CHAPTER 9: WORKER PROTECTION

Worker Protection: How To Do It

1. Since worker exposure to lead during residential lead abatement work may be greater than the permissible exposure limit (PEL) set by the Occupational Safety and Health Administration (OSHA), develop a written compliance plan and designate a competent person to oversee worker protection efforts (usually an industrial hygienist or a certified lead abatement supervisor). [See the OSHA Lead in Construction Standard for complete details (29 CFR 1926.62). Call your local OSHA office for a copy (see Appendix 4 for a listing).] A model written compliance plan is provided at the end of this chapter.

2. Conduct an exposure assessment for each job classification in each work area. Monitoring current work is the best means of conducting exposure assessments. Perform air sampling in 1 dwelling unit out of every 20 being treated, with an emphasis on sampling "worst-case" dwellings. Alternatively, if working conditions are similar to previous jobs by the same employer, previously collected exposure data can be used to estimate worker exposures. Finally, objective data (as defined by OSHA) may be used to determine worker lead exposures in some cases. Exposures to airborne leaded dust greater than 30 $\mu g/m^3$ (8-hour, time-weighted average) trigger protective requirements that are enforced by OSHA.

3. If lead hazard control will include manual demolition, manual scraping, manual sanding, heat gun use, or use of power tools such as needle guns, then specific worker protection measures (outlined in this chapter) are required until an initial exposure assessment is completed. If the initial exposure assessment indicates exposures are less than 30 $\mu g/m^3$, the requirements do not legally apply, although exposure to lead should be kept as low as possible at all times.

4. Implement engineering, work practice, and administrative controls to bring worker exposure levels below the PEL. Examples of such controls include the use of wet abatement methods and the selection of other work methods that generate little dust.

5. Where needed, supplement the use of engineering and work practice controls with appropriate respirators (at a minimum, use a half-mask, air-purifying respirator approved by the National Institute for Occupational Safety and Health (NIOSH)) and implement a respiratory protection program. Provide a respirator to any employee who requests one, regardless of the degree of exposure. Most residential lead hazard control projects will involve the use of a half-mask, air-purifying respirator with high-efficiency particulate air (HEPA) cartridges.

6. Arrange for a medical exam before work begins for each worker who will be required to wear a respirator. The exam will indicate whether the worker is physically capable of wearing a respirator safely. Conduct fit testing for all workers who will be required to wear respirators. Workers with beards, scars, or unusual facial shapes may not be able to wear certain kinds of fitted respirators.

7. Provide protective clothing and arrange for proper disposal or laundering of work clothing.

8. Provide handwashing facilities, preferably with showers.

9. Implement a medical surveillance program that includes blood lead monitoring under the supervision of a qualified physician pursuant to OSHA regulations. Initial blood testing for lead exposure is required by OSHA for workers performing certain tasks, such as manual scraping, and for any worker who may be exposed to greater than 30 $\mu g/m^3$ of lead on any day.

10. Ensure that workers are properly trained in the hazards of lead exposure, the location of lead-containing materials, the use of job-specific exposure control methods (such as respirators), the use of hygiene facilities, and the signs and symptoms of lead poisoning. See Appendix 15 for a Worker Fact Sheet on the OSHA Standard that can be used for training purposes. OSHA and the U.S. Environmental Protection Agency require all lead hazard control workers to be trained, even if exposures are very low.
11. Post lead hazard warning signs around work areas. Also, post an emergency telephone number in case an on-the-job injury occurs.
12. Conduct work as specified.
13. Conduct worker decontamination before all breaks, before lunch, and at the end of the shift. Decontamination usually consists of:
    - Cleaning all tools (end of the shift only).
    - HEPA vacuuming all protective clothing if visibly contaminated with paint chips or dust before entering the decontamination area.
    - Entering the decontamination area (dirty side).
    - Removing protective clothing by rolling inward (do not remove respirator yet); removing work shoes and putting in plastic bag.
    - Entering shower or washing facility.
    - Washing hands and then removing respirator.
    - Taking a shower using plenty of soap and water; washing hair, hands, underneath fingernails, and face especially well (hand and face washing only is permitted for lunch and breaks).
    - Entering the clean area and putting on street clothing and shoes.
14. Maintain exposure assessment and medical surveillance records for 30 years. Notify workers within 5 days after receiving air sampling and blood lead level results.

Chapter 9: Worker Protection

I. Introduction

The potential for worker exposure to lead (as well as to other hazardous substances, safety hazards, and physical agents) exists during all lead hazard control projects. This chapter provides recommendations to:

- Assist contractors and facility owners in establishing programs to control employee lead exposures.
- Help employers and facility owners understand and meet the requirements of the Occupational Safety and Health Administration (OSHA) interim final rule for lead exposure in construction as it applies to residential work (29 CFR 1926.62) (OSHA, 1993).

A model written compliance plan is provided at the end of this chapter to help employers comply with the standard. A summary of the standard for workers prepared by the Alice Hamilton Occupational Health Center is found in Appendix15.

Due to the recognized adverse health effects of lead, employers should minimize worker lead exposures as much as possible. The OSHA construction lead standard is the minimum level of protection that employers must legally provide to workers during all lead hazard control projects. Employers should refer directly to the OSHA construction lead standard for complete requirements.

Where To Get the OSHA Standard

The OSHA standard can be obtained by writing or calling OSHA, Office of Publications, Room N–3101, United States Department of Labor, Washington, DC 20210; (202) 219–4667, or by contacting any local OSHA office (see Appendix 4).

II. Adult Occupational Exposure to Lead

Inhalation of dust and fumes, and ingestion resulting from contact with lead-contaminated food, cigarettes, clothing, or other objects, are the major routes of worker exposure to lead. Once absorbed, lead accumulates in the blood, soft tissues, and bones, with the highest accumulation initially in the liver and kidneys (NIOSH, 1992a). Lead is stored in the bones for decades, and may cause toxic effects in adults as it is slowly released over time (Silbergeld, 1992). Chronic overexposure to lead results in damage to the kidneys, the gastrointestinal tract, the peripheral and central nervous systems, the reproductive system, and the blood-forming organs. Adverse effects in adults include:

- Abdominal discomfort.
- Anemia.
- Colic.
- Constipation.
- Excessive tiredness.
- Fine tremors.
- Headache.
- High blood pressure.
- Irritability or anxiety.
- Loss of appetite.
- Muscle and joint pain.
- Pallor.
- Pigmentation on the gums (“lead line”).
- Sexual impotence.

- Weakness.
- Inability to keep the hand and arm fully extended ("wrist drop").

The frequency and severity of symptoms associated with lead exposure increase as blood lead levels increase. The signs and symptoms of chronic lead poisoning are well recognized (Hernberg, 1988; Landrigan, 1985; Proctor, 1988).

Overt symptoms of lead poisoning in adults generally become apparent when blood lead levels are between 60 and 120 micrograms per deciliter (µg/dL) (Figure 9.1). Neurologic, hematologic, and reproductive effects, however, may be detectable at much lower levels. OSHA recommends a blood lead level no greater than 30 µg/dL to prevent reproductive problems, although the medical removal provisions do not take effect until the level reaches 50µg/dL. In 1990, the U.S. Public Health Service established the national goal of eliminating, by the year 2000, all occupational exposures that result in worker blood lead levels greater than 25 µg/dL (DHHS, 1990). The mean blood lead level for men in the United States during the period from 1976 to 1980 was 16 µg/dL (Mahaffey, 1982; Annest, 1983). In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) has proposed that worker blood lead levels be controlled to 20 µg/dL (ACGIH, 1993).

Recent studies suggest that adverse health effects can be detected when blood lead levels are *below* the current OSHA standard for occupational exposure (50 µg/dL). Therefore, the OSHA standard may not sufficiently protect workers' health. OSHA is currently developing a final rule to address this issue (the current rule is an interim final standard).

In males, increased blood lead levels are associated with increased blood pressure, with no apparent blood lead threshold (less than 10 µg/dL). A number of studies have found neurological symptoms in workers with blood lead levels as low as 40 µg/dL. In addition, decreased fertility in men (low sperm count, low sperm motility, and abnormal sperm shape) has been identified at blood lead levels as low as 40 µg/dL.

In women, exposure to lead (as low as 10 to 15 µg/dL) before and during pregnancy is associated with preterm delivery, low birth weight, an increased frequency of miscarriage and stillbirth, and problems in early mental development of the fetus (ATSDR, 1990; National Academy of Sciences, 1993).

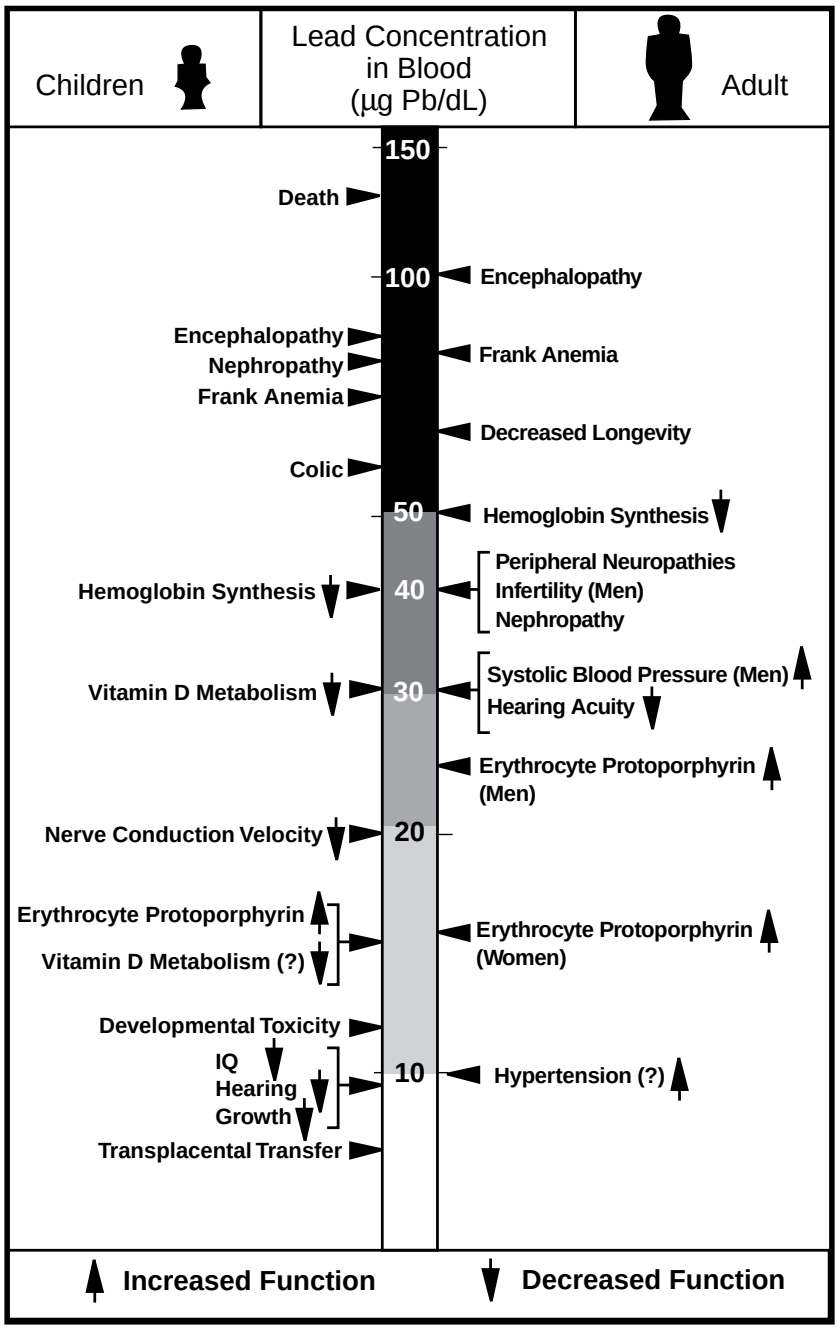
When a family member is occupationally exposed to lead, leaded dust may be carried home on clothing, on skin and hair, and in vehicles. High blood lead levels in resident children and elevated concentrations of lead in house dust have been found in the homes of workers employed in industries associated with high lead exposure (Grandjean, 1986). Children of workers with lead poisoning or children of any worker exposed to high lead levels should be tested for lead exposure by a qualified health-care provider.

