

*OSHA Consultation's
Guideline for
Reducing Lead Exposure
in the workplace*



Oklahoma Department of Labor

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Reducing Lead Exposure in the Workplace

29 CFR 1910.1025

Lead in General Industry

HEALTH HAZARDS OF LEAD EXPOSURE

Pure lead (Pb) is a heavy metal (at room temperature and pressure) and is a basic chemical element. It can combine with various other substances to form numerous lead compounds.

When absorbed into the body in certain doses lead is toxic. It can be absorbed into the body by inhalation and ingestion. Except for certain organic lead compounds not covered by this standard, lead is not absorbed significantly through the skin. When scattered through the air as a dust, fume, or mist, lead can be inhaled and absorbed through the lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. Lead can also be absorbed through the digestive system if it enters the mouth and is ingested.

A significant portion of the lead inhaled or ingested gets into the blood stream. Once in the blood stream, lead is circulated through the body and stored in various organs and body tissues. Some of this lead is quickly filtered out of the body and excreted, but some remains in the blood and tissues. As exposure continues, the amount stored will increase if the body is absorbing more lead than it is excreting. The lead stored in the tissues can slowly cause irreversible damage, first to the individual cells, then to organs and whole body systems.

Lead adversely affects numerous body systems and causes forms of health impairment and disease that arise after periods of exposure as short as days (acute exposure) or as long as several years (chronic overexposure). A short-term dose of lead exposure can lead to acute encephalopathy, a condition affecting the brain that develops quickly into seizures, coma, and death from cardiorespiratory arrest. Short-term occupational exposures of this type are highly unusual, but not impossible. Similar forms of encephalopathy, however, may arise from extended chronic exposure to lower doses of lead. Consequently, there is no sharp distinction between rapidly developing acute effects of lead and longer term chronic effects.

Long-term (chronic) overexposure to lead may result in severe damage to the blood-forming, nervous, urinary, and reproductive systems. Some common symptoms include the following:

loss of appetite	metallic taste in the mouth	anxiety
constipation	weakness	pallor
excessive tiredness	nervous irritability	insomnia
headache	hyperactivity	numbness
fine tremors	dizziness	
colic with severe abdominal pain	muscle and joint pain or soreness	



Lead Poisoning

Lead poisoning is a disease that can be prevented in every single case. The general idea is simple: lead has no useful role in the human body, so keep it out. Two kinds of actions are required: first, cut the amount of lead-containing dust and fumes in the workplace; second, give workers the knowledge and tools to protect themselves from the lead that remains.

Damage to the central nervous system in general and the brain in particular is one of the most severe forms of lead poisoning. Chronic overexposure to lead also significantly impairs the reproductive systems of both men and women. Lead can alter the structure of sperm cells—raising the risk of birth defects—and there is evidence of miscarriage and stillbirth in women exposed to lead or whose husbands have been exposed to lead. Children born of parents who were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders, or to die during the first year of childhood.

SCOPE & APPLICATION

For the purpose of this standard, lead includes metallic lead, all inorganic lead compounds and organic lead soaps; excluded are all other organic lead compounds. OSHA’s lead in general industry standard applies to all occupational exposure to lead, except to the construction industry or to agricultural operations covered by 29 CFR Part 1928.

PROVISIONS OF THE STANDARD

The standard established maximum limits of exposure to lead for all workers covered, including a permissible exposure limit and action level.

Permissible Exposure Limit

The permissible exposure limit, or PEL, sets the maximum worker exposure to lead. For example, no employee may be exposed to lead at airborne concentrations greater than 50 $\mu\text{g}/\text{m}^3$ averaged over an 8-hour period. If an employee is exposed to lead for more than 8 hours in any work day, the permis-



sible exposure limit, as a time-weighted average (TWA) for that day, shall be reduced according to the following formula:

Maximum permissible limit (in $\mu\text{g}/\text{m}^3$) = $400 \div$ hours worked in the day. ¹

Action Level

An action level is the level at which an employer must begin certain compliance activities outlined in the standard. The action level, regardless of respirator use, for the lead in general industry standard is an airborne concentration of 30 micrograms per cubic meter of air ($30 \mu\text{g}/\text{m}^3$) averaged over an 8 hour period.

