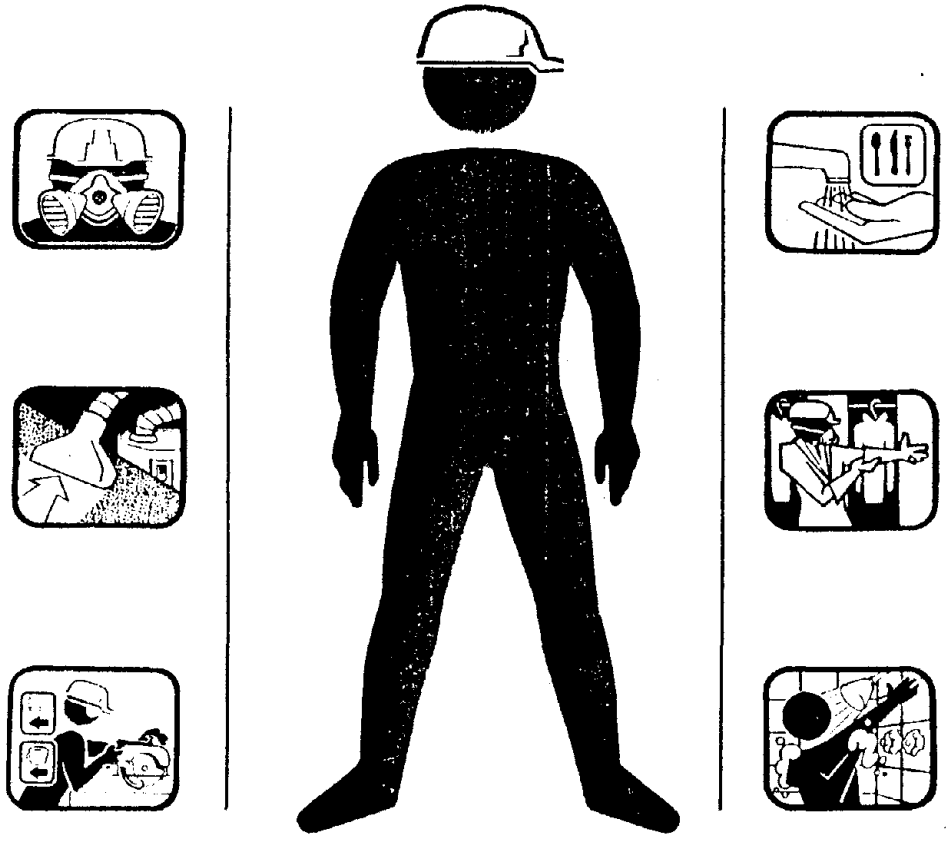
Working with Lead in the Construction Industry

U.S. Department of Labor
Occupational Safety and Health Administration

U.S. Department of Health and Human Services
National Institute for Occupational Safety and Health

April 1991

OSHA 3126



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U.S. Department of Labor
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Introduction

Lead has been poisoning workers for thousands of years. In the construction industry, traditionally most overexposures to lead are found in the trades, such as plumbing, welding and painting.

In building construction, lead is frequently used for roofs, cornices, tank linings, and electrical conduits. In plumbing, soft solder, used chiefly for soldering tinplate and copper pipe joints, is an alloy of lead and tin. Soft solder, in fact, has been banned for many uses in the United States. The use of lead-containing paint in residential applications has also been banned by the Consumer Product Safety Commission. However, since lead-containing paint inhibits the rusting and corrosion of iron and steel, it is still used on bridges, railways, ships, lighthouses, and other iron and steel structures, although substitute coatings are available.

Significant lead exposures can also arise from removing paint from surfaces previously coated with lead-containing paint, such as in bridge repair, residential renovation, and demolition. With the increase in highway work, including bridge repair, residential lead abatement, and residential remodeling, the potential for exposure to lead-containing paint has become more common. The trades potentially exposed to lead include iron work, demolition work, painting, lead-based paint abatement work, plumbing, heating/air-conditioning, electrical work, and carpentry/renovation/remodeling.

