

Proposed Appendix A to MN Rule 5205.XXXX

Substance Data Sheet for Occupational Exposure to Lead

This appendix is a substance data sheet for occupational exposure to lead. It includes information about how exposure to lead can affect your health.

I. Substance Identification

Substance: 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.

Compounds Covered by the Standard: The word “lead” when used in this standard means elemental lead, all inorganic lead compounds and a class of organic lead compounds called lead soaps. This standard does not apply to other organic lead compounds.

Uses: Exposure to lead occurs in at least 120 different occupations, including primary and secondary lead smelting, lead storage battery manufacturing, lead pigment manufacturing and use, solder manufacturing and use, shipbuilding and ship repairing, auto manufacturing and repair, painting, printing, working with scrap metal, and working with firearms or ammunition.

Permissible Exposure: The Permissible Exposure Limit (PEL) set by the standard is 50 micrograms of lead per cubic meter of air (50 µg/m³), calculated as an 8-hour time-weighted average (TWA).

Action Level: The standard establishes an action level of 10 micrograms per cubic meter of air (10 µg/m³), calculated as an 8-hour TWA. The action level refers to employee exposure, without regard to the use of respirators. The action level initiates several requirements of the standard, such as exposure monitoring, respiratory protection, protective clothing, hygiene, medical surveillance, a training program, and signs.

II. Health Hazard Data

A. Ways in which lead enters your body.

When absorbed into your body, lead is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect you not only from the immediate toxic effects of lead but also from the serious toxic effects that may not become apparent until years of exposure have passed.

Lead can be absorbed into your body by inhalation (breathing) and ingestion (swallowing). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not significantly absorbed through your skin. When lead is scattered in the air as a dust, fume or mist it can be inhaled and absorbed through your lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. You can also absorb lead through your digestive system if

lead gets into your mouth and is swallowed. If you handle food, beverages, cigarettes, chewing tobacco, or make-up which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion.

Lead that is absorbed into your body by inhalation (breathing) and ingestion (swallowing) gets into your bloodstream. Once in your blood stream, lead is circulated throughout your body and stored in various organs and body tissues. Some of this lead is quickly filtered out of your body and excreted, but some remains in the blood and other tissues. As exposure to lead continues, the amount stored in your body will increase if you are absorbing more lead than your body is excreting. Even though you may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing damage, first to individual cells, then to your organs and whole body systems.

B. Effects of overexposure to lead.

(1) Short-term (acute) overexposure. Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. With large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise which develops quickly to seizures, coma, and death from cardiopulmonary arrest. A very high, short-term dose of lead can lead to acute encephalopathy. 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. 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.

There is no sharp dividing line between rapidly developing acute effects of lead and chronic effects which take longer to develop. Lead adversely affects numerous body systems and causes forms of health impairment and disease which arise after periods of exposure as short as days or as long as several years. For example, short-term reproductive effects may include miscarriage and reduced birth weight of children exposed to lead during pregnancy. Both high and lower level lead exposures have been associated with these outcomes. Sperm abnormalities may develop at relatively high blood lead levels (at or above 20 micrograms of lead per deciliter of whole blood ($\mu\text{g}/\text{dl}$)).

(2) Long-term (chronic) overexposure. Chronic overexposure to lead may result in severe damage to your cardiovascular, blood-forming, nervous, urinary and reproductive systems. Damage to multiple organs may occur at blood lead levels previously thought to be without recognized harm. At higher lead levels, some symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and lead colic. In lead colic there may be severe abdominal pain. Some people may not experience any symptoms even though lead is causing toxic effects in their bodies. It is important to note that for some people, permanent damage may occur even in the absence of symptoms.

Cardiovascular system (heart and blood circulation). Exposure to lead may cause increased blood pressure, heart disease, and stroke.

Neurologic system (brain and nervous system). Exposure to lead may cause declines in brain (cognitive) function, slowing of nerve conduction velocity, brain damage (encephalopathy), and nerve damage resulting in weakness or paralysis.

Renal system (kidneys). Exposure to lead may cause declines in kidney function that can progress to kidney failure requiring dialysis and to death.

Reproductive system. Chronic overexposure to lead impairs the reproductive systems of both females and males. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Reduced birth weight of children exposed to lead during pregnancy has been documented. Biological parents' lead exposure can harm the physical and mental development of a baby before birth. Lead exposure also may result in decreased fertility and abnormal menstrual cycles in females.

Exposure to lead may result in decreased sex drive, impotence, and sterility in males. Lead can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in females whose reproductive partners were exposed to lead or who were exposed to lead themselves.

Blood-forming system. Exposure to lead also disrupts 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 fatigue as a result of decreased oxygen-carrying capacity in the blood.

(3) Health protection goals of the standard. Prevention of health damage for most employees from exposure to lead throughout a working lifetime requires that employee blood lead levels (BLL) be maintained as low as possible. The BLLs of employees who intend to have children should be maintained below 3.5 µg/dl to minimize adverse reproductive health effects.

The measurement of your BLL is the most useful indicator of the amount of lead being absorbed by your body. Your BLL is a measure of the amount of lead in your blood. This reflects both recent exposure as well as how much lead is stored in your bones. Past research into lead-related diseases has focused heavily on associations between BLLs and various diseases. As a result, your BLLs over time provide an important indicator of the likelihood that you will gradually develop a lead-related health impairment or disease.

As your BLL increases, your risk of disease increases. There is a wide variability of individual response to lead; thus, it is difficult to say that a particular BLL in a given person will cause a particular effect. Health damage has been found at chronic BLLs of 5 µg/dl and greater, including high blood pressure, reduced birth weight, and kidney dysfunction. At the other extreme, studies have associated fatal encephalopathy with BLLs of 150 µg/dl, but encephalopathy may occur at BLLs of 80 µg/dl. Your BLL is a crucial indicator of the risks to your health, but one other factor is also extremely important. This factor is the length of time you have had elevated BLLs. The longer you have an elevated BLL, the greater the risk that large quantities of lead are being gradually stored in your organs and tissues (body burden). The greater your overall body burden, the greater the chances of substantial permanent damage.

The best way to prevent all forms of lead-related health impairments and diseases (both short-term and long-term) is to maintain your BLL as low as possible. The standard is designed to detect BLL increases early and take action to control exposures.

Your employer has prime responsibility to ensure that the provisions of the standard are complied with both by the company and by individual employees. You as an employee, however, also have a responsibility to assist your employer in complying with the standard. You can play a key role in protecting your own health by learning about the lead hazards and their control, learning what the standard requires, following the standard where it governs your own actions, and seeing that your employer complies with provisions governing their actions.

(4) Reporting signs and symptoms of health problems. You should immediately notify your employer if you develop signs or symptoms associated with lead poisoning or if you desire medical advice concerning the effects of current or past exposure to lead on your ability to have a healthy child. You should also notify your employer if you have difficulty breathing during a respirator fit test or while wearing a respirator. In each of these cases your employer must make available to you appropriate medical examinations or consultations. These must be provided at no cost to you and at a reasonable time and place. The standard contains a procedure whereby you can obtain a second opinion by a PLHCP of your choice if the employer selected the initial PLHCP.

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