

What is lead?

Lead is a heavy, bluish-gray metal with a low melting point that occurs naturally in the Earth's crust. However, it is rarely found naturally as a metal. It is usually found combined with two or more other elements to form lead compounds. Most lead used by industry comes from mined ores ("primary") or from recycled scrap metal or batteries ("secondary").

How is lead used?

Lead can be combined with other metals to form alloys. Lead and lead alloys are commonly found in pipes, storage batteries, weights, shot and ammunition, fishing sinkers, cable covers, and sheets used to shield us from radiation. The largest use for lead is in storage batteries in cars and other vehicles.

Lead compounds are used as a pigment in paints, dyes, and ceramic glazes, and in caulk. Lead paint was banned for consumer use in 1978 in the U.S.; however, it is still used in industrial paints such as those used on cars, bridges, and ships. Lead has also been used as a stabilizer in some plastics like vinyl miniblinds.

Tetraethyl lead and tetramethyl lead were once used in the U.S. as gasoline additives to increase octane rating, but their use was phased out nationwide in the 1980s. Lead was banned for use in gasoline for motor vehicles beginning January 1, 1996. Tetraethyl lead may still be used in gasoline for off-road vehicles and airplanes.

How does lead enter the environment?

Lead occurs naturally in the environment - though most of the high levels found throughout the environment come from human activities. Before the 1950s, lead was used in pesticides applied to fruit orchards. Lead use increased between the years 1950 and 2000, and reflected increasing worldwide use of leaded gasoline. Since EPA banned the use of leaded gasoline for highway transportation in 1996, the amount of lead released into the air has greatly decreased in the U.S. Most of the lead in inner city soils comes from old houses with paint containing lead and previous automotive exhaust emitted when gasoline contained lead.

Lead can enter the environment through releases from mining lead and other metals, and from factories that make or use lead, lead alloys, or lead compounds. Lead is released into the air during burning coal, oil, or waste. Once lead gets into the atmosphere, it may travel long distances if the lead particles are very small. Lead is removed from the air by rain and by particles falling to land or into surface water.

Lead may enter rivers, lakes, and streams when soil particles are moved by rainwater. Lead may remain stuck to soil particles or sediment in water for many years. Lead may occasionally be found in private drinking water wells. Lead is commonly found in household plumbing materials. Homes built before 1986 are more likely to have lead pipes, fixtures, and solder. Lead can leach into water

systems when these plumbing materials corrode. Your water's acidity or alkalinity (often measured as pH) greatly affects corrosion. Temperature and mineral content also affect how corrosive it is. In N.C., on average 3.8% of private wells tested have exceeded the maximum contaminant level (MCL) established by the EPA of 15 parts per billion (15 ug/l).

How might I be exposed to lead?

The most common source of lead exposure in the United States derives from lead paint in old homes or dust from improperly renovated homes built before 1978. People living in areas where there are old houses with lead paint may be exposed to higher levels of lead in dust and soil. People living near hazardous waste sites may be exposed to lead or chemicals that contain lead by breathing air, drinking water, eating foods, or swallowing dust or dirt that contain lead. People may be exposed to lead by eating food or drinking water that contains lead.

Drinking water in houses containing lead pipes may contain lead, especially if the water is acidic or "soft". Similarly, people who live near busy highways or on old orchard land where lead arsenate pesticides were used in the past may be exposed to higher levels of lead. Cigarette smoke may also contain small amounts of lead. Children may be exposed to lead by hand-to-mouth contact with lead-containing soil, paint chips, or dust or by mouthing lead containing objects.

Lead can also be found in components of home and private well plumbing. Corrosion can cause lead to release out of plumbing components into drinking water.

People who are exposed at work are usually exposed by breathing in air that contains lead particles. Exposure to lead occurs in many jobs. People who work in lead smelting and refining industries, brass/bronze foundries, rubber products and plastics industries, soldering, steel welding and cutting operations, battery manufacturing plants, and lead compound manufacturing industries may be exposed to lead. Construction and demolition workers and people who work at municipal waste incinerators, pottery and ceramics industries, radiator repair shops, and other industries that use lead solder may also be exposed. Painters who sand or scrape old paint may be exposed to lead in dust.