Operations that generate lead dust and fume include the following:

- Flame-torch cutting, welding, and grinding of lead painted surfaces in repair, reconstruction, dismantling, and demolition work;
- Abrasive blasting of bridges and other steel structures containing lead-based paints;
- Using torches, heat guns, and sanding machines during abatement of residential lead-based paint; and
- Maintaining process equipment or exhaust ductwork.

Operations that involve exposure to lead-containing products include:

- Spray painting bridges and other structures with lead-based paints and primers;
- Using solder in plumbing and electrical work.

Health Effects

Lead can be absorbed into the body by inhalation (breathing) and ingestion (eating). Very small amounts of lead that may be unintentionally ingested via eating, drinking, or smoking on the job can be harmful. Good personal hygiene is important on jobs where lead is present.

Lead exposure can *kill* you! It can affect the brain, leading to seizures, coma, and death. Lead poisoning can occur at high exposure concentrations (acute) or at low exposure concentrations over a long period of time (chronic) and can cause either temporary or permanent damage. Even jobs of 1 or 2 weeks' duration can cause lead poisoning.

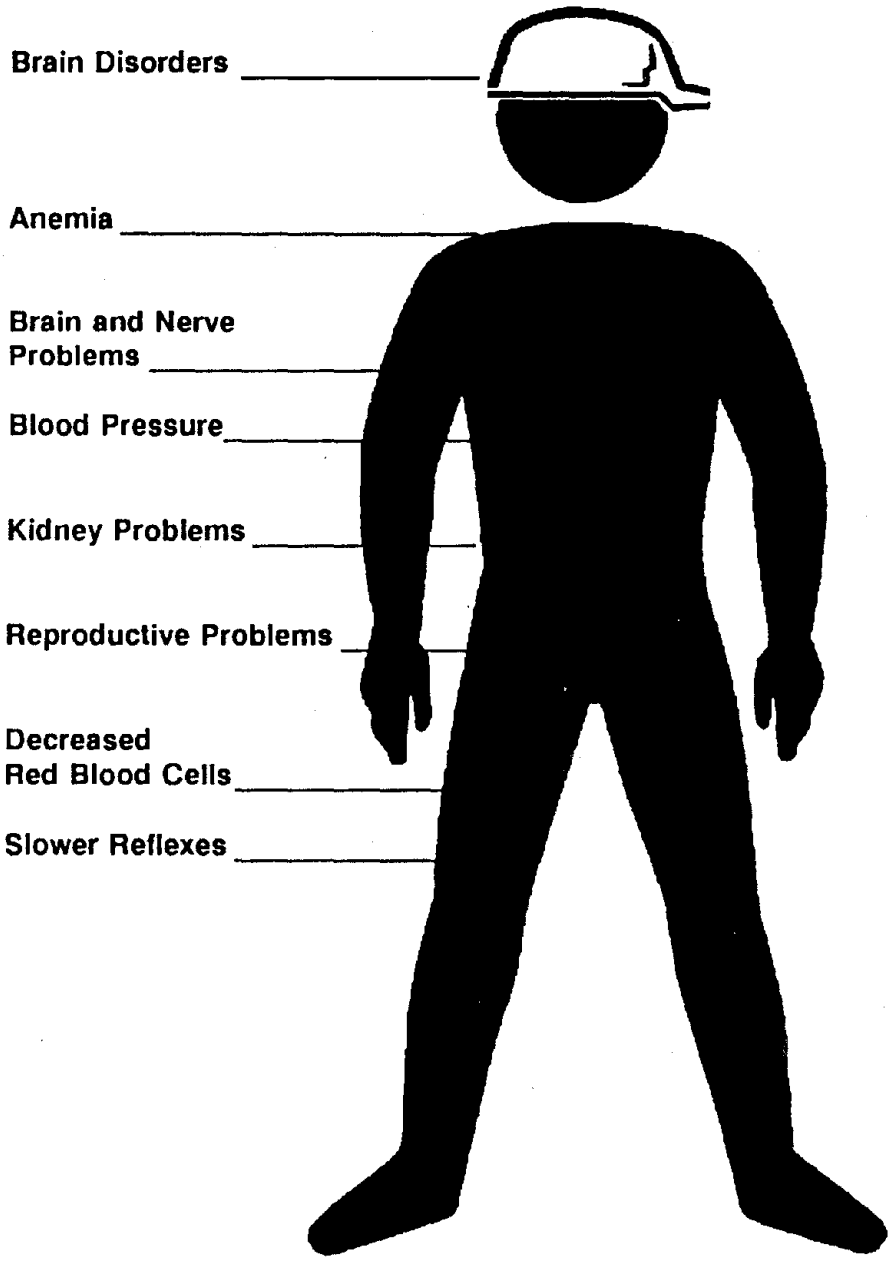
Lead is a cumulative poison. It accumulates in the blood, bones and organs, including the kidneys, brain and liver. It stays in the bones for decades. It may be slowly released over time to cause toxic effects. An increasing blood lead level usually means that there has been recent exposure and that lead is building up in the body faster than it is being eliminated. The early effects of lead poisoning are not specific and resemble "flu-like" illnesses. Worker awareness and training are important so that employees can recognize the symptoms of exposure and get prompt medical attention.