III. Background on Federal Worker Protection Standards for Lead

For many years, there was a large disparity between OSHA's requirements for lead-exposed workers in general industry and those in construction. In 1978, OSHA promulgated a final lead standard for general industry (29 CFR 1910.1025). This comprehensive standard established a permissible exposure limit (PEL) of 50 micrograms of lead per cubic meter of air (µg/m^3) (8-hour, time-weighted average) and included requirements for engineering controls, personal protective equipment, air monitoring, medical surveillance, and employee training. Medical removal, with economic protection of wages and benefits, was specified for employees with an average blood lead level at or above 50 µg/dL.

The construction industry was exempted from the 1978 lead standard, primarily due to concerns regarding feasibility, the short duration of many exposures, and the relatively high number of temporary employees (OSHA, 1978). Prior to 1993, worker exposures to lead in the

Figure 9.1 Adverse Health Effects of Lead In Adults and Children.



- Effects in children generally occur at lower blood lead levels than in adults.
- The developing nervous system in children can be affected adversely at blood lead levels of less than 10 µg/dL.

Adapted from: ATSDR, *Toxicological Profile for Lead* (1989)

construction industry were regulated by several sections of the 1971 construction industry standards (29 CFR 1926), which included a PEL for lead of 200 μg/m^3, and did not include requirements for medical monitoring, removal of exposed workers, or other specific protective measures regarding lead.

The *HUD Interim Guidelines for Lead-Based Paint Abatement in Public and Indian Housing* (Revised Chapter 8, 55 FR 39973, August 1991) recommended that the requirements of the OSHA general industry lead standard be established as a minimum level of protection for workers performing lead-based paint abatement, and that additional medical monitoring and respiratory protection be provided. Both OSHA and the National Institute for Occupational Safety and Health (NIOSH) have recently published recommendations that exposures to lead in construction be minimized through the use of engineering controls and work practices, and that comprehensive worker protection programs be provided for lead-exposed workers (OSHA/NIOSH, 1991; NIOSH, 1992a).

In 1990, OSHA began to develop a comprehensive standard regulating lead exposure in the construction industry. Since no proposed final rule was forthcoming by late 1992, Congress required in Title X of the Housing and Community Development Act of 1992 (October 28, 1992) that OSHA issue an interim final rule for the construction industry within 180 days. Congress required that the standard be as protective as the worker protection requirements contained in the 1991 *HUD Interim Guidelines for Lead-Based Paint Abatement in Public and Indian Housing* (i.e., PEL of 50 μg/m^3). OSHA complied with this mandate, issuing an interim final rule for lead exposure in construction on May 4, 1993 (OSHA, 1993).

Workers engaged in routine maintenance work are covered by the general industry standard. Maintenance workers engaged in interim control or abatement work are covered by the construction standard.

Generally speaking, the new lead in construction standard requires employers to do the following:

- Evaluate workers' exposures.
- If exposures cannot be assessed before a job begins, determine if the job will involve manual demolition, manual scraping, or heat gun or power tool use.
- Implement engineering, work practice, and administrative controls.
- If these controls do not reduce exposures below the PEL, implement a respiratory protection program.
- Provide protective clothing.
- Provide handwashing or shower facilities.
- Provide a medical surveillance and blood lead monitoring program.
- Ensure that workers are trained adequately.
- Post warning signs.

IV. Previous Evaluations of Worker Exposures During Residential Lead Hazard Control Work

Prior to the initiation of lead hazard control work, employers should review the results of previous exposure assessments to help select proper methods, engineering controls, personal protective equipment, and work practices. In general, the data collected to date indicate that workers are occasionally exposed to lead levels greater than 50 μg/m^3 in most types of lead hazard control work, and that exposures are highly variable. Practically speaking, this means that *most* lead hazard control workers will need protective measures, such as respirators and medical surveillance. Some forms of lead hazard control (such as wet cleaning) may require only minor worker protection measures while others may require more substantial measures.

OSHA has recently collected exposure data that are representative of employees' lead exposure levels (8-hour, time-weighted average) for various construction activities, and are summarized in a table in the *Federal Register* (58 FR, No. 84, May4, 1993, Table 4, p.26612).

While *average* exposures in housing are generally below the PEL, it is important to understand that worker exposures at a given site may vary widely from previous exposure assessments (even for the same activity) due to variations in environmental conditions, work practices, the lead concentration in paint, and the total quantity of lead-based paint abated. Results from two relevant NIOSH studies of abatement activities are summarized below to illustrate how variable exposures can be.

A. The HUD Lead-Based Paint Abatement Demonstration

NIOSH investigators evaluated exposures and analyzed the exposure data collected by HUD contractors during the 1990 HUD Lead-Based Paint Abatement Demonstration that took place in single-family Federal Housing Authority (FHA) homes (NIOSH, 1992). During the demonstration, HUD prohibited certain abatement methods with high exposure potential (such as torch burning) and required the use of competent persons (as defined in the OSHA Lead Exposure in Construction standard), engineering and work practice controls, worker training, protective clothing and equipment, medical surveillance, and exposure monitoring.

Table 9.1 Personal Breathing Zone Air Sampling for Lead by Method or Activity*

Abatement Method/Activity	Personal Breathing Zone Lead Concentrations				
	Number of Samples	Minimum ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	Geometric Mean ($\mu g/m^3$)	Geometric Standard Deviation
Abrasive	28	0.4	399	8.8	7.6
Chemical removal	291	0.4	476	3.3	4.1
Cleaning	138	0.4	588	1.9	3.6
Encapsulation	83	0.4	26	1.4	2.8
Enclosure	50	0.4	72	1.7	3.2
Final cleaning	56	0.9	36	2.1	2.8
Heat gun	360	0.4	916	6.4	4.7
Precleaning	31	0.9	11	1.5	2.2
Replacement	110	0.4	46	2.5	3.9
Setup	153	0.4	137	1.5	3.1
Other[1]	15	0.4	207	1.9	5.1
Missing[2]	87	—	—	—	—

NOTE: Underlined methods resulted in maximum exposures above the OSHA PEL.

OSHA PEL (8-hour, time-weighted average) = 50 $\mu g/m^3$

* Data collected by HUD Industrial Hygiene Contractors.

[1] Other abatement activities.

[2] Samples with no identified method/activity are not reported.

Laboratory-assigned Limit of Quantitation (LOQ): 0.4 $\mu g/m^3$

Understanding Worker Exposure Variability: Why Every Contractor Needs to Monitor Worker Exposure

Worker lead exposures during lead hazard control activities have been found to be highly variable. Due to differences in individual work practices and environmental variations, personal airborne lead exposures even among workers in the same job category and work area can vary significantly. Therefore, it is recommended that employers sample each type of worker on the job, preferably over several shifts (days) that are representative of the entire job. This recommendation is based on the NIOSH determination that estimating the exposures of a group of workers with similar exposure risk (e.g., same job category) by sampling only a few workers in the group is reasonably accurate (within 20 percent) *only* if the geometric standard deviation (GSD) of the group's exposures is less than 1.15 (McDermott, 1985). In the vast majority of occupational groups, and particularly in the construction industry, this condition will *not* be met; therefore, employers should monitor every type of employee at the worksite. For example, NIOSH investigators found that GSDs for residential lead-based paint abatement during the HUD demonstration ranged from 2.2 to 7.6 by method (see Table 9.1). However, it is *not* necessary for employers to conduct monitoring on each and every residence where work is proceeding. If the work is similar, monitoring may be performed in 1 of every 20 dwellings.

The NIOSH summary of the personal monitoring results is presented in Table 9.1. This personal breathing zone sampling was conducted primarily to examine exposures during different methods and activities. Sampling periods were generally less than a full shift, making it impossible to compare these results to typical lead hazard control jobs. While the average personal exposures to lead were generally low, the variability of exposures was very high. The geometric mean exposures were 3.1 $\mu g/m^3$, but the geometric standard deviation was 4.4. NIOSH recommends that generalizing the results from a limited sample, such as the HUD demonstration, to an entire population of workers is reasonable only if the variability is low and if the geometric standard deviation is less than 1.15. According to the maximum exposure levels, workers were exposed to lead above the OSHA PEL in 7 of the 11 NIOSH-assigned method categories, which would indicate that most types of lead hazard control can produce exposures above the PEL.

Personal lead exposures were found to vary significantly for different abatement methods, contractors (with significant method-contractor interaction), and housing units. Paint lead concentration alone was found to be a poor predictor of personal breathing zone exposures during abatement.

The HUD data should be useful for initial planning purposes. However, when reviewing the exposures, it is important to recognize that exposures during the HUD demonstration will not be representative of other contractors, work locations, or types of buildings.

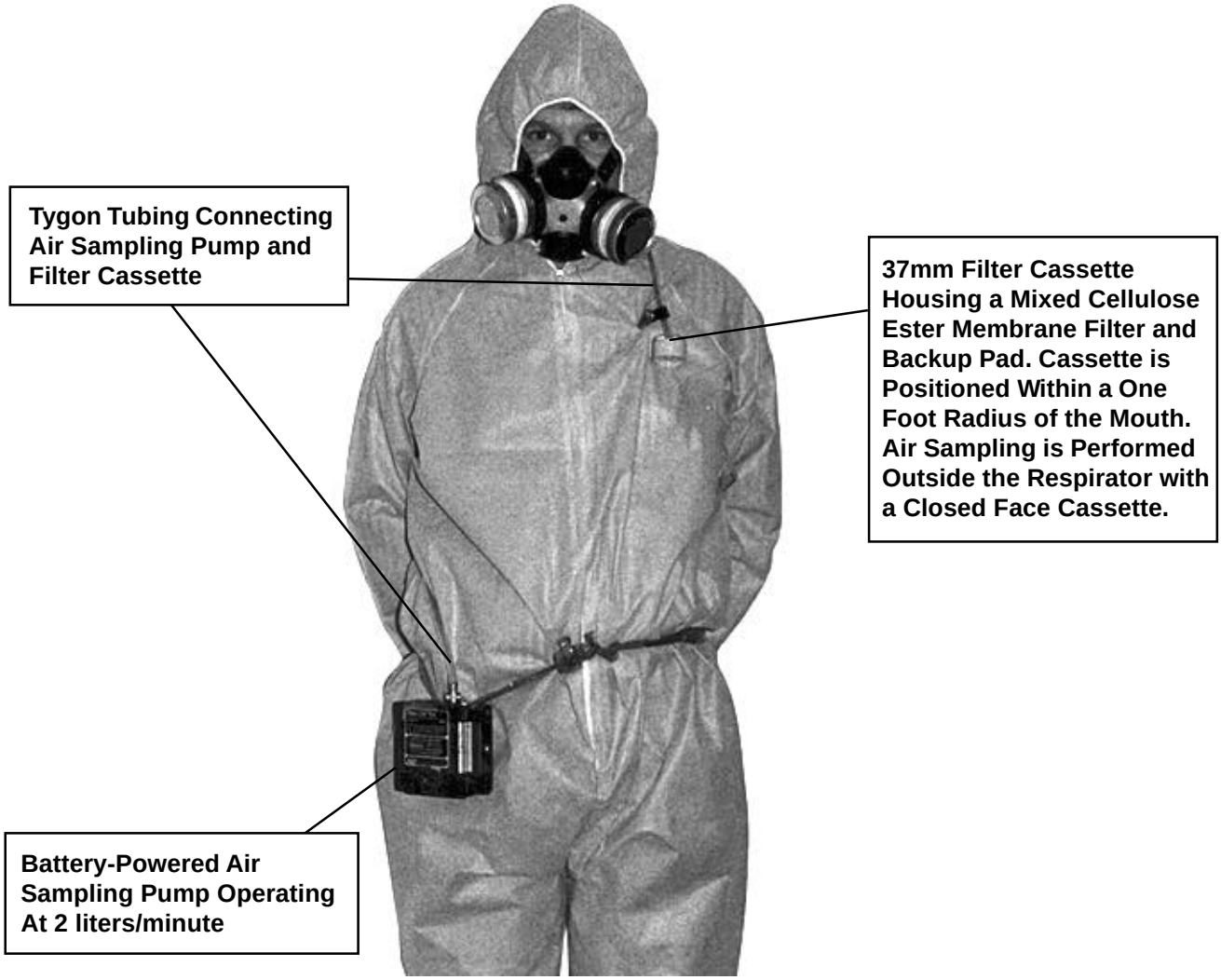
Limited air sampling for at least a few job sites for each contractor is therefore recommended, although it is *not* necessary to perform air sampling on every job.

