Module 20: Lead Exposure

Page 439-453

- Page 439-453

Page 439-453

Module 20: Lead Exposure

Module Description

Lead is a very toxic substance. People who are exposed to lead or lead compounds may become ill or even die due to lead poisoning. Our bodies remove lead from our systems at a slow rate, so inhaling even small doses of lead for a prolonged period of time can result in lead poisoning. Workers who are required to work at or near sites that are contaminated with lead are at a greater risk of lead poisoning.

This module is designed for workers who work in areas where the hazard of lead exposure exists. The module focuses on the health risks associated with exposure to lead and how workers can protect themselves against lead.

Module Learning Objectives

At the conclusion of this module, you should be able to:

- Identify the health effects and risks of exposure to lead
- Identify the ways in which lead can enter the body
- Identify the signs and symptoms of exposure to lead
- Describe the medical monitoring program
- Discuss the medical tests that are required before an employee begins work
- Control lead exposure
- Identify common control measures

Lesson 1: Lead in the Workplace

Lesson Focus

This lesson focuses on the following topics:

- Introduction
- Lead in the Construction Industry
- Routes of Exposure to Lead
- Activities That Can Cause Lead Exposure
- Health Hazards of Lead Exposure
- Signs and Symptoms of Lead poisoning
- Medical Monitoring
- Exposure Assessment

Introduction

At room temperature and pressure, pure lead is a heavy metal. It is mixed with many substances to form lead compounds that are used for a multitude of purposes. However, despite its usefulness, lead can be toxic if it is absorbed by the body in sufficient quantities through inhalation or ingestion.

When lead enters the body it circulates in the bloodstream and accumulates in various organs, possibly causing irreversible harm to body tissues. Although the body routinely rids itself of absorbed lead, some may still remain in the blood and tissues. With increased exposure, the stored amount of lead may continue to increase and eventually leads to lead poisoning which can cause serious illness or death.

Lead in the Construction Industry

Lead is abundantly used in the construction industry due to properties that render it useful for the manufacture of many materials. Some of these properties include:

- Low melting point.
- High molecular weight.
- High density.
- Very easy to shape (ductile).
- Readily available.

Lead compounds were often applied to steel and iron structures in the form of paint primer. Lead was also commonly used for making different metal alloys found in lead shielding in walls, and in lead pipes.

Workers in the construction industry are at an increased risk of exposure to lead and lead compounds. Continuous exposure can be catastrophic if specific control measures are not taken.

Routes of Exposure to Lead

Lead most commonly enters the body through inhalation or ingestion. Lead is usually not absorbed through the skin.

Inhalation

In the construction industry, inhalation is the most common route of lead absorption into the body. It occurs when there are airborne lead particles in the work area and workers take them in by breathing. Inhalation can also occur when a worker smokes in a contaminated area.

Ingestion

Workers can accidentally consume lead particles while eating or drinking contaminated food or beverages, or by eating, drinking, or smoking with contaminated hands. If workers do not follow specific work guidelines and hygiene practices they may take contaminants home, causing harm to the whole family.

Activities That Can Cause Lead Exposure

Construction workers may be exposed to lead while performing the following tasks:

- Removing and applying lead-based paints
- Melting and casting lead and babbitt metal
- Soldering
- Reclaiming lead-acid batteries
- Grinding or sanding lead-containing materials
- Machining lead
- Cutting or heating lead-containing materials

Health Hazards of Lead Exposure

Lead is a toxic substance and can cause severe adverse health effects if there is long-term or acute overexposure. Lead can severely damage your nervous, urinary, blood-forming, and reproductive systems.

Lead can cause anemia as it hinders the formation of hemoglobin in the blood. It can also cause damage to the cells in the kidneys, leading to kidney failure. Lead has also been found to reduce sperm count in men and decrease their fertility.

If a pregnant woman is exposed to lead, the lead particles can pass from the mother to the infant through the placenta.

Signs and Symptoms of Lead Poisoning

Exposure to lead may affect each person differently. Lead can cause severe damage to the body even before the symptoms appear.

Early Signs

Early signs of lead poisoning can be overlooked as everyday medical complaints. These include:

- Loss of appetite.
- Metallic taste.
- Irritability.
- Moodiness.
- Joint and muscle aches.
- Trouble sleeping.
- Lack of concentration.
- Fatigue.
- Decreased sex drive.
- Headaches.

