupant. The sofa and chair to be replaced will be designated by ______ and a new sofa and chair will be selected by the Occupant from a catalogue presented by a representative of ______ at the time this agreement is executed.**

4. **______ may replace some carpeting owned by the Occupant now present in the residence. The carpeting to be replaced will be designated by ______ at the time this agreement is executed. The new carpeting will be selected by the Occupant(s) from some samples made available to the Occupant(s) at the time this agreement is executed.**

5. **The existing carpeting designated at the time of this Agreement and the Occupant's furniture designated at the time of this Agreement will become the property of ______ at the time when the new carpeting and new furniture selected by the Occupant(s) is delivered to the Occupant(s). The Occupant's carpeting, sofa and chair designated to become the property of ______, will be removed at the same time. The new furniture and carpeting supplied under this Agreement will become the property of the Occupant at the time of this exchange.**

I/We understand that ______ is doing the work without acknowledging any liability for the presence of lead in the residence and ______ is not purporting to remove 100% of any lead dust present in the residence at the time of abatement.

SIGNED: _____________________________ DATED: ____________

________________________________ ____________

OCCUPANT(S)

LIMITED RELEASE OF LIABILITY

In order to complete the cleaning of the dwellings of the families participating in the project, the __________ employs a bonded contractor to perform the work. The contractor is responsible for any damage or breakage resulting from the actions of its employees. The contractor and the _____ assume no liability for the loss or disappearance of jewelry and/or money belonging to families participating in the project. While the contractor is working in the dwelling of a family participating in the project, that family must remove or personally guard all money and/or jewelry.

By signing this form the participating family releases the contractor and __________ from any liability associated with the disappearance or loss of any and all monies and jewelry belonging to that family.

SIGNED: ________________________________

____

DATED: ________________________________

OWNER AGREEMENT (Exterior Dust)

THIS AGREEMENT, made this __________ day of _________________ 19___, by and between __________________ _____, hereinafter called___________, and ___________________________________, hereinafter called the Owner.

_______________ and the Owner agree as follows:

1. **_____, for purposes of reducing potential lead exposures, will reduce the amount of dust on paved surfaces on your property located at ____.**

2. **The purpose of this abatement is to reduce the availability of dust to residents within the neighborhood. The goals of the project call for the removal or abatement of dust in the environment. _____, through bonded Contractors, will remove as much dust as possible consistent with project design and budgetary constraints from specified areas on the Owner's property.**

3. **_____ agrees to remove as much of the dust as practical from the exterior paved surface(s) through a combination of sweeping and/or vacuuming.**

4. **_____ will restore the Owner's property to the conditions as far as may be reasonable that existed prior to the commencement of the abatement except for the improvements described in this Agreement. Prior to commencement of abatement work, _______________ will make a photographic record of the then present state of the property and will provide a copy to the Owner, along with a schedule of the proposed work, if requested. Immediately prior to the commencement of the abatement work, the owner may require a more complete and detailed photographic record which will be retained on file and may be viewed at the discretion of the Owner and _________________.**

5. **_____ will obtain an agreement from the Occupant of the property, if necessary, if other than the Owner, prior to the commencement of the abatement work.**

6. **_____, along with its Contractors, assumes full financial responsibility for the proposed work.**

7. **_____ will and shall indemnify the Owner against any liens placed on behalf of the Contractor, the Subcontractors and materialmen.**

The Owner understands that _____ is doing the work without acknowledging any liability for the presence of lead on the property, and _____ is not purporting to remove 100% of any lead present in the dust at the time of abatement.

SIGNED: ______________________ DATED: ________________

SIGNED: ______________________ DATED: ________________

OCCUPANT AGREEMENT

I/We____________________________________, the Occupant(s) of property at_________________________, __________________, the Owner of which is participating in the _____, project concerning the removal and replacement, or the tilling of lead contaminated soil on the above-mentioned property. In consideration of _____ undertaking the removal or tilling of the contaminated soil; I/We do hereby acknowledge that during the removal of soil, it may be necessary to temporarily remove items of personal property from the contaminated areas. It is understood and agreed that if I/We do not remove and store our personal property, the Contractor selected by the _____ to perform the work of removing or tilling the soil will be required to move or remove and store our personal property. It is understood and agreed that due care will be taken in moving or removing, storing and replacing items of personal property. I/We hereby release the _____ from all claims for loss or damage to such personal property while being temporarily moved or removed and stored or while being replaced on the above-mentioned property.

DATED: ___________________________

OCCUPANT: ___________________________

____

OWNER AGREEMENT (Soil)

THIS AGREEMENT, made this________________ day of _________, 19 ___ by and between the
_______________, hereinafter called ___________, and _____________________________________,
hereinafter called the Owner(s).

______________________ and the Owner(s) agree as follows:

1. ______, for purposes of reducing potential lead exposure, will reduce the amount of lead-contaminated soil on the Owner's property located at _____________________________________. The lead concentration of the soil will be reduced to a level consistent with guidelines established by the project.

2. In those abatement situations where guidelines call for the replacement of soil, the new soil will be tested for lead concentration prior to installation. The new soil is not warranted to be lead free, but will have as low lead concentration as practical based on market availability. The replacement soil will be tested for known pesticides and some known carcinogens. If any known tested contaminates are found, the soil will not be used. ______ does not warrant the soil against contamination by unknown and/or untested contaminates.

3. The following guidelines will be used in determining the method of abatement. If the average lead concentration in the soil in the l5cm column is 500ppm or higher, regardless of the adequacy of the grass cover, the soil will be removed and replaced and the area re-sodded. If the average lead concentration in the column is less than 500ppm but the average concentration in the top two (2)cm is 500ppm or higher, regardless of its grass cover, the area will be cultivated, to reduce the concentration in the top 2cm to less than 500ppm, and re-sodded. For areas where grass cover is adequate and the lead concentration is less than 500ppm in both the top 2cm and in the column, no abatement will occur. If the soil lead concentration in the top two (2)cm is 300ppm or higher, but less than 500ppm, the average concentration in the column is less than 500ppm and the grass cover is inadequate, the area will be re-sodded. No soil abatement will occur where the grass cover is inadequate, but the concentration in the top two (2)cm is less than 300ppm and in the column is less than 500ppm.

4. ______ will employ a competent contractor to perform the abatement work.

5. ______ will restore the Owner's property to the conditions as far as may be reasonable that existed prior to the commencement of the abatement except for the improvements described in this Agreement. Prior to commencement of abatement work, ______ will make a photographic record of the then present state of the property and will provide a copy to the Owner, along with a schedule of the proposed work. Immediately prior to the commencement of the abatement work, the Owner may require a more complete and detailed photographic record which will be retained on file and may be viewed at the discretion of the Owner and ______.

6. ______ will obtain an agreement from the Occupant of the property, if necessary, if other than

the Owner, prior to commencement of the abatement work.

7. ______, along with its Contractors, assumes full financial responsibility for the proposed work.

8. ______ will and shall indemnify the Owner against any liens placed on behalf of the Contractor, the subcontractors and materialmen.

The Owner understands that ______ is doing the work without acknowledging any liability for the presence of lead in the residence and ______ is not purporting to remove 100% of any lead present in the soil at the time of abatement.

____________________________ DATED: ______________

____________________________ DATED: ______________

OWNER

INTERIM CONTROLS

OBJECTIVES:

To present information regarding proper and appropriate interim controls for the control of lead-based paint, dust, and soil hazards.

LEARNING TASKS:

Supervisors/Contractors should be able to:

- Describe the principles of interim control of LBP hazards:
    - When Appropriate
    - Determining the Scope
    - Qualifications of Contractors
    - Resident Protection During Control Activities
    - Proper Waste Disposal
- Describe the paint film stabilization process.
- Describe friction and impact surface treatment.
- Describe dust removal and control.
- Describe soil interim controls.

Please note that this section contains Chapter 11, "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing," in its entirety.

This section is important to supervisors/contractors who plan to perform interim control measures because proper methods are necessary to assure the protection of current and future occupants, workers, workers' families, and themselves.

SAMPLING FOR LEAD & POST-ABATEMENT CLEARANCE

OBJECTIVE:

To present methods for monitoring worker exposures and for testing paint, soil, and settled dust.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Explain the use of XRF instruments, paint chip sampling, and field chemistry to test for lead in paint.
- Interpret lead-based paint inspection and risk assessment reports.
- Explain how post-abatement clearance testing is done, and list the post-abatement clearance levels for lead in settled dust.
- Describe how airborne lead is monitored on a lead abatement project.
- Explain why it is important for a third-party inspector or risk assessor to do final clearance sampling.

As a supervisor/contractor of a lead-abatement project, this section is important to you because:

- **you must know and understand the limitations of the methods used to complete the environmental survey;**
- **you need to know the procedures for clearance testing at the end of active lead abatement; and**

- **you may have to do worker monitoring to comply with the OSHA Interim Final Lead in Construction Standard (29 CFR 1926.62).**

INTRODUCTION

We provide the following descriptions of paint, dust, and soil collection methods for your information. Only licensed, certified lead inspectors and risk assessors should collect these types of samples and report results to owners. However, you may have to use an inspection report to bid on a job that requires you to remove all the lead-based paint or lead-contaminated soil. Or, as a supervisor, you may need to decide where there is other lead-based paint in the home that might be disturbed by the work you are proposing. Being able to interpret the reports is essential.

Contractors & supervisors can collect air monitoring samples

OSHA requires that employers measure workers' average exposure to lead in the air for each task. This air monitoring can be done by the employer (usually by the supervisor) or by an industrial hygienist hired by the employer (for "third-party" measurements). It is better to have these samples collected by industrial hygienists, for the same reasons that it is a good idea to have clearance samples taken by a third-party. This avoids conflict of interest or the appearance of conflict of interest. It is in the employer's best interest to have worker exposures as low as possible. If a worker is injured by being exposed to lead or other toxic chemicals, measurements from a third party are much more believable than ones collected by the employer. If the supervisor (or other contractor employee) collects the personal air samples, we recommend that these people get additional training in air sampling.

Lead-Based Paint Inspections versus Risk Assessments

Contractors & supervisors must understand inspection & risk assessment reports

You may sometimes need to read and understand an inspection or risk assessment report. See the end of this chapter for a sample of each of these items. You can also refer to the student manuals for lead-based paint inspectors and risk assessors.

Lead-based paint (LBP) inspections and lead risk assessments are done for different reasons.

Purpose of a lead inspection

> In a lead inspection, any surface coated with paint, shellac, varnish, stain, coating, or coated surface covered by wallpaper, is tested to see if there is LBP in the dwelling. It also includes preparing a report that describes the locations where LBP was found.

So, ALL painted and varnished surfaces are tested during a LBP inspection, but, usually, dust, soil, and water samples are not collected. You can't tell from an inspection report whether dust in the home or soil outside the home contains lead and needs to be treated. Because of this limitation, you might want to have dust and soil sampled before the abatement begins, so you can establish what the levels were before you began abatement work. (Some states require pre-abatement soil testing if exterior lead work is to be done.)

Purpose of lead risk assessment

> The purpose of a lead risk assessment is to find out whether there is a lead hazard present, what kind, how much, and where it is located. It also includes a report that explains the findings and presents ways of treating the lead hazard that

has been found.

During a risk assessment, the risk assessor tests chewed surfaces and deteriorated paint, not all surfaces. For this reason, there may be LBP in the home that is not identified. If you are reducing some lead hazards, there may be advantages to treating other surfaces which contain lead-based paint.

For example, a risk assessment report notes deteriorated LBP on windows. You have been asked to remove the windows and replace them with new aluminum windows. Exterior siding paint was not tested during the risk assessment because it was not deteriorated. If the siding paint contains lead, your work may contaminate the foundation soil from chips of lead paint. So, you should recommend the siding be tested before you begin work.

A risk assessment also tests settled dust and bare soil. Water may or may not be tested.

In some instances an owner may request a combined lead risk assessment and lead inspection. Usually, because of the cost, owners will choose one or the other depending on their needs.

The remainder of this chapter discusses how paint, dust, and soil are sampled. This information should help you interpret both inspection and risk assessment reports.

Sample Collection

The first part of testing for lead is collecting samples in the field, or

sometimes, doing direct field tests for lead. There is a lot of information available on how to collect samples, but not very much information on how to choose the location where you take the sample. Some state regulations require different collection locations than federal guidelines, especially for soil. And even though there is a lot of information available on collecting samples, and a lot of training required for lead inspectors and risk assessors, we have seen many samples collected improperly.

Since states have different requirements for collecting samples, we emphasize the sampling procedures specified in the HUD Guidelines. See the Lead Inspector and Risk Assessor course manuals for more information on sample collection.

<u>Sample Analysis</u>

Samples are collected in the field and sent to laboratories for analysis. Laboratories follow specific procedures or approved methods when they process the samples. Laboratories also participate in laboratory proficiency programs, if they exist, for different types of analyses. For some types of analyses, the lab must participate in the program. A laboratory recognized by the U.S. Environmental Protection Agency National Lead Laboratory Accreditation Program (NLLAP) should be used for lead-based paint analysis. NLLAP was established by U.S.EPA in order to assist people in the selection of laboratories capable of analyzing samples containing lead. A list of laboratories recognized by NLLAP can be obtained by calling the National Lead Information Center at 800/424-LEAD.

TESTING FOR LEAD IN PAINT

I. Introduction

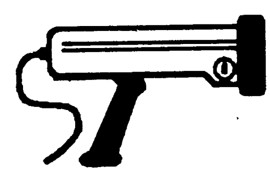
Lead in paint may be determined by one of three methods:

I. XRF Analysis
II. Paint Chip Sampling
III. Wet Chemical Field Testing

Each of these methods is discussed below.

II. X-Ray Fluorescence (XRF) Testing

How do XRF instruments find lead in paint



Theory

X-rays are like radio waves because both are part of the electromagnetic wave spectrum. However, X-rays are dangerous because they carry a lot of energy with them. If an X-ray strikes an atom, it can damage the atom. Since all living things are made up of atoms, exposure to X-rays can be dangerous to health.

Fluorescence is the giving off of electromagnetic waves by an atom when something excites (hits) it. An example of fluorescence is a "black light" (a purple looking light - ultraviolet light). When you shine black light on certain paints they give off a visible light or glow. This is the basic concept used in an X-ray lead paint detector. A radioactive X-ray source is used to excite the lead atoms in a painted surface. As the surface returns to its normal state, is fluoresces. The fluorescence is sensed by a detector and displayed

on a digital readout.

X-ray fluorescence, used for lead detection, is defined as "exciting an atom with X-rays causing the excited atom to give off its characteristic X-rays." So we excite (shoot) an atom with X-rays and it, in turn, fluoresces and gives back an X-ray of a specific (and different) frequency that we can measure. The X-rays we shoot the atom with cannot be the same frequency as the ones we want to measure.

Available XRF Analyzers

X-rays have different frequencies, just like different radio stations. Different elements give off different X-ray frequencies. This means that if we know what frequency we are "tuned" in to, we know to what elements (lead, for example) we are listening to.

Direct read XRF instruments

If we are only interested in one "radio station," we can build a cheaper radio because we don't have to pay for a frequency tuner. Two X-ray fluorescence (XRF) analyzers use this single frequency idea and are called direct-read instruments because they show the amount of lead in the paint film on a digital display.

XRF spectrum analyzers

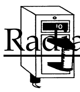
If we build an XRF analyzer that we can tune to many different frequencies, we will be able to detect different atoms, for example, lead, iron, zinc, titanium, etc. This is called a spectrum analyzer because it can analyze a range (or spectrum) of items. Several spectrum analyzers specifically designed for lead paint inspectors are available on the market. See Appendix O-1 for a list of the direct read and spectrum analyzers that are currently available.

Source of X-rays

Where do we get the X-rays that we shoot at the lead atoms to excite them? Most dentists' offices have X-ray machines that use electricity, but they are too large to be useful for our work. Because of size and energy requirements, the only practical way to get the right X-rays is to use nuclear materials. We use radioactive isotopes such as Cobalt 57 and Cadmium 109 which create the X-rays that cause lead to fluoresce. Cobalt has a chemical symbol, "Co," just as lead has the symbol "Pb." Cadmium has the symbol "Cd".