B. Lead-Based Paint Removal

NIOSH investigators conducted an evaluation of worker exposures during a lead-based paint removal and cleaning pilot project (NIOSH, 1993). The project was designed to evaluate the following removal methods:

- Dry scraping followed by broom sweeping (dry sweeping)—this was selected to demonstrate exposures with no use of engineering or work practice controls.
- Wet scraping (painted surfaces were wetted with water mist) followed by high-efficiency particulate air (HEPA) vacuuming (wet HEPA).
- Wet scraping followed by HEPA vacuuming, with an air-filtration device (AFD) that is

Figure 9.2 Personal Breathing Zone Air Sampling.



Personal Breathing Zone Air Sampling involves drawing air through a 0.8µ Mixed Cellulose Ester Filter in a closed-face 37mm filter cassette using an air sampling pump running at 2 liters/minute.

equipped with a HEPA filter (wet HEPA/AFD) to pump air out of the work area (i.e., "negative air").

The final step for each of the methods was the wet mopping of floors.

In this study, workers were potentially overexposed to lead when using each of the removal methods. Short-term exposures ranged from 5 to 360 µg/m^3, with a geometric standard deviation of 2.9 overall. Of the methods evaluated, the wet HEPA method appeared to offer the best control for worker exposures and area airborne lead concentrations. Extrapolated 8-hour exposures for workers who used all three methods during a shift (which should be considered minimum values) ranged from 6 to 73 µg/m^3.

The method, mean paint lead concentration, precleaning surface lead concentration, and work crew practices were all found to be related to average worker exposures.

V. OSHA Requirements for Residential Lead Hazard Control Work

The preceding NIOSH data indicate that the OSHA standard will apply to most forms of residential lead hazard abatement work. The OSHA interim final rule for construction applies a level of protection (generally equivalent to the lead standard for general industry) to all occupational exposures to lead in construction, including lead abatement, repair or renovation of structures containing lead, cleaning and disposal of lead-contaminated materials, and maintenance operations.

The OSHA standard covers the following work:

- Demolition or salvage of structures containing lead.
- Removal, enclosure, or encapsulation.
- Renovation, alteration, repair, or construction of structures or substrates that are coated with lead-based paint.
- Lead cleanup.
- Transportation, storage, disposal, or containment of lead debris at the site of lead hazard control activities.
- Any maintenance work.

Various provisions of the standard are triggered by an action level of 30 $\mu g/m^3$ (the same as the general industry standard) and a PEL of 50 $\mu g/m^3$ (both measures are expressed as 8-hour, time-weighted averages). Employers may use a combination of engineering controls, work practices, and respiratory protection to comply with the PEL. However, engineering and work practice controls must be used first. As a practical matter, engineering and work practice controls in residential lead hazard control work are limited largely to the use of low dust-generating hazard control methods, such as enclosure and wet methods. This means that respirators will be needed for most types of lead hazard control work in housing, since the variability of exposures is quite high.

As in the general industry standard, OSHA requires adjustment of the PEL to ensure that employees who work longer than 8 hours are not exposed to a greater daily dose of airborne lead. For work shifts longer than 8 hours, the PEL is reduced according to the following formula:

$$\text{Adjusted PEL} = \frac{400}{\text{number of hours worked}}$$

For example, if the work shift is 10 hours, the PEL becomes 40 $\mu g/m^3$.

$$\frac{400}{10 \text{ hours}} = 40\ \mu g/m^3$$

A trigger for worker protection requirements based on paint lead concentration was considered by OSHA, but rejected. Given the variability of work practices and methods, OSHA concluded that no useful correlation between surface concentrations and occupational exposures could be established.

In recognition of the difficulties of conducting exposure assessments during construction jobs, the interim final rule establishes task-related triggers. Certain protective measures are triggered by tasks (listed in Table 9.4) that commonly produce exposures greater than the PEL, even with prescribed protective measures. Performance of any task on one of the lists triggers specific interim protective requirements that will remain in effect until results of an exposure assessment demonstrate that such protection is not necessary.

The interim final rule requires that the following provisions be made:

- Written compliance plan and competent person(s).
- Initial exposure assessment and periodic exposure monitoring.
- Task-related triggers, with interim protection during assessment.
- Engineering, work practice, and administrative controls.
- Respiratory protection program.

Table 9.2 Worker Exposure Limits and Guidelines

Air lead	
OSHA Permissible Exposure Limit (PEL)	50 μg/m³
OSHA action level	30 μg/m³
Blood lead	
OSHA medical removal limit	50 μg/dL
OSHA recommended level to prevent reproductive problems	30 μg/dL
ACGIH proposed Threshold Limit Value	20 μg/dL

Table 9.3 Required Action Under the OSHA Standard by Exposure Level

CATEGORY I	CATEGORY II	CATEGORY III
30 μg/m³* and under (below the action level)	30–50 μg/m³ (above the action level, but below the PEL).	50 μg/m³ and over (above the PEL).
Train employees. Conduct exposure monitoring. Maintain records.	Same as category I, plus: Provide respirator at employee request. Conduct exposure monitoring every 3 months. Conduct blood lead monitoring.	Same as category II, plus: Enforce respirator use. Enforce use of protective clothing. Develop monitoring every 6 months. Enforce housekeeping. Provide hygiene facilities and enforce washing.

* All exposure levels are 8-hour, time-weighted averages.

- Protective clothing and equipment.
- Housekeeping.
- Hygiene facilities and practices.
- Medical surveillance.
- Medical removal protection.
- Hazard communication programs and training on specific operations causing lead exposure.
- Signs.
- Recordkeeping.
- Observation of monitoring.

Individual States that have approved plans for OSHA enforcement may adopt their own lead standards for the construction industry, as long as their requirements are at least as stringent as the Federal OSHA standard. Employers will need to ensure that their programs for worker protection meet applicable State requirements.

The OSHA standard does not specify the methods for any given type of operation, such as lead-based paint removal. The method of

removal is left to the discretion of the employer, and constitutes an important potential engineering control. In some cases, however, the method of abatement or interim control will have already been selected by a risk assessor and/or the property owner based on other considerations.

A. Written Compliance Plan and Competent Person(s)

For every job, OSHA requires employers to prepare a written compliance plan that specifically describes how the standard will be implemented and includes regular and frequent inspections of the job site by a competent person. The written compliance plan, in conjunction with frequent work area inspections by a competent person, should ensure the prevention of dangerous, unhealthy, or unsafe conditions.

1. Written Compliance Plan

An example of a written compliance plan appears at the end of this chapter. Prior to the start of every job in which employee exposure will potentially exceed the OSHA PEL, employers must develop and implement a written compliance plan. (Providing respirators does *not* make a written plan unnecessary.) The written plan should be an organized strategy for protecting workers and should account for potential exposure problems, control alternatives, and a schedule for inspection of the job by the competent person(s). At a minimum, OSHA requires that written plans include:

- A description of equipment and materials, controls, crew size, job responsibilities, and operations and maintenance procedures for each activity in which lead is emitted.
- A description of specific control methods (e.g., abatement process selection, wet methods). For engineering controls, include supporting engineering plans and studies used to select methods.
- Technology considered in meeting the PEL.
- Air monitoring data documenting sources of lead emissions.
- A detailed implementation schedule for the compliance plan, including the schedule for inspections by a competent person.
- A description of the lead work practice program that will be used to control worker exposures. (This includes the use of protective work clothing and equipment, hygiene facilities and practices, and housekeeping practices.)
- A description of arrangements made among contractors on multicontractor worksites to inform affected employees (including bystanders) of potential lead exposures, and to clarify responsibilities with regard to control of those exposures.

For those hazard control jobs that proceed over an extended period in multifamily housing, OSHA requires that the written compliance plan be updated at least every 6 months. Single-family housing will require a separate plan for each dwelling. The plan must be available at the worksite for representatives of OSHA or NIOSH, and at the request of any affected employee or employee representative. (See the end of this chapter for copies of blank and completed written compliance plans.)

2. Competent Person(s)

As defined by OSHA, a "competent person" is one who is capable of identifying existing and predictable hazards at the worksite, and who has the authority to ensure prompt corrective measures are taken to eliminate them. The employer must utilize a competent person (or persons) to ensure that the worker protection program is effective. The definition of a competent person and the requirement for regular and frequent inspections of job sites, materials, and equipment by a competent person are identical to those already required by OSHA's general safety and health provisions for construction work (29 CFR 1926.32 and 29 CFR 1926.20). In the context of a lead-based paint abatement job, the competent person should have knowledge of the lead exposures for each abatement method in use; the potential hazards from lead and other substances or physical agents in the worksite; the appropriate engineering controls,

work practices, and personal protective equipment for the job; the requirements of OSHA construction standards (29 CFR, Part 1926); and the recommendations of these *Guidelines* and other general sources of information. The competent person's worksite inspection frequency should be based on the magnitude of potential lead exposures, the number of workers at each site, and the employer's past experience. Duties of the competent person include:

- Determining whether lead is present before work begins.
- Ensuring that employee exposure assessment is performed.
- Ensuring that workers use required protective clothing and respirators.
- Ensuring that up-to-date copies of respirator fit tests and medical examination results are available.
- Ensuring that proper hygiene facilities are available and in use.
- Ensuring that engineering controls are operating properly and are effective.
- Posting lead hazard work areas with warning signs.

B. Exposure Assessment

1. Initial Exposure Assessment

The OSHA standard requires all employers to conduct initial exposure assessments for all jobs involving the use or removal of lead or lead-containing materials. The purpose of the initial assessment is to determine if *any* workers are being exposed to lead equal to or greater than the action level of 30 $\mu g/m^3$. The exposure assessment can include current results from exposure monitoring of employees, previous monitoring results, or other objective data demonstrating that the specific product, process, operation, or activity involving lead cannot result in exposures above the action level under any circumstances. Each of these methods for exposure assessment is discussed in more detail below.