Later Signs

Brief intense exposure or prolonged overexposure can result in severe damage to your blood-forming, nervous, urinary, and reproductive systems. Some noticeable medical problems include:

- Anemia.
- Kidney failure.
- Stomach pains.
- High blood pressure.
- Convulsions or seizures.
- Constipation or diarrhea.
- Tremors.
- Nausea.
- Wrist or foot drop.

- Reduced fertility.

Medical Monitoring

Lead has an action level of 30 micrograms per cubic meter (30 ug/m3). If you work in the construction industry and are exposed to lead at or above the action level, initial medical surveillance is required.

Your employer may be required to perform medical monitoring every six months. If you have a blood lead level of 40 ug/100g, you must be tested at least every other month until your blood lead level goes below 40 ug/100g for two consecutive blood tests. Your employer is required to notify you in writing within 5 days of the test if your blood lead level exceeds 40 ug/100g.

If your blood lead level is at or above 50 ug/100g, you must not enter any lead contaminated areas until two consecutive tests confirm that your blood lead level has been reduced to 40 ug/100g or less. Your employer is required to provide annual medical examinations to all employees whose blood lead levels have been at or above 40 ug/100g during the previous year.

Exposure Assessment

Your employer is responsible for assessing each employee's exposure level. If the initial exposure is assessed to be at or above the action level (30 ug/m3), your employer must obtain samples that indicate the level of exposure for each work shift and for each task in each work area. The degree of daily exposure to lead for each monitored employee can be assessed through these samples.

The results of all assessments that indicate the exposure level of employees to lead must include the following information:

- All observations, information, and calculations that show an employee's exposure to lead
- Measurements of any previous airborne lead
- Any complaints made by an employee of symptoms that indicate lead exposure
- Objective information about the materials that are used or the processes that have to be carried out

If two consecutive readings that have been taken a week apart are below the action level, your employer can discontinue lead monitoring and choose to only monitor those employees who are at a greater risk of lead exposure. Your employer can also use the information related to lead exposure for the same task that was taken in the previous 12

months. However, your employer must maintain an accurate account of the nature and the pertinence, of any preceding exposure data.

If initial assessment is not performed by your employer, the company must assume that all employees carrying out lead-related tasks are exposed at levels above the permissible exposure level (PEL) of 50 ug/m3 and must provide them with the appropriate respirators, protective clothing and equipment, enclosed changing areas, washing facilities, and proper training.

If initial assessment indicates that the level of exposure is below the action level (30 ug/m3), your employer must document these findings, including the date, exact work location, and the names and social security numbers of all the employees that were monitored.

Monitoring and Observing

If initial assessment indicates that the exposure is below the action level, your employer is not required to assess the workplace unless the processes or controls are changed. However, the company is required to perform monitoring at least every six months if the exposure level is at or above the action level, but at or below the PEL. Monitoring must be continued until at least two consecutive measurements, that have been taken at least seven days apart, are below the action level.

Monitoring must be performed quarterly if the employee exposure is above the PEL. When at least two consecutive measurements that have been taken at least seven days apart are at or below the PEL, but at or above the action level, monitoring should be continued every six months until the exposure is below the action level.

Your employer is required to perform additional monitoring if there is a change in the equipment, control, process, or personnel. Additional monitoring is also required when a new task has been started that can increase the risk of exposure to lead. Your employer is required to inform all employees about the assessment results within five working days after they have been received.

If the exposure level is determined to be at or above the PEL, your employer is required to issue a written notice to you informing you about the exposure level and the preventive measures they must take in order to reduce exposure.

If you are required to perform lead-related tasks you have the right to observe the monitoring of your lead exposure. Furthermore, you are entitled to receive respirators, protective clothing, and any other equipment that is required for performing the task.

Lesson Summary

Lead can be very toxic—even deadly—if it is absorbed by the body in sufficient quantities, most commonly by either unintentional inhalation or ingestion. Because our bodies are slow to remove lead from our systems, someone who inhales small doses of lead—over a long period of time—can end up with lead poisoning. When lead enters the body it circulates in the bloodstream and accumulates in various organs, possibly causing irreversible harm to body tissues.

