

1 in 4 Residential Backyards May Have Unsafe Levels of Lead

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STORY AT-A-GLANCE

- › Nearly 25% of U.S. households may have soil lead levels exceeding the EPA's new 200 ppm safety threshold, potentially affecting 29 million homes and costing up to \$1.2 trillion to remediate
- › Lead contamination in soil persists due to historical use of leaded gasoline, lead-based paint, industrial processes, and agricultural practices, posing ongoing health risks, especially to children
- › Lead exposure can cause severe health issues, including reduced IQ, developmental problems, cardiovascular issues, and kidney damage. There is no known safe level of lead exposure, particularly for children
- › A global study found lead exposure led to 765 million lost IQ points in children under 5 and 5.5 million adult deaths from cardiovascular disease in 2019, with a global economic cost of \$6 trillion
- › To reduce lead exposure, homeowners should inspect pre-1978 homes for lead paint, use water filters, be cautious of lead in consumer products, and consider blood lead testing for family members

Nearly one-quarter of U.S. households may be exposed to soil lead levels exceeding a new safety threshold set by the U.S Environmental Protection Agency (EPA). The implications of this finding are significant, potentially affecting the health and well-being of residents in about 29 million homes across the U.S.

After remaining unchanged for more than 30 years,¹ in January 2024, the EPA decided to lower the recommended screening level for lead in residential soils from 400 to 200 parts per million (ppm). "I was shocked at how many households were above the new 200 ppm guideline," said study author Gabriel Filippelli with Indiana University in a news release. "I assumed it was going to be a more modest number. And results for the 100 ppm guideline are even worse."²

The EPA's new guidelines also include a lower screening level of 100 ppm for residential properties with multiple sources of lead exposure, such as lead in air or water. Nearly 40% of U.S. households have lead in soil at levels that exceed the 100 ppm threshold.³ Certain states, however, have adopted lower guidelines, such as California, which set its soil lead screening level at 80 ppm.⁴

US Public Health at Risk From Lead in Backyards, Gardens and Alleys

Even though the U.S. began phasing out leaded gasoline in the 1970s,⁵ lead poisoning remains a major problem globally.⁶ As vehicles burned this fuel, lead particles were released into the air and eventually settled into the soil. Lead-based paint was also used extensively in homes built before 1978. Even after its ban for residential use, many older homes still contain this paint, which can chip and flake, contaminating surrounding soil.

Meanwhile, many industrial processes, including mining, smelting and manufacturing, have historically released [lead into the environment](#), contaminating nearby soils. Old lead pipes and solder in water systems can also leach lead into water, which can then contaminate soil through irrigation or leaks. Even agricultural practices, including the use of pesticides and fertilizers that contain lead, have contributed to soil contamination in farming areas.

As a result, researchers wrote in GeoHealth, "Lead exposure is prevalent due to past lead emissions and the substantial legacy lead loads that remain in soils and structures within communities."⁷ They conducted a nationwide analysis of 15,595 residential soil

samples collected from yards, gardens, driplines and alleys, which revealed that just over 12% exceed the previous 400 ppm standard.

"This alone is a startling finding," the researchers noted, but when using the newer 200 ppm standard, they found nearly one-quarter exceeded the threshold. This rose to more than 40%, or nearly 50 million households, when they used the 100 ppm screening level for residences with multiple lead exposure sources.⁸ This raises the question of how the EPA intends to help those affected. According to the study:⁹

"Our analysis of the on-the-ground reality suggests why it has taken the US EPA awhile to lower this protective guideline – namely, once the threshold for lead in soils is lowered, the agency needs to consider providing guidance and resources to every household whose soils exceed the new threshold. The scale is astounding, and the nation's lead remediation efforts just became substantially more complicated."

Removing Lead From Contaminated Backyards Could Cost Up to \$1.2 Trillion

Contaminated soils are usually remediated using a "dig and dump" method, in which contaminated soil is removed and replaced with clean soil. But the "dig and dump" method, while effective, is increasingly seen as less desirable due to its high cost, environmental impact and sustainability concerns:¹⁰

"The projected price tag for mitigating all households in the country estimated to have soil above the new US EPA standard is a staggering \$290 billion to \$1.2 trillion."