The initial exposure assessment may be limited to workers that are believed to have the greatest exposures to airborne lead. When planning which employees to include in the initial exposure assessment, the following should be considered: any information, observations, or calculations that would indicate potential airborne exposure to lead, including previous measurements of airborne lead; and any employee complaints of symptoms consistent with exposure to lead. Additional factors that should be considered include the worker's distance from airborne lead sources; employee movement, ventilation, and airflow patterns; and individual work practices. If no information is available for assessing maximum-risk employees, then all workers should be assumed to be at risk. NIOSH has published recommendations for selecting maximum-risk employees (NIOSH, 1977).

Positive initial determination

When the initial assessment shows the potential for any employee to be exposed to lead at or above the action level (for 1 day or more), the determination is *positive* and exposure monitoring (or assessment with existing data) for each individual on the job must be conducted during representative work shifts.

Negative initial determination

When the determination shows that no employee is potentially exposed to lead at or above the action level (for 1 day or more), the determination is *negative* and further exposure assessment is not necessary until there is a change in the workplace (see Monitoring frequency below).

2. Exposure Monitoring

Personal monitoring

"Exposure monitoring" refers to the measurement of a worker's exposure to an airborne contaminant, regardless of any respiratory protection worn. An air sample is collected outside of any respirator worn, as close to the worker's mouth and nose as is practical (often the collection device is located on the shirt collar).

OSHA requires that exposure monitoring consist of full-shift samples (at a minimum, one sample for each job classification in each work area). In the case of multiple shifts, each shift or the shift with the highest expected exposure level should be monitored. Since the degree of worker protection provided may depend on the results of exposure monitoring, it is critical that the sampling be representative of the employees' regular, daily, and highest exposure to lead. It is not necessary to perform sampling in each dwelling where work is performed.

Number of samples

There is no formula for determining the total number of samples to be collected during each job. The sampling protocol should be developed on a case-by-case basis by an industrial hygienist or other qualified occupational safety and health professional.

Sampling methods

NIOSH and OSHA have published laboratory-based sampling methods for personal airborne lead, with guidelines for acceptable precision and accuracy (OSHA, 1985; NIOSH, 1984). The sampling method used for monitoring must have an accuracy rate not less than ±25 percent for the action level of 30 $\mu g/m^3$. Employers should use laboratories that are accredited for environmental lead analyses. Requirements for a National Lead Laboratory Accreditation Program (NLLAP) have been developed by the U.S. Environmental Protection Agency's (EPA's) Office of Pollution Prevention and Toxics for the recognition of private and/or State laboratory accreditation systems. A complete list of EPA NLLAP-recognized laboratories is available to the public from NIOSH (1–800–35–NIOSH) or the National Lead Information Center Clearinghouse (1–800–424–LEAD).

Monitoring frequency

Employers do not need to perform air sampling in each dwelling treated. A reasonable approach would be to conduct air sampling in 1 dwelling out of every 20 treated, with an emphasis on sampling worst-case dwellings. This approach can be used for both large, multifamily and small, single-family jobs.

If employee exposures to lead are at or above the action level, but not exceeding the PEL, then employers must perform monitoring at least every 6 months. If employee exposures are above the PEL, then monitoring must be performed at least every 3 months. The monitoring must be continued every 6 months (or every 3 months) until at least two consecutive measurements that are taken at least 1 week apart are below the action level (or PEL).

Employee notification

Employees must be provided with written results of their exposure within 5 (working) days of the completion of the exposure assessment. This concludes the exposure assessment requirement.

Other air sampling

Samples collected inside a worker's respirator may be used to determine the effectiveness of a respiratory protection program, although such sampling is often quite difficult for most types of respirators. "Area" samples (those collected in the general area of the work activity or at the perimeter of the lead hazard work area) may be used to assess potential bystander exposures. While inside-respirator and area samples are potentially useful, neither can be used to meet OSHA monitoring requirements and they should not be considered a substitute for personal sampling.

3. Previous Monitoring Results

To use previous monitoring results for exposure assessment of employees, the data must have been collected within the past 12 months, and the work operations and work conditions should closely resemble the processes and types of materials, control and containment methods, work practices, and environmental conditions in the current workplace, including the condition of the lead-based paint, the concentration of lead in paint, and the degree of employee training and supervision. Employers must have this data in their possession to present to an OSHA compliance officer.

4. Objective Data

Objective data may not be used for exposure assessment for any of the activities listed in OSHA's task-related triggers (see below). Examples of objective data that OSHA would allow are the results of laboratory product test results from manufacturers of lead-containing products or materials, or results of an industrywide study. (The HUD demonstration project described earlier does not constitute an industrywide study since project conditions were different from ordinary conditions.) Since manufacturers' data are of varying quality, employers should determine whether the data have been collected in a sound and objective manner.

Additional requirements for the use of objective data are:

- The data must show that the product, process, or material cannot result in employee exposure to lead that is equal to or greater than 30 μg/m^3 during any aspect of the job.
- The employer must establish and maintain accurate records of the objective data and its relevancy (see the information on recordkeeping below).

C. Task-Related Triggers

Until exposure assessments have been completed, employers must rely on OSHA's task-related triggers to determine appropriate controls and work practices. OSHA's task-related triggers are based on three categories of exposure (see Table 9.4). If lead is present when any of these tasks are performed, interim protective provisions are required prior to and during assessment of employee exposures.

Required interim protection during initial exposure assessment includes respiratory protection, protective work clothing and equipment, change areas, handwashing facilities, training, and initial blood sampling and analysis. Requirements for the three lists of tasks are identical except for the minimum respiratory protection, which depends on the assumed exposure range. For example, for airborne concentrations of lead less than 500 μg/m^3, the required minimum respiratory protection is a half-mask, air-purifying respirator with HEPA filters (see Figure9.3).

The employer can discontinue the interim protection for any employee performing one of these tasks only after it is documented that the employee's exposure is below the PEL. Respiratory protection can be reduced only after it is documented that the exposure is below the assumed range for the task. It is unlikely that risk assessors or inspector technicians, who scrape limited surface areas, will require respiratory protection. It is not necessary for such individuals to wear respirators, unless a large number of samples will be collected on a single day.

Table 9.4 Residential Lead Hazard Control Assumed Exposures for OSHA's Task-Related Triggers (adapted from 29 CFR 1926.62)

50 μg/m^3 to 500 μg/m^3	500 μg/m^3 to 2,500 μg/m^3	Greater than 2,500 μg/m^3
Manual demolition Manual scraping Manual sanding Heat gun use Power tool paint removal in the HEPA vacuum-assist dust collection system	Cleanup on dry, abrasive blasting jobs Abrasive blasting enclosure movement/removal	Abrasive blasting

Note: Abrasive blasting without a HEPA local exhaust system is not permitted in residential dwellings.

Figure 9.3 How to Inspect Your Respirator.

YES!

A Half-Mask, Air-Purifying Respirator with HEPA Cartridges Is Appropriate for Many Residential Lead Hazard Control Jobs. Paper Dust Masks are NOT Adequate.

NO!

STRAPS—hold the respirator on your head. One goes over the crown of your head. Another headband has two plastic straps, which go straight up and straight back on your head.

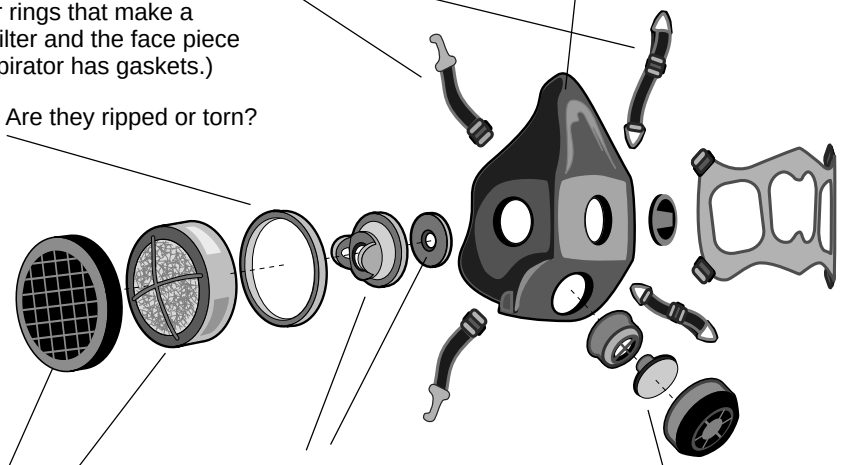
Check: Are they elastic? Are they torn? Do the buckles and snaps work?

GASKETS—are rubber rings that make a tight seal between the filter and the face piece present. (Not every respirator has gaskets.)

Check: Are they there? Are they ripped or torn?

FACE PIECE—is made of rubber, silicon, or other materials.

Check: Is it ripped or worn? Is the face piece bent? Is it clean?



INHALATION VALVES—are where you breathe in. There are two small rubber flaps behind the filters.

Check: Are both there? Are they ripped or bent? Are they dirty?

Filters—filter the air. They are also called "cartridges."

Check: Do you have the right one for the job? When you work with lead, you need HEPA filters. When you use solvents or caustic paste, you will need other filters, too. Change filters regularly, especially when it becomes harder to breathe.

EXHALATION VALVE—is where you breathe out. It is a small rubber flap about the size of a quarter. It is underneath a cover.

Check: Take off the cover. Is the valve there? Is it ripped or bent? Is it dirty?

Courtesy: Alice Hamilton Occupational Health Center

Figure 9.4 Qualitative Respirator Fit Checks.

Negative-pressure fit check

Cover the two filters or the air hose with your hands and inhale gently. Hold for a count of ten. You will feel the respirator pull against your face. You can feel the area of the seal tightening to your face. If there is a leak, air will rush in through the leak instead of pulling the mask against your face. You will feel air move against your cheeks. It may feel like a feather brushing across your face. The air will move toward your mouth. You may hear the air flow. If someone is watching you, they should see the respirator suck in a little at your nose.

Negative-pressure fit check

Positive-pressure fit check

Cover the rubber flap exhalation valve with one hand and puff out gently. You should feel the force of your breath balloon the respirator out a tiny bit. This is like the feeling you get when you first blow up a balloon. You have to blow harder to get over the resistance of the balloon. As the mask moves out, you will feel the seal of the respirator tighten on your face. If there is a leak in the mask, air will rush out of the leak instead of making the mask balloon out. If there is a leak, you will feel air rush out against your cheeks. You will not feel the seal tightening to your face. Don't blow too hard, or you can blow out your intake valves and break a good seal.

Positive-pressure fit check

Courtesy: Alice Hamilton Occupational Health Center

D. Engineering and Work Practice Controls

OSHA requires employers to institute engineering and work practice controls to the extent feasible to reduce worker exposures so they are at or below the PEL. The Society for Occupational and Environmental Health (SOEH) has published recommendations on engineering and work practice controls (SOEH, 1993).

Some examples of good engineering controls are:

- Providing HEPA-filtered local exhaust ventilation for devices and abrasive power tools, including all blasting equipment, needle guns, sanders, and grinders.
- Using HEPA vacuums for cleanup instead of dry sweeping or compressed air.
- Providing adequate ventilation during indoor heat gun use to prevent buildup of lead and volatile organic compounds.
- Using wet methods to reduce airborne dust generation; for example, a water sprayer to hold down settled leaded dust on the plastic sheeting covering the floor or ground.