Radioactive materials in XRF instruments

Cobalt 57 (^{57}Co) generates gamma rays which are very dangerous, high energy X-rays. These X-rays are created as the Cobalt decays and changes to another atomic form. When you think of radioactive energy, imagine a light bulb that stays on even when it is not plugged in. In fact, this nuclear light bulb cannot be shut off, no matter what. This creates a problem because the X-rays this atomic light bulb gives off are very dangerous. We have to shield the Cobalt until we are ready to shine it on the material we are testing. The shield we use must open and close so that the ray can shine on the specific area we want to analyze. We use the word "shine" because light rays are electromagnetic and have properties like X-rays. So we can tilt and focus the Cobalt's gamma rays on the material we want to analyze, just as we can focus a flashlight beam on an object. Think of it as a flashlight with a shutter in front of it that you want to open and close. It's hard to keep light from escaping through the shutter, and its just as hard to keep some of the gamma rays from escaping. No matter how hard you try, some leakage occurs. All X-ray analyzers give off some radiation even when their shutters are closed.



Radiation Protection

Protection from radiation

To protect yourself from harmful X-rays, you must never misuse the analyzers. First you must know where the radiation comes out. Keep all body parts as far away as possible from the radioactive areas. Avoid "shooting" yourself and others with the instrument by keeping the source pointed away from people. Anyone trained in the use of the XRF should know the dangers of radioactivity in the analyzer and keep away from it.

Curious people, especially children, can accidentally cross the radioactive path and can be exposed to dangerous gamma rays. Unlike the light or radio waves, X-rays, especially gamma rays, can go through solid objects like wood and plaster. Keep children and women of child-bearing age out of the housing unit being tested. If this is impossible, have them stay in a different room, at least ten feet away from any surface you are testing. For example, don't shoot a wall while people are sitting right on the other side. Although some experts think that ten feet is a safe distance, it is better never to expose anyone to the source of radiation.

Monitoring people's exposure to radiation is different than protecting them from it. Monitoring only records how much you have been exposed when using the X-ray analyzer, it doesn't prevent radiation sicknesses. The item often used to monitor a person's exposure is called a dosimeter. Usually the dosimeter is a badge that you wear on your body. Women should wear it in the breast area, and men should wear it on their belts near the groin, because those are the areas most sensitive to radiation. You change your badge every month and it is sent out for analysis to find out if you have been exposed. It is even better to wear a second badge on one of the fingers of the hand that uses the analyzer, because that hand probably gets more exposure than any other part of the body.

Interpreting XRF Instrument Readings

The available XRFs are all built differently. The detectors that count the returning X-rays are significantly different. However, none of these test detectors can tell us if the X-rays they count are from the lead fluorescing or from the X-rays that are deflected (bounced back) from the source (^{57}Co or ^{109}Cd). This bouncing back is called "back-scattering." Usually, the more dense the material you are testing, the higher reading you get, because more dense materials back scatter more X-rays. Each machine has a built-in method for adjusting for the various types of substrates that you find lead paint on. Substrates like wood, sheet rock, and metal can all affect the XRF's readings differently, making them read higher or lower than they should.

For some instruments the built-in method for adjusting for various substrates is not adequate when lead loadings are near 1.0 mg/cm^2. For these instruments the lead inspector must perform a substrate correction. If the substrate correction process does not work, the inspector must collect a paint chip sample.

To correct an XRF's reading, we first test the same substrate by placing a standard reference material (something like a standard paint chip, but which has a known amount of lead in it) on an unpainted area of the substrate. We either locate bare substrate material in the dwelling or scrape the paint from a small area. We then take a series of readings on the reference material that has been placed over the bare substrate. Since we know how much lead is in the reference sample (or spike, as it is also called), we can tell what effect the substrate has on the XRF reading, and allow for it. This "allowance" is called a "correction factor" and we subtract it from readings that we take on similar substrates. This process reduces the amount of the error but does not completely eliminate it.

The lead paint XRF analyzers are portable, and read milligrams of lead per square centimeter (mg of lead/cm^2). The reading an XRF gets is <u>not</u> the same as percent of lead by weight because XRFs read in weight per unit of surface area. Percent lead is the weight of lead compared to the entire weight of the dried film. For example, suppose that we made some paint and put 1% lead in it. We apply one coat of paint of average thickness and measure it dry with the XRF. It reads 2 mg/cm^2. When we apply a second coat of paint, it reads 4 mg/cm^2 because there is twice as much lead in the same area. However, when we analyze a chip of this paint, the lab tells us it is 1% lead no matter how many coats of paint we apply.

If you were to apply a third coat of paint, which contained no lead, the XRF reading would not be higher than the 4 mg/cm^2 because you did not add more lead. The percent of lead in the paint chip would be less than 1% because you added more material to the paint film (it is now three coats thick) but no lead was added. This is what has happened in a lot of older housing. Many coats of "unleaded" paint have been added to the paint film. Each additional layer of "unleaded" paint has reduced the percent of lead in the paint film. The XRF readings, had they been made, would not have changed. The XRF readings of mg/cm^2 are apples and the percentage measurements from a laboratory are oranges. Don't confuse the two.

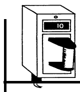
XRF Action Levels

Although no level of lead in paint is absolutely safe, different regulatory agencies consider different amounts of lead in paint dangerous enough to be removed. Regulatory standards for lead in paint are defined by concentration and loading. Concentration is measured by laboratory analysis and expressed as parts per million or percent by weight, generally equivalent terms. The Federal Standard expressed by concentration is 0.5% (5,000 parts of lead per million parts of paint). This is considered the action level (that is, the level at which we have to do something about it). Most state and local regulations are the same as the Federal Standard when expressed in concentration. When lead in paint is defined by loading, it is more commonly measured in the field by an XRF instrument, rather than by laboratory analysis. Loading is expressed in mg/cm^2. There are many standards for XRF readings: the Federal Standard is 1.0 mg/cm^2; state regulatory standards range from 0.7mg/cm^2 to 2.0 mg/cm^2.

Lead-based paint

The following table shows how different agencies define Lead-Based Paint:

Test Method	Agency**	Limit
XRF	HUD & EPA	1.0 mg/cm^2
	States	Ranges from 0.7 mg/cm^2 to 2.0 mg/cm^2
	Local Government	May differ from state or federal. Check with your local govern-



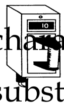
		ment agency
Paint Chip	HUD & EPA	0.5% (5000 ppm)*

* paint chip samples also can be measured in mg/cm^2 as long as the laboratory knows the area sampled. HUD recommends sampling an area 2" x 2". All paint in that area must be collected. HUD recommends using mg/cm^2 when reporting lead but most inspectors do not use these units when reporting results from paint chips.
** The HUD Guidelines have always recommended the use of the more stringent standard, if local or state standards differ from the HUD standard.

Because of variability in the instruments, XRF readings close to these standards may not be accurate. Different types and models of XRF analyzers have different levels of accuracy and precision, especially when we are talking about readings near 1.0 mg/cm^2. The XRF instrument's Performance Characteristic Sheet will tell you when paint has ≥1.0 mg/cm^2 and when you need to correct for the substrate. When XRF testing is inconclusive and the substrate correction process results in an inconclusive XRF reading, HUD and EPA recommend collecting a paint chip for laboratory analysis to resolve the inconclusive. In some states, inconclusive XRF readings may be resolved through chemical spot testing.

Review

An XRF is an electronic device that measures incoming X-rays using a detector that counts the number of X-rays of certain frequencies. To generate the X-rays, the XRF has a separate part that holds radioactive Cobalt (or Cadmium) behind a shutter that can be opened and closed. The Cobalt gives off gamma rays that hit the lead atoms and cause them to fluoresce (give off their



characteristic X-rays). You may have to correct for some or all substrates, depending on the particular XRF analyzer you use.

The XRF also needs a battery to run the electronics. Batteries must be charged daily or back-up batteries must always be available. Otherwise, you are stuck with a very expensive piece of useless equipment.

Cobalt 57 has a half-life of 270 days

Radioactive Cobalt 57 and Cadmium 109 are dangerous, so XRF operators must be trained in how to use the equipment safely. Radioactive sources also decay ("wear out") whether or not they are used. As a matter of fact, all radioactive materials decay and become weaker with time. The Cobalt 57 source should be replaced by the factory about every 12 months. The Cadmium 109 source should be replaced about every 15-18 months.

III. Collecting Paint Chips

Paint chip samples are collected during environmental surveys and lead risk assessments for the following reasons:

1. Paint chips are collected from surfaces where the amount of lead in the paint is near the 1.0 mg/cm^2 standard. At this level of lead the accuracy of XRF instruments make the readings inconclusive. These paint chips are sent to the lab to determine whether or not that surface is coated with lead-based paint. Other surfaces may be curved or in other ways inaccessible to the instrument. paint chips are also collected in these cases.

2. Lead risk assessors may collect paint chips from

friction surfaces, impact surfaces, deteriorating paint films and mouthed or chewed surfaces to see if a hazard exists.

3. Paint film samples may be collected from surfaces that are going to be abated to decide how you will dispose of the waste, (You might, for example, use these samples to do a hazardous waste determination when scraping is going to be the abatement method. See the Chapter P “Waste Disposal” for more information on hazardous waste determination.)

Depending on the type of analysis being done, there are two ways of collecting paint chips. Each of the methods has advantages and drawbacks.

1. With the first paint chip collection method, you collect only the paint film. This is a difficult process because you can’t include any of the substrate in your sample. Including substrate “dilutes” the sample since most substrates do not contain lead. It is also important to collect all layers of the paint, since the bottom layers are the ones most likely to have high levels of lead. In this kind of sample collection, the laboratory is asked to report mass concentration, which can be expressed in any the following (basically equivalent) ways:

- parts per million (ppm);
- milligrams per kilogram (mg/kg);
- micrograms per gram (ug/g);
- percent weight (%Pb).

Laboratory reports may use different units of measure

If substrate is included, parts per million will be lower because of the "other parts" of plaster, wood, etc., that were included in the sample. In most states, paint film is considered hazardous if the lead concentration is equal to or greater than:

- 5000 ppm;
- 5000 mg/kg;
- 5000 ug/g; or
- 0.5% Pb by weight.

NOTE: There is at least one state with a different paint chip standard.

2. With the second paint chip collection method, you collect the paint film from an area of known size. With this method, substrate can be included. The laboratory should be asked to report total lead found in the sample. This process results in a quantity of lead over a defined area, specifically mg/cm^2. This is the same kind of value that you get from XRF instruments. Substrate is not important because the end result is the weight of the lead over a given area, not the concentration of that lead. However, the surface area where the paint film was collected must be measured. The major

difficulty of this method is controlling loss of sample. It is easy to lose part of the chip as it is being removed from the surface.

With a great deal of effort, it is possible to collect only the paint film from a known area and obtain both concentration and total lead from the laboratory. However, it is not necessary to obtain both concentration and lead loading.

III. Wet Chemistry Field Testing

Wet chemistry field testing of paint involves using a small amount of a chemical that reacts with any lead in the paint and turns it a specific color. There are two common field test kits available: sodium sulfide and sodium rhodizonate. The HUD Guidelines <u>do not permit</u> wet chemistry field test kits for testing for lead in paint. In addition, U.S. EPA and the Consumer Product Safety Commission do not recommend their use. For more information you can read the EPA reports “A Field Test of Lead-Based Paint Testing Technologies: Summary Report” (EPA 747-R-95-002a) and “A Field Test of Lead-Based Paint Testing Technologies: Technical Report” (EPA 747-R-95-002b).

<u>Sodium Sulfide</u>

Sodium sulfide & sodium rhodizonate are not acceptable testing methods in most states

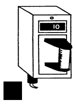
Sodium sulfide can currently be used in Massachusetts to test for lead in paint. At present (1997), no other state has lead regulations approves the use of sodium sulfide. There are several reasons why sodium sulfide is not acceptable. A good deal of research has shown that:

- Reading the test results requires the ability to tell the difference between colors. Individuals with different degrees of color sensitivity would get different results from the test.
- Other metals used in paint, such as titanium, also react with the sodium sulfide, and can give a false positive result.
- It will not work on grey and black paints because a chemical reaction to the lead shows up as grey or black.
- Most importantly, it is a qualitative, not a quantitative measure, that is, it tells you that there is lead present, but it doesn't tell you how much.

Some lead experts believe that sodium sulfide should not be used at all.

This is the testing procedure:

- ■ The technician makes a small cut in the surface of the paint to be tested. The cut must expose all layers of paint down to the substrate. The paints with higher concentrations of lead are often farthest from the surface.



- The technician puts a drop of the 6-8% sodium sulfide solution on the cut surface. The applicator must not to touch the surface because it could contaminate the stock solution.

- If the paint layers turn dark grey or black, lead is present. The darker the color, the greater the amount of lead.

- An alternative method is to take a paint chip from the surface being tested and apply sodium sulfide to its edge. The tester then looks for the color change. If the paint is a dark color, the tester may not be able to see a color change. The tester then might report a false negative.

<u>Sodium Rhodizonate</u>

Sodium rhodizonate is like sodium sulfide except that the color changes to pink or red if lead is present. The process for testing is the same as the one used for sodium sulfide. The same limitations also apply. It is a legal testing method in only two states, Rhode Island and California.

The use of sodium sulfide and sodium rhodizonate should be limited to building owners who are not going to invest the money for proper testing of surface coatings. For these individuals, *some* information is better than *no* information.

SETTLED DUST AND CLEARANCE SAMPLING

I. Introduction

Settled dust on surfaces is sampled for several reasons.

Why test for settled lead dust

1. Lead risk assessments and testing of EBL (elevated blood lead) in children. Knowing dust lead levels is important for these specialized kinds of health-related processes.

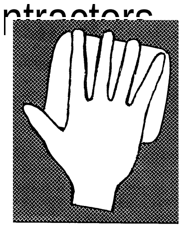
2. Pre-abatement dust sampling. Contractors planning to do limited abatements in dwellings should know about dust-lead levels in areas where they will not be working, for two reasons:

    - To decide whether cleaning should be expanded to include other areas of the dwelling; and

    - To protect the contractor from accusations that the abatement work contaminated other areas of the dwelling. (This is the same reasoning behind doing pre-abatement soil sampling when doing exterior abatement work.)

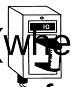
3. Post-abatement clearance sampling. Following lead abatement and lead hazard reduction activities, you must do testing to judge whether the dwelling is safe to live in. This is especially true if young children are involved.

Post-abatement clearance testing is of great importance to contractors.



A third party, not the contractor doing the work, should do all the dust sampling for lead hazards. Some states, as well as the EPA, prohibit the contractor from performing the pre- and post (clearance) testing. This is because it is best for the contractor if the pre-work dust lead levels are high and the post-work levels are low. (These results make his work look good.) Using an independent third-party inspector or risk assessor avoids this apparent conflict of interest.

Surface dust sampling may be done by a wipe method or a vacuum method. Most people use the wipe method, and current standards for settled dust testing specify a wipe method. The Department of Housing and Urban Development (HUD), state lead regulations



(where they exist), and the U.S. EPA all recommend a surface wipe sampling procedure for post-abatement clearance and surface dust testing.

The major advantages of the wipe sample is that it is easy to do and relatively inexpensive. It is a reliable method when used on hard-surfaced floors such as wood, clay tile, vinyl, etc. It is less reliable on soft surfaces such as carpets and upholstered furniture; and rough textured surfaces such as brick and concrete. EPA recommends that these surfaces should not be wipe-tested.

There are two widely-used wipe methods: the HUD method and the ASTM method.

II. The HUD Method - Surface Wipe Sampling Procedure

What does the inspector need to collect dust samples

Equipment & Supplies

The equipment and supplies necessary to do the HUD surface wipe test are as follows:

- commercial wet wipes with a non-alcoholic wetting agent;
- re-usable or disposable templates, or masking tape for marking the sample area;
- measuring tape;
- pen and sample labels;
- 50 ml polypropylene tube (centrifuge tube) with screw-on lid;
- sample data collection sheet; and
- disposable, powder-free vinyl or latex gloves (exam gloves)

Procedure

This is how the test is done. The inspector collects samples from three different surfaces in a dwelling after abatement or lead hazard reduction:

- floors;
- window sills (stools); and
- window troughs (previously called as wells).

Floor samples are collected from an area where the inspector has not walked. He/she marks the selected location with a template or masking tape. The sample area for window sills and window wells is marked by masking tape. After wiping the surface, the inspector measures the area to the nearest one eighth inch and records the measurements on the sample collection sheet.

The inspector also records the following information on the collection form:

- Location of sample
- Surface type (floor, window sill, or window trough)
- Surface material (wood, vinyl, metal, etc.)
- Surface area
- Abatement status (was it abated or not?)
- Abatement method

This is the surface wipe procedure:

After selecting the area to be sampled, the inspector cleans his/her hands with wet wipes. If using a template, the inspector cleans it with wipes. After cleaning his/her hands and the template, the inspector:

How do you collect a dust wipe sample

♦ Puts on a clean pair of disposable rubber gloves.

