LEAD IN BATTERY INDUSTRY
Lead In Battery Manufacturing

Lead is a toxic metal that is also used in burning fossil fuels. It can be combined with other metals to produce alloys. Lead and lead alloys are often used to make batteries, ammunition, and other metal products.

Exposure to lead is the primary health concern in battery manufacturing.

Any operation in which battery plates, lead scrap, or oxide is handled may be a significant source of lead exposure.

Lead fumes from lead pots, torching, burning, or other operations where a flame contacts lead, or lead is heated above the melting point, may also be sources of lead exposure.

The employer shall assure that no employee is exposed to lead at concentrations greater than fifty micrograms per cubic meter of air (50 ug/m³) averaged over an 8-hour period.

If an employee is exposed to lead for more than 8 hours in any work day, the permissible exposure limit, as a time weighted average (TWA) for that day, shall be reduced according to the following formula:

$$\text{Maximum permissible limit (in } \text{ug/m}^3) = \frac{400}{\text{hours worked in the day}}$$

At present, however, the best available method for monitoring biological exposure to lead is measurement of the blood lead level (BLL).
Routes of Exposure for Lead

Breathing in lead fumes or lead dust
Lead fumes are produced during metal processing, when metal is being heated or soldered. Lead dust is produced when metal is being cut or when lead paint is sanded or removed with a heat gun. Lead fumes and lead dust do not have an odor, so you may not know you are being exposed.

Ingesting lead dust
Lead dust can settle on food, water, clothes, and other objects. If you eat, drink, or smoke in areas where lead is being processed or stored, you could ingest lead dust. Not washing your hands before you eat or touch your mouth are also ways you could ingest lead. Though not always the case, ingested lead may leave a metallic taste in your mouth.

Coming in contact with lead dust
Some studies have found lead can be absorbed through skin. If you handle lead and then touch your eyes, nose, or mouth, you could be exposed. Lead dust can also get on your clothes and your hair. If this happens, it’s possible that you may track home some of the lead dust, which may also expose your family.

Symptoms of Exposure To Lead

A person who is exposed to lead prolonged over time may feel:
- Abdominal pain
- Constipated
- Excessively tired
- Headache
- Irritable
- Loss of appetite
- Memory loss
- Pain or tingling in the hands and/or feet
- Weakness

Exposure to high levels of lead may cause:
- Anemia
- Weakness
- Kidney Damage
- Brain Damage.

Very high lead exposure can cause death.

Early Symptoms of Lead Poisoning

- Fatigue
- Headaches
- Irritability
- Metallic Taste
- Uneasy Stomach
- Poor Appetite
- Weight Loss
- Reproductive Problems
Neurotoxin Effects, Hematological And Renal Effects

Severe exposures resulting in BLLs > 80 μg/dL may cause coma, encephalopathy, or death.

The most severe damage to the peripheral nervous system from high, chronic, workplace exposures to lead (two or more times higher than the current OSHA Permissible Exposure Limits [PEL] of 50 μg/m3) resulted in local paralysis described as “wrist drop” or “foot drop.”

BLLs as low as 30 to 40 μg/dL decrease motor nerve conduction velocity in workers, although these lead exposure levels are not associated with clinical symptoms. These subclinical symptoms represent early stages of neurologic damage to the central and peripheral nervous system.

Anemia is one of the most characteristic symptoms of high and prolonged exposures to lead associated with BLLs > 80 μg/dL.

Effects on heme synthesis can be observed at BLLs below 15 μg/dL, but the clinical significance of these effects at low BLLs is undetermined.

Workers with BLLs of 40 to 50 μg/dL may experience fatigue, irritability, insomnia, headaches and subtle evidence of mental and intellectual decline.


Chronic high exposure to lead, above the OSHA PEL, may cause chronic nephropathy and, in extreme cases, kidney failure.

There is substantially less evidence of kidney disease at lower exposures to lead.

Reproductive And Developmental Effects

Exposures to lower concentrations of lead, with BLLs at or below 15 μg/dL may result in adverse pregnancy outcomes, such as shortened time of gestation and decreased fetal mental development and growth.

Even low maternal exposures to lead, resulting in BLLs as low as 10 μg/dL, produce intellectual and behavioral deficits in children. BLLs of 60 μg/dL may be associated with male infertility.

Several reports indicate that decreased sperm quality and hormonal changes can occur among male workers exposed to lead with BLLs of 30 to 40 μg/dL.

Studies in male workers indicate that exposures to lead resulting in BLLs as low as 40 μg/dL may cause decreased sperm count and abnormal sperm morphology.

Chronic high exposures to lead that existed earlier in this century were associated with an increased incidence of hypertension and cardiovascular disease.

Increased BLLs are associated with small increases in blood pressure. This relationship appears to extend to BLLs below 10 μg/dL.

Several studies have examined the relationship between workers' lead exposure and the occurrence of cancer among the workers.
Employer’s Role

Replacing lead-containing products with lead-free or lower lead content products when feasible. Where lead-containing products cannot be replaced, train workers on hazards and safe work practices.

Use proper engineering controls to ensure the work area is well-ventilated.

Conduct routine Blood Lead Level testing for workers who are potentially exposed to lead.