Cumulative exposure to lead, which is typical in construction settings, may result in damage to the *blood, nervous system, kidneys, bones, heart,* and *reproductive system* and contributes to high blood pressure.

The symptoms of lead poisoning include the following:

- Headache
- Poor appetite
- Dizziness
- Irritability/anxiety
- Constipation
- Pallor
- Excessive tiredness
- Numbness
- Metallic taste in the mouth
- Muscle and joint pain or soreness
- Sleeplessness
- Hyperactivity
- Weakness
- Reproductive difficulties
- Nausea
- Fine tremors
- Insomnia
- "Lead line" on the gums
- Hyperactivity
- "Wrist drop" (weakness of extensor muscles)

Health Effects of Lead in Adults



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

Exposure Monitoring

Jobs involving the use of construction materials containing lead or the potential disturbance of in-place lead paints and coatings should be targeted for detailed evaluation of their potential for lead exposure.

If any employee is or will be potentially exposed to airborne concentrations of lead, initial monitoring of the workplace should be conducted. Airborne concentrations of lead capable of causing permanent harm may not be visible to the eye so that air samples should be taken to monitor exposure concentrations. Exposure monitoring should be performed for all job categories unless the employer can document from previous monitoring that exposures are not significant in some specific categories. The samples should be taken in accordance with the National Institute for Occupational Safety and Health (NIOSH) Method 7082, or equivalent, and under conditions that represent each employee's regular daily exposure to lead. Analysis should be performed by a laboratory certified by the American Industrial Hygiene Association and participating in the Proficiency Analytical Testing Program for lead. Written records of monitoring results should include exposure concentrations, sampling data, location within the worksite, and the name and social security number of each employee monitored.

Whenever there has been a change in the job, crew, tools, materials, or setup that may result in new or additional exposures to lead, the employer should perform additional monitoring.

Available studies indicate that lead exposures during construction work can be extremely high. For example, lead exposures during torch-cutting can be from 25 to 175 times greater than the lead construction permissible exposure limit (PEL) of 0.2 milligrams per cubic meter (mg/m^3), and abrasive blasting exposures can be 100 times greater than the PEL. The construction site also can involve work in enclosed spaces and other settings that make exposure predictions difficult.

Exposure monitoring results enable employers to:

- Identify sources of exposure;
- Select the appropriate respiratory device and monitor effectiveness;
- Determine the need for engineering controls;
- Determine the effectiveness of work practices in controlling exposures;
- Recognize the need for modifying exposure/control practices including the need for additional engineering controls; and
- Determine the need for medical monitoring.