If the amount of lead stored in the body continues to increase, the person can suffer numerous adverse health effects, including severe damage to kidneys, nervous, urinary, blood-forming, and reproductive systems; anemia; decreased fertility; and danger to the unborn babies of pregnant workers, since lead particles can pass through the placenta. Workers must learn to recognize the early and later symptoms of lead poisoning, which range from headaches and fatigue to seizures and tremors.

Workers in the construction industry are at an increased risk of lead exposure, because lead is used in everything from steel and iron structures to walls and lead pipes. Specific measures must be taken to protect workers from the deadly hazards posed by lead. Such measures include medical monitoring, medical surveillance where indicated, exposure assessments, regular monitoring of exposure levels, and additional monitoring where indicated.

Lesson 2: Exposure Reduction & Employee Protection

Lesson Focus

This lesson focuses on the following topics:

- Lead Control Measures
- Personal Hygiene and Housekeeping Practices
- Protective Clothing
- Respiratory Protection
- Recordkeeping

Lead Control Measures

In order to minimize employee exposure to lead, your employer must make sure that lead control measures and good work practices are used when workers are performing lead-related tasks. The permissible exposure level of lead is 50ug/m3. If exposure beyond this level exists, additional controls are required.

Some control measures that can be adopted to reduce your exposure to lead include exhaust ventilation, encapsulation, substitution, process modification, and isolation.

Exhaust Ventilation

All equipment and tools used to remove lead-based paint must have a high-efficiency particulate air (HEPA) vacuum system attached, to collect lead dust particles. Your employer must provide local exhaust ventilation for tasks such as welding, cutting, burning, or heating. To clean up the work area, you must only use HEPA vacuums in order to prevent lead particles from becoming airborne.

Some operations, such as abrasive blasting, may require full containment or enclosure. The structure of the enclosure must allow the flow of ventilation air past you. This reduces the concentration of airborne lead and increases visibility.

The enclosure must be equipped with dust collection and air-cleaning devices so that the emission of lead particles can be controlled. Your employer is required to maintain a negative pressure inside the enclosure in order to prevent lead particles from contaminating areas outside the enclosure.

Encapsulation

Your employer is required to follow similar precautions if they are making all lead-based paint inaccessible by encapsulating it with a material that adheres to the surface, such as epoxy coating, acrylic, or flexible wall coverings. In addition to painting or coating, lead can also be enclosed by using systems such as plywood paneling, gypsum wallboard, aluminum, or vinyl. Vinyl tiles or linoleum flooring can be used to cover floors that are coated with lead-based paint.

Your employer is also responsible for supervising the workers and contractors who are required to carry out activities that involve encapsulated lead-based paint, and ensuring that a minimum amount of lead is released in the air during maintenance or demolition.

A Substitution

You can avoid using lead-containing materials by selecting other materials. Epoxy-covered zinc-containing primers can be used instead of lead-containing coatings. Also, you can use equipment that decreases the risk of lead emission. When cutting lead-containing materials, for example, you can use a mobile hydraulic shear instead of a torch. For some operations, you can use surface preparation equipment instead of abrasive blasting.

Hand scraping using a hand gun can be replaced by chemical strippers. This considerably reduces the amount of lead dust released in the air. However, care must be taken because these strippers can be hazardous.

Process Modification

In order to reduce the risk of lead hazard, lead-containing paints can be applied using brushes or rollers instead of spraying them. Using this method ensures that only a little amount of lead is introduced into the air. For abrasive-blasting operations, you should use a non-silica containing abrasive instead of sand when possible, as free silica in the sand can create an increased respiratory hazard for the workers.

A large amount of dust may be produced while performing abrasive blasting. Less dusty techniques should be used in order to minimize the dust being produced. These techniques can include:

- **Hydro-blasting** that involves using high-pressure water with or without abrasives to remove coatings from different substances.
- **Vacuum blasting** in which there is a vacuum system attached to the blast head that removes the blast material immediately after it is produced.

When removing lead-based paints in residential housing units workers must use a flameless electrical heat gun type softener. Furthermore, the temperature of these heat guns must be set below 700 degrees Fahrenheit.