One may also be exposed to lead at work or at home through hobbies such as making stained glass, casting lead fishing weights or ammunition, or if you are involved in home renovation that involves the removal or disturbance of lead-based paint.

Recent data have shown that inexpensive cosmetic jewelry pieces may contain high levels of lead which may be transferred to the skin through routine handling. Imported candies may also contain lead.

In the home, one could be exposed to lead if they take home remedies or cook with spices that contain lead compounds. Lead compounds are in some non-Western cosmetics, such as surma, sindoor, and kohl. Some types of hair colorants, cosmetics, and dyes contain lead acetate.

How can lead affect my health?

Lead can have numerous adverse health effects. The main target for lead toxicity is the nervous system. Long-term exposure of adults to lead at work has resulted in decreased performance in some tests that measure functions of the nervous system. Lead exposure may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure. Lead exposure may also cause anemia. At high levels of exposure, lead can severely damage the brain and can cause death. In pregnant women, exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

Children are more vulnerable to lead poisoning than adults. No safe blood lead level in children has been determined. Lead can affect a child's mental and behavioral development and physical growth. Fetuses exposed to lead in the womb may be born prematurely and have lower weights at birth. Exposure in the womb, in infancy, or in early childhood also may slow mental development and cause lower intelligence and hyperactivity later in childhood. There is evidence that these effects may persist beyond childhood.

The Department of Health and Human Services (DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens based on limited evidence from studies in humans and sufficient evidence from animal studies, and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans.

What regulations and recommendations have been made to protect human health?

Numerous federal agencies have developed regulations or recommendations to limit lead exposure in the home, environment, and workplace.

CDC recommends that medical providers test pregnant women and children:

- at ages 1 and 2 years;
- at ages 3-6 years if they have never been tested for lead;
- if they receive services from public assistance programs such as Medicaid or the Supplemental Food Program for Women, Infants, and Children (WIC);
- if they live in a building or frequently visit a house built before 1950;
- if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or

- if they have a brother, sister, or playmate who has had lead poisoning.

North Carolina Childhood Lead Poisoning Prevention Program:

- Requires testing for children enrolled in WIC, Medicaid, or Health Choice.
- Recommends screening of children at their 1 and 2-year-old well-check visits using the NC DHHS Lead Risk Assessment Questionnaire.
(<http://ehs.ncpublichealth.com/docs/forms/cehu/2012-0416-46LeadRiskAssessmentQuestionnaire3958.pdf>)

The Federal Hazardous Substance Act (FHSA) bans children's products containing hazardous amounts of lead.

The Department of Housing and Urban Development (HUD) requires that federally funded housing and renovations, Public and Indian housing be tested for lead-based paint hazards and that such hazards be fixed by covering the paint or removing it.

Occupational Safety and Health Administration (OSHA) regulations limit the concentration of lead in workroom air and may require blood be tested periodically if air levels are elevated. If a worker has a blood lead level of 50 ug/dL or higher, then OSHA requires that the worker be removed from the workroom where lead exposure is occurring.

The Food and Drug Administration (FDA) includes lead on its list of poisonous and deleterious substances and has regulations restricting use of lead in food packaging materials.

The North Carolina Childhood Lead Poisoning Prevention Program coordinates the care of children with elevated blood lead levels through local health departments, social services, and medical providers who provide clinical and environmental interventions.

The Environmental Protection Agency established a maximum contaminant level of 15 micrograms per liter of lead in drinking water, based on current treatment technologies for public water supply systems in the US. There are no regulations for private drinking wells.

When should I see a doctor?

If you suspect you or your child may have been exposed to lead or note changes in your child's school's performance or behavior, then ask your physician for a blood lead test. If your doctor suspects lead exposure then he/she may order additional test to evaluate potential adverse effects from lead exposure.

References

ATSDR. Toxicological Profile for Lead. <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=96&tid=22>

EPA. Protect Your Family from Exposures to Lead. <https://www.epa.gov/lead/protect-your-family-exposures-lead>

CDC. Lead Program Website. <https://www.cdc.gov/nceh/lead/>