Engineering and Work Practice Controls

High airborne concentrations of lead can occur in both indoor and outdoor activities, even in brisk winds. Engineering and work practice controls may be required to minimize the hazards of lead. Good controls include:

1. Process/equipment/product modification or substitution

   Examples:

   - Increasing the length of the cutting torch, thereby increasing the distance from the source of contamination, to reduce the exposure of lead burners, and
   - Substituting vacuum-blasting for open-air blasting in the removal and containment of lead-based paints from steel structures;
   - Removing and replacing interior woodwork and entire window systems rather than scraping during residential abatement work;
   - Using non-lead-based coatings, and
   - Using chemical stripping systems to remove lead-based paint (**CAUTION**: Many chemical strippers, e.g., methylene chloride, are **toxic** or release toxic by-products when subjected to high temperatures).

2. Exhaust ventilation equipped with dust collection system to capture lead dust and fume at the point of generation

   Examples:

   - Outfitting hand-held rotary peening machines and right angle sanders with a dust-collector vacuum attachment;
   - Blasting and spray painting bridges with total containment under negative pressure and properly designed so that the airflow will move the contaminants away from the workers.

3. Work Practices

   Examples:

   - Reducing lead exposures during torch cutting by stripping the paint away from the area to be cut;
   - Working upwind of the cutting torch when the configuration of the job permits;
   - Using wet methods to reduce the spread of dust; and
   - Using vacuuming equipment with high-efficiency particulate air (HEPA) filters.

Respiratory Protection

Because of the variability of exposure concentrations in the construction industry and the difficulty of monitoring a mobile work force, respirators should be used whenever construction employees are potentially exposed to lead. Respirators should be donned before entering the work area and should not be removed until the worker has left the work area, or has entered a decontamination area. The use of respirators should supplement the continued use of engineering controls and good work practices. Employers must assure that the respirator issued to the employee is properly selected (see Respirator Selection, p. 7) and properly fitted so that it exhibits minimum facepiece leakage. Respirators should be supplied by the employer at no cost to employees. Employers should perform qualitative or quantitative face-fit tests at the time of the initial fitting and at least semiannually thereafter for employees wearing negative-pressure respirators.

Respirator Program

When respirators are provided, the employer must establish a respiratory protection program in accordance with the OSHA standard in 29 CFR 1910.134. Requirements for a minimally acceptable respirator program include the following elements:

- Written standard operating procedures governing the selection and use of respirators must be established;
- Respirators must be selected on the basis of hazards to which the worker is exposed;
- The user must be instructed and trained in the proper use of respirators and their limitations including fit testing ;
- Respirators must be regularly cleaned and disinfected;
- Respirators must be stored in a convenient, clean, and sanitary location and protected against sunlight and physical damage;
- Respirators used routinely must be inspected during and after cleaning; worn or deteriorated parts must be replaced;
- Respirators should be assigned to workers for their exclusive use;
- Appropriate surveillance must be maintained of work area conditions and degree of worker exposure and stress;
- There must be regular inspection and evaluation to determine the continued effectiveness of the program;
- Employees should not be assigned to tasks requiring the use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. A physician must determine, through a medical examination, the respirator user's medical status and review it annually;
- NIOSH/MSHA certified respiratory protection must be used when available. The furnished respirator must fit properly and provide

adequate respiratory protection against lead or other hazards for which it is designed.

Respirator Selection

For some construction activities, employers can provide workers with an air-purifying respirator with HEPA filters as an aid to keeping employee blood lead levels low. (A HEPA filter is one that is at least 99.97 percent efficient against particles that are 0.3 micron in diameter.) This type of respirator can be used in environments where the concentration of lead in the air is not in excess of 0.5 mg/m^3. However, there may be certain conditions where air monitoring results or the type of jobs indicate that a more protective respirator is needed. Jobs that may require air-supplied or special respirators include torch cutting, abrasive blasting, sanding of lead-containing paints, and cleaning up in dusty areas. A table of suggested respirators can be found in the back of this booklet. In addition, if exposure monitoring indicates airborne exposures to contaminants other than lead, such as solvents, a reevaluation of the respirator type is required. A reevaluation of the respirator program is also indicated when a worker demonstrates a continued increase in blood lead levels.