Some examples of good work practices are:

- Wetting of surfaces with water mist prior to scraping, sweeping, or sawing.
- Providing onsite washing facilities, and following good hygiene practices.
- Daily cleanup of work area and equipment to prevent leaded dust accumulations.
- Whenever feasible, avoiding methods with known high exposure potential, such as machine sanding without local exhaust ventilation.

E. Respiratory Protection Program

Even with implementation of engineering and work practice controls, respiratory protection will probably be necessary for most abatement methods, such as lead-based paint removal by chemicals, heat gun, or abrasive techniques, and some other operations, including setup, cleaning, many forms of interim control, and maintenance. Due to the variability of exposures in construction, contractors may need to use more than one type of respirator at a given job. Respirator selection for each job should be determined by an industrial hygienist or other trained health and safety professional.

OSHA requires the use of respirators:

- When an employee's exposure exceeds the PEL and as interim protection for tasks specified in the task-related triggers.
- In work situations where engineering and work practice controls are not sufficient to reduce employee exposures below the PEL.
- Whenever an employee requests a respirator.

Because there are recognized health effects at blood lead levels below what is allowed by OSHA, employees may wish to use respirators even when their exposures are below the PEL.

Whenever respirators are used, either on a voluntary or mandatory basis, employers must establish a respiratory protection program. Respirators are devices that must be used carefully (29 CFR 1910.134, OSHA respirator standard). A minimally acceptable respiratory protection program must include selection of respirators on the basis of worker exposures; written standard operating procedures; training of workers in the proper use of respirators; fitting, regular cleaning, maintenance, and inspection of equipment; and storage in a clean and sanitary location. Workers must not be assigned to tasks requiring the use of respirators unless it has been determined by a physician that they are physically able to perform the work and use the respirator. Under the OSHA Lead Exposure in Construction standard, employers are required to:

- Provide respirators approved by NIOSH and the Mine Safety and Health Administration (MSHA) for protection against leaded dust, fume, and mist at no cost to the employee.

- Select required respirators for employees based on the maximum airborne concentrations of lead, expected or measured, according to Table 1, 29 CFR 1926.62.
- Upon employee request, provide a powered air-purifying respirator (PAPR) to any employee in lieu of the selected respirator if this will provide sufficient protection.
- Ensure that the respirator issued to each employee fits properly and exhibits minimum face piece leakage.
- Perform qualitative or quantitative fit tests at the time of the initial fitting and at least every 6 months thereafter for employees wearing negative-pressure respirators.
- If an employee exhibits difficulty during fit testing or subsequent use, provide an appropriate medical examination to determine whether the employee can wear a respirator while performing the job.
- If filter respirators are used, maintain an adequate supply of filters, and instruct each employee to change the filter elements whenever an increase in breathing resistance is detected.

1. Respirator Selection

If a respirator is required, it is the employer's duty to enforce its use.

Employers should refer to the OSHA interim construction lead standard (Table 1, 29 CFR 1926.62) for the proper selection of respirators. In the absence of hazardous contaminants other than lead, the half-mask, air-purifying respirator with HEPA filters should be adequate for most lead hazard control jobs, since most exposures are usually less than 500 $\mu g/m^3$.

Respirators specified for higher concentrations can also be used at lower concentrations of lead. For example, PAPRs may be preferred over half-mask, negative-pressure respirators because they are more protective, produce less cardiovascular stress, and are generally more comfortable to wear. PAPRs include a small, battery-powered blower that provides clean air to the worker, thus reducing breathing resistance.

If an initial determination or exposure monitoring indicates potential airborne exposure to contaminants other than lead, such as solvents used during chemical stripping or heat gun use, reevaluation of the respirator selection is warranted. It would be prudent to select a respirator (or filter) that protects against *both* lead particulate and organic vapors. If a worker has an increase in blood lead level, reevaluation of the respirator program, personal hygiene, and work practices is needed.

F. Protective Clothing and Equipment

OSHA requires that employers provide and enforce the use of protective clothing whenever employees are exposed to airborne lead above the PEL (irrespective of respirator use) and as interim protection for employees performing tasks listed in the task-related triggers. Hardhats, goggles, safety shoes, and other personal protective equipment may also be required by other OSHA standards, depending on the type of work performed. These materials must be supplied at no cost to employees.

Leaded dust is not absorbed directly through the skin; however, lead contamination of workers' clothing and person has resulted in lead exposure for workers and their families in the past. The use of protective equipment, in conjunction with good hygiene practices and washing facilities, should prevent contamination of workers' personal clothing and prevent the transfer of lead contamination from the work area to lunch and break areas, personal vehicles, and workers' homes. Workers should be equipped with disposable or reusable coveralls or similar full-body work clothing, gloves, hardhats, safety shoes, disposable shoe covers, chemical-resistant clothing (for skin-contact hazards), safety glasses, face shields, and goggles (in conjunction with portable eyewash equipment).

Since workers may spend most of their time on abatement jobs wearing protective clothing, it should be selected to prevent heat stress. For

Figure 9.5 Types of Respirators Used in Residential Lead Hazard Control Work.

Half-Mask, Air Purifying Respirator

Adequate for Atmospheres Up To 500 μg/m³ Lead

Full-Face, Air Purifying Respirator

Adequate for Atmospheres Up To 2500 μg/m³ Lead

Powered Air Purifying Respirator

Adequate for Atmospheres Up To 2500 μg/m³ Lead
(Filter and Battery-Powered Blower are worn on Belt)

example, the use of breathable clothing (cotton or paper fabric) is appropriate during most abatement work to reduce the potential for employee heat stress. Shoes or disposable shoe covers should have nonskid soles, particularly for work on plastic-covered surfaces. Shoe covers should *not* be used when workers need to climb ladders and scaffolding because they may cause slips and falls; nonskid work boots should be used instead. Work boots or shoes should be removed from the work area only in a sealed plastic bag. Torn shoe coverings also present a serious hazard and should be replaced as often as necessary. Chemical-resistant protective clothing will be necessary for any work involving caustic or solvent-based strippers and other substances that are hazardous upon skin contact. For example, caustic paint strippers require special clothing and gloves (see the Manufacturer's Material Safety Data Sheet). Paper suits and shoe covers are not appropriate for chemical processes.

The possibility of heat stress and its signs and symptoms while wearing protective clothing should be included in worker training. Contractors should consult an industrial hygienist or other qualified health and safety professional for the proper selection of protective clothing.

OSHA requires that employers supply clean work clothing at least weekly to employees with personal exposures above the PEL, and daily to those with levels greater than 200 $\mu g/m^3$ as an 8-hour, time-weighted average.

Employers are responsible for cleaning, laundering, and disposing of protective clothing and equipment; repairing or replacing protective clothing and equipment to maintain its effectiveness; ensuring that all protective clothing is removed at the end of a work shift only in designated change areas; ensuring that contaminated clothing is placed in a closed container in the change area to prevent the spread of lead contamination; and notifying in writing anyone who cleans or launders the protective clothing that the clothing is contaminated with lead.

Removal of lead from clothing by blowing, shaking, or any other means that disperses lead into the air is prohibited. HEPA vacuuming heavily contaminated protective work clothing as an initial cleaning method is recommended.

G. Housekeeping

Employers must keep all surfaces in the worksite as free as practicable from lead accumulations. This is important to prevent dispersal of leaded dust into the air during work activities, thus reducing employee exposure to lead. Cleanup of floors and other surfaces must be completed by vacuuming (using vacuums equipped with HEPA filters and/or wet washing methods) or other methods that minimize airborne lead during cleaning.

Shoveling, wet sweeping, and brushing may only be used for cleanup where vacuuming or other equally effective methods have been tried and proven ineffective. For example, shoveling and sweeping may be necessary to pick up large debris. In such cases, the debris should be misted with water prior to cleanup to minimize leaded dust generation.

OSHA prohibits the use of compressed air to clean leaded dust from any surface.

H. Hygiene Facilities and Practices

OSHA requires that employers provide hygiene facilities and ensure good hygiene practices for all employees performing work that is covered by the task-related triggers or for workers who are exposed to airborne lead above the PEL (irrespective of respirator use). Employers must ensure that no food, beverage, or tobacco product be present or consumed, and that cosmetic products not be applied in work areas. Employers must also provide change areas, showers (where feasible), eating areas, and handwashing areas. Good hygiene facilities and practices will minimize additional employee exposure to lead from ingestion or inhalation, and prevent contamination of workers' vehicles and homes. Wipe sampling of designated "clean" areas during abatement jobs longer than 2 weeks should be conducted. Even if exposures are less than 50 $\mu g/m^3$, contamination of workers' automobiles, clothes, and homes with settled leaded dust can be a serious problem. Good personal

hygiene is essential even if airborne dust exposures appear to be low.

Specific hygiene requirements for employees exposed above the PEL (without regard to respirators) are listed below. Change areas and handwashing facilities are also required as interim protection during exposure assessment for the task-related triggers.

1. Decontamination Procedures

Conduct worker decontamination before all breaks, before lunch, and at the end of the shift. Decontamination consists of:

- Cleaning all tools (at the end of the shift).
- HEPA vacuuming all protective clothing before entering the decontamination area.
- Entering the decontamination area (dirty side).
- Removing protective clothing by rolling inward (do not remove respirator yet); removing work shoes and putting in plastic bag.
- Entering shower or washing facility.
- Removing respirator after washing hands.
- Taking a shower, if available, using plenty of soap and water; washing hair, hands, fingernails, and face thoroughly (before lunch and at the end of the shift only).
- Entering the clean area and putting on street clothing and street shoes.

2. Change Areas

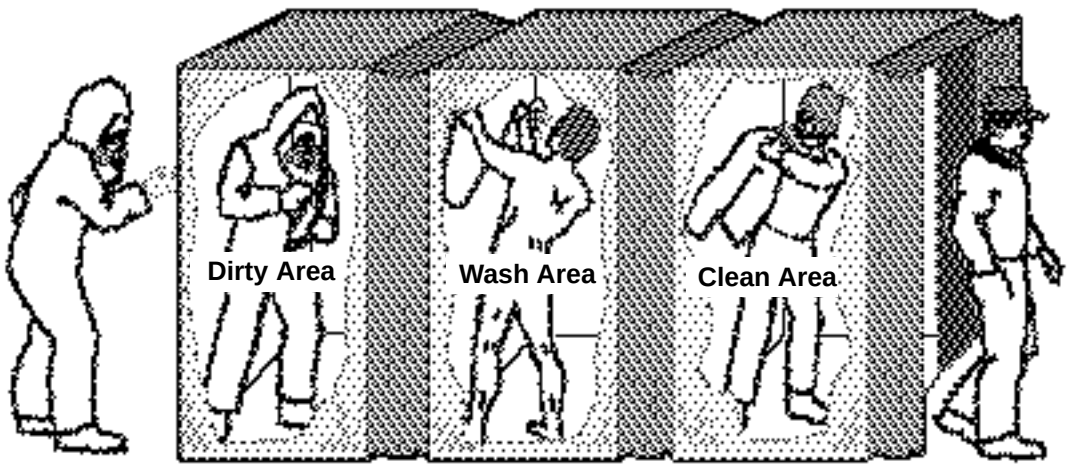
To prevent cross-contamination, change areas must have separate storage facilities for protective work clothing and equipment and workers' street clothes. The employer is responsible for ensuring that employees do not leave the worksite wearing protective work clothing. Change areas and clean areas should be cleaned on a regular basis.