♦ Pulls one wipe from the sample wipe container, wipes gloved hands and discards the wipe. (The first wipe is never used to collect a sample because the tip of the wipe used to pull the wipe from the container could have dried slightly or the inspector could have accidently touched the tip as the container was being closed after the previous sample was collected. If the wipe was touched by the inspector's gloved hand or bare hand, the tip of the wipe might contain a small amount of lead. To ensure that none of this lead--<u>if lead is there</u>--becomes part of the current sample, the inspector should pull the wipe from the container and wipe his/her gloved hands with the portion of the wipe which was not sticking out of the container and then discard that wipe. This ensures that any lead on the tip of the wipe is discarded with the wipe and removes any lead from the gloves that could have been transferred from the wipe to the gloves as the wipe was being pulled from the container.)

- Pulls one wipe from the sample wipe container, and handles it for the same amount of time it would take to collect a sample. This process includes folding the wipe several times.

- Puts this wipe in a sample tube and sends it to the lab as a "field blank."

- Pulls one wipe from the sample wipe container, opens it completely, puts it on the surface, and wipes the area inside the template or masking tape.

- Wipes the surface area in an "S"-shaped pattern, overlapping the loops of the "S" while trying to cover 100% of the area. The inspector then picks up the wipe material and carefully folds it in half, the dirty side in. He/she then does an additional wipe of the area at ninety degrees to the first one, using the folded wipe.

- The inspector puts each wipe in a labeled tube immediately after the wiping process. The wipe must not touch any surface other than the one being wiped.

- The "field blank" described above should be collected only once a day, or one for every fifty samples

collected per day.

Other rules to follow when collecting samples:

- Collect samples from areas of low lead (if you know where they are) then collect from areas of high lead (where lead levels were higher before abatement began). This reduces the possibility of contaminating samples.

- Spiked samples (samples with known amounts of lead) should be done and put in the set of samples at the rate of one spike per fifty samples.

Clearance Standards

Post-abatement clearance standards

Clearance surface wipe levels must be below the following lead levels:

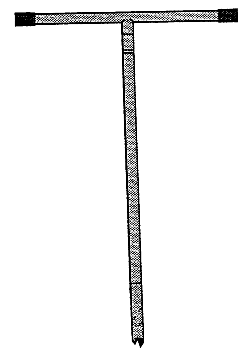
Floors:	100 µgPb/ft^2
Window sills (stools):	500 µgPb/ft^2
Window troughs (exterior sills):	800 µgPb/ft^2

(HUD Guidelines specify these clearance levels and they apply to Federal housing. Also, they match EPA's interior dust lead standard. Other areas or groups may have different clearance criteria.)

III. The ASTM Wipe Method

The ASTM method is the same as the HUD method, except that it requires a third pass (with the same wipe folded another time into a quarter) around the edge of the wiped area. The purpose of this third pass is to capture any dust which was pushed to the edge of the area by the other two passes. This additional step is probably more important if a template is used.

SOIL SAMPLING



There are two important parts of soil sampling if you want to know how much lead is in the soil. They are:

- The way you collect the soil.

- Where you collect it (in what pattern).

These concepts are described below in "Collection Technique" and "Sample Collection Pattern." Just as there are different protocols for collecting dust wipes, there are different published protocols for collecting soil samples. Those protocols are:

- Chapter V of the 1995 HUD Guidelines

- ASTM Standard E1727

- "Residential Sampling for Lead: Protocols for Dust and Soil Sampling" by U.S.EPA

- U.S.EPA's 403 Guidance published in the *Federal Register* on 9/11/95.

- Your state or local government's published protocols in their lead regulations.

Since this is not a curriculum for lead inspectors or risk assessors, this manual will not describe the differences between these protocols. Following is an overview of the essential elements of soil sampling.

Collection Technique

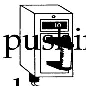
Soil samples are often collected with a coring device. The device can be used in two ways:

- Most coring devices have a "T" handle that can be attached to the top of the coring tool or probe. This allows the operator to push the tool into the ground. The operator twists the coring tool with the "T" handle and pushes it into the ground. This allows the cutting edge of the soil probe to cut through roots and packed earth.

- The other method for using the coring tool is to attach a hammer device to the top of it. The operator first attaches the hammer to the top of the coring tool and puts the tip of the probe on the ground where the sample is being collected. The operator raises the hammer and then allows it to fall while guiding it. The hammer attachment works best when the soil is hard and compacted. Otherwise, the "T" handle is easier to use.

Surface soil samples are of greatest interest

Since lead does not move rapidly in the ground, it is best to sample the surface of the soil, since this is where most of the lead is concentrated. The operator collects soil samples by driving or



pushing the coring tool into the ground <u>approximately two inches</u> deep. The operator then moves the tool gently from side to side to loosen a plug of soil. He/she then pulls the tool from the ground and pushes the sample (with finger or pencil) until the upper part of the soil plug lies between the one inch markings on the coring device. The operator then cuts the <u>top ½ inch (or 1 centimeter)</u> of the soil sample from the core with a stainless steel knife or cutting tool and transfers it to a sample container. All sub-samples are collected in this way. The collection of sub-samples from the area being sampled is called a <u>"composite" sample</u> that is, it is "composed" of the individual sub-samples.

After collecting a composite sample, the operator decontaminates the soil probe: he/she wipes the end of the probe with wet wipes until no more visible dirt can be removed.

Composited soil samples provide average levels of lead in the soil sampled

Instead of using a coring device to collect soil samples, some inspectors modify a 50cc syringe by cutting off the end. They can then use the plunger part of the syringe to push out the plug of soil. Syringes don't work well in hard or rocky soil. As another option, some inspectors scrape dirt from the surface with a stainless steel spoon or trowel and collect it. However, the sub-samples are not uniform.

<u>Equipment & Supplies</u>

Technicians collecting soil samples normally use the following items:

- Clipboard and pens;
- Rubber gloves;

- Wet wipes, paper towels, and trash bag;
- Soil probe, handle, and hammer attachment;
- Stainless steel spatula;
- Environmental sampling forms and graph paper for sketches;
- Bags or other container for soil samples;
- Tape measure.

Sample Collection Pattern

If lead-based paint is the suspected source of lead, there will be higher concentrations of lead near the structure that is coated with the paint. Because of this, you collect a composite soil sample from the four sides of the structure. You take composite samples because lead is usually not distributed evenly in the environment. Collect three to six sub-samples from each side of the building where there is soil. The best place to collect these samples is three feet from the outside wall of the structure. How you space your samples depends on where there are sidewalks, plants, or other obstacles. If there is a sidewalk all along the side of the building, you should collect the sample along the edge of the sidewalk that is closest to the three-foot line.

If contamination from mine tailings or a smelter is the suspected source of lead, the lead would be distributed in the soil differently. This requires a different sampling pattern. In some cases an "X" is placed over the front or back yard being tested. The technician collects a composite sample is collected, with the sub-samples coming from the four corners of the "X" and from the intersection or center of the "X".

Some states have specific requirements collecting soil samples. These requirements are mostly related to the pattern used in collecting samples. At present (1997), the State of Ohio requires that soil samples be collected before and after the work is done on exterior abatement projects. If there are statistically significant increases in lead in the soil, the contractor must abate the soil. Lead inspectors must be aware of all local regulations about collecting samples and preparing reports.

Action Levels

How much lead in the soil is a problem

States with regulations which include soil will either define their own action levels or will refer to the U.S. EPA Guidance criteria for lead in soil.

The current EPA & HUD interim standards are:

- 400 to 5000 ppm lead in bare soil which is used by children requires response (that is, at a minimum, some interim action, such a planting grass or sod on the affected area);

- 2000 to 5000 ppm lead in bare soil where contact by children is less likely requires response;

- >5000 ppm lead requires abatement.

PERSONAL AIR SAMPLING

Contractors should understand worker monitoring processes

Contractors are required to:

1. Monitor workers to see how much lead, on the average, they are exposed to in the air; and

2. Provide the appropriate kind of respiratory protection for workers on abatement projects.

Requirements for protective clothing and equipment may change depending on the amount of lead in the air, so contractors need to find out what those levels are. To get this information, you must do personal air sampling.

Follow the standard NIOSH protocol Method 7082, because it is designed to determine how much lead the worker is exposed to. The NIOSH method consists of using a personal air monitoring pump with a flow rate of one to two liters per minute. This is how the sampling process works:

The NIOSH Method for air sampling

1. The sample train (the entire sampling apparatus) is assembled as shown in Figure O-1.

2. The sampling pump is calibrated at the beginning and end of the day. Use a bubble meter to figure out what the flow rate is before and after sampling

(see Figure O-2). This will verify what the actual pump flow rate is, and that it has not changed during the day. You need an accurate flow rate to calculate how much air you have sampled.

3. Pick workers whose jobs are typical, and use them for your sample. For example, on a soil abatement site, some workers use hand tools such as wheel barrows or shovels on the site. Other workers operate mechanical equipment, direct traffic, or drive waste trucks. You must sample at least one worker using hand tools and one worker operating mechanical equipment.

All types of lead work should be monitored

4. Attach the sampling pump to the worker’s belt. (You either provide a heavy belt, or attach it to the worker’s belt if it is sturdy.) Attach the pump to the back of the belt so that it doesn’t get in the way of the worker’s doing his/her job.

5. Connect the tubing to the sampling pump. The tubing is usually routed diagonally across the worker's back to the “off-shoulder” (that is the left shoulder if the worker is right-handed, the right shoulder if the worker is left-handed). Attach the tubing to clothing with clamps, pins or tape. Don’t let the attachment damage the worker's clothing or get in the way of the worker's movement. Arrange the tubing so that it ends within nine inches of the

worker's nose and mouth.

6. Attach a three-piece air sampling filter cassette to the tubing. Point the inlet of the cassette downward. For the filter membrane in the air monitoring cassette, use a 0.8 μm cellulose ester membrane (MCE).

7. When you start sampling, remove the plug on the inlet of the cassette and start the pump. Do not remove the face of the cassette as you would for asbestos sampling. Record the time the sampling begins and ends.

8. Check the pump to see that it is working correctly. Do this after 30 minutes, 60 minutes, and each hour after that during the sampling time.

9. The purpose of this sampling is to arrive at the 8-hour time weighted average (TWA) for lead exposure. To get an accurate time weighted average, you should do the sampling for one entire work day.

10. At the end of the sampling period, remove the cassette from the worker and send it to a laboratory for analysis. You need to be sure that you keep a detailed record of each person who handles the sample, from the time you take the sample to the

time the results are returned to you. (This is sometimes called “chain of custody records,” because it is a record of every person who had custody of the sample.)

Acceptable time-weighted averages are discussed in other sections of this manual. You must notify workers of their test results, in writing, within five (5) days after you receive them.

Workers must be notified of results within 5 working days after receipt

You can also do area sampling on an abatement site to see how much lead is released into the air during the abatement process. You can collect this kind of air sample with either the personal monitoring pump a high volume sampling pump. The high volume sampling pump has a flow rate of 1 to 20 liters per minute. This pump uses the same filter and cassette as the one used for worker monitoring. These air samples are collected from fixed locations with the cassette located at four to five feet above the ground (near the “breathing zone” of the worker).

OSHA does not require area sampling and it is usually done by the owner’s representative rather than the contractor or supervisor. The owner collects it for information only.

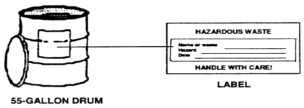
APPENDIX O-1

X-RAY FLUORESCENCE INSTRUMENTS

Brand Name	Direct Read	Spectrum Analyzer
Advanced Detectors; LeadStar	X	
Niton Corporation; XL-309		X
Princeton Gamma-Tech, Inc.; XK-3	X	
Radiation Monitoring Devices; LPA-1	X	
Scitec Corporation; MAP-3		X
Scitec Corporation; MAP-4	X	
TN Technologies (TN Spectrace); Pb Analyzer Model 9292		X
Warrington, Inc.; Micro Lead I revision 4	X	

APPENDIX O-2

A sample risk assessment report will be provided to students for use during training



WASTE DISPOSAL

OBJECTIVE:

To present and discuss rules and regulations for waste disposal in lead-abatement projects.

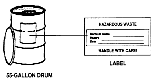
LEARNING TASKS:

Supervisors/contractors should be able to:

- List four criteria for deciding whether material is a solid or hazardous waste.
- Explain what is meant by "cradle to grave" in hazardous waste disposal.
- Describe how to package and label hazardous waste.

As a supervisor/contractor of a lead-abatement project, this section is important to you because:

- **you will be responsible for storage and shipment of hazardous waste;**
- **you will be responsible for separating hazardous waste from solid waste on the abatement site.**



WASTE DISPOSAL

Introduction

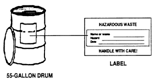
Problems with disposal of abatement waste

One of the most difficult and challenging parts of a lead abatement/hazard reduction project is disposing of the waste it generates. The difficulties are caused by the fact that:

- Sometimes it is difficult to decide whether the waste is solid or hazardous.
- The generator of the waste (building owner) may not have experience with hazardous waste disposal.
- Regulations are applied inconsistently.
- Regulations often do not seem logical.
- New lead abatement contractors have no experience in these processes.

The Federal government is currently reviewing the regulations that control the disposal of lead waste. New regulations will probably be created from this process, but for now, contractors and owners must follow current regulations. It is a good idea to consult with regulatory agencies in your locality before you begin a project.

Waste Disposal Regulations



Federal regulations governing waste disposal

Federal legislation regulates the disposal of all solid and hazardous waste. This EPA legislation, the Resource Conservation and

Recovery Act (RCRA), was passed in 1976. It was amended in 1980 and 1984 by the Hazardous and Solid Waste Amendments (HSWA). This legislation created the RCRA standard of "cradle to grave" responsibility. The "cradle to grave" idea is that the person or group creating or generating a hazardous waste is responsible for handling it from the time it is generated to the time it is finally disposed of at a RCRA-approved treatment or disposal facility. This also includes all storage and transportation.

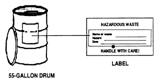
Solid waste consists of solid, liquid, and gaseous waste products. These waste products include all household wastes, institutional wastes, and waste from industrial processes. Waste can be divided into three categories: hazardous, solid (nonhazardous), and listed wastes (for example, asbestos, PCBs). Listed wastes have special characteristics and are controlled by other Federal regulations.

Individual states can regulate waste disposal, and most states have their own waste disposal programs. States operate their programs with the approval of EPA under RCRA. If a state has regulations regarding waste disposal, these regulations must be at least as strict as the Federal regulations. (This is usually the case: most state regulations are stricter than the federal ones.) If state regulations are stricter than Federal regulations, then you must follow the state’s.

Lead Abatement Waste

Contractors doing lead-abatement projects produce four types of waste:

- solid non-hazardous waste;



- liquid non-hazardous waste;
- solid hazardous waste; and
- liquid hazardous waste.

Some lead-contaminated soil is hazardous waste

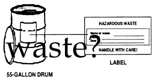
Waste from abatement projects may include doors, windows, trim, paint chips, soil, dust, rocks, garbage, trash, brush from soil sites, and debris from paved surfaces. This is not a complete list. Sometimes, soil and other waste containing lead can be classified as solid waste, not hazardous waste, because of certain characteristics of the lead and the material it is found in. Soil and dust with high concentrations of lead are usually considered hazardous waste.

Soil abatement projects can produce other unexpected hazardous materials. When soil samples are sent to a testing facility for lead testing, local or landfill regulations may also require that the soil be tested for other contaminants before they will accept it at the disposal facility. The requirement may include testing for other heavy metals, PCBs, pesticides and other toxic materials. Sometimes industrial and residential sites are contaminated with one or more of these materials.

A mixture of waste, both solid and hazardous, can also be generated on lead-based paint abatement projects. Lead-based paint abatement projects may produce more complex hazardous wastes because they use paint removers or strippers. Often, the lead is mixed with paint remover. Some paint removers are more dangerous than lead.

Hazardous Waste

How do waste regulations distinguish between solid and hazardous



waste?

- Solid waste is a very broad term that includes solid, liquid and some gaseous forms of household trash, discarded industrial material, sludge from waste treatment plants, refuse from mining operations, and a variety of other materials.

- Hazardous waste is solid waste that is considered to be dangerous; that is, it is a major threat (present or future) to health or to the environment, if it is not properly managed. A “solid” hazardous waste under RCRA includes solids, liquids, slurries, and gaseous wastes.

How does a lead abatement contractor know if he or she has a solid or hazardous waste? If a waste appears on an EPA list of harmful materials, it is a “listed” waste. If it doesn’t appear on that list, you need to consider four characteristics of the waste. Is it easily set on fire (ignitable)? Is it corrosive? Does it react easily with other substances? Is it toxic?

