

OCCUPATIONAL HEALTH GUIDE FOR LEAD

For complete requirements concerning use of lead in the workplace, see [MIOSHA Part 310 Lead in General Industry](#) or [MIOSHA Part 603 Lead in Construction](#). This handout summarizes MIOSHA Lead in General Industry only.

PROPERTIES

Lead is a soft bluish-gray material, extremely malleable and ductile and protected from erosion by the formation of a film of gray oxide. When heated above its boiling point, it gives rise to lead fume by volatilization. Lead oxide forms on the surface of molten lead and, when disturbed, is released to the atmosphere. Of its compounds, only tetraethyl and tetramethyl lead are volatile at room temperature.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The Permissible Exposure Limit (PEL) for lead is 50 ug/m³ (micrograms per cubic meter of air) measured as an 8-hour, time-weighted average value.

ACTION LEVEL (AL)

The action level for lead is 30 ug/m³ (micrograms per cubic meter of air) measured as an 8-hour, time-weighted average value. This level triggers various requirements of the lead rules.

HEALTH HAZARDS

General - Lead can enter the body by inhalation and ingestion. Additionally, some organic lead compounds can be absorbed through the skin. Once lead enters the body, it is absorbed by the blood and carried to all organs of the body. Some of the lead is quickly filtered out of the blood and removed as body wastes but some will remain in the blood and other tissues. If exposure to lead continues, the amount stored in the body will increase. Even though you may not be aware of any symptoms of disease, this stored lead can be slowly causing irreversible damage - first to cells, then to organs and whole body systems.

Acute Overexposure Effects - Lead is a potent poison that serves no known useful body function. Taken into the body in large enough doses, lead can kill in a matter of days. A condition affecting the brain called acute encephalopathy may arise which develops quickly into seizures, coma, and death from cardiorespiratory arrest. A short-term dose of lead can lead to acute encephalopathy (swelling of the brain). Short term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects which take longer to acquire.

Chronic Overexposure Effects - Chronic overexposure to lead may result in severe damage to blood-forming, nervous, kidney and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation and nausea. Also reported are symptoms of pallor, excessive tiredness, weakness, insomnia, headache and nervous irritability. Muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic are among other symptoms of lead poisoning. In lead colic, there may be severe abdominal pain.

Damage to the central nervous system in general and to the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor and convulsions. It may arise suddenly with the onset of seizures, followed by coma and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy.

Chronic overexposures to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression to kidney dialysis or death is possible.

Lead may impair the reproductive systems of both men and women. Lead can result in decreased sex drive, impotency and sterility in men. Lead can alter the structure of sperm cell raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood.

Lead may also disrupt the blood-forming system resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigability as a result of decreased oxygen carrying capacity in the blood.

In addition to the permissible exposure limit, given on page one, the MIOSHA Part 310 Lead in General Industry contain many provisions designed to assure that no employee suffers adverse health effects from working with lead or lead bearing materials. These provisions are summarized in the following paragraphs.

Exposure Monitoring [1910.1025(d)] - Employers are responsible to determine the level of lead exposure by periodic monitoring by air sampling. If the exposure level equals or exceeds the airborne "action level" (30 ug/m³, 8-hr. TWA) additional requirements are required. Each employee shall be notified of the results of monitoring relevant to his/her lead exposure.

Protective Clothing and Housekeeping [1910.1025(g)-(h)] - The employer must provide appropriate, clean protective work clothing (coveralls, gloves, head covers, etc.) to workers who are exposed above the PEL. This clothing is to remain at the place of employment to minimize lead exposure away from the worksite. The worksite shall be kept as free as practical of lead dust accumulations.

Hygiene Practices and Facilities [1910.1025(i)] - The employer shall prohibit the presence or consumption of food, beverage and tobacco products and application of cosmetics in areas where the exposure level exceeds the PEL. Where presently available, the employer shall require the use of change rooms, clothes lockers and shower rooms.

Medical Surveillance and Removal [1910.1025(j)-(k), R 325.51933, R 325.51937, R 325.51943 and R 325.51945] - This set of rules require physical exams and blood-lead tests to be made for each employee exposed above the airborne action level. Employee blood-lead levels of 30 ug/dL (30 micrograms per deciliter of whole blood) require the employee be moved to a different job where the lead exposure is less than the Action Level without loss of pay or benefits. Additionally, medical removal is required when the average of 3 consecutive blood tests or all tests conducted during the previous 6 months (whichever is longer) is equal to or greater than 20 ug/dL unless the last test is less than 15 ug/dL. The employee may be returned to the original job when the blood-lead test shows the level to be satisfactory below 15 ug/dL.

Employee Information and Training [1910.1025(l)] - The employer is required to conduct an annual training program for all employees exposed at or above the airborne action level. This training shall cover all aspects of the rules, the hazards of lead, medical program, engineering controls, work practices, etc.

Recordkeeping [1910.1025(n)] - The employer is required to maintain records of exposure monitoring, medical surveillance, medical removal, etc. Such records must be made available for inspection and copying to employees, former employees, their physicians or a designated employee representative. There are also provisions requiring the transfer of such records to a new business owner, or if none, follow the requirements in [MIOSHA Part 470 Employee Medical Records and Trade Secrets](#).

CONTROL OF LEAD EXPOSURE

General - Employees must not be exposed above the PEL and employers should find it advantageous to keep exposures below the action level. To achieve the minimal exposure conditions and provide maximum protection to employees, there are several types of control procedures that may be used. These are briefly pointed out in the following paragraphs.

Engineering Controls - Procedures in this category may include the following:

1. Change product/process design to eliminate use of lead.
2. Install or improve local exhaust ventilation to capture lead dust/fume near point of origin.
3. Isolate contaminating operations to protect other plant areas.
4. Use wet methods to control dust.
5. Heat lead to lowest working temperature to minimize fume generation.

Good Housekeeping - If lead exposure cannot be controlled through engineering, this is the simplest single method of reducing lead exposure, daily cleaning of all lead dust generated will remove this source of contamination. Particular attention should be paid to the walls, overhead structures and machinery. Air pressure jets should not be used for cleaning; wet or vacuum methods are preferable.

Personal Hygiene - For personal hygiene of the employees, adequate washing facilities, including showers and lockers, must be provided. Eating cannot be permitted in the work areas; a lunchroom must be provided. No food or beverages should be kept in the workroom and smoking must be prohibited except in specified areas. Personal cleanliness on the part of the workers should be stressed and should be a part of the educational program.

Personal Protection - When other control methods do not result in exposure levels below the PEL, personal respiratory protection must be used. Respiratory protection must be selected from NIOSH/MSHA approved equipment, and a comprehensive respirator program must be developed.

Note: This guide is intended for the benefit of the public and may not contain all of the information pertinent to a specific hazard and/or control of personnel exposure. For further information, consult with the Division.

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