EXPOSURE MONITORING & MEDICAL SURVEILLANCE

Assessing Exposures

When initial employee exposure² is at or above the action level, the employer must collect full shift (for at least 7 continuous hours) personal samples including at least one sample for each shift for each job classification in each work area. These samples must represent the monitored employees regular, daily exposure to lead.

An initial determination of whether employees are exposed to lead at or above the action level and the results of that determination must be made available based on the following:

- any information, observations, or calculations that indicates employee exposure to lead;
- any previous measurements of airborne lead; and
- any employee complaints of symptoms attributable to exposure to lead.

The employer may discontinue required monitoring when at least two consecutive measurements—at least taken seven (7) days apart—are below the action level.

Monitoring for the initial determination whether employees are exposed at or above the action level may be limited to a representative sample for those employees exposed to the greatest concentration of airborne lead. Measure-

Blood-Lead Tests

A blood-lead test cannot be used alone to assess a person's health. The blood-lead test only helps to show how much lead is in the person's body, not whether the lead has caused any damage.

To find out whether any damage has been done, a doctor must do a thorough medical evaluation, including a physical exam.

¹ When respirators are used to limit employee exposure to lead, the measured exposure can be considered at the level provided by the protection factor of the respirator for those periods worn. Those periods may be averaged with exposure levels during periods when respirators are not worn to determine the employee's daily TWA exposure.

² For the purpose of this section, exposure is considered to be the level occurring if the employee were not using a respirator.

ments of airborne lead made in preceding 12 months may be used to determine how far above the action level employee exposure may be as long as the employer uses a method of monitoring and analysis which has an accuracy (to a confidence level of 95%) of not less than plus or minus 20% for airborne concentrations of lead equal to or greater than $30 \mu\text{g}/\text{m}^3$.

Where initial determination shows the possibility of any employee exposure at or above the action level, the employer must conduct monitoring that is representative of the exposure for each employee in the workplace who is exposed to lead.

Measurements of airborne lead made in preceding 12 months may be used to determine how far above the action level employee exposure may be as long as the employer uses a method of monitoring and analysis which has an accuracy (to a confidence level of 95%) of not less than plus or minus 20% for airborne concentrations of lead equal to or greater than $30 \mu\text{g}/\text{m}^3$.

For an initial determination that indicates no employee is exposed at or above the action level ($30 \mu\text{g}/\text{m}^3$), the employer must keep a written record of the determination, including the date, location within the worksite, and the name and social security number of each monitored employee.

Monitoring and Observing

If the initial determination proves employee exposure is below the action level, the measurement need not be repeated unless there is a change in production, process, control or personnel change that may result in new or additional exposure to lead or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to lead.

If employee exposure is at or above the action level, but at or below the PEL, the employer must perform monitoring at least every 6 months and continue until at least two consecutive measurements - taken at least 7 days apart - are below the action level.

If employee exposure is above the PEL, the employer must perform monitoring quarterly and continue until at least two consecutive measurements - taken at least 7 days apart - are at or below the PEL, but at or above the action level. The employer then must repeat and continue monitoring every six months to bring the exposure to or below the action level.

Where there has been a change of equipment, process, control, personnel or a new task has been initiated that could increase employee lead exposure at or below the action level, the employer must conduct additional monitoring. The employer must notify each employee in writing of employee exposure assessment results within 5 working days after their receipt. Whenever the



No One Knows

No one can tell whether employees are being over-exposed by just simply looking at them.

Air-sampling

Blood-lead testing can also identify lead problems that are missed by air sampling alone.



results indicated that the representative employee exposure, without use of respirators, is at or above the PEL, the employer must include a written notice stating that the employee's exposure was at or above that level, and describing the corrective action taken or to be taken to reduce exposure to below that level.

Medical Surveillance

Employers must institute a medical surveillance program for all employees who are or may be exposed above the action level for more than 30 days per year. All medical examinations and procedures are to be performed by or under the supervision of a licensed physician. Employers must provide the required medical surveillance including multiple physician review without cost to employees, and at a reasonable time and place.

Medical surveillance must include biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels to each employee who is or may be exposed to lead above the action level for more than 30 days per year. Biological monitoring tests must be conducted by a laboratory licensed by the Center for Disease Control, United States Department of Health, Education and Welfare (CDC), or which has received a satisfactory grade in blood lead proficiency testing from CDC in the prior twelve months and be accurate (to a confidence level of 95%) within plus or minus 15% or $6 \mu\text{g}/100 \text{ ml}$ whichever is greater.