Characteristics of hazardous waste

1. **Ignitability.** Liquids are considered to be hazardous if they have a flash point lower than 140 degrees Fahrenheit. Flammable solids, gases, and oxidizers are all potentially hazardous.

2. **Corrosivity.** Materials with a pH less than or equal to 2.0 or equal to or greater than 12.5, or materials that corrode steel at a specified rate are considered to be excessively corrosive and are therefore hazardous.

3. **Reactivity.** Any waste capable of reacting violently in air or with water are reactive and are considered hazardous.

4. **Toxicity.** If a standard testing procedure produces a toxic material above a certain concentration, the material is considered to be hazardous.

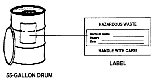
Lead abatement projects for soil and dust don't usually produce ignitable or excessively corrosive wastes. Lead-based paint abatement projects that include on-site paint stripping may generate hazardous wastes if the paint strippers used are corrosive or ignitable. Some materials such as toluene, methylene chloride, and xylene are "listed" wastes but are generally not found in lead abatement sites.

Dust abatement debris can include vacuum cleaner bags and their contents, lead-contaminated carpets, furniture, books, and other items. Exterior soil and dust abatement includes debris from exterior surfaces, contaminated soil and dust, vegetation and a variety of other items.

Usually, lead-abatement projects don't produce highly reactive materials, but they sometimes produce toxic ones. Lead is not ignitable, corrosive, or reactive, but it can sometimes be a toxic material (toxic according to RCRA standards).

TCLP testing for degree of toxicity

- The test for deciding if lead is present in amounts that make it a hazardous waste is the Toxicity Characteristic Leaching Procedure (TCLP).



- If the TCLP test results from the waste sample submitted to the laboratory show more than five parts per million (5 ppm) of lead, the waste is considered to be hazardous.

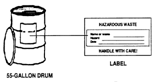
Some soils generated in abatement projects pass the TCLP test and can be considered a non-hazardous solid waste. Soils that fail the test are hazardous waste and disposal cost is much higher.

Similarly, parts of buildings covered with intact (not deteriorated) lead paint may fail the TCLP test. The cost of storing, transporting, and disposing of these items adds significant costs to lead abatement projects. These costs include not only what it actually costs to dispose of the material, but also record keeping, testing, and other administrative costs.

<u>Hazardous Waste Generators</u>

According to the RCRA legislation, the owner of the facility is considered to be the hazardous waste generator. Lead abatement contractors often manage the disposal of the waste because they are knowledgeable and experienced in this area. It is often hard for owners, especially individuals and small landlords, to meet the requirements of hazardous waste disposal, because the regulations are so complex. However, even though the owner contracts the job out, he/she is still ultimately responsible for legal disposal of the hazardous material.

Some abatement projects create only small amounts of hazardous waste, and are classified as small quantity hazardous waste generators. This means that the RCRA and EPA waste disposal



regulations don’t apply to them. The EPA hazardous waste regulations define three types of generators:

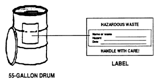
Determining your waste generator status

1. Individuals and institutions that generate no more than 220 lbs (100 kilograms) of hazardous waste per month are called *conditionally exempt small quantity generators*. They are exempt from many EPA hazardous waste regulations.

2. Individuals and institutions that produce more than 220 lbs (100 kilograms) but less than 2,200 lbs (1,000 kilograms) of hazardous waste per month are called *small generators*. They must comply with EPA regulations about the accumulation, treatment, storage and disposal of hazardous waste.

3. The third group is the *large generators*. They generate more than 2,200 lbs (1,000 kilograms) of hazardous waste per month. They must follow all of the EPA regulations for hazardous waste, including reporting and record keeping requirements.

These three categories of producers generate “typical hazardous wastes.” EPA also has a category called <u>acute hazardous waste</u>, which are very toxic materials. Generators that produce more than one kilogram of acute hazardous wastes in a month must follow all the requirements for hazardous waste. Wastes generated on residential lead-abatement projects don’t fall into this classification.



Handling Hazardous Waste

Storing hazardous waste is an important part of handling it. Most abatement projects that generate hazardous wastes accumulate the waste until it is cost effective to ship it to a disposal facility. There are, however, limits to the time and amount of hazardous material you can accumulate. After that point, you have to get a permit to be a storage facility.

Those limits are:

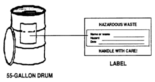
Time limits for storing hazardous waste

- 90 days for a generator that produces more than 2200 lbs. (1000 kg) of hazardous waste per month; or
- 180 days for a generator who produces between 220 lbs. (100 kg) and 2200 lbs. (1000 kg) of hazardous waste per month. If the disposal facility is more than 200 miles away, the waste can be stored for up to 270 days.

If the waste is stored in DOT (Department of Transportation) approved containers (usually 55 gallon drums), you must follow these rules:

Rules you must follow when storing hazardous waste

- the storage area must be secure;
- containers must be labeled "HAZARDOUS WASTE"
- the date the waste was first accumulated in that container must be marked on the container;



- containers must be kept in good condition, inspected weekly, and leaking containers must be replaced; and

- containers must be kept closed except when filling or emptying them.

A manifest must accompany the hazardous waste from the generator to the disposal facility. A copy of the manifest must be returned to the generator within 35 days of the waste being accepted for shipment. (See the section on “Record Keeping/Log Book in Chapter M “Project Management,” [page M-25] and Appendix M-1 [page M-48] to that section for more information on the uniform hazardous waste manifest.)

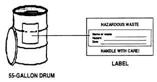
Waste Management Strategies

Waste management strategies

The HUD Lead-Based Paint Abatement Demonstration Project included the most complete study that has been done so far on waste generated on lead-based paint abatement projects. The contractor for that project grouped waste into different categories. Samples from those categories were submitted for analysis to determine whether or not they were hazardous. The following list comes from the final report on that project (HUD, August 1991) and it shows the categories of waste generated on paint abatement projects.

Common types of abatement waste

1. Paint chips from chemical stripping, heat gun removal, abrasive removal, or surface preparation for encapsulating or enclosing.



2. HEPA debris, dust from air filters, paint dust.

3. Woodwork, plaster, window and door systems, and any other substrates removed for replacement.

4. Polyethylene sheeting used to protect floors and other surfaces.

5. Solvents and caustics used during chemical stripping.

6. Sludge from chemical stripping.

7. Rinse water.

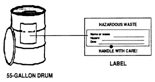
8. Rags, mops, sponges, HEPA filters, air monitoring. cartridges, scrapers, and other materials used for testing, abatement, and cleanup.

9. Disposable work clothes and respirator cartridges.

10. Rugs and carpets.

The HUD Demonstration Project included different abatement strategies including:

- encapsulation
- enclosure (same as Rigid Encapsulation as described in Chapter G)
- chemical removal
- hand scraping with heat gun



Most abatement projects do not include all of these strategies, so a single project does not usually generate all of these categories of waste.

Common types of hazardous waste

The laboratory tests indicated that some of the categories of waste were hazardous. Those hazardous materials were:

- paint debris from chemical stripping, heat gun removal, abrasive removal, or surface preparation for encapsulating or enclosing
- non-filtered waste water, rags or towels used to clean up chemical stripper residue
- HEPA vacuum bag debris
- HEPA vacuum filters
- any other material, particularly polyethylene sheeting, that was heavily contaminated with any of the above materials during the abatement process
- Some building components such as doors and window frames exceeded the RCRA regulatory limit.

The amount of hazardous waste generated in the HUD Demonstration Project using each of the five abatement strategies and the average disposal cost (per house) is shown in Table P-1. The techniques used for abating lead in an individual house was the one stated whenever it was possible, with other methods used in the order of preference shown below.

Table P-1

AVERAGE VOLUME AND COST OF HAZARDOUS WASTE DISPOSAL BY UNIT ABATEMENT STRATEGY**

Abatement Strategy	Average Vol. (per house) Hazardous Materials (lb.)	Average Cost (per house) of Hazardous Waste Disposal
Encapsulation	99.2	$117.02
Enclosure*	104.5	$123.36
Chemical	436.0	$514.48
Hand-Scraping w/Heat Gun	260.5	$307.42
Replacement	117.5	$138.65

* The Enclosure abatement method is the same as the Rigid Encapsulation Method described in Chapter G.
**These costs are given for comparison only. They are not meant to be used for bidding purposes as each abatement project is unique.

Each of the houses was single family.

Source: U.S. Department of Housing and Urban Development, The HUD Lead-Based Paint Abatement Demonstration (FHA), Washington, D.C., April 1991.

EPA is doing research to see whether it is feasible to send debris from lead-abatement projects to smelters to extract the lead from it. It is also exploring regulatory options for relieving the burdens of disposing of wastes from lead-based paint abatement under RCRA.

THE COMMUNITY RELATIONS PROCESS

<u>OBJECTIVE</u>:

To present the phases necessary to implement, maintain, and manage an effective community relations plan before and during a lead abatement project.

<u>LEARNING TASKS</u>:

Supervisors/contractors should be able to:

- List and define the phases necessary to have a successful community relations plan.

- Describe three major tasks a community relations coordinator must complete.

- Determine the role of the supervisor in implementing the community relations plan.

As a supervisor/contractor on a lead-abatement project, this section is important to you because you will be interacting with persons of the community and organizations involved. Dealing with the concerns of the community goes a long way in helping the project go as smoothly as possible. You should be aware of the existence and nature of the community relations plan.

THE COMMUNITY RELATIONS PROCESS

The community relations plan will provide the community* with specific guidelines which will enable the lead abatement project to proceed with the least amount of inconvenience and disruption to persons within the community as well as the organizations involved. Such a tool assures favorable resident, owner, and media interaction.

This community relations plan can best be executed in a four-phase process:

- The planning and development phase,
- The implementation phase,
- The maintenance phase, and
- The evaluation phase.

PHASE I:
PLANNING &
DEVELOPMENT

PHASE I: Planning and Development of the Community Relations Plan

In phase one it is important to address three major tasks:

- Appointment of the community relations coordinator,
- Development of the individual community relations plan,
- Defining contractor/resident needs.

---

*The term community as presented here refers to the residents, property owner(s), local government, business groups, community action organizations, and the abatement contractor/consultant which will be directly impacted by this abatement.

COORDINATOR

The Coordinator:

- Interacts with local, state, and federal agencies, other contractors, the residents, and the news media.
- Establishes a jobsite office.
- Maintains honest, open, and frank communication with all involved parties.

The community relations coordinator must be familiar with community groups and their interests. A listing of the tenant association, community council, action groups, and building managers including names, addresses and phone numbers is needed to gain an awareness of what is happening and who is in the community. This listing will be used in future mailings. Information on residents directly affected by the abatement process is also needed.

COMMUNITY RELATIONS PLAN

In the development of a community relations plan (the second step in the planning and development phase) it is essential to address six major areas:

❶ Knowledge of the community and its components,
❷ Selection of an information distribution process,
❸ Formulation of a resident relocation plan,
❹ Identification of areas of inconvenience to residents, business, and other neighborhood activities,
❺ Development of a process that addresses problems and complaints, and
❻ Generation of a master schedule and forms.

INFORMATION DISTRIBUTION PROCESS

Selection of an information distribution process is key in the development of the community relations plan. A timely area-wide press release announcing the abatement project and information sheets to residents via a general mailing are needed. A residential meeting for additional abatement questions (have a sign-in sheet) or door-to-door personal contact may also be needed. Also have a general "fact sheet" available to give to residents.

RESIDENT RELOCATION PLAN

Formulation of a resident relocation plan is a critical part of the community relations plan. This includes:

- Identifying the units scheduled for abatement,
- Locating alternative housing and storage (other public housing units or motels),
- Estimating the time needed for abatement, and
- Identifying requirements for contingency housing, arranging for residents timely use of it.

Providing packing boxes for residents will help ensure they will be ready to vacate premises on the appointed date. Coordinating and confirming the moving contractor's schedule is also critical to the success of the abatement process.

Identification of possible inconveniences caused by the abatement project is another part of the community relations plan. If a trailer is used for the abatement office will resident parking spaces be lost? Will barricades hamper local business trade? What daily disruptions are likely to cause community concern?

Development of a process that addresses problems, concerns, and complaints is part of the community relations plan. Providing residents access to the coordinator is valuable. The coordinator must daily set aside time to respond to and resolve resident problems. Documentation of problems/complaints is necessary. For example, an "in-house" form allows for the abatement team to be aware of problems/complaints.

MASTER COMMUNITY RELOCATION SCHEDULE

The final task in the development of the community relations plan is the generation of a **master community relations schedule** and creation of any associated forms. The master schedule includes date assignment for major mailings, news media releases, resident moving and unit re-entry dates, and community meeting times and places.

DEFINE CONTRACTOR & RESIDENT NEEDS

The third step in the planning and development phase is to define contractor and resident needs. The coordinator makes sure that the community relations plan works in harmony with the abatement workplan. For example, news media announcements and resident notification are linked to the abatement work schedule. Abatement workers must be sensitive to resident concerns which can impact the success of a contractor in an abatement project and influence the awarding of future contracts. Abatement workers must also be aware of contractor liability for resident's personal property and containment of leaded materials (particularly if only part of a unit is being abated). Consider pre- and post-abatement video taping. Likewise, the resident must understand the contractor's need to complete the abatement process in a timely, cost-effective manner.

PHASE II: IMPLEMENTA-TION

<u>Phase II: Implementation of the Community Relations Plan</u>

PRESENT PLAN FOR APPROVAL

The second phase in the community relations process is to implement the plan. Implementation begins by meeting and **presenting** the community relations plan to the abatement project manager **for approval.** The presentation includes discussion of general community make-up supported by mailing lists, media procedures, sample resident letters and information sheet, as well as dates and times for mailings and publicity.

A comprehensive resident relocation plan is also presented to the project manager to verify compatibility with the abatement workplan. Does the abatement timetable work well with the community relations timetable? Make appropriate changes and implement relocation plan.

PUBLICIZE & PROMOTE

After the community relations plan has been approved by the project manager, the community relations coordinator begins to **publicize and promote** the abatement process through news media releases which outline the benefits of abatement and the steps to be taken for the health and safety for residents, workers, and the community-at-large. Inform area groups and organizations of the abatement workplan and solicit their support. General mailings and information sheets are then mailed to all area residents. Notify abatement residents of relocation dates and times. Timely release of unit abatement dates also occurs during the implementation step. Flyers mailed and hand-delivered to each resident scheduled for abatement are essential. Residents in surrounding units should also receive a flyer with general abatement information and dates.

Instruction of office support staff is an essential part of a successfully implemented community relations plan. Directing callers seeking project information and obtaining accurate telephone information for coordinator callbacks adds to the success of the community relations plan. Support staff assistance will be needed for mailings and distribution of flyers. Make arrangements for ample support staff during peak work periods as necessary.

Adherence to the community relations schedule is critically important. Daily meetings with the project manager are needed as the abatement process begins in order to ensure a smooth, cost-effective process. As the project proceeds, adjust meeting times as needed.

Checklists for:

- News media dates and announcements, if needed,
- Resident relocation information, (e.g. abatement start date, packing box delivery date), and
- Unit re-entry dates,

are important tools to help maintain the project timetable. (Sample forms are included at the end of this section.)

PHASE III: MAINTENANCE

Phase III: Maintenance of Community Relations Plan

Maintaining the Community Relations Plan is the third phase in the community relations process. At this time, there is a need to:

- Maintain weekly meetings with the project manager to review project and community relations plan timeliness,

- Address resident problems and suggested solutions to problems, and
- Re-evaluate the overall community relations plan and make necessary adjustments based on current needs.

Send resident reminder flyers to all abatement residents one week before the abatement relocation date. Verify moving dates with the moving contractor. A project representative must be on the abatement site as each family is relocated to address any areas of concern.