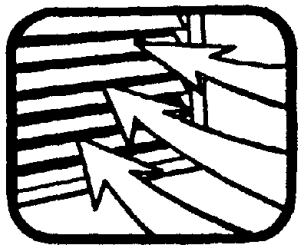
Protective Equipment

At no cost to employees, employers should provide those workers potentially exposed to lead with clean, dry protective work clothing and equipment, and appropriate changing facilities. Appropriate protective work clothing and equipment can include coveralls or similar full-body work clothing, gloves, hats, shoes or disposable shoe coverlets, face shields or vented goggles and, if applicable, blasting helmets. Contaminated clothing that is to be cleaned, laundered or disposed of should be placed in closed containers. Persons responsible for handling contaminated clothing should be informed of the potential hazards. At no time should lead be removed from protective clothing or equipment by any means that put lead into the work area, such as brushing, shaking, blowing, or using a regular vacuum cleaner.

At no time should workers be allowed to leave the worksite wearing lead contaminated clothing and equipment. All contaminated clothing and equipment should be prevented from reaching the worker's home or vehicle. This is a significant step in reducing the movement of lead contamination from the workplace into a worker's home and provides added protection to employees and their families.

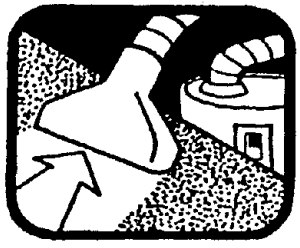
Safe Work Practices

The most important work practices include the following:

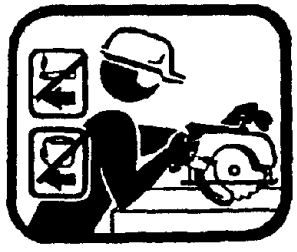


Use the exhaust ventilation system, where provided.

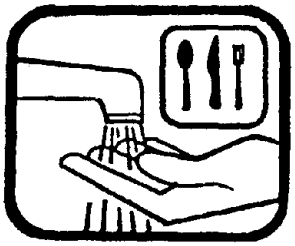
Use the correct, clean respirator.



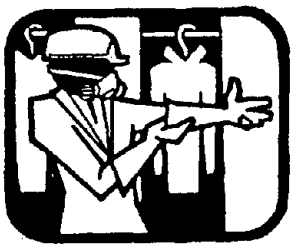
Keep the worksite clean.
Use only a vacuum with a HEPA filter or wet cleaning methods when removing lead dust.
Never use compressed air for cleaning.



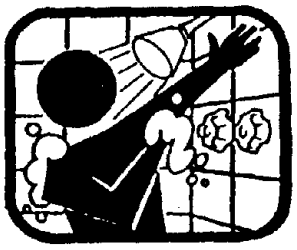
Eat, drink, or smoke in areas outside the worksite.
Keep all lunch boxes and coffee cups away from the work area.
Use a separate lunchroom.



Wash hands and face before eating, drinking, smoking, or applying cosmetics.



Use protective clothing. Store street clothes separately from work clothes. Never wear contaminated clothes home.



Shower and change into clean clothes, including shoes, before leaving the worksite so that no lead contamination is carried home.

Training

Construction standards, such as 29 CFR 1926.21, require that a potentially exposed employee be informed of the hazards of lead and be trained in the precautions to take when working around it. The employee shall also be instructed in proper work practices, personal hygiene procedures, and the use and limitations of protective equipment, such as eye and face protection, head protection, coveralls, and respirators.

Hazard Communication

Under the OSHA Hazard Communication Standard (29 CFR 1910.1200), employers using lead or lead-containing products must develop and make available a written hazard communication program and a list of hazardous chemicals. Material safety data sheets and labels must also be available.

In addition, employers must:

- Tell employees about the Hazard Communication Standard;
- Explain how it's being put into effect in their workplace; and
- Provide information and training on lead and other hazardous chemicals in their workplaces. This includes the use of labels and material safety data sheets and precautionary measures to protect against lead and other hazardous substances.