The tests must be performed as follows:

- at least every six months to each employee who is or may be exposed above the action level for more than 30 days per year;
- at least every 2 months for each employee whose last blood sampling and analysis indicated a blood lead level at or above $40 \mu\text{g}/100 \text{ g}$ of whole blood and continue until 2 consecutive blood samples and analyses indicated a blood lead level below $40 \mu\text{g}/100 \text{ g}$ of whole blood; and
- at least monthly during the removal period of each employee removed from exposure to lead due to an elevated blood lead level.

Within 5 days of receiving biological monitoring results, the employer must notify each employee, in writing, of his/her blood lead levels. The employee must receive written medical opinions from each examining or consulting physician that contain the following:

- opinions regarding any detected medical condition that could place the employee at an increased health risk from lead exposure;

- recommendations for special protective measures or limitations on the employee's exposure to lead;
- limitations on the employee's use of respirators; and
- results of the blood lead determinations.

The examining physician must not reveal to the employer either by written or oral opinion any findings unrelated to the employee's occupational exposure to lead. The physician must advise the employee of any medical condition (occupational or non-occupational) that requires further medical attention.

If the employer selects the initial physician who conducts any medical examination or consultation, the employee may designate a second physician to review the findings, determination or recommendations of the initial physician and to conduct exams, consultation and tests the second physician deems necessary to facilitate the review. The employer must promptly notify each employee of the right to seek a second medical opinion following each medical exam or consultation conducted by the initial physician.

Until the employee (1) informs the employer of his/her intent to seek a second medical opinion and (2) initiates steps to make an appointment with a second physician (within 15 days after receipt of notification or receipt of the initial physician's written opinion), the employer may condition its participation in, and payment for the multiple physician review mechanism. If the findings of the second physician differ from those of the initial physician, the employee and employer must work together to see that the two physicians resolve any disagreement. If no agreement is feasible, the employer and employee may designate a third physician to review findings and conduct examinations, tests and consultations to resolve the disagreement. The employer must act on the third physician's recommendations unless the employer and employee reach agreement consistent with those of at least one of the three physicians.

The employer and employee or authorized employee representative may agree upon the use of any expeditious alternate physician determination. The employer must assure that any person who he/she retains, employs, supervises or controls does not engage in prophylactic chelation of any employee at any time. If therapeutic or diagnostic chelation is to be performed, the employer must assure that it is done under the supervision of a licensed physician in a clinical setting with thorough and appropriate medical monitoring and that the employee is notified in writing prior to its occurrence.





Medical Removal Protection

Employer must remove employees with lead exposure at or above the action level each time:

- a periodic and follow-up blood sampling test indicates a blood lead level at or above $60 \mu\text{g}/100\text{g}$ of whole blood;
- the average of the last 3 blood sampling tests (or average of all blood sampling tests conducted over the previous 6 months, whichever is longer) indicates a blood lead level at or above $50 \mu\text{g}/100\text{g}$ of whole blood; and
- a final medical determination³ indicates a detected medical condition that increases health risks from lead exposure.

The employer must remove any limitations placed on employees or end any special protective measures when a subsequent final medical determination indicates they are no longer necessary.

When the multiple physician's review mechanism has not yet resulted in a final medical determination, the employer must:

- remove employees from lead exposure, provide special protective measures, or place limitations on employees; or
- return employees to their former job status, end special protective measures, and remove limitations except when the initial removal, special protection or limitation resulted from a medical determination different from the findings of the initial physician, or when the employee has been on removal status for the preceding eighteen months due to an elevated blood lead level and must await final medical determination.

The employer must provide up to eighteen months of medical removal protection benefits each time an employee is removed from lead exposure. This means that the employer must maintain the earnings, seniority and other employment rights and benefits of an employee as though the employee had not been removed from normal exposure to lead or otherwise limited. The employer may condition medical removal protection benefits on the employee's participation in follow-up medical surveillance.

If a removed employee files a worker's compensation claim for a lead-related disability, the employer must continue to provide medical removal protection benefits pending the disposition of the claim. The employer's obligation will be reduced to the extent that the employee receive compensation for earnings lost during removal either from a publicly or employer-funded compensation program or from employment with another employer during the employee's removal.