PHASE IV: EVALUATION

Phase IV: Evaluation of the Community Relations Plan

The fourth and final phase for an effective community relations plan is the evaluation of the plan. There are two times the plan is evaluated:

1. During the abatement process, and

2. At the abatement project's completion.

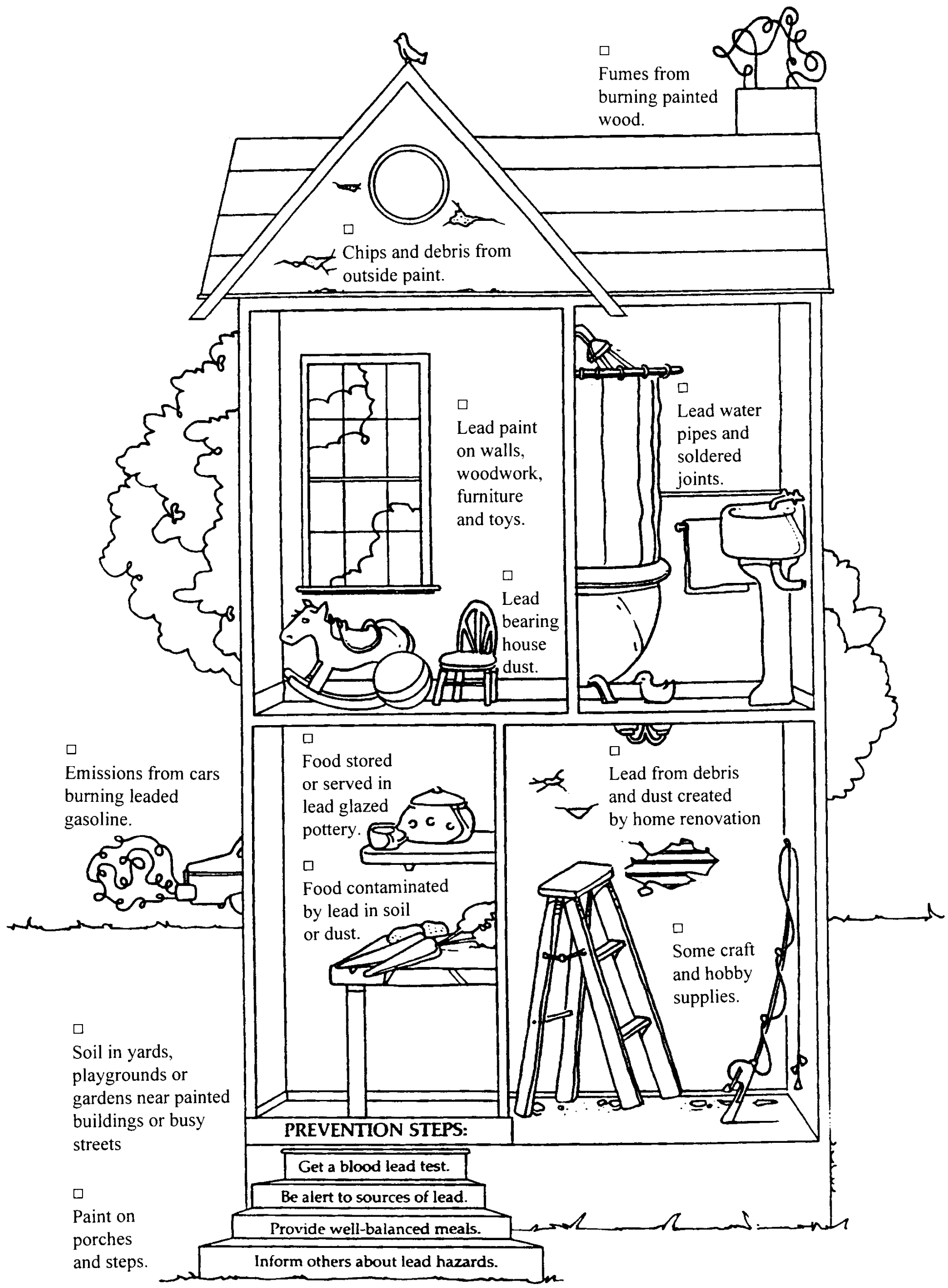
Consideration for needed changes during abatement should be evaluated and changes should be made to fit both contractor and resident needs. For example, it may be more cost-effective and practical to evacuate an entire building at one time versus a unit by unit approach. If so, implement the change during the abatement process.

A brief resident survey distributed at the end of the project to families both directly and indirectly involved in abatement provides important feedback to the Community Relations Coordinator. Questions about the benefits of abatement, staff courtesy, and resident comments should be included in the survey.

Several questions to be asked during the evaluation step are:

1. Did the information provided to all parties throughout the abatement process work well?
2. Did the resident relocation plan work well?
3. Were contractor, community, and resident needs met?

In summary, the four phases of the community relations plan are: the planning and development phase, the implementation phase, the maintenance phase, and the evaluation phase. The success of the project depends upon the understanding and active support of the community. With a well constructed Community Relations Plan, this is possible.


□ Fumes from burning painted wood.
□ Chips and debris from outside paint.
□ Lead paint on walls, woodwork, furniture and toys.
□ Lead water pipes and soldered joints.
□ Lead bearing house dust.
□ Emissions from cars burning leaded gasoline.
□ Food stored or served in lead glazed pottery.
□ Lead from debris and dust created by home renovation
□ Food contaminated by lead in soil or dust.
□ Some craft and hobby supplies.
□ Soil in yards, playgrounds or gardens near painted buildings or busy streets
□ Paint on porches and steps.
PREVENTION STEPS:
Get a blood lead test.
Be alert to sources of lead.
Provide well-balanced meals.
Inform others about lead hazards.

ABC CONSTRUCTION, INC.
555-1234

REMINDER!!

Dear ______________________

Your home is scheduled for lead paint removal soon. The moving van will be at your home on:

Day: ___________________

Date: ___________________

Time: ___________________

Please be at home so you can tell the mover what things are to be moved.

Reminder:

1. If you need your telephone transferred call:__________________

2. Complete your mail transfer card and place the card in your mailbox.

Your new temporary address is: _________________________________

Apt.#____________________________

Zipcode__________________________

RESIDENT/PROPERTY COMMUNICATION

AREA:______________________________

PROPERTY
ADDRESS:____APT.#__________

RESIDENT:___________________________________

TELEPHONE NUMBER:_____________________ CONTACT
NUMBER:__________________

CONTACT NAME__________________________
RELATIONSHIP:_______________________
==
MESSAGE

DATE:_______________ TIME:_______________ RECORDED
BY:_______________________
==
ACTION TAKEN

DATE:_______________ TIME:_______________RECORDED
BY:________________________
==
RESOLUTION
COMMENTS:

DATE:_________________
SIGNATURE____

BUILDING COMPONENTS

OBJECTIVE:

To describe the architectural components of residential buildings.

LEARNING TASKS:

Supervisors/contractors should be able to:

- Identify the architectural components commonly found on residential buildings.
- Describe the types of materials commonly used in housing construction during the last one hundred years.

As a supervisor/contractor of a lead-abatement project, this section is important to you because your responsibilities include:

- **reading and understanding inspection reports which list lead-paint loadings on architectural building components;**
- **telling abatement workers which components require treatment;**
- **ordering construction materials to be used on abatement projects.**

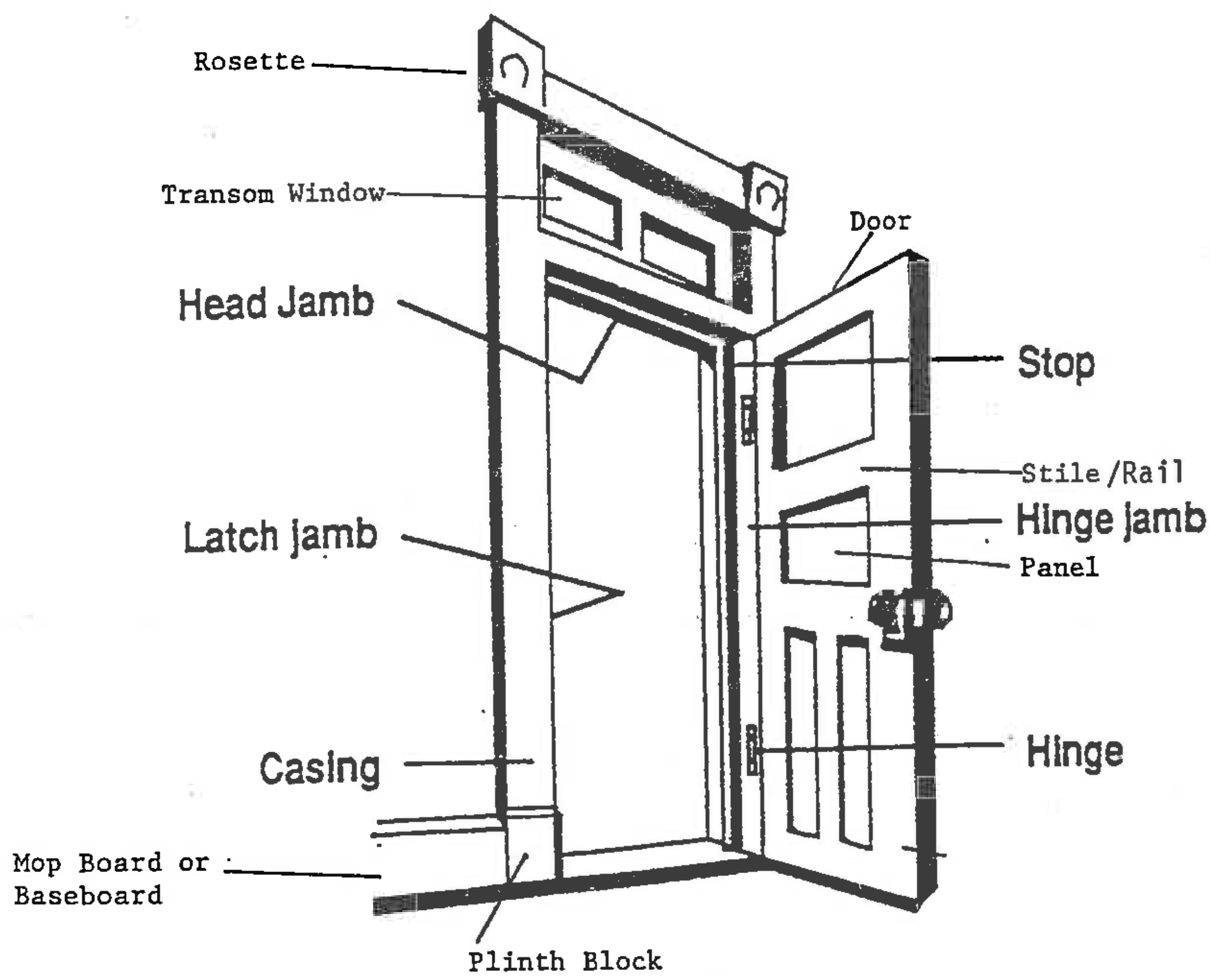

Rosette
Transom Window
Door
Head Jamb
Stop
Stile/Rail
Hinge jamb
Latch jamb
Panel
Casing
Hinge
Mop Board or
Baseboard
Plinth Block