Multi-Employer Worksites

Any employer who produces, uses, or stores hazardous chemicals in such a way that the workers of other employers may be exposed must ensure that the hazard communication program includes how he or she will:

- Make available to other employers a copy of the material safety data sheet for each hazardous chemical to which the other employer's workers may be exposed to while working;
- Inform the other employers of any precautionary measures that need to be taken to protect employees; and
- Inform the other employer of the labeling system used in the workplace.

Medical Monitoring

All workers who are potentially exposed to lead should be monitored in a systematic program of medical surveillance. Medical surveillance helps to identify exposed workers and protect them from the toxic effects of overexposure.

Medical Evaluations

Prior to placing a worker in a job with a potential for exposure to lead, the physician should evaluate and document the worker's baseline health status by collecting medical, environmental, and occupational histories; by performing a physical examination; and by requesting physiologic and laboratory tests appropriate for the anticipated occupational risks.

A complete and detailed work history is important in the initial evaluation. This initial evaluation can be used as a baseline to evaluate future exposures. A listing of all previous employment with information on work processes, exposure to fumes or dust, known exposures to lead or other toxic substances, respiratory protection used, and previous medical surveillance should be included in the worker's record. Smoking or eating habits in work areas, laundry procedures, and use of any protective clothing or respiratory protection equipment should be noted.

The medical history should include a listing of all past and current medical conditions; any current medications; previous surgeries and hospitalizations; allergies, smoking history, alcohol consumption, and also non-occupational lead exposures from hobbies or other activities (e.g., target shooting, stained glass, ceramics). This history, however, which is not related to work conditions, is personal and must be kept as confidential by the examining physician.

The medical examination, both initial and periodic, should include the following:

- A thorough physical examination that pays particular attention to the hematologic, gastrointestinal, renal, cardiovascular, and neurological systems;
- An evaluation of pulmonary status to determine whether the worker is capable of wearing a respirator;
- Blood pressure measurement;
- A blood sample for analysis to determine blood lead levels, hemoglobin and hematocrit, blood urea nitrogen, serum creatinine, and zinc protoporphyrin;
- A routine urinalysis with microscopic examination;
- Pregnancy testing, or laboratory evaluation of fertility, if requested by a worker; and
- Any laboratory or other test that is recommended by the examining physician.

Lab results or medical findings unrelated to lead exposure must not be revealed to the employer.

Periodic Exams and/or Biological Monitoring

Work and medical interviews, biological monitoring, and physical examinations should be performed at regular intervals, unless otherwise indicated based on emergencies, variations in work periods, and preexisting health status. The appropriate medical examination and biological monitoring tests should identify any adverse trend in the function of the relevant body systems as compared to the health status

of the individual worker in his/her preplacement medical examination. Periodic measurement of blood lead can provide useful information. A rise in blood lead can mean that the worker is being overexposed to lead and that engineering controls, respiratory protection, and work practices are inadequate. While blood lead levels below 50 micrograms per deciliter are of medical concern, OSHA currently regards 50 micrograms per deciliter of blood as a level that requires removal from lead exposures.

Job Transfer or Termination

The medical, environmental, and occupational history interviews; the physical examination; and selected physiologic and laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination of employment. Because occupational exposure to lead may cause adverse reproductive effects and chronic diseases long after occupational lead exposure has ceased, the need for medical monitoring may extend well beyond termination of employment. Therefore, a copy of the medical records, including blood lead data, should be transferred to the worker's designated physician, if requested by a worker.

Medical Removal and Chelation

Workers who become lead poisoned should be removed from further exposure, based upon biological monitoring or a physician's determination.

Under certain limited circumstances, special drugs called chelating agents may be administered in some cases of lead poisoning. Chelating agents provide a means of removing circulating blood lead. Chelation should always be carried out under the supervision of a physician. It is unethical to use chelation as a prophylactic agent, that is, to lower blood level but continue to expose a worker. Chelation is only a means of medically controlling the effects for overexposure.