The employer must take the following measures with respect to any em-

³ Refers to the written opinion on the employee's health status or the outcome of the multiple physician review mechanism.

ployee removed from exposure to lead due to an elevated blood lead level whose blood lead level has not declined within the past 18 months of removal so that the employee has been returned to his or her former job status:

- make available medical exam to obtain final medical determination;
- assure that final medical determination obtained indicates whether or not the employee may be returned to his or her former job status, and if not, what steps should be taken to protect the employee's health;
- when final medical determination has not yet been obtained, or once obtained indicates that the employee may not yet be returned to his or her former job status, the employer shall continue to provide medical removal protection benefits to the employee until either the employee is returned to former job status, or a final medical determination is made that the employee is incapable of ever safely returning to his or her former job status; and
- when the employer acts pursuant to a final medical determination which permits the return of the employee to his or her former job status despite what would otherwise be an unacceptable blood lead level, later questions concerning removing the employee again shall be decided by a final medical determination. Employer need not automatically remove such an employee pursuant to the blood lead level removal criteria provided by this section.



Voluntary Removal or Restriction of an Employee

Where an employer, although not required by this section to do so, removes an employee from exposure to lead or otherwise places limitations on an employee due to the effects of lead exposure on the employee's medical condition, the employer shall provide medical removal protection benefits to the employee equal to that required.

Information and Training

The employer must inform employees about lead hazards according to the requirement of OSHA's Hazard Communication standard for general industry, 29 CFR 1910.1200, including— but not limited to— the requirements for warning signs and labels, material safety data sheets (MSDSs), and the employee information and training. Employer who has a workplace in which there is a potential exposure to airborne lead at any level must inform employees of the content of Appendices A and B of this regulation.

The employer must post the following warning signs in each work area where the PEL is exceeded:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING



All signs must be well lit and kept clean so that they are easily visible. Statements that contradict or detract from the signs' meaning are prohibited. Signs required by other statutes, regulations, or ordinances, however, may be posted in addition to or in combination with, this sign.

The employer must institute a training program and ensure participation by all employees who are subject to exposure to lead at or above the action level or for whom the possibility of skin or eye irritation exists. Initial training must be provided prior to initial job assignment, or 180 days from the standard's effective date. Training must be repeated at least annually and must include the following:

- the content of the standard and its appendices;
- the specific nature of operations that could result in exposure to lead above the action level;
- the purpose, proper selection, fitting, use, and limitations of respirators;
- the purpose and a description of the medical surveillance program, and the medical removal protection program including information concerning the adverse health effects associated with excessive exposure to lead (with attention to the adverse reproductive effects on both males and females);
- the engineering controls and work practices associated with the employee's job assignment;
- the contents of any compliance plan in effect; and
- instructions to employees that chelating agents 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.

All materials relating to the training program and a copy of the standard must be made available to all employees.

METHODS OF COMPLIANCE

Compliance Program

When any employee is exposed to lead above the permissible exposure limit for more than 30 days per year, the employer shall establish and implement a written compliance program to reduce exposures to or below the permissible exposure limit and interim levels if applicable, solely by means of engineering and work practice controls. Written programs shall be revised and updated at least every 6 months and must include the following:

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

- a description of the specific means that will be employed to achieve compliance, including engineering plans and studies used to determine methods selected for controlling exposure to lead;
- a report of the technology considered in meeting the permissible exposure limit;
- air monitoring data which documents the source of lead emissions;
- a detailed schedule for implementation of the program, including documentation such as copies of purchase orders for equipment, construction contracts, etc.;
- a work practice program which includes regulations for the use of protective work clothing and equipment; housekeeping and hygiene facilities and practices;
- an administrative control schedule, if applicable; and
- any other relevant information.



Engineering, Work Practice and Administrative Controls

The lead general industry standard requires employers to use— when feasible— engineering, work practice and administrative controls to reduce and maintain employee lead exposure to or below the PEL. When all feasible controls have been instituted but are not sufficient to reduce employee exposure to or below the PEL, they must be used to reduce exposure to the lowest feasible level and supplemented by respirators.

Engineering Control

Engineering controls reduce employee exposure in the workplace either by removing or isolating the hazard or isolating the worker from exposure through the use of technology.

Where any employee is exposed to lead above the permissible exposure limit, but for 30 days or less per year, the employer must implement engineering controls to reduce exposures to $200 \mu\text{g}/\text{m}^3$, but thereafter may implement any combination of engineering, work practice, administrative, and respiratory controls to reduce and maintain employee exposure to lead to or below $50 \mu\text{g}/\text{m}^3$.