Diagram of Building Components

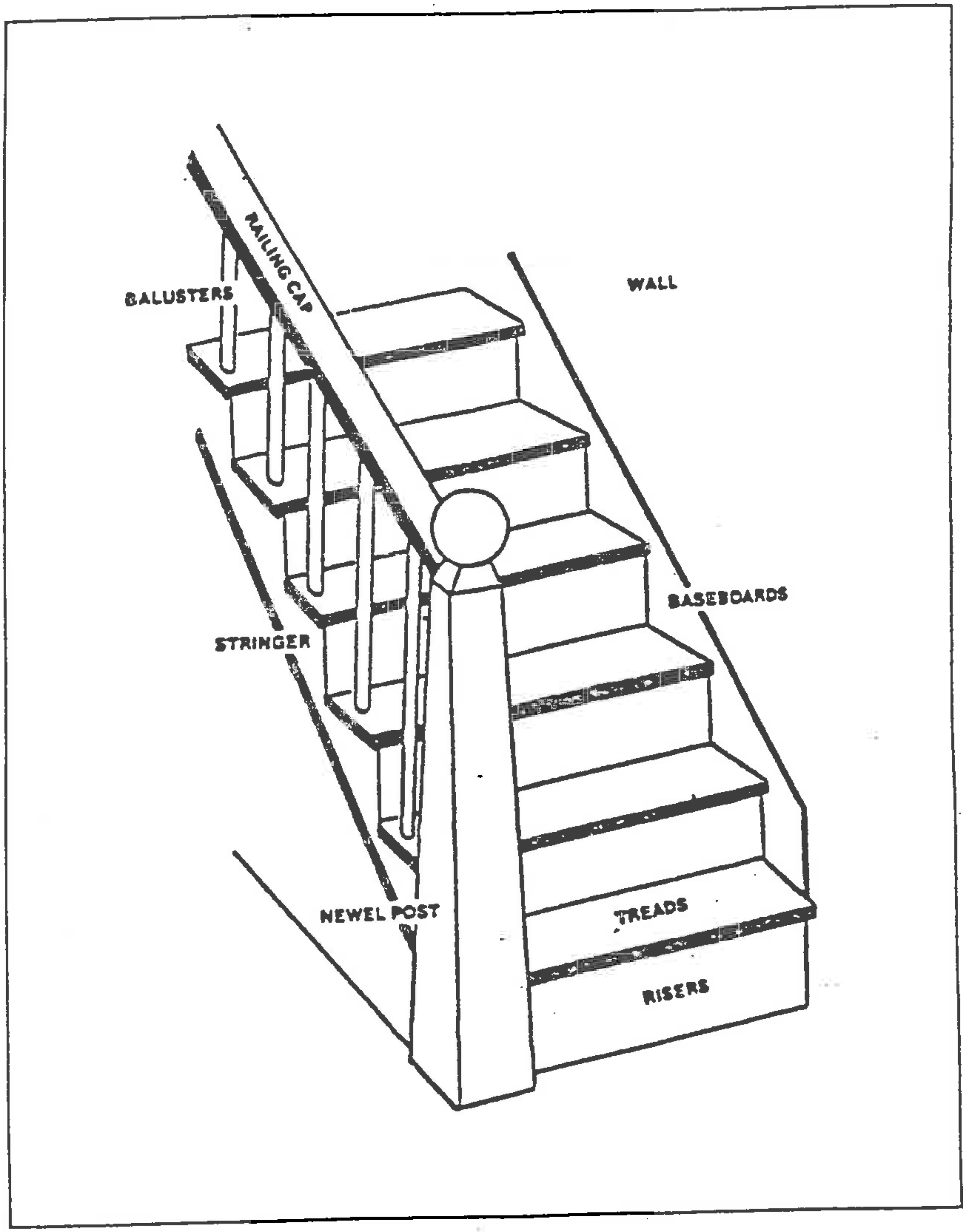


Diagram of Building Components

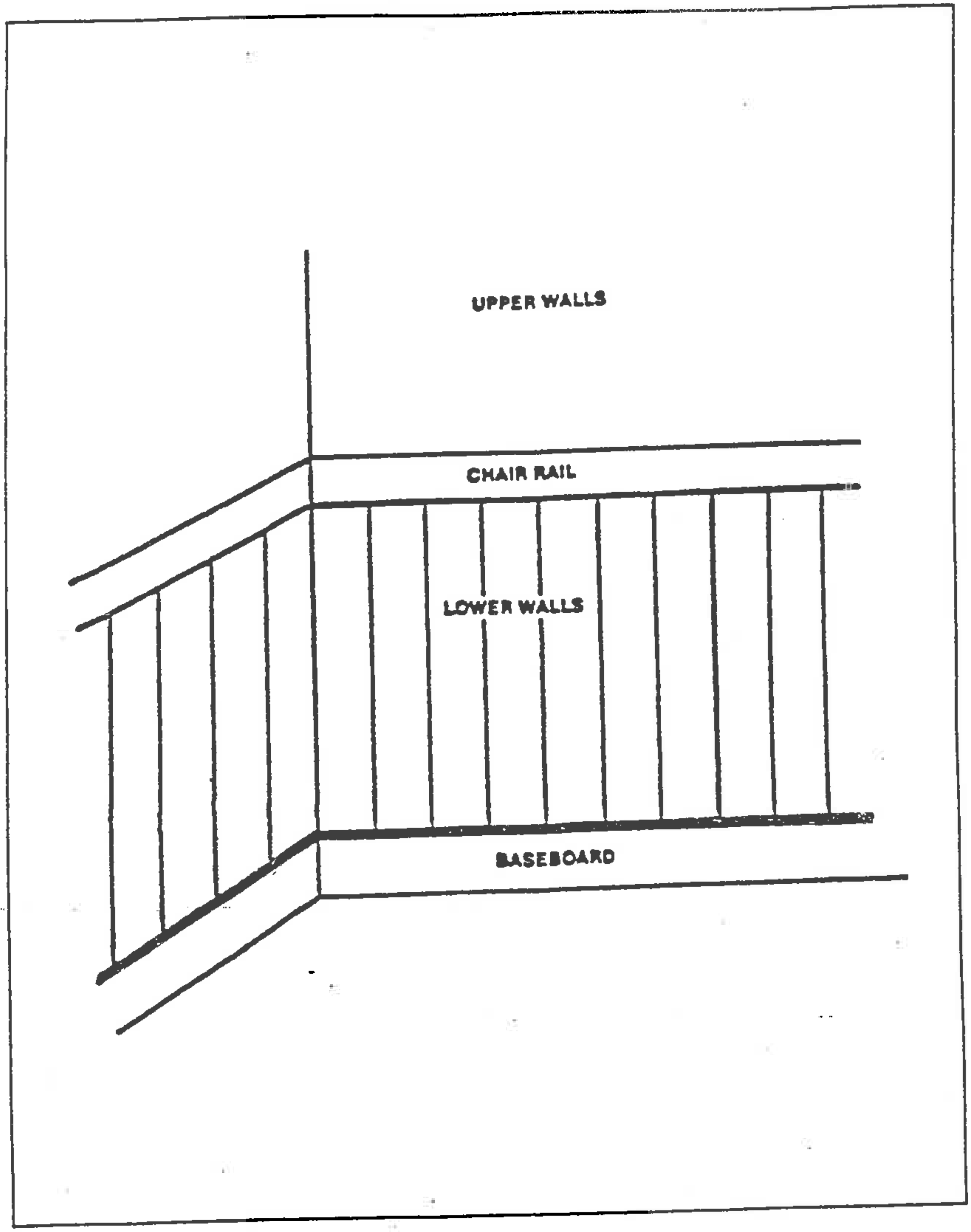


Diagram of Building Components

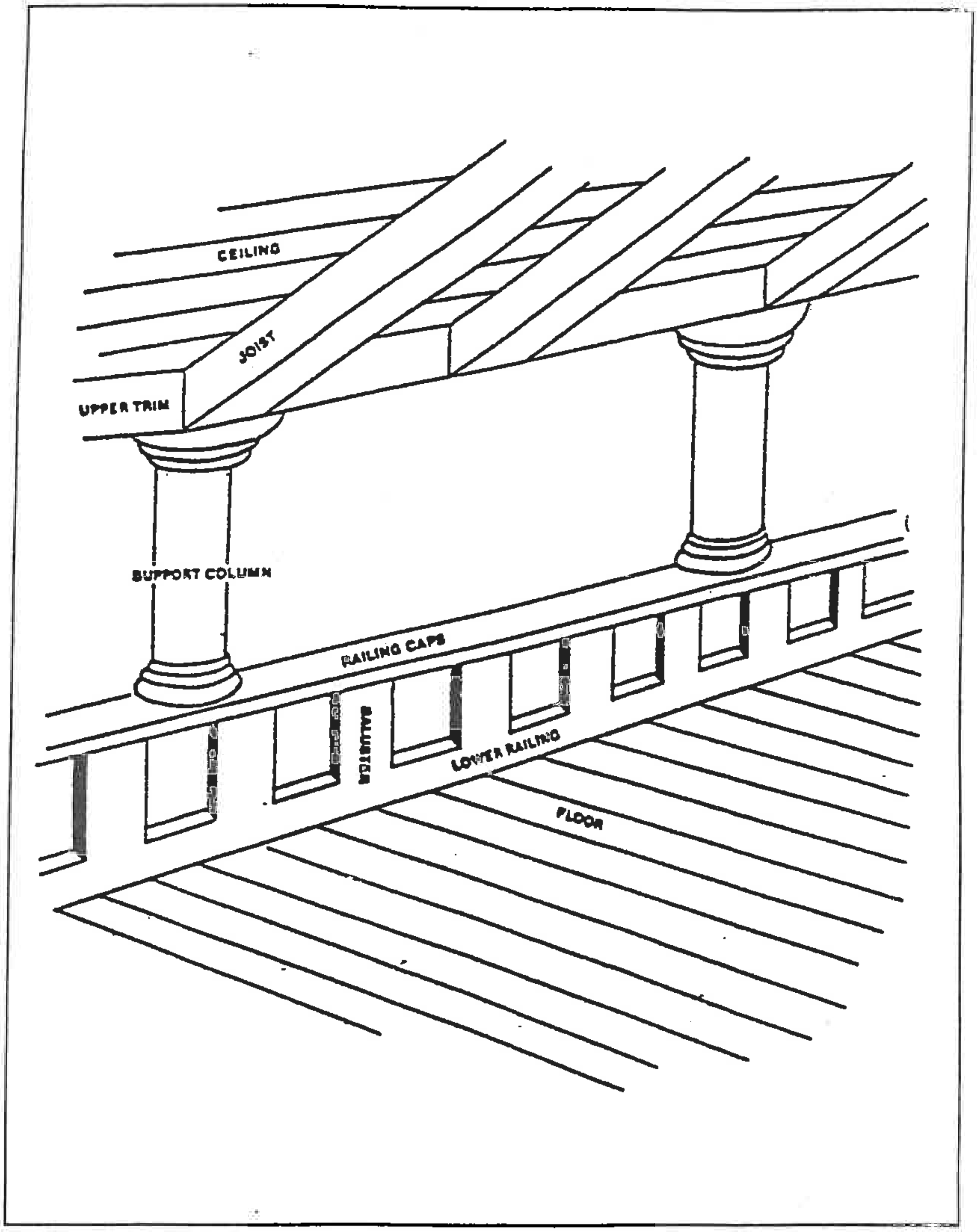
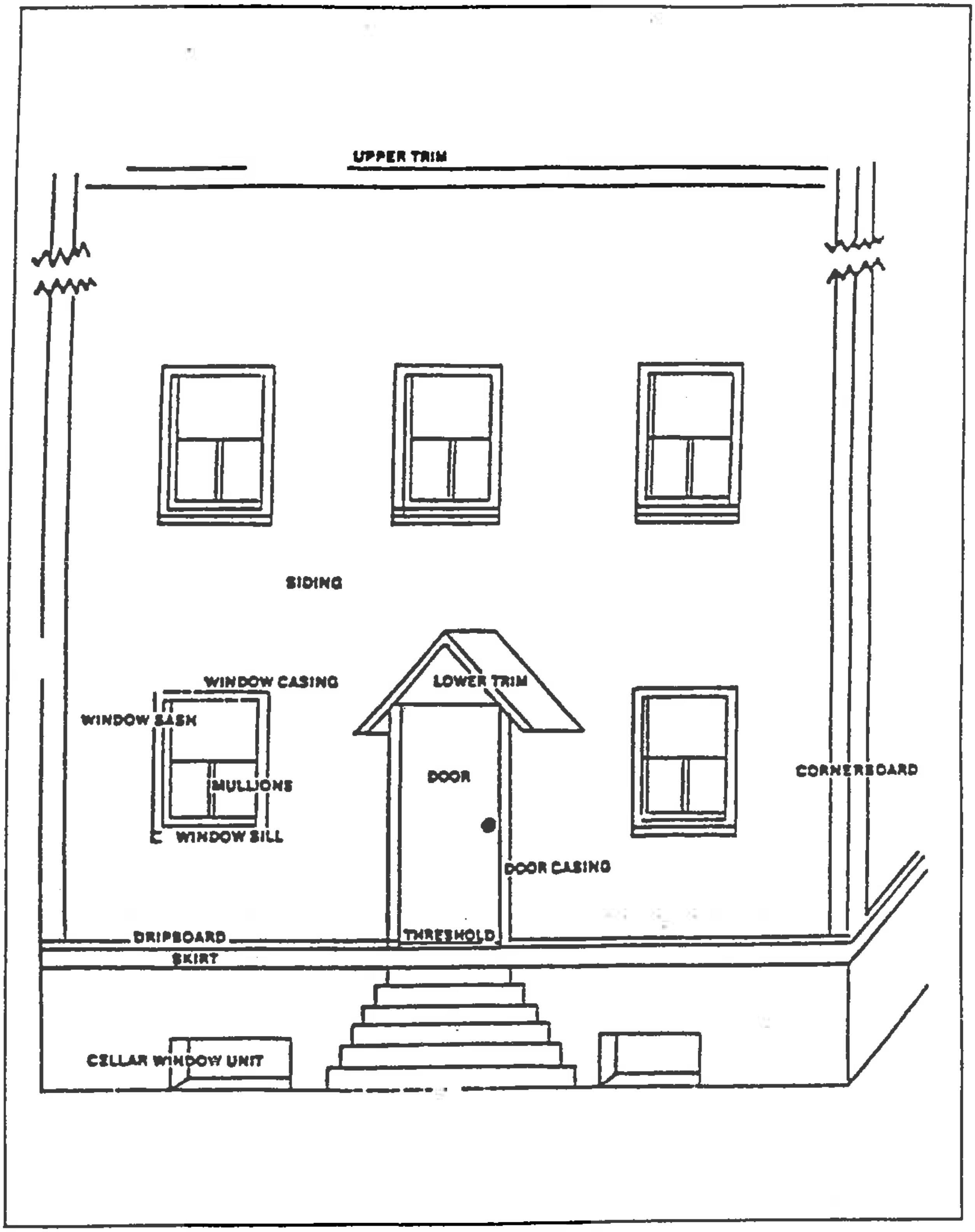
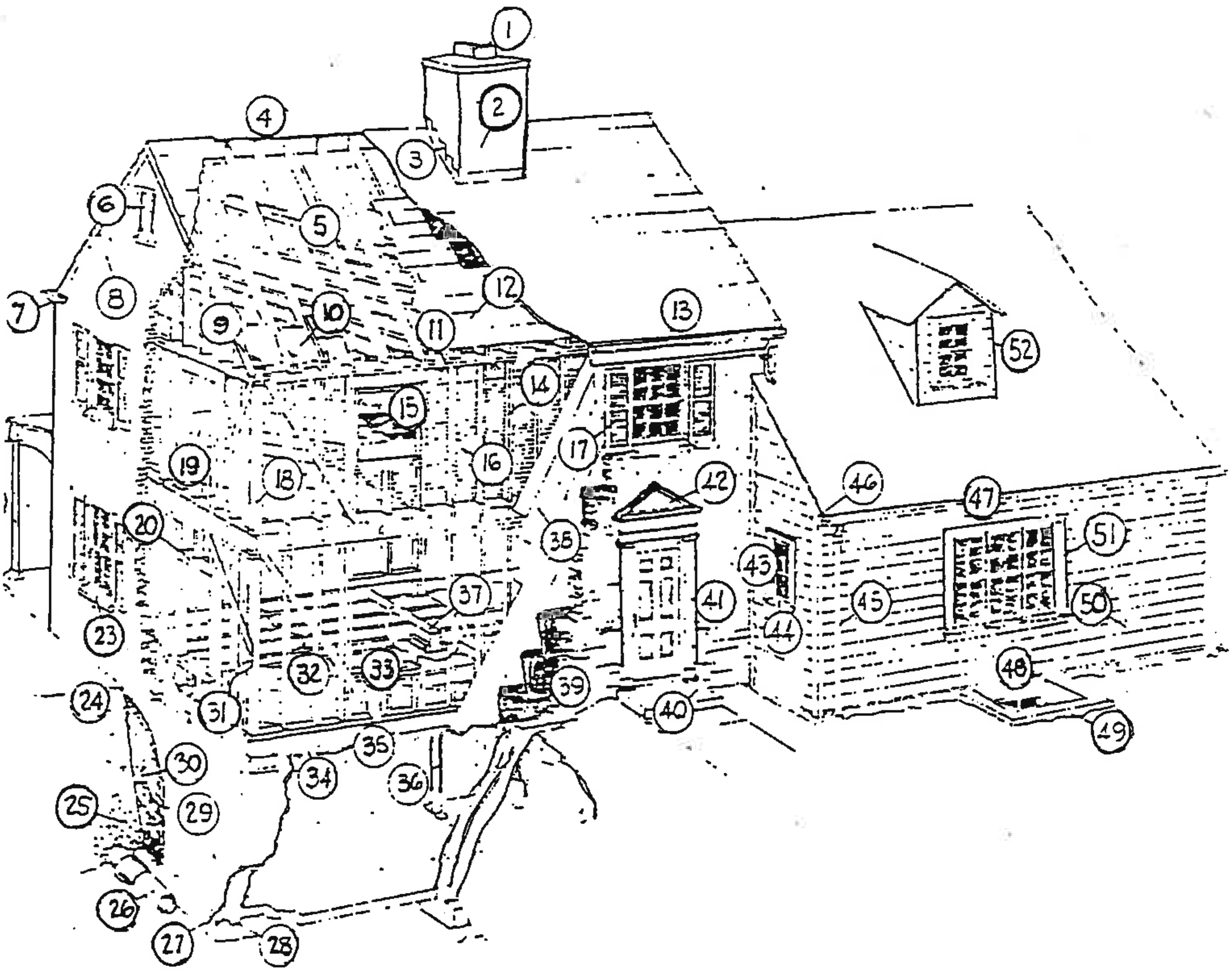
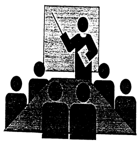


Diagram of Building Components





imney flues or pots
imney
ıshing
dgeboard
llar beam
nt; louver
rnice return
ick veneer
d rafter
ısulation
op double plate
12. Roof decking
13. Gutter
14. Stud
15. Flooring paper
16. Finish flooring
17. Shutter
18. Corner post
19. Subfloor
20. Lintel; header
21. Porch frieze board
22. Porch post
23. Brick sill
24. Grade line
25. Cinder or gravel fill
26. Drain tile
27 Footing
28. Keyway
29. Foundation wall
30. Waterproofing
31. Knee brace
32. Bridging
33. Floor joists
34. Sill plate
35. Corner brace
36. Steel column
37. Beam; girder
38. Wall sheathing
39. Building paper
40. Stoop
41. Trim pilaster
42. Pediment door trim
43. Double-hung window
44. Windowsill
45. Downspout
46. Rake mold
47. Mullion
48. Basement window
49. Areaway wall
50. Bevel siding
51. Wood window trim
52. Dormer



REVIEW
LEAD ABATEMENT TRAINING FOR SUPERVISORS AND CONTRACTORS

Section B: History: Lead - Its Uses and Environmental Impact

- How are children typically exposed to lead?
- Give several examples of lead-based paint hazards.
- What are some possible locations in a residential environment where lead may exist?
- How does the use of lead as white-lead pigment compare to lead used as a gasoline additive over the past 100 years? What is its importance to lead hazard reduction plans?

Section C: Regulatory Review

- What are the major provisions (including purpose and focus) of the federal OSHA, and HUD regulations in regard to lead exposure and lead paint abatement?
- What is a "competent person for health and safety" as defined by OSHA (29CFR1926.62)?
- What are the major provisions of the federal EPA regulations in regard to training and certification requirements for lead abatement personnel?
- To whom do the federal OSHA and HUD regulations apply?
- Why is it important to check that worker licenses and certificates are current?
- What are the OSHA action level and permissible exposure limit?
- What actions must be taken if the OSHA action level for exposure is exceeded?
- What actions must be taken if the OSHA permissible exposure limit for

exposure is exceeded?

- What are the units used to express lead levels in air, and paint?

Section D: Legal & Insurance Issues

- What rules govern contract and tort liability?

- What is the relationship between the standard of reasonable care and applicable regulatory standards?

- What is vicarious liability and the circumstances under which it may arise in lead abatement?

- What are the elements of property damage and personal injury awards and their potential amounts?

- Compare/contrast the types of insurance applicable to lead abatement.

Section E: Health Effects of Exposure

- What are the common routes of worker lead exposure?

- What are the basic health effects of lead exposure to adults?

- Why are children at special risk of lead exposure health effects?

- Which body systems are affected by exposure to lead-contaminated substances and chemicals used on lead abatement projects?

Section F: Medical Surveillance

- What are the requirements of a medical surveillance program on a lead abatement project?

Section G: Site Characterization

- List several types of physical hazards at abatement work sites.

- What are the elements of a HAZ-COM program?

- What should be listed on an MSDS?

Section H: Safety and Health Plan

- What are three work practice control measures?
- What are examples of administrative and engineering controls?

Section I: Other Safety & Health Considerations

- What are some other chemical hazards on a lead abatement project, besides lead?
- What are several types of physical hazards at abatement work sites?
- What are examples of administrative and engineering controls and work practices used to reduce hazards?

Section J: Respiratory Protection

- How do different exposure measurements compare and contrast?
- What methods can be used for lead abatement worker air monitoring?
- What are the main routes of lead exposure on lead abatement sites?
- What should be considered when selecting proper respirators for use on a particular abatement project?
- What steps are involved in properly cleaning, storing, and maintaining respirators?
- What are the protection factors for each type of respirator?
- What are the different types of respirator fit tests?
- What are the advantages and disadvantages of respirator use?
- How and why should the supervisor enforce proper respiratory protection practices among workers?