If you are required to perform abrasive blasting on the exterior surfaces of buildings, you must ensure that the configuration of the head of the blasting nozzle is appropriate for the substrate being used, so that the vacuum can contain all the debris. You must also have HEPA vacuum cleaner attachments for different surfaces. Using the right brush and attachment for the right surface will reduce the amount of lead dust emitted into the air.

Isolation

Employers cannot completely enclose and ventilate some abrasive blasting tasks. However, they can isolate many operations in order to reduce the risk of exposure to lead. Your employer must restrict unauthorized personnel from entering the isolated work areas by posting warning signs.

Personal Hygiene and Housekeeping Practices

Exposure to lead can have adverse health effects. However, you can minimize your exposure to lead by adopting rigorous personal hygiene and housekeeping practices. Furthermore, these practices ensure that you do not take lead-contaminated dust from the worksite to your home where it can endanger your family.

Housekeeping

All accumulations of lead and lead debris must be removed every day or after every work shift. At the end of each shift you must either use a high-efficiency particulate air (HEPA) vacuum to clean lead dust, or wet it before sweeping. All workers performing clean up tasks must wear proper protective equipment and clothing, including suitable respirators, in order to prevent contact and inhalation of lead particles.

All lead debris and contaminated material that has to be disposed of must be placed in impermeable bags or containers and properly sealed. These bags and containers must be labeled as lead-containing waste. These measures ensure that no worker is exposed to lead. Your employer is responsible for disposing of lead waste according to federal, state, and local government laws.

Personal Hygiene Practices

Your personal hygiene practices must focus on minimizing your exposure to lead. The work area must have adequate washing facilities so that workers do not take

contaminants into uncontaminated areas. Your employer is responsible for providing workers with clean changing areas. Furthermore, they must also provide non-contaminated eating areas that are separate from the work areas.

Changing Areas

If you are exposed to lead above the permissible exposure limit (PEL), you must be provided with a clean changing area. This changing area must be divided into two sections: one for storing clean street clothes, and the other for removing and storing contaminated clothing. This segregation ensures that your street clothes do not come in contact with contaminated work clothes.

Employees must NEVER wear contaminated clothes away from the work site. They should not be taken home for washing under any circumstances. They should only be laundered by professionals. Disposable clothing must be properly disposed of according to federal, state, and local laws.

Showers

If you get a considerable amount of contaminants on your skin, hair, and protective clothing while performing your assigned tasks you must take a shower before leaving the work site. It is the responsibility of the employer to provide you with adequate showering facilities to remove contaminants and change into clean clothing.

If you do not shower and change into clean clothing before leaving the worksite, you may contaminate your vehicle and home with lead dust. This lead contamination can harm your family members.

Eating and Drinking Practices

All employees who perform lead-related tasks must clean or remove their protective clothing and thoroughly wash their hands and face before eating, drinking, or smoking. It is the responsibility of the employer to inform all workers that they must not eat, drink, or smoke in the work area or in areas where lead-containing material is present.

Washing Facilities

Your employer is required to provide workers with adequate washing facilities that are located near the worksite. These washing facilities must be equipped with water, soap, and clean towels so that employees can thoroughly remove lead contamination from their skin.

Contaminated water from all showers and washing facilities must be disposed of according to the local, state, or federal laws.

End-of-Day Procedures

At the end of the workday you must follow certain procedures to minimize your exposure to lead. These procedures include:

- Placing disposable clothes and shoe covers into impermeable containers that are assigned for lead waste and then properly sealed off.
- Placing all lead-contaminated clothes, shoes, and personal protective equipment in a closed container to be laundered by a professional.
- Taking a shower and washing hair and skin as necessary.
- Changing into regular street clothes.

Protective Clothing

If you are required to perform lead-related tasks, your employer must provide you with clean, dry, protective clothing and equipment free of cost. Clothing that may be required at lead-containing construction sites include:

- Full-body protective work clothing.
- Gloves.
- Goggles with protective shields.
- Blasting or welding helmets.

If there are no laundering services available, your employer should provide you with disposable clothes and shoe covers. You must change into clean non-disposable coveralls every day. Before you take off your work clothes and respirator, you must clean all loose particles on your clothing by using high-efficiency particulate air (HEPA) filter vacuum equipment. Loose particles of lead can also be removed from the respirator by using a damp wipe. All protective clothes worn must fit you properly.