When mechanical ventilation is used to control exposure, measurements which demonstrate the effectiveness of the system in controlling exposure, such as capture velocity, duct velocity, or static pressure must be made at least every 3 months. Measurements of the system's effectiveness in controlling exposure shall be made within 5 days of any change in production, process, or control which might result in a change in employee exposure to lead.



Work Practice Control

Work practice controls reduce the likelihood of exposure by altering the manner in which a task is performed. Safe work practices include, but are not limited to maintaining separate hygiene facilities (i.e., change rooms, showers, hand washing facilities, and lunch areas) and requiring proper house-keeping practices (i.e., cleanup methods).

Housekeeping

- All surfaces must be maintained as free as practicable of accumulation of lead.
- Compressed air may not be used to cleanup floors and other surfaces where lead accumulates.
- Shoveling, dry or wet sweeping, and brushing must be used only where vacuuming or other equally effective methods have been tried and found not to be effective.
- Vacuums must be used and emptied in a manner which minimizes the reentry of lead into the workplace.

Hygiene Facilities and Practices

Food, beverages, tobacco products, and cosmetics are prohibited in all areas where employees are exposed to lead above the PEL regardless of respirator use.

Employers must provide clean change areas and hand washing and shower facilities for employees who work in areas where airborne exposure to lead is above the PEL regardless of respirator use. Employers also must provide an adequate number of lavatory facilities.

Change rooms must be equipped with separate storage facilities for protective work clothing and equipment and for street clothes to prevent cross-contamination. Shower facilities must contain an adequate supply of cleansing agents and towels for those employees required to shower. Employees required to shower must not leave the workplace wearing any protective clothing or equipment worn during the work shift.

Employers must provide lunchroom facilities for employees who work in areas where their airborne exposure to lead is above the PEL regardless of respirator use. These facilities must have a temperature controlled, positive pressure, filtered air supply, and are readily accessible to all employees. Employees must wash their hands and face prior to eating, drinking, smok-

Unsafe Habits

Lead poisoning can also be caused by unsafe personal habits rather than airborne dust or fumes.

ing or applying cosmetics in eating areas. In addition, employees are prohibited from entering these areas when wearing personal protective clothing or equipment unless surface lead dust has been removed by vacuuming, downdraft booth, or other cleaning method.

Administrative Controls

Administrative controls can be used to reduce employee exposure by removing the employee from the hazard (i.e., job rotation). If administrative controls are used to reduce employee exposure to lead, the employer must establish and implement a job rotation schedule that includes the following:

- name or identification number of each affected employee;
- duration and exposure levels at each job or work station where each affected employee is located; and
- any other information which may be useful in assessing the reliability of administrative controls to reduce exposure to lead.

Respiratory Protection

Where engineering and work practice controls do not reduce employee exposure at or below the $50 \mu\text{g}/\text{m}^3$ permissible exposure limit, the employer must supplement these controls with respirators. The employer must provide respiratory protection, at no cost to the employee and must ensure its use when:

- periods necessary to install or implement engineering or work-practice controls;
- work operations for which engineering and work practice controls are not sufficient to reduce employee exposures to or below the permissible exposure limit; and
- periods when an employee requests a respirator.

An appropriate respirator, which has been approved by the Mine Safety and Health Administration (MSHA) and NIOSH must be selected to protect against lead dust, fumes and mists. (See the table for recommended respiratory protection.) Employer must provide a powered air-purifying respirator instead of the respirator specified in the table for recommended respiratory protection when an employee chooses to use this type of respirator and such a respirator provides adequate protection to the employee.

Respirators issued to employees must exhibit minimum facepiece leakage and fit the employee properly. Employers must perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every 6 months for each employee wearing a negative-pressure respirator. If the employee shows signs of breathing difficulty during the fit test or during



Lead in History

Lead poisoning has existed for thousands of years.

At least since the ancient Greek civilization, lead has been known to cause illness among workers in lead-using occupations.



use, the employer must make available an examination in accordance with the medical surveillance requirements of the standard.

A respiratory protection program is required in accordance with 29 CFR 1910.134.