Make a lead monitoring program available for workers. The program should consist of biological monitoring and medical surveillance.

Measure the level of lead in the air frequently.

Put in place systems of work and other controls, such as fume and dust extraction, to prevent or control your exposure to lead, and keep equipment in efficient working order.

Train employees to use control measures and protective equipment correctly.

If the amount of lead in your blood reaches 50 μg/dl – called the action level – employer must investigate why this has happened and try to reduce it to below that level by:
• reviewing the control measures and checking that they are working properly;
• making sure that proper hygiene procedures are followed;
• consulting relevant health professionals such as a doctor or occupational hygienist about any additional protective measures.
Provision and use. If an employee is exposed to lead above the PEL, without regard to the use of respirators or where the possibility of skin or eye irritation exists, the employer shall provide at no cost to the employee and assure that the employee uses appropriate protective work clothing and equipment such as, but not limited to: **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**.

Ensure workers are using their personal protective equipment, such as goggles, proper respiratory protection, coveralls, gloves, etc.

Provide workers with effective lead removal products. Hand washing with standard soap and water is not effective at removing lead residues from hands.

The employer shall provide lunchroom facilities for employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators.

The employer shall assure that lunchroom facilities have a temperature controlled, positive pressure, filtered air supply, and are readily accessible to employees.

The employer shall provide an adequate number of lavatory facilities.
Instructions for employees

Keep immediate work area as clean and tidy as possible

Do not allow anyone to take home any protective clothing or protective footwear for washing or cleaning.

Wash and/or shower and change before going home.

Clear up and get rid of any lead waste at the end of each day or shift.

Do not leave the workplace wearing any clothing or equipment worn during the work shift.

Employees who work in areas where their airborne exposure to lead is above the PEL without regard to the use of a respirator wash their hands and face prior to eating, drinking, smoking or applying cosmetics.

Employees should not enter lunchroom facilities with protective work clothing or equipment unless surface lead dust has been removed by vacuuming, down draft booth, or other cleaning method.

Employees must remember:

• Floors and other surfaces where lead accumulates may not be cleaned by the use of compressed air.

• Shoveling, dry or wet sweeping, and brushing may be used only where vacuuming or other equally effective methods have been tried and found not to be effective.

• Vacuuming. Where vacuuming methods are selected, the vacuums shall be used and emptied in a manner which minimizes the reentry of lead into the workplace.
Medical surveillance

According to OSHA Guidelines

The employer shall institute a medical surveillance program for all employees who are or may be exposed at or above the action level for more than 30 days per year.

The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician.

Blood lead and ZPP level sampling and analysis. The employer shall make available biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels to each employee on the following schedule:

- At least every 6 months to each employee
- At least every two months for each employee whose last blood sampling and analysis indicated a blood lead level at or above 40 ug/100 g of whole blood. This frequency shall continue until two consecutive blood samples and analyses indicate a blood lead level below 40 ug/100 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.
Medical Examinations And Consultations

The employer shall *make available medical examinations and consultations* to each employee.

At least *annually for each employee* for whom a blood sampling test conducted at any time during the preceding 12 months indicated a blood lead level at or above 40 ug/100 g;

*A detailed work history and a medical history*, with particular attention to past lead exposure (occupational and non-occupational), personal habits (smoking, hygiene), and past gastrointestinal, hematologic, renal, cardiovascular, reproductive and neurological problems.

*A thorough physical examination*, with particular attention to *teeth, gums, hematologic, gastrointestinal, renal, cardiovascular, and neurological systems*. *Pulmonary status* should be evaluated if respiratory protection will be used.

*A blood pressure* measurement

*A blood sample and analysis* which determines

- Blood lead level
- Hemoglobin and hematocrit determinations, red cell indices, and examination of peripheral smear morphology
- Zinc protoporphyrin
- Blood urea nitrogen
- Serum creatinine

A routine *urinalysis* with microscopic examination
“Occupational health programme for lead workers in battery plants”

Published in Journal of Power Sources for Fourth Asian Battery Conference.

A three-year occupational health programme for lead workers has contributed to improvements in the working conditions of lead industries, particularly in large-scale battery plants, and has decreased the unnecessary high lead burden of workers through on-going medical surveillance with biological monitoring and health education schemes.

The following occupational health services are provided by the Institute: (i) physical health examination; (ii) biological monitoring with zinc protoporphyrin, urine δ-aminolevulinic acid and blood lead; (iii) respiratory protection with maintenance-free respirators; (iv) measurement of the environmental condition of workplaces; (v) health education.
Please Note: The guidelines / precautions in this document are recommendations of Occupational Health and safety Administration (OSHA), United States of America.

For More Information you may like to visit:

Occupational Safety & Health Administration

Centers for Disease Control and Prevention

Public Health Service Agency for Toxic Substances and Disease Registry.


Published by the Health and Safety Executive INDG305(rev1)

NIOSH Adult Blood Lead Epidemiology and Surveillance (ABLES)

Council of State and Territorial Epidemiologists (CSTE) 2009 Position statement: Public health reporting national notification for elevated blood lead levels [PDF - 98.5 KB]
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