Related Requirements

The following OSHA standards may apply to lead work in construction:

1910.20	Access to Employee Exposure and Medical Records
1910.94	Abrasive Blasting
1910.134	Respiratory Protection
1926.20	General Safety and Health Provisions
1926.21	Safety Training
1926.28	Personal Protective Equipment
1926.51	Sanitation
1926.55	Gases, Vapors, Fumes, Dusts and Mists
1926.57	Ventilation
1926.59	Hazard Communication
1926.103	Respiratory Protection
1926.200	Accident Prevention Signs and Tags
1926.353	Ventilation and Protection in Welding, Cutting and Heating
1926.354	Welding, Cutting and Heating in Way of Preservative Coatings

Further Assistance

If you have a question regarding lead in construction, you should contact your local OSHA Area Office for assistance. Free consultation services are also available to assist employers, and information regarding these services can be obtained through the OSHA Area and Regional Offices as well (see lists at end of this booklet). NIOSH has a toll-free telephone number: 1-800-35-NIOSH (1-800-356-4674).

Respiratory Protection for Lead Exposures

Airborne concentration of lead or condition of use	Required respirator*
Not in excess of 0.5 mg/mg^3	Any air-purifying respirator equipped with HEPA filters.**
Not in excess of 1.25 mg/m^3	Any powered, air-purifying respirator equipped with HEPA filters.**
Not in excess of 2.5 mg/m^3	Any air-purifying full-facepiece respirator equipped with HEPA filters.** Any powered, air-purifying respirator with a tight-fitting facepiece and HEPA filters.**
Not in excess of 50 mg/m^3	Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode.
Not in excess of 100 mg/m^3	Any supplied-air respirator that has a full-facepiece and is operated in a pressure-demand or other positive-pressure mode.
Greater than 100 mg/m^3, unknown concentration, or fire fighting	Any self-contained breathing apparatus that has a full-facepiece and is operated in a pressure-demand or other positive-pressure mode.

* Respirators specified for high concentrations can be used at lower concentrations of lead.

** A HEPA filter is one that is at least 99.97 percent efficient against particles that are 0.3 micron in diameter.

Selected Bibliography

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U.S. DHHS. NIOSH. **NIOSH Guide to Industrial Respiratory Protection.** Pub No. 87-116. Cincinnati:NIOSH, 1987.

U.S. Department of Housing and Urban Development (HUD). **Lead-Based Paint: Guidelines for Hazard Identification and Abatement in Public and Indian Housing.** Washington, D.C.:HUD, 1990.

U.S. Department of Labor (DOL). Occupational Safety and Health Administration (OSHA). 29 **Code of Federal Regulations** 1910.1025 Lead. Washington, D.C.:U.S. Government Printing Office, 1990

Related Publications

Single free copies of the following publications can be obtained from the OSHA Publications Office, U.S. Department of Labor, 200 Constitution Avenue, N.W., Room N-3101, Washington, D.C. 20210. Send a self-addressed mailing label with your request.

OSHA - 2056 All About OSHA

OSHA - 2207 Construction Industry Digest

OSHA - 2254 Training Requirements in OSHA Standards and Training Guidelines

OSHA - 3084 Chemical Hazard Communication

OSHA - 3047 Construction Services for the Employer

OSHA - 3021 OSHA: Employee Workplace Rights

OSHA - 2098 OSHA Inspections

OSHA - 3077 Personal Protective Equipment

OSHA - 3079 Respiratory Protection

A "Hazard Communication Compliance Kit" may be ordered from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Specify OSHA Publication 3104, GPO Order Number 929-022-00000-9. The kit can be ordered from GPO by phone using VISA or MasterCard; call (202)783-3238.

States with Approved Plans

States administering their own occupational safety and health programs through plans approved under section 18(b) of the Occupational Safety and Health Act of 1970 must adopt standards and enforce requirements that are at least as effective as Federal requirements. There are currently 25 State plan States: 23 cover the private and public (State and local government) sectors and 2 (New York and Connecticut) cover the public sector only.