Protective Clothing and Equipment

The employer must provide at no cost to the employee and ensure the proper use of personal protective equipment where employees are exposed to lead above the PEL, or are exposed to lead compounds that may cause skin or eye irritation regardless of respirator use. Appropriate personal protective work clothing and equipment, which prevent contamination of employees and their garments, include but not limited to the following:

- coveralls or similar full-body work clothing;
- gloves, hats, and shoes or disposable shoe coverlets; and
- face shields, vented goggles, or other appropriate protective equipment which complies with 29 CFR 1910.133.

The employer is required to provide clean and dry protective clothing at least weekly, and daily to employees whose exposure levels, regardless of respirator use, are above $200 \mu\text{g}/\text{m}^3$ of lead as an 8-hour TWA.

To maintain the effectiveness of the personal protective clothing and equipment, the employer must:

- clean, launder, or dispose of contaminated protective clothing;
- repair or replace torn and defective clothing or requirement; and
- ensure all protective clothing is removed at the end of the work shift in change areas provided for that purpose.

All contaminated protective clothing and equipment to be cleaned, laundered, or disposed of must be placed in a closed container in the change area to prevent dispersion of lead outside the container. Blowing, shaking, or otherwise dispersing lead into the air is prohibited for removing lead from contaminated materials. Containers of contaminated personal protective clothing and equipment must be labeled as follows:

CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, OR FEDERAL REGULATIONS.

The employer also must inform, in writing, any person who cleans or launders the protective clothing or equipment to the potentially harmful effects of lead exposure.

RECORDKEEPING

The employer must establish and maintain an accurate record of all monitoring and other data used to conduct employee exposure assessments as required by this standard. The following must be included in exposure assessment record:

- the dates, number, duration, location and results of each of the samples taken, including 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 protective devices worn, if any;
- name, social security number, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent; and
- the environmental variables that could affect the measurement of employee exposure.

The employer must maintain these monitoring records for at least 40 years or for the duration of employment plus 20 years, whichever is longer.

The employer must establish and maintain an accurate record for each employee subject to medical surveillance, including:

- name, social security number, and description of the duties of the employee;
- a copy of the physician's written opinions;
- results of any airborne exposure monitoring done for that employee and the representative exposure levels supplied to the physician; and
- any employee medical complaints related to exposure to lead.

In addition, the employer must keep or ensure that the examining physician keeps the following medical records:

- a copy of the medical examination results including medical and work history;





- a description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to that information; and
- a copy of the results of biological monitoring.

The employer must maintain, for at least the duration of employment, an accurate record for each employee subject to medical removal, including:

- name and social security number of the employee;
- the date on each occasion that the employee was removed from current exposure to lead as well as the corresponding date on which the employee was returned to his or her former job status;
- a brief explanation of how each removal was or is being accomplished; and
- a statement with respect to each removal indicating whether or not the reason for the removal was an elevated blood lead level.

The employer must make available upon request all records required to be maintained—including exposure monitoring, medical removal, and medical records—to affected employees, former employees, and their designated representatives and to the OSHA Assistant Secretary and the Director of NIOSH for examination and copying in accordance with 29 CFR 1910.1020.

When an employer ceases to do business, the successor employer must receive and retain all required records. If no successor is available, these records must be sent to the Director of NIOSH. At the expiration of the retention period for the records required to be maintained, the employer must notify the Director of NIOSH at least 3 months prior to the disposal of such records and must transmit those records to the Director of NIOSH if requested within the period.

Airborne concentration of lead or condition of use	Required respirator
Not in excess of 0.5 $\mu\text{g}/\text{m}^3$ (10X PEL)....	Half-mask, air-purifying respirator equipped with high efficiency filters. ^{2,3}
Not in excess of 2.5 $\mu\text{g}/\text{m}^3$ (50X PEL)....	Full facepiece, air-purifying respirator with high efficiency filters. ³
Not in excess of 50 $\mu\text{g}/\text{m}^3$ (1000X PEL)....	(1) Any powered, air-purifying respirator with high efficiency filters ³ ; or (2) Half-mask supplied-air respirator operated in positive-pressure mode. ²
Not in excess of 100 $\mu\text{g}/\text{m}^3$ (2000X PEL)....	Supplied-air respirators with full facepiece, hood, helmet, or suit, operated in positive pressure mode.
Greater than 100 $\mu\text{g}/\text{m}^3$, unknown concentration or fire fighting.	Full facepiece, self-contained breathing apparatus operated in positive-pressure mode.



¹ Respirators specified for high concentrations can be used at lower concentrations of lead.

² Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.

³ A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

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