In those worksites where a decontamination zone is not feasible, workers can wear two layers of protective clothing, if heat stress is not a problem. The first layer is removed at the work area exit; the second is removed in the clean area.

3. Showers

Wherever feasible, employers should provide shower facilities onsite. Employers must make soap and towels available, and make sure that

Figure 9.6a Worker Decontamination.



employees shower before lunch and at the end of their shifts to remove lead from skin and hair.

4. Eating Facilities

Employers must provide clean, accessible eating areas for employees. The dwelling and work area should not be used as eating areas.

Employers must ensure that workers wash their hands and face prior to eating, drinking, smoking, or applying cosmetics. Also, workers may not enter eating areas with contaminated protective work clothing or equipment unless surface leaded dust has been removed by vacuuming or another cleaning method that controls leaded dust dispersion.

Although not specifically addressed by OSHA Lead Exposure in Construction standard, if workers voluntarily leave the worksite for lunch, they should be required to wash or shower, and change into street clothing to prevent contamination of their personal vehicles. Showering is not needed for other breaks, although workers should always wash their hands and face before eating, drinking, or smoking.

5. Handwashing Facilities

Employers must provide adequate handwashing facilities for employees exposed to lead. Handwashing facilities must be in accordance with general construction health and safety requirements (29 CFR 1926.51 (f)). The facilities should be located near the worksite and be sufficiently equipped so that workers can remove lead effectively. Where showers are not provided, employers must ensure that workers wash their hands and face at the end of their work shift.

I. Medical Surveillance

Workers must undergo both initial and routine medical surveillance, depending on the level and duration of their airborne exposures to lead. Employers and physicians should consult AppendixC in 29 CFR 1926.62 for detailed guidelines on medical surveillance of lead-exposed workers. All medical examination procedures must be under the supervision of

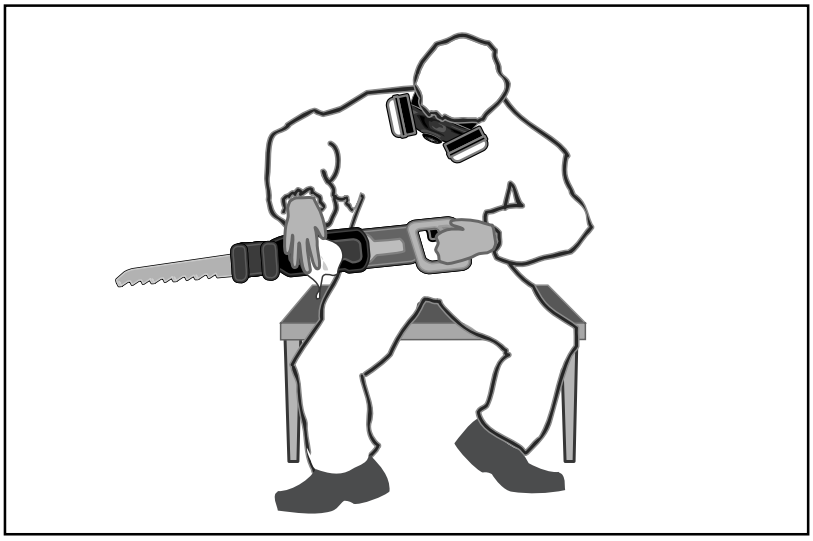
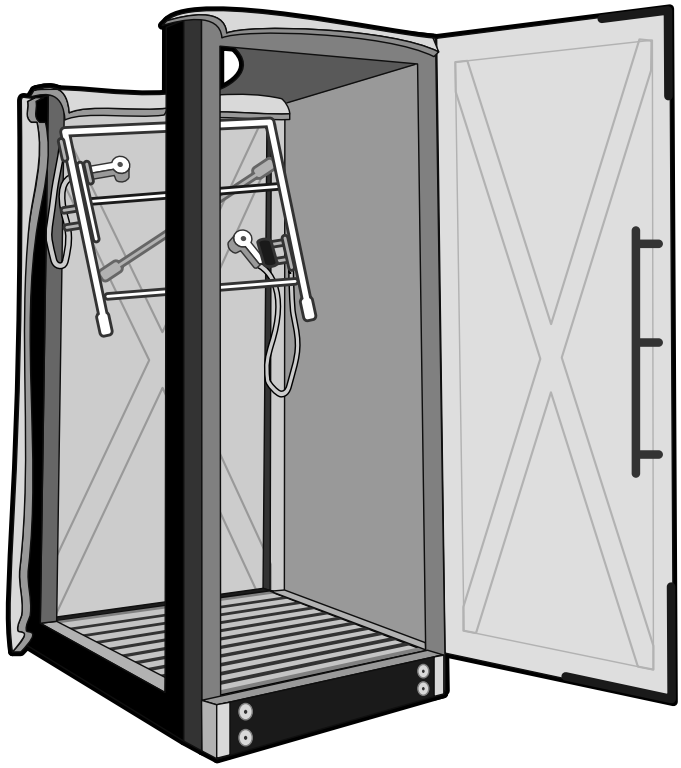


Figure 9.6b Decontamination of Tools.

Figure 9.7 Portable Showers Make Worker Decontamination More Effective and Feasible.



a licensed physician, preferably one who is board-certified in occupational health.

Lead abatement contractors should use medical surveillance to measure the effectiveness of their worker protection programs. For example, significant increases in blood lead levels of 10 µg/dL or greater or blood lead levels exceeding 20 µg/dL should trigger timely investigations of exposures, work practices, respirators, and personal hygiene practices.

1. Initial Surveillance

One purpose of initial medical (or biological) monitoring is to establish baseline blood lead levels and to allow early detection of increases in worker blood lead levels. Another purpose is to detect workers who have already been overexposed to lead on previous jobs. OSHA requires employers to:

- Make initial biological monitoring available to all employees who are exposed *on any single day* to lead levels equal to or greater than 30 µg/m^3.
- Provide initial biological monitoring to all employees who will be performing task-related trigger activities (see Table9.4).
- Conduct biological monitoring of workers' blood lead levels *and* zinc protoporphyrin levels (zinc protoporphyrin levels are one way of measuring long-term exposures).
- When an employee's initial blood lead level is equal to or greater than 40 µg/dL, provide continued biological monitoring at least every 2 months, until two consecutive blood lead level results are less than 40 µg/dL.

2. Routine Surveillance

Generally, most lead hazard control workers in the residential setting should have their blood lead levels checked every month or two and a baseline level determined before beginning work. An ongoing medical surveillance program, including biological monitoring of blood lead and zinc protoporphyrin levels and medical examinations, must be provided for all employees who *are or may be* exposed to lead levels greater than 30 µg/m^3 for more than 30 days in any consecutive 12-month period. OSHA requires employers to pay for biological monitoring and medical examinations.

Biological monitoring requirements

The employer must make available the following:

- Biological monitoring for blood lead and zinc protoporphyrin levels at least every 2 months for the first 6 months, and every 6 months thereafter.
- When an employee's blood lead level is equal to or greater than 40 µg/dL, biological monitoring at least every 2 months, until two consecutive blood lead level results are less than 40 µg/dL.
- When an employee's blood lead level meets the criterion for removal from the worksite (equal to or greater than 50 µg/dL), followup blood testing within 2 weeks.
- Monthly blood lead level testing during the removal period for any employee medically removed due to an elevated blood lead level (EBL).
- Blood lead sample analysis by an OSHA-approved laboratory (call 1–800–35–NIOSH for a list of OSHA-approved laboratories).

The employer must notify all employees of their individual blood lead level in writing within 5 working days after receipt of results. In addition, each employee with a blood lead level greater than 40 µg/dL must be informed that temporary medical removal from the worksite (with benefits) is required when periodic and followup blood testing indicate a blood lead level equal to or greater than 50 µg/dL. Medical removal means that a worker is not permitted to continue to work in a leaded environment. If no other equivalent work is available from the employer, wages and benefits must be maintained in full. A worker cannot be penalized for having an elevated blood lead level.

Medical examinations

The employer must:

- Provide medical examinations prior to assignment for workers whose exposures will be equal to or greater than 30 μg/m^3 for more than 30 days per year.
- Make medical examinations available at least annually for any employee who had a blood lead level equal to or greater than 40 μg/dL any time during the past 12 months.
- Provide a medical examination as recommended by the treating physician for any employee who either has reported symptoms consistent with lead intoxication or upon employee request. Reasons that an employee may request a medical examination include medical advice related to conceiving a healthy baby, pregnancy, and difficulty in breathing during respirator fit test or use.
- Furnish employees with written medical opinions from examining physicians.
- Make available medical examinations for employees medically removed from the job due to exposure to lead.
- Provide a multiple-physician review mechanism as specified in the standard 29 CFR 1926.62(j)(3)(iii) to give workers the opportunity to obtain a second and possibly a third medical opinion.

At termination of employment, an employer would be well advised to have an exit medical examination performed for each worker, due to workers' compensation considerations.

Medical examinations provided to employees must include detailed work history; medical history; physical examination; pulmonary status to determine if respirator can be worn; blood pressure check; blood sampling and analysis for blood lead level, zinc protoporphyrin level, and other specified parameters (hematocrit, hemoglobin, peripheral smear morphology, and red cell indices); routine urinalysis with microscopic examination (checking levels of urea nitrogen and serum creatinine); pregnancy testing or laboratory evaluation of male fertility, if requested by the worker; and any other test relevant to lead exposure recommended by the examining physician. Prophylactic chelation (routine use of drugs to keep blood lead levels low) of any employee at any time is prohibited.

J. Medical Removal Protection

Medical removal protection is designed to give employees time away from lead exposure to reduce blood lead levels. The trigger for required medical removal protection is either a blood lead level equal to or greater than 50 μg/dL, or a "final medical determination," which is the examining physician's written opinion on the employee's health or the outcome of the multiple-physician review mechanism (see Medical examinations above).

Since medical removal protection includes retention of salary and benefits for employees removed from work, employers have a strong economic incentive to prevent excess lead exposure. With effective controls very few employees should reach the trigger levels requiring removal during lead hazard control work.

The following are OSHA's basic medical-removal protection requirements for construction employers:

- Remove employee on each occasion that a worker's periodic and followup blood lead levels are equal to or greater than 50 μg/dL; employee can return to work when two consecutive blood lead levels are less than 40 μg/dL.
- Remove employee on each occasion when a final medical determination indicates a medical condition that places the employee at "increased risk of material impairment to health" due to lead exposure.
- Implement protective recommendations for the employee that are included in the results of final medical determinations.
- Provide medical-removal protection benefits for up to 18 months, or as long as the job continues, each time an employee is removed.

- Maintain employee's normal earnings, seniority, and other employment benefits during removal, including the right to return to the former job.
- Provide the same medical-removal protection benefits to any employee who is removed even if not required under the standard.

K. Hazard Communication Programs and Training on Specific Operations Causing Lead Exposure

The employer must establish a hazard communication program for all potentially exposed workers (29 CFR 1926.59). This program should at a minimum include warning signs and labels, material safety data sheets, and the required employee information and training, including discussion of the Hazard Communication Standard. Employers must also have a written hazard communication program for their workplaces.

OSHA requires that employers provide a lead training program for all employees who are exposed to lead at or above the action level (30 μg/m^3) *on any single day*. The training program must be provided prior to the time of job assignment and at least annually for employees.