Section K: Protective Clothing & Equipment

- List and define at least six types of protective clothing used on an abatement project.
- Explain the reasons for the sequence used in dressing and undressing prior to entering and leaving a contaminated area.
- How should protective clothing be cleaned?

Section L: Employee Information and Training

- What are the required and recommended topics which must be included in a worker training program?
- When and under what circumstances must workers be trained?
- Why does the OSHA Hazard Communication Standard (HAZ COM) apply to lead-based paint abatement projects?

Section M: Project Management

Overview of the Abatement Process

- List and describe the responsibilities of at least six participants in a lead abatement or hazard reduction project.
- What are three major steps required in the abatement and hazard reduction processes?

Contract Specifications

- What is the purpose of contract specifications.
- What are three contract documents the supervisor may need to utilize?
- What are three ways in which a contract protects the parties involved?
- What are the types of drawings/blueprints which may be included with the contract documents?

Record Keeping & Log Books

- What is the difference between the types of records recommended and the types required to be kept by abatement contractors?

- What is the value of good record keeping?

- What elements are required in the mandatory EPA Abatement Report?

- Why is it important to check that worker licenses and certificates are current?

Supervisory Skills

- What are two methods used in team building?

- How do communication and expectation compare as they are used in supervision? How do they contrast?

Cost Estimation

- What are five cost considerations unique to hazardous environments often found on lead hazard control projects?

- What is the difference between the relative costs of waste disposal associated with encapsulation, on-site paint removal, and other strategies?

Section N: Lead Hazard Reduction Strategies

Building Components

- What architectural components are commonly found on residential buildings?

- What types of materials were commonly used during the last 100 years in the construction of residential buildings?

Lead-Based Paint Abatement

- What procedures are used to protect the workers, the public, and the environment during a paint abatement project?

- What materials and techniques are used to prepare a work site for paint abatement?

- What are the post-abatement clearance criteria for a public housing authority lead-based paint abatement project?
- What are the hazards associated with paint abatement strategies?

Interior Dust Reduction & Control

- What are the major sources of lead-contaminated dust in the interior residential environment?

- What processes are used to remove dust from carpeted and bare floors?

Soil Lead Abatement

- Describe the hazards workers encounter on soil abatement projects. What are the proper personal protective equipment required to safeguard workers from those hazards?

- What soil abatement strategies are available at present?

- Describe the sequence of abatement in a combined paint, soil, and dust abatement project. Why is that sequence important?

Exterior Dust Reduction & Control

- Describe the hazards workers encounter on exterior dust reduction projects. What are the proper personal protective equipment required to safeguard workers from those hazards?

- What types of cleaning equipment are suitable for exterior dust reduction?

Interim Controls

- When are interim control measures appropriate for the control of LBP hazards?

- What qualifications must supervisors/contractors possess for the implementation of interim control measures?

- What measures must be taken to protect residents during interim control activities?

- What are the proper waste disposal procedures for interim control measures?
- What is the paint film stabilization process?
- What is friction and impact surface treatment?
- What is the proper method of dust removal and control?
- What are proper soil interim controls?

Section O:Sampling for Lead & Post-Abatement Clearance

- How is XRF instrumentation used to test for lead in paint?
- What is the technique used for post-abatement clearance testing?
- Describe worker exposure monitoring on a lead abatement project.
- Why is it important to have a third-party inspector or risk assessor conduct air clearance sampling?

Section P: Waste Disposal

- What are the four criteria to use in determining whether material is a solid or hazardous waste?
- What is meant by “cradle to grave” as it applies to lead abatement waste disposal?
- What is meant by “large” and “small” waste generators? Why is this important to lead abatement supervisors/contractors?
- Describe how to package and label hazardous waste.

Section Q:Community Relations Process

- What phases are necessary to have a successful community relations plan for a large multi-unit lead abatement project?

- What are three major tasks a community relations coordinator must complete?
- What is the role of the supervisor in implementing the community relations plan?

GLOSSARY

Abatement - (general definition)is a comprehensive process of eliminating exposure or potential exposure to lead paint and lead-containing soil and dust which must include testing, measures for worker protection, containment of dust and debris, cleanup and disposal of waste, and clearance testing. (Title X definition: The term means any set of measures designed to permanently eliminate lead-based paint hazards in accordance with standards established by appropriate Federal agencies.)

Accessible, Mouthable Surfaces - are interior or exterior architectural surfaces or fixtures five feet or less from the floor or ground that form a protruding corner or similar edge, or protrude one-half inch or more for a flat wall surface, or are free-standing so that a child may place his/her mouth on the surface or suck the surface. In general, "accessible, mouthable surfaces" refers to woodwork such as doors, door jambs, stairs and stair rails, etc. Base boards with an exposed horizontal edge may have quarter round molding applied to the top so that only vertical edges forming outside corners, if present, constitute accessible, mouthable surfaces.

Accuracy - the degree to which a measurement process determines a known amount of lead or other component in a particular reference material.

ACGIH - American Conference of Governmental Industrial Hygienists, which develops and publishes recommended occupational exposure limits for hundreds of chemical substances and physical agents.

Acid - Any chemical with a low pH that in water solution can burn the skin or eyes. Acids turn litmus paper red and have pH values of 0 to 6.

Action Level - the point at which something needs to be done to correct or eliminate the presence of the hazard (e.g. lead).

Acute Effect - Adverse effect on a human or animal which has severe symptoms developing rapidly and coming quickly to a crisis. Also see "chronic effect."

Administrative Control - written policies prepared before abatement work begins which remove or prevent exposure to physical, biological, or chemical hazards.

Administrative Removal - is the temporary removal of workers prior to their reaching blood lead levels requiring medical removal in order to provide additional protection to both workers and employers.

AIHA - American Industrial Hygiene Association.

Air-line respirator - A respirator that is connected to a compressed breathing air source by a hose of small inside diameter. The air is delivered continuously or intermittently in a sufficient volume to meet the wearer's breathing requirements.

Air-purifying respirator - A respirator that uses chemicals to remove specific gases and vapors from the air or that uses a mechanical filter to remove particulate matter. An air-purifying respirator must only be used when there is sufficient oxygen to sustain life and the air contaminant level is below the concentration limits of the device.

Alkaline - Substances having a pH >7. In the lead abatement industry, alkaline substances are often used to remove LBP from substrates.

ANSI - The American National Standards Institute is a voluntary membership organization (run with private funding) that develops consensus standards nationally for a wide variety of devices and procedures.

Apparent Lead Concentration (ALC) - is the average of at least 3 XRF single cycle readings on a painted surface.

ASTM - American Society for Testing and Materials.

Atomic Absorption - is a method of measuring elements such as lead. The lead is vaporized at high temperature, usually several thousand degrees, and light of a very specific wave-length is shined through the vapor. If lead is present the light is partially extinguished. The instrument converts this change into a number that describes how concentrated the lead is in the test material.

Bias - is the lead reading provided by any XRF on a lead free surface, also called the Substrate Effect Lead Concentration (SEL).

Biennial Report - a report (EPA Form 8700-13A) submitted to generators of hazardous waste to the Regional Administrator due March l of each even-numbered year. The report includes information on the generator's activities during the previous calendar year. The owner or operator of a treatment, storage, and disposal facility must also prepare and submit a biennial report using EPA Form 8700-1313.

Biohazard - is a combination of the words "biological" and "hazard." Organisms or products of organisms that present a risk to humans.

Biological Monitoring - is the analysis of a person's blood and/or urine, to determine the level of lead contamination in the body.

Blank - a non-exposed sample of the medium used for testing, such as a wipe or filter, which is analyzed like other samples to determine whether (1) samples are contaminated with lead before samples are collected (e.g., at the factory, or at the testing site), (2) the samples are contaminated after sample collection (e.g., during transportation to the laboratory or in the laboratory).

Block Diagram - is the square picture used to indicate the exact position of a dwelling on an inspection report.

Blood Tests

Capillary - commonly referred to as "the finger-stick" method. This is the most frequently used way to collexct blood samples from children in lead screening programs or services.

Venipuncture - using a needle to puncture and draw blood directly from a vein into a "vacutainer" (a tube sealed at the factory). This blood sampling method presents fewer chances for contamination and produces more accurate results.

Body Burden - is the total amount of a substance that is deposited in the entire body. Metal substances, such as lead and mercury, tend to accumulate in the kidneys, the liver, and especially the bones.

Breathing Zone - Air that would most nearly represent that which is inhaled.

CFR - The Code of Federal Regulations - is the basic component of the Federal Register publication system. The CFR is a codification of the regulations of the various Federal Agencies.

Carbon monoxide - is a colorless, odorless toxic gas produced by any process that involves the incomplete combustion of carbon-containing substances. It is emitted through the exhaust of gasoline-powered vehicles.

Carcinogen - is a substance or agent capable of causing or producing cancer in mammals, including humans.

CAS (Chemical Abstracts Service) - is an organization under the American Chemical Society. CAS Numbers are used to identify specific chemicals or mixtures.

Certified supervisor - an individual who has been trained by an accredited training program and certified by a state or federal agency to supervise and conduct abatements, and to prepare occupant protection plans and abatement reports.

Characteristics - EPA has identified four characteristics of a hazardous waste: Ignitability; Corrosivity; Reactivity; and Toxicity. Any solid waste that exhibits one or more of these characteristics is classified as a hazardous waste under RCRA.

Chelation Therapy - describes the medical treatment in which a drug that is attracted to metals (such as lead) is infused into a patient's vein. The drug binds to the metal in the blood, and both are excreted by the kidney as urine. A new orally administered drug (Succimer) is now being tested.

Child-Occupied Facility - a building, or portion of a building, constructed prior to 1978, visited regularly by the same child, 6 years of age or under, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3 hours and the combined weekly visit lasts at least 6 hours, and the combined annual visits last at least 60 hours. Child-occupied facilities may include, but are not limited to, day-care centers, preschools and kindergarten classrooms.

Chronic Effect - is an adverse effect on a human or animal body, with symptoms which develop slowly over a long period of time or which recur frequently.

Clearance examination - Visual inspection for dust and completion of required work and testing for surface lead-contaminated dust by a risk assessor or lead inspector (in some localities) following lead abatement, application of interim controls, or maintenance work. Some clearance examinations may include soil samples if exterior work was performed. Lead loadings and/or concentrations would ave to meet criteria established by the EPA Administrator under Title IV of the Toxic Substances Control Act.

Common Area - a room or area that is accessible to all residents in a multi-family building (e.g., hallway, laundry room). Generally, any area that is not kept locked.

Competent person - one who is capable of identifying existing and predictable lead hazards in the surroundings or working conditions; and who has authorization to take prompt corrective measures to eliminate them.

Component - Finish materials used in residential buildings which are usually painted; e.g., ceilings, walls, doors, and chair rails.

Concentration - is the amount of a given substance in a stated unit of measure. Common methods of stating concentration are percent by weight or by volume, weight per unit volume, normality, etc.

Container - any portable device in which material is stored, transported, treated, disposed of, or otherwise handled.

Containment - is a process for protecting both workers and the environment by controlling exposures to lead dust and debris created during abatement.

Contingency Plan - a document setting out an organized, planned, and coordinated course of action to be followed in case of a fire or explosion or a release of hazardous waste or hazardous waste constituents from a treatment, storage, or disposal facility that could threaten human health or the environment.

Contractor - means any business entity, public unit, or person performing the actual abatement for a lead abatement project.

Corrected Lead Concentration (CLC) - is the difference between the Apparent Lead Concentration (ALC) and the Substrate Effect Lead Concentration (SEL).

Corrosive - A substance that causes visible destruction or permanent changes in human skin tissue at the site of contact.

Critical Path Method - is a method of scheduling in a detailed manner the various sequence of steps that must be taken by each trade from the start to the completion of a construction project in order to complete the project in the most efficient manner.

Degrees Celsium (Centigrade). The temperature on a scale in which the freezing point of water is 0°C and the boiling point is 100°C. To convert to Degrees Fahrenheit, use the following formula: °F = (°C x 1.8) + 32.

Degrees Fahrenheit - is the temperature on a scale in which the boiling point of water is 212 °F and the freezing point is 32 °F.

Density - is the mass per unit volume of a substance. For example, lead is much more dense than aluminum.

Detection Limit - the minimum amount of a component that a method can reliably measure.

Direct Reading XRF - is an X-Ray Fluorescence analyzer which provides the operator with a display of a lead concentration calculated from the lead "K" x-ray intensity.

Discharge or Hazardous Waste Discharge - the accidental or intentional spilling, leaking, pumping, pouring, emitting, discharge, emptying, or dumping of hazardous wastes onto any land or water or into the air.

dl stands for "deciliter." The prefix "deci-" means "one-tenth." One deciliter is roughly the same as about one tenth of a quart, or about 1.6 ounces.

Dose-response relationship - is the correlation between the amount of exposure to an agent or taxic chemical and the resulting effect on the body.

DOL - U.S. Department of Labor. OSHA and MSHA are part of the DOL.

DOT - U.S. Department of Transportation.

Dusts - are solid particles generated by handling, crushing, grinding, rapid impact, detonation, and decrepitation of organic or inorganic materials, such as rock, ore, metal, coal, wood, and grain.

Dwelling Unit - refers to the room or group of rooms within a residential premises used or intended for use by one family or household for living, sleeping, cooking and eating. "Dwelling Unit" includes a condominium.

Encapsulation - involves resurfacing or covering surfaces, and sealing or caulking with durable materials, so as to prevent or control chalking, flaking lead-containing substances from becoming part of house dust or accessible to children

Enclosure - Rigid construction materials which are mechanically fastened to the substrate in order to form a barrier to the LBP. The barrier must have an expected life span of at least twenty years.

Engineering Controls - are measures implemented at the work site to contain, control and/or otherwise reduce exposure to lead dust and debris.

EPA - U.S. Environmental Protection Agency

EPA Identification Number - The unique number assigned by EPA to each generator or transporter equivalent of hazardous waste, and each treatment, storage, or disposal facility.

Erythrocyte Protoporphyrin (E.P.) - is a molecule found in significantly increased amounts in lead-poisoned people. Lead inhibits the formation of the heme molecule, resulting in the increased release of the E.P. molecule into the blood.

Evaporation - is the process by which a liquid is changed into the vapor state.

Exposure - the condition of being unprotected from a harmful influence or substance.

Exposure Monitoring - is the personal air monitoring of an employee's breathing zone to determine the amount of contaminant (e.g. lead) to which he/she is exposed.

Exterior Work Area - means an exterior paved area, a soil area, an outdoor porch, stairway or other element of trim or walls on the exterior of a building.

Facility - all contiguous land, structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units, e.g., one or more landfills, surface impoundments, or a combination of them.

Federal Register - a document published each day following a government working day by the Federal government. It contains either proposed or final regulations.

Fire point - is the lowest temperature at which a material can evolve vapors fast enough to support continuous combustion.

Final Inspection - inspection by a qualified inspector, industrial hygienist, or local public health official to determine whether abatement and cleanup are complete.

Flammable liquid - is any liquid having a flash point below 141 °F, or any material in a liquid phase with a flash point at or above 100 °F that is offered for transportation at or above its flash point.

Flash point - is the minimum temperature at which a liquid gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. Two tests are used: open cup and closed cup.

Friction Surfaces - An interior or exterior painted surface which is subject to friction resulting in damage to the paint film; e.g., window parts and painted stair treads.

Force Account - is a term used to describe a Public Housing Authority's (PHA's) self-performance of modernization work by the use of employees as opposed to performance by a contractor.

Generator - any person who first creates a hazardous waste, or any person who first makes the waste subject to the Subtitle C regulation (e.g., imports a hazardous waste, initiates a shipment of a hazardous waste from a TSD, or mixes hazardous wastes of different DOT shipping descriptions by placing them into a single container).

Ground Water - is water below the land surface in a zone of saturation.

Hazardous Waste - as defined in RCRA the term "hazardous waste" means a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may

A. cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or

B. pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

As defined in the regulations, a solid waste is hazardous if it meets one of four conditions:

1. Exhibits a characteristic of a hazardous waste (40 CFR Sections 261.20 through 262.24).
2. Has been listed as hazardous (40 CFR Section 261.31 through 261.33).
3. Is a mixture containing a listed hazardous waste and a non-hazardous solid waste (unless the mixture is specifically excluded or no longer exhibits any of the characteristics of hazardous waste).
4. Is not excluded from regulation as a hazardous waste.

High Efficiency Particulate Air Filter (HEPA) - means a filter capable of filtering out particles of 0.3 microns or greater from a body of air at 99.97% efficiency or greater.