All contaminated clothes that have to be laundered, cleaned, or disposed of should be placed in closed containers and sealed off. These containers must be labeled with warning signs that advise workers not to remove dust by blowing or shaking.

Your employer must inform all persons who handle lead contaminated clothing or equipment, in writing, about potential lead hazards. You must be careful never to remove lead from protective clothing using means that can release lead dust into the work area, such as shaking, brushing, or blowing.

You must never wear protective clothing outside the work area, or take contaminated clothing and equipment to your homes or vehicle.

Some tasks require you to wear gloves. Underneath the protective clothing, you should wear clothes that are appropriate for the existing weather and temperature conditions.

Respiratory Protection

At some construction sites the lead content in the air may be high, or can vary widely. At such sites you may be required to use respirators in addition to the basic protective measures.

If lead levels require the additional protection, you must wear your respirator before you enter the work area and remove it only after you have left the work site. Your employer is required to initiate a respiratory protection program in order to train all employees about the usage of their respirators.
Minimum requirements of the program include:

- A written guide explaining how to select and use respirators.
- Selection of respirators according to the hazards associated with a particular task.
- Training sessions about the proper usage of respirators along with their limitations.
- Inspecting, cleaning, disinfecting, and maintaining the work site on a regular basis.

Respirator Selection

Protection from lead particles can be obtained by using different types of respirators. Usually a respirator is selected according to the nature of the work and the amount of lead present in the workplace.

Before entering the work area, you must fit test your respirator by putting it on and making sure that it fits properly and that there are no gaps where lead dust or vapors can enter.

Types of Respirators

There are two basic types of respirators that can be used to provide protection against lead: air-purifying respirators and atmosphere-supplying respirators.

Air-Purifying Respirators

A respirator with an air-purifying filter, cartridge, or canister is called an air-purifying respirator. A properly selected respirator removes lead contaminants from the air by passing air through the air-purifying component and making it acceptable to breathe normally.

Atmosphere-Supplying Respirator

An atmosphere-supplying respirator consists of a component that provides you with breathable air not taken from the ambient atmosphere. There are two types of atmosphere-supplying respirators: the supplied-air respirator (SAR) and self-contained breathing apparatus (SCBA) unit.

Supplied-air respirators use a hose called an airline to provide clean air from the air tank. There are two types of supplied-air respirators: pressure-demand respirators and continuous-flow respirators.

Pressure-demand respirators prevent the contaminated air from entering the face-piece by maintaining a positive pressure. Continuous-flow respirators also maintain a positive pressure by constantly supplying fresh air to the face-piece.

A self-contained breathing apparatus (SCBA) consists of a hose that is connected to a cylinder of compressed air.

Record Keeping

Your employer is required to maintain a record of all the findings of the employee exposure assessments. These records should be accurate and must contain the following information:

- The name, social security number, and job classification of the employee who was monitored
- Description of the sampling procedures along with the date, number, duration, location, and results of each sample taken
- Details of all sampling and analytical methods used along with the evidence of their accuracy
- The type of respirator worn
- The factors that might affect the measurement of employee exposure

Your employer is required to make these records available to you and your representatives. Furthermore, if your employer stops doing business all records and

documents regarding employee monitoring and assessment must be handed over to their successor.

Lesson Summary

Employers are responsible for supervising workers to ensure compliance with all control measures, as well as necessary personal hygiene and housekeeping practices, to minimize employees' lead exposure. This may require supplying employees with protective clothing, a professional laundering service (or disposable clothes and shoe covers), and respiratory protection (including proper training) where needed. The two basic types of respirators that can provide protection against lead are air-purifying respirators and atmosphere-supplying respirators.

Good housekeeping practices include removing all lead accumulations every day or after every work shift; using HEPA vacuums to clean lead dust; sealing off impermeable bags or containers; and having all workers doing clean-up wear protective equipment (including respirators) and clothes. Personal hygiene practices include using clean changing areas, non-contaminated eating areas, adequate washing facilities, and strictly adhering to end-of-day and all other hygiene-related procedures. Employees must NEVER wear lead-contaminated work clothes away from the work site, and disposable clothes must be discarded in accordance with all laws. Your employer must inform all persons who handle lead contaminated clothing or equipment, in writing, about potential lead hazards, and must maintain records of all employee exposure assessments.