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(CO, MT,ND, SD, UT,* WY*)
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1961 Stout Street
Denver, CO 80294
Telephone: (303) 844-3061

Region IX
(American Samoa, AZ,* CA,
*** Guam, HI,* NV,**
*** Trust Territories of the Pacific**
71 Stevenson Street, Room 415
San Francisco, CA 94105
Telephone: (415) 484-7107

Region X
(AK,* ID, OR,* WA*)
111 Third Avenue
Suite 715
Seattle, WA 98174
Telephone: (206) 442-5930

*These states and territories operate their own OSHA-approved job safety and health plans (Connecticut and New York plans cover public employees only). States with approved plans must have a standard that is identical to, or at least as effective, as the federal standard.

OSHA/State Consultation Project Directory

Consultation programs provide free services to employers who request help in identifying and correcting specific hazards, want to improve their safety and health programs, and/or need further assistance in training and education. Funded by OSHA and delivered by well-trained professional staff of state governments, consultation services are comprehensive, and include an appraisal of all workplace hazards, practices, and job safety and health programs; conferences and agreements with management; assistance in implementing recommendations; and a follow-up appraisal to ensure that any required corrections are made.

For more information on consultation programs, contact the appropriate office in your state listed below.

STATE	TELEPHONE	STATE	TELEPHONE
Alabama	(205) 348-3033	Illinois	(312) 917-2339
Alaska	(907) 264-2599	Indiana	(317) 232-2688
Arizona	(602) 255-5795	Iowa	(515) 281-5352
Arkansas	(501) 682-4522	Kansas	(913) 296-4386
California	(415) 557-2870	Kentucky	(502) 564-6895
Colorado	(303) 491-6151	Louisiana	(504) 342-9601
Connecticut	(203) 566-4550	Maine	(207) 289-6460
Delaware	(302) 571-3908	Maryland	(301) 333-4218
D. C.	(202) 576-6339	Massachusetts	(617) 727-3463
Florida	(904) 488-3044	Michigan	(517) 335-8250 (H) (517) 322-1814 (S)
Georgia	(404) 894-8274	Minnesota	(612) 297-2393
Guam	011 (671) 646-9246	Mississippi	(601) 987-3981
Hawaii	(808) 548-7510	Missouri	(314) 751-3403
Idaho	(208) 385-3283	Montana	(406) 444-6401

STATE	TELEPHONE	STATE	TELEPHONE
Nebraska	(402) 789-0546	Rhode Island	(401) 277-2438
Nevada	(702) 789-0546	South Carolina	(803) 734-9599
New Hampshire	(603) 271-3170	Tennessee	(615) 741-7036
New Jersey	(609) 984-3507	Texas	(512) 458-7254
New Mexico	(505) 827-2885	Utah	(801) 530-6868
New York	(518) 457-2481	Vermont	(802) 828-2765
North Carolina	(919) 733-3949	Virginia	(804) 367-1986
North Dakota	(701) 224-2348	Virgin Islands	(809) 772-1315
Ohio	(614) 644-2631	Washington	(206) 586-0961
Oklahoma	(405) 528-1500	West Virginia	(304) 348-7890
Oregon	(503) 378-3272	Wisconsin	(608) 266-8579 (H) (414) 521-5063 (S)
Pennsylvania	(412) 357-2561 (800)382-1241 Within State	Wyoming	(307) 777-7786
Puerto Rico	(809) 754-2134-2171	**H** - Health	**S** - Safety

NIOSH OFFICES

National Institute for Ocupational
Safety and Health Headquarters
1600 Clifton Road, N.E.
Atlanta, GA 30323
(404) 639-3771

Regional Office
Government Center
JFK Federal Building
Room 1401
Boston, MA 02203
(617) 233-3848

Regional Office
101 Marietta Towers
Suite 107
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(404) 331-2396

Regional Office
1961 Stout Street
Room 1185
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