The employer must ensure that employees are trained in:

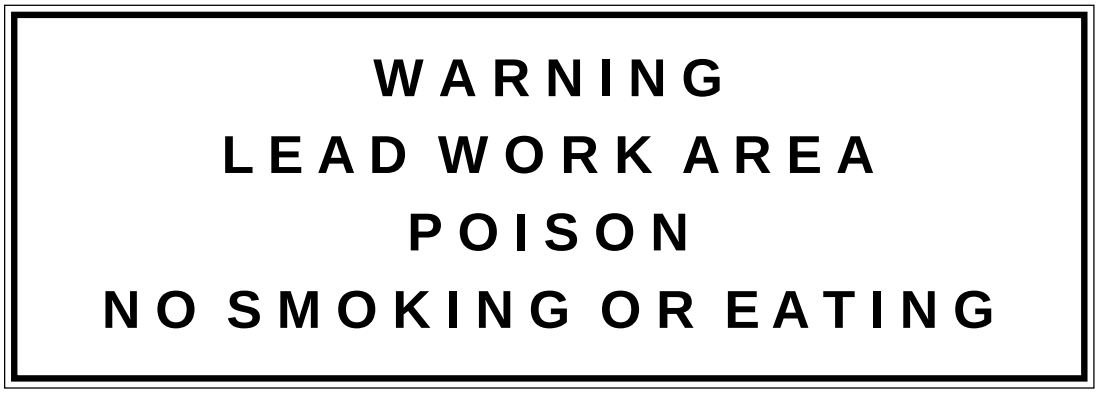
- The content of the OSHA interim lead standard for construction (29 CFR 1926.62) and its appendixes, including supplying a copy of the standard and appendixes to the employee.
- The specific nature of the operations that would result in lead exposure above the action level.
- The purpose, proper selection, fitting, use, and limitations of respirators.
- The purpose of the medical surveillance program and the medical-removal protection program.
- The adverse health effects of excessive exposure to lead, with particular attention to the adverse reproductive effects on both males and females.
- The hazards to the fetus and precautions for pregnant employees.
- The specific engineering controls and work practices associated with the employee's job assignment.
- Relevant good work practices described in Appendix B of the OSHA standard.
- The content of any compliance plan.
- The risks associated with chelating agents. They should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician.
- Their right of access to records under OSHA's Access to Exposure and Medical Records Standard (29 CFR 1910.20).

EPA Regional Lead Training Centers currently provide training courses for inspector technicians, project supervisors, and abatement workers. SOEH has also developed a training guide, which is referenced in the OSHA standards (SOEH, 1993). Other training providers also offer EPA training (see Chapter2). Appendix 15 contains a summary of the OSHA standard for workers. It is likely that EPA worker training will meet the OSHA training requirements as long as job-specific information is included.

L. Signs

Employers are required to post warning signs with the wording shown in Figure 9.8. This requirement does not preclude the employer from posting other appropriate hazard warnings, such as "Respirators required in this area." The signs must be posted in each work area where an employee's lead exposure is above the PEL, and illuminated and cleaned as necessary so that the legend is readily visible.

Figure 9.8 Example of Required Sign.



M. Recordkeeping

OSHA requires employers to maintain records of exposure assessments, medical surveillance, medical removals, and, if applicable, objective data used for exemption from the requirement for initial monitoring. Records must be made available upon request to affected employees, former employees, designated employee representatives, and OSHA and NIOSH. These records (except medical removals) must be kept for 30 years (29 CFR 1910.20). If an employer ceases to do business, the records must be transferred to a successive employer. If there is no successor, these records must be submitted to the Director of NIOSH. Employers should refer to 29 CFR 1926.62(n)(6) for additional requirements for transfer and disposal of records.

Employer records can provide a basis for assessment of regulatory compliance and the effectiveness of the employer's worker protection program. Additionally, records of exposures and health effects may be useful in epidemiologic studies.

1. Exposure Assessments

Exposure monitoring records must include the following information:

- Date(s), number, duration, location, and results of each of the samples taken.
- A description of the sampling procedure used to determine representative employee exposure, where applicable.
- A description of the sampling and analytical methods used and evidence of their accuracy.
- The type of respiratory protection worn by monitored employees.
- Name, social security number, and job classification of the monitored employee and all other representative employees.
- The environmental variables that could affect the measurement of exposure (for example, temperature and relative humidity).

It is also recommended that the name of the laboratory conducting the monitoring and a contact person be included in the records.

2. Medical Surveillance

The employer must establish and maintain an accurate record for each employee included in the medical surveillance program. Medical records must be kept for the duration of employment plus 30 years, in accordance with 29 CFR 1910.20. Some States may require blood lead levels to be reported to a central occupational health registry. The record for each employee must include:

- Name, social security number, and description of the duties of the employee.
- A copy of the examining physician's written opinions.

- Results of any airborne exposure monitoring done and provided to the physician.
- Any medical complaints related to lead exposure.
- Medical examination results, including medical and work history information.
- A description of laboratory procedures and standards or guidelines used to interpret test results (or references to that information).
- Results of biological monitoring.
- Name of physician and laboratory and date of examination.

3. Medical Removals

Records for each employee who is medically removed should be kept at least for the duration of employment and must include:

- An explanation of how removal was accomplished.
- A statement of whether or not the removal was due to an elevated blood lead level.

4. Objective Data

Limitations on the use of objective data for exemption from initial monitoring were discussed above (see Initial Determinations and Exposure Assessment). The employer must maintain a record of the objective data.

N. Observation of Monitoring

OSHA requires that employers provide affected employees or their designated representatives (e.g., union representatives) with an opportunity to observe any monitoring of employee lead exposures that is conducted as part of exposure assessments. The observers are entitled to receive an explanation of measurement procedures, observe all steps related to the monitoring of lead at the worksite, and either record the results or receive copies of the laboratory results of air sampling.

VI. Other Employer Requirements

In addition to the OSHA construction lead standard, there are many other applicable construction standards that employers must comply with during lead hazard control projects. OSHA standards for construction are found in 29 CFR, Part 1926. Some of these standards are:

- General safety and health provisions, 29 CFR 1926.20.
- Medical services and first aid, 29 CFR 1926.50.
- Sanitation, 29 CFR 1926.51.
- Occupational noise exposure, 29 CFR 1926.52.
- Gases, vapors, fumes, dusts, and mists, 29 CFR 1926.55.
- Hazard communication, 29CFR 1926.59.
- Ventilation: welding, cutting, or heating of toxic metals, 29 CFR 1926.353(c).
- Safety equipment, such as hardhats, safety shoes, eyewash stations, etc.

VII. Example of an OSHA Written Compliance Plan

Following is a model worker protection compliance plan that meets the requirements of the OSHA Lead Exposure in Construction standard as they apply to housing. The model plan should be completed by applying its general provisions to the specific lead hazard control job.

Form 9.1
Model OSHA Written Compliance Plan

Date: __/__/__

This plan has been developed to comply with the OSHA Construction Lead Standard, 29 CFR 1926.62.

1. Location of Project:

This job will take place at the residence located at _____ (full address).

A previous lead inspection of this residence by _____ (name and address of inspection or risk assessment firm) revealed that lead hazards or lead-based paint are present in the following locations:

_____ (location and name of all building components to be treated)

_____

_____

_____

These building components are coated with lead-based paint and represent a hazard to workers who may disturb it during lead hazard control, renovation, or maintenance activities.

2. Brief Description of Job:

This job will involve the following lead hazard reduction measures (complete all that apply):

Replacement of _____ (name all components)

Enclosure of _____ (name all components)

Paint removal of _____ (name all components)

Encapsulation of _____ (name all components)

Paint film stabilization of _____ (name all components)

Friction surface treatments of _____ (name all components)

Impact surface treatments of _____ (name all components)

Dust removal in the following areas: _____ (name all areas)

3. Schedule:

The job is expected to start on _____ (date) and end on _____(date). This compliance plan will take effect immediately on _____(date). The competent person will conduct worksite visual inspections on a daily basis.

Work will proceed according to the following schedule:

Day 1: Initial setup, followed by:

_____ (name all tasks to be completed)

_____

_____

Daily cleanup: wet mopping, HEPA vacuuming

Day 2: Tasks

Day 3: Tasks

Day 4: Final cleanup and clearance examination

4. Equipment and Materials:

HEPA vacuums, cleaning detergents, protective clothing, cotton work gloves, electric power saws, hammers, wrecking bars, pry bars, screwdrivers, plastic sheeting, metal scrapers, compressed air-powered water pumps, rollers, brushes, butyl rubber gloves, respirators, cutting shears, mops, plastic sheeting, paintbrushes, paint rollers.

5. Crew:

The work will be completed by a crew of _____(insert number) workers. Crew assignments are as follows:

Crew 1 _____(name) _____ (task)

Crew 2 _____(name) _____ (task)

6. Competent Person:

_____(Name), a certified lead abatement supervisor, will be onsite at all times and will act as the competent person for occupational health and safety issues. The lead supervisor license (or certificate) number is:_____. The lead supervisor will conduct daily inspections of the work areas to ensure that control measures, work practices, personal protective equipment, and hygiene facilities are used as prescribed in this document.

7. Control Measures:

The primary control methods for this project are (check all that apply):

_____ method substitution (building component replacement, enclosure)

_____ wet methods

_____ wrapping materials to be discarded in plastic

_____ respiratory protection

_____ local exhaust ventilation (needle guns, vacuum blasting)

_____ general room ventilation

_____ on-the-job training

_____ HEPA vacuums

_____ containment (use of plastic barriers)

8. Technology Considered in Meeting the Permissible Exposure Limit:

The *HUD Guidelines for Evaluation and Control of Lead Hazards in Housing* and *Protecting Workers and Their Communities From Lead Hazards: A Guide for Protective Work Practices*, published by the Society of Occupational and Environmental Health, and other publications were reviewed to determine the appropriate engineering controls to be used in this project. The only specialized equipment that will be utilized for this project are HEPA-filtered vacuum cleaners and _____ (name all special equipment).

9. Respirators:

All individuals in the work area will be provided with a NIOSH/MSHA-approved half-mask, air-purifying respirator equipped with HEPA cartridges or a powered air-purifying respirator (if so requested).

Respirators will be provided in the context of a complete respiratory protection program; the written respirator program is attached.

Respirators will be required during (name phases of job for which respirators will be required):

_____

_____

_____

Respirator use during other activities, including initial setup (laying down plastic for containment), and enclosure and encapsulation after surface preparation is not necessary, *unless* other workers nearby (same interior room or outside wall) are performing activities for which respirators are required.

10. Protective Clothing:

Disposable protective clothing will be worn at all times inside the work area. Protective clothing will be made of breathable fabric to reduce the potential for worker heat stress. If visibly contaminated with dust or paint chips, protective clothing will be vacuumed before it is removed.

11. Hygiene Facilities:

Handwashing facilities will be used to decontaminate workers, since leaded dust levels are expected to be low. Showers are used on jobs that generate high leaded dust levels. The facilities will be located in a portable trailer, which will be parked in the driveway of the residence. The trailer will contain two sinks, a fresh water tank, hot water heater, wastewater collection tank, and easily cleanable floors and benches. Labeled plastic bins with covers will be used to separate disposable protective clothing from street clothing. Hot water, soap, and towels will be provided. Hands and face will be washed before all breaks and at the end of the day. Wastewater will be collected, pretreated onsite with filtration, and disposed of in accordance with prior arrangements made with _____(name of local water and sewage authority).

12. Air Monitoring Data:

Previous data for lead hazard control projects conducted with similar controls, environmental conditions, personnel, and methods were reviewed. Air sampling will not be performed on this job, since typical exposures have already been established for these work crews by:

_____(name of person or firm completing air sampling).

Based on these results, the major exposures to lead will occur during _____(name tasks during which substantial exposures are likely to occur).

