Properties Contaminated by Lead

California Environmental Protection Agency
Office of Environmental Health Hazard Assessment
February 2017

A fact sheet on lead contamination in soil and the use of "soil screening levels."

How does lead contaminate the environment?

The widespread use of lead has resulted in environmental contamination. Lead has been used in a wide range of products, including gasoline, batteries, paint, ceramic products, caulking, and pipe solder. Concerns about health impacts have led to dramatic decreases in its use in recent years. Before it was phased out of gasoline in the 1980s, emissions from motor vehicles deposited lead in soil near roadways. Deteriorating lead-based paint—widely used before the mid-1970s—has contaminated residential soils and house dust. Industrial processes such as metal smelting and lead battery manufacturing or recycling, while significantly reduced today, continue to release lead to the environment as air emissions, solid waste, or spills. Shooting ranges can be contaminated with lead bullet fragments that build up in soil.

Lead adheres to soil particles and does not break down in the environment. Soil and dust containing lead can be transported to nearby properties by human activities and by wind and rain. In addition, lead-containing soils or dust can be carried into homes on shoes, clothing, or pets.

Why is lead a concern at contaminated properties?

Health effects are associated with even low levels of exposure to lead. Lead can enter the body when contaminated soil or dust is swallowed or inhaled, and a small amount can be absorbed through the skin. Home gardening in soils with high levels of lead may contribute to lead exposure. Lead-containing dust may be deposited on plant surfaces and lead from the soil may be taken up by certain plants. Thus, exposure to small amounts of lead from eating homegrown produce is possible.

The blood circulates lead throughout the body, providing a way to measure how much a person has been exposed to lead. The body stores lead in the teeth and bones, where it can accumulate over time with repeated exposure. During pregnancy, lead may be released from the mother's bones into the blood, resulting in exposures to the fetus.

Children are more likely to be exposed to lead, and more sensitive to its toxic effects.

Lead exposures in infants and young children are especially of concern. They are more likely to ingest contaminated soil and dust when they put their hands, toys, or other objects into their mouths. Exposure to lead can affect their developing brains and nervous systems. Among the effects of lead on children's development and behavior are delayed growth, lower intelligence, hyperactivity, and hearing problems. In pregnant women, lead exposure can result in reduced growth of the developing fetus and premature birth. Decreased kidney function, reproductive problems, cardiovascular effects (such as high blood pressure) and damage to nervous system function have been reported in adults with prolonged, high levels of exposure such as those that occur in certain workplace settings.

How is lead contamination characterized at a property?

The amount and distribution of lead contamination is established by collecting and analyzing soil samples for lead concentrations (sometimes following field analyses). Depending on the source of the contamination, lead may be unevenly distributed in soil across the property. In undisturbed soils, lead contamination is usually limited to the top one to two inches. Previous digging or excavation at a site can result in deeper contamination. This type of site-specific information

helps investigators decide the number, locations and depth of soil samples collected.

Sampling results are interpreted in light of background lead levels in the area. These levels can arise from natural lead present in local soils, and contamination from releases of lead not related to the site, such as vehicle emissions. Background levels are determined by measuring lead at nearby locations unlikely to have been affected by the property contamination, or by consulting reliable references that report soil lead levels in the area. Where the background lead comes from is considered along with other factors specific to the site when making clean-up and other health-related decisions at a contaminated property.

What are lead soil screening levels?

California's Office of Environmental Health Hazard Assessment has developed soil screening levels for lead of **80 mg/kg (or ppm)** and **320 mg/kg** in residential and workplace settings, respectively. A screening level is a concentration of a contaminant at or below which health effects are not expected to occur. Exposures exceeding a screening level will not necessarily produce an adverse health effect. The level incorporates data about the toxicity of a chemical with assumptions about human exposures.

The residential soil screening level is based on the effects of lead on intelligence in young children—its most sensitive effect. From a study (Lanphear et al., 2005) that examined the relationship between blood lead levels and intelligence quotient (IQ) test results in 1,333 children, an increase of 1 microgram lead per deciliter (1 µg/dL) of blood was estimated to correspond to a loss of up to one IQ point. Next, the concentration of lead in soil that would result in exposures that could increase a child's blood lead level by 1 µg/dL was estimated using an exposure model and assumptions intended to be protective: that children ingest 0.1 gram of soil or dust (about 2% of a teaspoon) every day, and that 44% of lead ingested with soil is available for absorption into the bloodstream. These represent ingestion and absorption rates close to the highest values reported in the scientific literature. In this way, most potential exposures are accounted for. The resulting soil lead concentration, **80 mg/kg (or 80 ppm)**, is therefore highly unlikely to produce adverse effects to the most sensitive individuals exposed in a residential setting. Since children, infants, and fetuses are the most sensitive to the effects of lead, protecting them will also protect adults.

The soil screening level of **320 mg/kg** for commercial or industrial sites is based on the same increase in blood lead of 1 µg/dL. A different exposure model was used, with the following assumptions: that adults at a commercial or industrial site ingest lead at half the rate of children in the residential setting (0.05 gram of soil or dust daily), that exposure occurred only on work days (250 days/year), and that 12% is absorbed into the bloodstream. A further assumption was used to ensure that the screening level is protective of a pregnant adult worker: that the fetal blood-lead level is 90 percent of the mother's blood level.

How are soil screening levels used?

Screening levels help identify areas and conditions that require further attention. Screening levels are also used as tools for identifying initial cleanup goals at a property, and as long-term targets to consider when deciding among options for remediation. Generally, at properties where contaminant concentrations fall below soil screening levels, there is no health-related concern and no further action or study is warranted.

Soil lead concentrations may vary across a property and the screening level is not an absolute number that cannot be exceeded for any specific sample. Chemical concentrations above the screening level would not automatically trigger action; however, exceeding a screening level can suggest a need for further evaluation of the potential risks posed by lead at the property.

For more information on the health effects of lead and ways to reduce exposures, visit:
https://biomonitoring.ca.gov/sites/default/files/downloads/LeadFactSheet.pdf
https://www.p65warnings.ca.gov/fact-sheets/lead-and-lead-compounds