High Phosphate Detergent - detergent which contains at least 5% tri-sodium phosphate (TSP).

Impervious - is a material that does not allow another substance to pass through or penetrate it. Frequently used to describe gloves.

In-place Management - An abatement strategy which reduces exposure by encapsulating or covering the lead. This process leaves the lead in place but reduces the chance of exposure.

Incinerator - any enclosed device using controlled flame combustion that neither meets the criteria for classification as a boiler nor is listed as an industrial furnace.

Indian Housing Authorities - a public housing agency established (a) by exercise of a tribe's powers of self-government independent of state law, or (b) by operation of State law providing specifically for housing authorities for Indians.

Industrial Hygienist - is a person certified by the American Board of Industrial Hygiene or an industrial hygienist in training, or an individual with equivalent education or experience.

Ingestion - taking into the body through the mouth and digestive system.

Inhalation - breathing of a substance in the form of a gas, vapor, fume, mist, or dust.

Initial Survey - a systematic inspection of a dwelling unit by a qualified inspector, using a portable XRF analyzer, atomic absorption spectroscopy, or other approved testing techniques, to determine whether a lead-based paint hazard is present.

Insoluable - incapable of being dissolved in a liquid.

Inspection - a surface-by-surface investigation to determine the presence of lead-based paint and the provision of a report explaining the results of the investigation.

Intact Surface - refers to a surface with no loose paint or damaged surfaces.

Interim Controls - a set of measures designed to temporarily reduce human exposure or likely exposure to lead-based paint hazards, including specialized cleaning, repairs, maintenance, painting, temporary containment, ongoing monitoring of lead-based paint hazards or potential hazards, and the establishment and operation of management and resident education programs.

Interior Work Area - means a hallway, room or group of rooms in which an abatement takes place on the inside of a building.

Irritant - a chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact.

Landfill - a disposal facility or part of a facility where solid or hazardous waste is placed in or on land and which is not a land treatment facility, a surface impoundment, or an injection well.

Landfill Liner - a continuous layer of natural or man-made materials, beneath or on the sides of a surface impoundment, landfill, or landfill cell, which restricts the downward or

lateral escape of hazardous waste, hazardous waste constituents, or leachate.
Latent period - the time that elapses between exposure and the first manifestation of damage.

Lead (inorganic) - is an element, which means that its atomic structure is permanently arranged and is not changed by chemical reactions. Lead can combine chemically with other atoms or molecules to make new compounds. Lead is considered a heavy metal: "heavy," because lead weighs much more than the same volume of water, and "metal," because when it is refined from raw ore into its pure form, lead can be hammered or drawn into shapes.

Lead-Based Paint - paint or other surface coatings that contain lead equal to or in excess of 1.0 milligrams per square centimeter or more than 0.5 percent by weight (U.S.EPA 402/404 rules).

Lead-Based Paint Hazard - (EPA) any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, or lead-contaminated paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects as identified by the EPA Administrator pursuant to TSCA Section 403.

Lead-Contaminated Dust - (EPA) surface dust in residential dwellings, or child-occupied facilities that contain an area or mass concentration of lead ≥ levels identified by the EPA Administrator pursuant to TSCA Section 403.

Lead-Contaminated Soil - (EPA) bare soil on residential real property and on the property of a child-occupied facility that contains lead ≥ levels identified by the EPA Administrator pursuant to TSCA Section 403.

Listed - hazardous wastes that have been placed on one of three lists developed by EPA: Non-specific source wastes; Specific source wastes; Commercial chemical products. These lists were developed by examining different types of waste and chemical products to see if they exhibit one of the four characteristics, meet the statutory definition of hazardous waste, are acutely toxic or acutely hazardous, or are otherwise toxic.

Liter (L) - is a measure of capacity - one quart equals 0.9L.

Logbook - a notebook that accompanies each XRF analyzer, to record such information as daily performance, maintenance problems, and average reading time.

Manifest - the shipping document, EPA form 8700-22, used for identifying the quantity,

composition, origin, routing, and destination of hazardous waste during its transportation from the point of generation to the point of treatment, storage, or disposal.
Mean (arithmetic) - the arithmetic average of data values. The algebraic sum of the data values divided by the number of data values. When using an XRF, the mean is the average of a series of numerical readings reported by the XRF.

Medical Removal - is the temporary removal of workers due to elevated blood lead levels as defined in the OSHA Lead Standard.

Meter - a metric unit of length, equal to about 39 inches.

Micrograms - one millionth of a gram: µg: The prefix "micro-" means "1/1,000,000 of" (one millionth of). Since there are 453 grams in one pound and 16 ounces in one pound, one gram equals 0.035 ounces. A microgram is equal to about 35/1,000,000,000 (thirty-five billionths) of an ounce.

Micron (µ) - a shortened form of "micrometer" - a unit of length in the metric system equal to one-millionth of a meter or 0.000039 inches.

MSDS - Material Safety Data Sheet.

MSHA - Mine Safety & Health Administration, U.S. Department of Labor.

Negative Air Machine - an exhaust fan which reduces air pressure inside the work area and filters the lead particles from the exhaust air.

NIOSH - The National Institute for Occupational Safety & Health is a federal agency which conducts research on health and safety concerns, tests and certifies respirators, and trains occupational health and safety professionals.

NLLAP - National Lead Laboratory Accreditation Program (EPA).

Off-Site Paint Removal - The removal of paint at a site away from the abatement project such as the stripping of lead paint from the surface of a component at the facilities of a commercial paint-stripping operation occurring in chemical tanks.

On Site Paint Removal - The removal of lead-based material/paint down to the bare substrate usually through heat, chemical or mechanical means. The affected component remains in-place on the premises during this removal process.

OSHA - U.S. Occupational Safety & Health Administration, U.S. Department of Labor.

Owner - means a person, firm, corporation, guardian, conservator, receiver, trustee, executor or other judicial officer, who, alone or jointly owns property.
Oxygen deficiency - that concentration of oxygen by volume below which atmosphere supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

Paint Removal - is a strategy of abatement which entails stripping or other removal of lead paint from surfaces of components.

Pattern - the process of identifying specific building components containing Lead Based Paint (LBP) at a hazardous level within a project or group of buildings.

PEL - Permissible Exposure Limit - an exposure limit that is published and enforced by OSHA as a legal standard.

Performance Characteristics Sheet - These sheets are supplemental information to be used in conjunction with the HUD Guidelines' chapter seven. They give field operation guidance on XRF operation to lead inspectors and risk assessors for the specific XRF instrument being used. They are jointly developed by the U.S.EPA and HUD.

Permit - an authorization, license, or equivalent control document issued by EPA or an authorized State to implement the regulatory requirements of Subtitle C Parts 264 and 265 for Treatment, Storage and Disposal facilities (TSDs).

Personal Protective Equipment (PPE) - Devices worn by the worker to protect against hazards in the environment. Respirators, gloves, and hearing protectors are examples.

Personal Samples (for sampling lead dust) - air samples collected from within the breathing zone of a worker, but outside the respirator. The samples are collected with a personal sampling pump, pulling 1 to 4 liters/minute of air.

Pigments - are chemicals which have color, or properties which affect color. Usually, a small amount of these chemicals are mixed with another material to color all of the material. Lead carbonate and lead oxide are chemical forms of lead used as pigments. Lead carbonate is white and thus its color can be changed by adding yet another colored chemical. In contrast, lead oxide is red and by itself gives a strong red color. Desirable properties of pigments (particularly those of lead) are that they keep their color over time and do not otherwise fade or change into less pleasing colors.

ppm - stands for "parts per million," meaning the weight of one part per weight of the total amount of material. For example, a lead concentration of 1 ppm expresses the ratio of one gram of lead dissolved into one million (1,000,000) grams of water.

Precision - the degree of repeatability of a series of successive measurements.

Public Housing Agency (PHA) - any State, county, municipality, or other governmental entity or public body (or agency or instrumentality thereof) which is authorized to engage or assist in the development or operation of housing for low income families.

Random Testing - the process of performing an initial survey in a representative sampling of units in a project.

RCRA - Resource Conservation and Recovery Act of 1976. What we commonly refer to as RCRA is an amendment to the Solid Waste Disposal Act of 1965. RCRA was amended in 1980 and most recently on November 8, 1984 by Hazardous and Solid Waste Amendments.

Reading Cycle - direct reading XRF analyzers calculate the lead "K" x-ray intensity in a specific time interval (10 to 30 seconds) which is fixed by the manufacturer and related to the age of the source. The calculated result in this time interval is a reading cycle. In order to determine a concentration of lead Apparent Lead Concentration (ALC) or Substrate Equivalent Lead concentration (SEL) the displayed results of a minimum of 3 single reading cycles must be averaged. The difference between the lowest and highest reading from at least three reading cycles must be less than 1.7 mg/cm^2.

Regulation or Rule - all or part of any Federal statement of general or particular applicability and future effect designed to: (1) implement, interpret, or prescribe law or policy or (2) describe the Federal Department's organization or its procedure or practice requirements.

Replacement - is a strategy of abatement which entails the removal of components such as windows, doors, and trim that have lead painted surfaces and installing new components free of lead paint.

Representative Sample - a sample of a universe or whole (e.g., waste sample pile, lagoon, ground water, or waste stream) which can be expected to exhibit the average properties of the universe or whole.

Risk Assessment - (1) an on-site investigation to determine the existence, nature, severity, and location of lead-based paint hazards, and (2) the provision of a report by the individual or the firm conducting the risk assessment, explaining the results of the investigation and options for reducing lead-based paint hazards.

Route of Entry - the path by which chemicals can enter the body. There are three main routes of entry: inhalation, ingestion, and skin absorption.

SCBA - Self-contained breathing apparatus.
Sample Site - a specific spot on a surface being tested for lead concentration through portable XRF or laboratory analysis.

Site - the land or water area where any facility or activity is physically located or conducted, including adjacent land used in connection with the facility or activity.

Small Quantity Generator - a generator who produces less than 100 kg of hazardous waste per month (or accumulates less than 100 kg at any one time) or one who produces less than 1 kg of acutely hazardous waste per month (or accumulates less than 1 kg of acutely hazardous waste at any one time).

Sodium Sulfide - is a chemical used to test a paint sample qualitatively for lead; typical concentrations are from 6 to 10%. A positive test is characterized by a gray, black, or other dark discoloration of the paint film cross section.

Solid Waste - as defined in RCRA the term "solid waste" means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under the Clean Water Act, or special nuclear or byproduct material as defined by the Atomic Energy Act of 1954.
Solvent - is a substance, usually a liquid, in which other substances are dissolved. The most common solvent is water.

Sorbent - is (1) a material that removes toxic gases and vapors from air inhaled through a canister or cartridge; (2) material used to collect gases and vapors during air sampling.

Spectrum Analyzer XRF - is a type of XRF analyzer which provides the operator with a plot of the energy and intensity of both "K" and "L" x-rays, as well as a calculated lead concentration.

Standard - used in two ways in this manual: (a) levels established by law or regulation, such as 1.0 mg/cm^2 (b) materials to which known quantities of lead have been applied;

used to evaluate the accuracy and performance of the XRF analyzer, usually called Standard Reference Materials.

Standard Deviation - a measure of the precision of the readings, the average deviation of the deviations from the mean. The smaller the standard deviation, the more precise the analysis, and the less variation there is when an analysis is repeated.
Storage - the holding of hazardous waste for a temporary period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere.

Substrate - a surface upon which paint or varnish has been or may be applied. Examples of substrates include wood, plaster, metal, and drywall.

Substrate Effect - the returning of backscattered radiation from the paint, substrate or underlying material to the XRF analyzer. This radiation when counted as lead x-rays by an XRF contributes to Substrate Effect Lead (SEL) or bias. The inspector may have to compensate for this effect when using some XRF analyzers. The need for this is specified in the Performance Characteristic Sheet. The SEL is the average of at least 3 XRF single cycle readings on the unpainted substrate.

Substrate Effect Lead Concentration (SEL) is the average of at least 3 XRF single cycle readings on an unpainted surface.

Synergism - cooperative action of substances whose total effect is greater than the sum of their separate effects.

TCLP - Toxic Characteristic Leaching Procedure, is one of the tests for the determinations of whether a solid waste is classified as a hazardous substance, see EP Toxicity which it replaced.

Toxicity - measured by TCLP. The TCLP (Toxicity Characteristic Leaching Procedure) is a test designed to identify wastes likely to leach hazardous concentrations of particular toxic constituents into the ground water as a result of improper management. Toxicity is a characteristic of hazardous waste. The TCLP has recently replaced the EP (Extraction Procedure) Toxicity test as the laboratory test used to determine the toxicity of material making up the waste stream.

Transporter - any person engaged in the off-site transportation of hazardous waste within the United States, by air, rail, highway, or water, if such transportation requires a manifest under 40 CFR Part 262.

Treatment - any method, technique or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize it, or render it non-hazardous or less hazardous, or to recover it, make it safer to transport, store or dispose of, or amenable for recovery, storage, or volume reduction.

TSD - acronym for treatment, storage, or disposal hazardous waste facility.

TSP - acronym for tri-sodium phosphate.

TWA - Time-weighted average - refers to concentrations of airborne toxic materials which have been weighted for a certain time duration, usually 8 hours.

Ultra Low Penetration Air (ULPA) - means a filter capable of filtering out particles of 0.13 microns or greater from a body of air at 99.9995% efficiency or greater.

Volatile - easily converted to vapor at relatively low temperatures (e.g., paint thinners)..

Window Trough (well) - for a typical double-hung window, the portion of the exterior window sill between the interior window sill (or stool) and the frame of the storm window. If there is no storm window, the window tough is the area that receives both the upper and lower window sashes when they are both lowered. Sometimes inaccurately called the window "well."

Window Sill (interior) - the portion of the horizontal window ledge that protrudes into the interior of the room, adjacent to the window sash when the window is closed; often called the window stool.

XRF Analyzer - an instrument which determines lead concentration in milligrams per square centimeter (mg/cm^2) using the principal of x-ray fluorescence. Two types of XRF analyzers are used, direct readers and spectrum analyzers.

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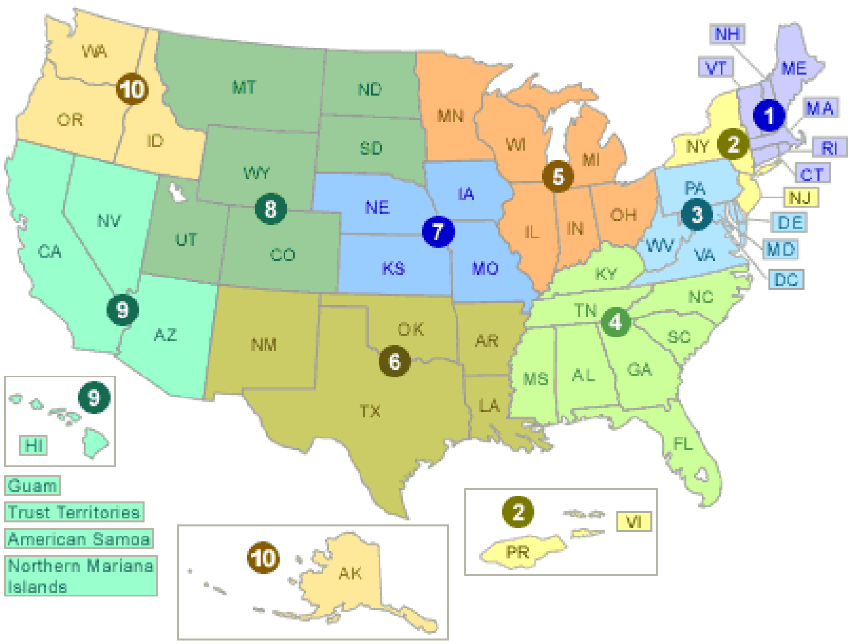
EPA Geographical Regions



Also, for detailed information or questions, you can call the **National Lead Information Center (NLIC)** and speak with an information specialist Monday through Friday, 8:00 am to 6:00 pm eastern time at **1(800) 424-LEAD**.

REGION 1
States: CT, ME, MA, NH, RI, VT

REGION 2
States: NY, NJ, PR, VI

REGION 3
States: DE, MD, PA, VA, WV, District of Columbia

REGION 4
States: AL, GA, KY, MS, NC, TN, FL, SC

REGION 5
States: IL, IN, MI, MN, OH, WI

REGION 6
States: AR, LA, OK, NM, TX

REGION 7
States: IA, MO, KS, NE

REGION 8
States: CO, MT, ND, SD, UT, WY

REGION 9
States: AZ, CA, HI, NV, Guam, Samoa, Guam

REGION 10
States: AK, ID, OR, WA