In previous work conducted by the same contractor and work crew on similar houses in the same city, using the same methods, *maximum* personal exposures measured for various activities were:

Maximum Exposure ($\mu g/m^3$)	**Task**
_____	_____
_____	_____
_____	_____

The environmental conditions in the homes previously abated closely resemble the current location. These maximum exposures are expected to represent "worst-case" exposures because they did not include breaks or setup time; it is expected that 8-hour, time-weighted average exposures on this job will be lower than these figures. However, worker respiratory protection requirements will be based on the maximum exposures to allow for unexpected variations.

13. Medical Surveillance Program:

A medical surveillance program is already in place for this work crew. It is supervised by:

Dr. _____ (name, address, and phone number of physician and/or firm).

Worker blood lead levels are measured initially before the onset of work, each month for the first 6 months of employment, and every 6 months thereafter.

Blood lead levels for current employees who will be assigned to this job are between:

_____ µg/dL to _____ µg/dL (list range of blood lead levels) based on the report dated _____ (add date for latest medical monitoring report). Worker blood lead increases of 10 µg/dL or greater or any blood lead level greater than 25 µg/dL will trigger an investigation of protective equipment and work practices. All workers on this project are informed of their blood lead levels as soon as they are received.

14. Training:

The following workers have been trained using the EPA Worker Training Curriculum and SOEH's *Guide For Protective Work Practices and Effective Worker Training*. The training was conducted by _____(name, address, and phone number of training provider) on _____(insert date).

Trainees	**Social Security Number**
_____	_____
_____	_____
_____	_____

Plan completed by:

_____ (name and signature)

_____ (date)

Example of a Completed Worker Protection OSHA Compliance Plan

OSHA Written Compliance Plan
Date: 5/19/99

This plan has been developed to comply with the OSHA Construction Lead Standard, 29 CFR 1926.62.

1. Location of Project:

This job will take place at a private residence located at 2952 Channing Way, Anywhere, New York. A previous lead inspection of this residence by Carefree Consultants, Inc., revealed that windows, window frames, and all interior walls in both units are coated with lead-based paint (the range was 1.5 mg/cm^2 to 24 mg/cm^2). In some areas the existing lead-based paint is deteriorated, with loose and peeling paint chips. The existing lead-based paint represents a hazard to workers who may disturb it during lead hazard control or renovation activities.

2. Brief Description of Job:

The abatement job will involve the removal and replacement of six windows in the residence and the encapsulation or enclosure of kitchen and bathroom walls.

The primary window replacement activities that are expected to generate leaded dust are manual removal of existing wood frame windows and cleaning.

3. Schedule:

Work will proceed according to the following schedule:

Window Replacement

Day 1: Initial setup, including placement of plastic sheeting on interior floor and exterior ground surfaces for containment purposes.

Begin manual removal of windows. All window components will be wetted with water mist prior to removal to minimize dust generation.

Daily cleanup: wet sweeping, HEPA vacuuming

Day 2: Complete removal of all windows.

Preparation of window openings for replacement windows—sawing or planing may be required.

Install replacement windows; employ daily cleanup as above.

Apply new caulking around replacement windows; final cleanup.

Encapsulation and Enclosure

Day 1: Initial setup, including placement of plastic sheeting on floors, and nonmovable furnishings, appliances, and furniture items.

Prepare surfaces for enclosure system by removing loose and peeling paint. All surfaces will be thoroughly wetted with water mist prior to scraping. Surfaces will be lightly scraped with 9-inch metal paint scrapers.

Daily cleanup: wet sweeping followed by HEPA vacuuming and mopping with detergent solution

Day 2: Install all mineral glass wallcovering material.

Manually apply the initial and final coats of the liquid encapsulant, polymer surfacing system over the mineral glass substrate. Rollers and brushes should be used to apply liquid encapsulant. Allow 8 hours to dry between coats, or until surface is hard and dry to the touch. Install enclosure system (drywall) over encapsulated surface.

Daily cleanup

Day 3: Final cleaning

4. Equipment and Materials:

Window Replacement

"Olofson" metal frame, thermal-pane, replacement windows (Model 000–111), HEPA vacuums, trisodium phosphate detergent, protective clothing, cotton work gloves, electric power saws, hammers, wrecking bars, pry bars, screwdrivers, plastic sheeting, and other hand tools as needed.

The abatement job will also include encapsulation or enclosure of all interior walls in the kitchen and bathroom areas. The primary activities that are expected to generate leaded dust are manual scraping and cleaning involved with surface preparation.

Encapsulation and Enclosure

"Cover It Up" Encapsulant System (Item 333–55), drywall, metal scrapers, compressed air- powered water pumps, rollers, brushes, butyl rubber gloves, respirators, cutting shears, brooms, HEPA vacuums, detergent solution, mops, and plastic sheeting.

The job is expected to start on July 11, 1999, and end on July 13, 1999. This compliance plan will take effect immediately on July 8, 1999. The competent person will conduct worksite visual inspections on a daily basis.

5. Crew:

The replacement of windows and encapsulation enclosure will each be completed by a crew of two workers. Crew assignments are as follows:

R. Smith, T. Jones	Crew 1, Window Replacement
Z. Topp, J. Gonzales	Crew 2, Encapsulation/Enclosure

6. Competent Person:

Mr. Homer Simpson, a licensed lead abatement supervisor, will be onsite at all times and will act as the competent person for occupational health and safety issues. Mr. Simpson's lead supervisor license number is: XMZ 678. Mr. Simpson will conduct daily inspections of the work areas to ensure that control measures, work practices, personal protective equipment, and hygiene facilities are used as prescribed in this document.

7. Control Measures:

The primary control method for this project is method substitution; that is, building component replacement and encapsulation and enclosure will be used for lead-based paint hazard abatement, instead of onsite paint removal.

During replacement, existing window frames, sashes, and troughs will be wetted with water mist prior to removal to reduce airborne dust generation during removal activities. During both replacement and encapsulation, all scraping or sawing activity will be done on wet surfaces; all debris will be wetted down before handling. Building components coated with lead-based paint will be wrapped in plastic sheeting after removal to reduce contamination of workers' hands and clothing

during handling and disposal. After initial surface preparation for encapsulation and window removal, it is expected that there will be minimal disturbance of existing lead coatings during this job. Wet methods (mopping) and HEPA vacuums will be used during cleaning to minimize worker exposures to lead.

To reduce generation of leaded dust in the work areas, paint chips and dust will be vacuumed on at least a daily basis with HEPA-filtered vacuums. Final cleaning will be accomplished by three successive cleanings consisting of HEPA vacuuming alternated with wet mopping with trisodium phosphate solution. The use of HEPA vacuums and wet cleaning methods will minimize worker lead exposures.

8. *Technology Considered in Meeting the Permissible Exposure Limit:*

The *HUD Guidelines for Evaluation and Control of Lead Hazards in Housing* and other publications were reviewed to determine the appropriate engineering controls to be used in this project. The only specialized equipment that will be utilized for this project are HEPA-filtered vacuum cleaners and air-powered water pumps with high-pressure hoses attached to aerosol-generating nozzles (for water misting of surfaces). Natural ventilation will be utilized, as mechanical ventilation with HEPA-filtered exhaust fans has not been found to reduce worker lead exposures with the methods that will be used during this project.

9. *Respirators:*

All individuals in the work area will be provided with a half-mask, air-purifying respirator equipped with HEPA cartridges or a powered air-purifying respirator if so requested. Respirators will be provided in the context of a complete respiratory protection program; the written respirator program is attached.

Respirators will be required during window removal, surface preparation for encapsulation, any sawing or use of power tools, manual scraping, cleaning activities, and final cleanup. Respirator use during other activities, including initial setup (such as laying down plastic for containment), and enclosure and encapsulation after surface preparation is not necessary, *unless* other workers nearby (same interior room or outside wall) are performing activities for which respirators are required.

10. *Protective Clothing:*

Disposable protective clothing will be worn at all times inside the work area. Protective clothing will be made of breathable fabric to reduce the potential for worker heat stress. If visibly contaminated with paint dust or chips, protective clothing will be vacuumed before it is removed.

11. *Hygiene Facilities:*

Handwashing facilities will be used to decontaminate workers. The facilities will be located in a portable trailer that will be parked in the driveway or parking area of the residence. The trailer will contain two sinks, a fresh water tank, hot water heater, wastewater collection tank, and easily cleanable floors and benches. Labeled plastic bins with covers will be used to separate disposable protective clothing from street clothing. Hot water, soap, and towels will be provided. Hands and face will be washed before all breaks and at the end of the day. Wastewater will be collected, pretreated onsite with filtration, and disposed of in accordance with prior arrangements made with the Anywhere Municipal Wastewater Treatment Facility. The trailer will be cleaned with a HEPA vacuum and wet washed twice each week.

12. *Air Monitoring Data:*

Previous data for lead abatement projects conducted with similar controls, environmental conditions, personnel, and methods were reviewed. Air sampling will not be performed on this job, since typical exposures have already been established for these work crews (see attached report from previous jobs prepared by XYZ Industrial Hygiene, Inc.). Based on these results, the major exposures to lead will occur during window removal, although significant exposures may also occur during cleanup.

In previous work conducted by the same contractor and work crew on similar houses in the same city, using the same methods, *maximum* personal exposures measured for various activities were: window removal and replacement, 121 μg/m^3; encapsulation, 24 μg/m^3; cleaning, 110 μg/m^3; final cleaning, 50 μg/m^3; and initial setup, 6 μg/m^3. The environmental conditions in the homes previously abated closely resemble the current location. These maximum exposures are expected to represent "worst-case" exposures because they did not include breaks or setup time; it is expected that 8-hour, time-weighted average exposures on this job will be lower than these figures. However, worker respiratory protection requirements will be based on the maximum exposures to allow for unexpected variations.

13. Medical Surveillance Program:

A medical surveillance program is already in place for this work crew. It is supervised by Dr. William Jones, a board-certified occupational health physician with Occupational Health Clinic, Inc. (phone: 800–555–1111). Worker blood lead levels are measured initially before the onset of work, each month for the first 6 months of employment, and every 6 months thereafter. Blood lead levels for current employees who will be assigned to this job are 5–12 μg/dL, based on the May report (see attached). Worker blood lead increases of 10 μg/dL or more will trigger an investigation of protective equipment and work practices. All workers on this project are informed of their blood lead levels as soon as they are received.

14. Training:

All workers have been trained using the EPA Worker Training Curriculum. The training was conducted by Joe Smith, a certified industrial hygienist with XYZ Industrial Hygiene, Inc., and Bill Smith, the competent person, on March 3–5, 1993.

Workers trained on March 3–5 include:

R. Smith

T. Jones

Z. Topp

J. Gonzales

The job proceeded as planned. However, in the next month, one worker's blood lead level increased from 12 to 25 μg/dL. This employee was one of the most productive members of the crew. The employer investigated the possible causes of the significant increase (10 μg/dL or more). After observing and interviewing the worker on a subsequent job, it was clear that the worker was not wearing the half-mask, air-purifying respirator all the time and was not using enough water to moisten surfaces before scraping. A powered air-purifying respirator was provided to increase the worker's understanding of the need for respiratory protection. Additional training and counseling by the physician was also provided to this individual. The following month's blood lead level declined to 16 μg/dL, but the supervisor continued to conduct special oversight of this individual.

Plan completed by:

_____ (name)

_____ (signature)

_____ (date)