Additionally, removing and bringing in soil mined from other places for so many millions of households seems infeasible, economics aside. Lastly, soil remediation is extremely disruptive, and if done poorly, can scatter lead contaminated soils and dust to adjacent properties and homes."

A more cost-effective and less disruptive method involves capping contaminated soil with clean soil or mulch. Most lead that ends up in soil due to man-made activities is in the upper 10 inches of soil. According to the study, adding another 10 inches of clean soil on top would cut the total soil lead concentration in half.¹¹

However, while this is a more cost-effective and immediate solution, it's only a temporary one, since erosion, weather and human activities can compromise the cap, exposing the contaminated soil again. Still, if you live in an area with contaminated soil, and you can't move to a new location, capping the soil may help to reduce your lead exposure.

"A huge advantage of capping is speed; it immediately reduces exposure," Filippelli said. "You're not waiting two years on a list to have your yard remediated while your child is getting poisoned. It's done in a weekend."¹²

1 in 3 Children May Have Dangerous Lead Levels

A report from UNICEF and Pure Earth, titled Toxic Truth, also found that children worldwide are suffering from lead poisoning on a "massive and previously unknown scale."¹³ It found that about 1 in 3 children have blood levels above 5 micrograms per deciliter ($\mu\text{g}/\text{dL}$),¹⁴ which is considered the level at which action is required.

However, the U.S. Centers for Disease Control and Prevention uses a blood lead reference value of 3.5 $\mu\text{g}/\text{dL}$ to identify children with blood lead levels that are potentially dangerous.¹⁵

Using the report's numbers, up to 800 million children globally could be at risk of health damage from lead exposure, with close to half of those affected living in South Asia. However, if 3.5 $\mu\text{g}/\text{dL}$ was used as the cut-off, those numbers would be even higher.

Research published in Proceedings of the National Academy of Sciences, for instance, revealed that half of the U.S. population was exposed to high lead levels in early childhood due to exposure to car exhaust from leaded gas.¹⁶ As a result, 824 million IQ points may have been lost from the more than 170 million Americans affected.¹⁷

5.5 Million People May Die Due to Lead Exposure Annually

A 2023 Lancet Planetary Health study quantified the global effects of lead poisoning, finding health effects are much greater than previously estimated.¹⁸ Using data from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2019, World Bank economists conducted a modelling study to estimate the global burden, including cost of IQ loss and cardiovascular disease mortality, from lead exposure.

They found that, in 2019 alone, lead exposure led to 765 million lost IQ points in children under 5 years along with 5.5 million deaths in adults due to cardiovascular disease. The vast majority – including 729 million lost IQ points and 5 million cardiovascular disease deaths – occurred in low-income and middle-income countries (LMICs).¹⁹

According to the researchers, "We estimated that 90% of cardiovascular disease mortality and 95% of IQ loss from lead exposure in 2019 occurred in LMICs."²⁰ The numbers suggest the global burden of lead exposure has been significantly underestimated. The IQ loss uncovered by the study was 80% higher than a previous estimate, the study found.

Further, deaths from lead-related cardiovascular disease were six times higher than the GBD 2019 estimate. The team also calculated the global cost of lead exposure at \$6 trillion in 2019, which amounted to 6.9% of the global gross domestic product (GDP). Broken down, the study found, "77% ... of the cost was the welfare cost of cardiovascular disease mortality, and 23% ... was the present value of future income losses from IQ loss."²¹

What Are the Health Risks of Lead Exposure?

There is no known safe level of lead exposure, especially for children. Even low levels of lead in the blood can cause serious health effects that can be long-lasting and, in some cases, permanent.

As a powerful neurotoxin, exposure to lead may interfere with cognitive development, leading to reduced IQ scores, shortened attention spans and potentially increased violent and criminal behavior later in life.²²

Beyond the brain, lead can damage the nervous system, heart, lungs and kidneys. But in the early stages, it may cause only minor symptoms so it often goes undetected. Adults exposed to lead are at increased risk of heart disease and kidney damage, but children under 5 have the highest risk of suffering from lifelong effects. According to the World Health Organization:²³

"At lower levels of exposure that cause no obvious symptoms, lead is now known to produce a spectrum of injury across multiple body systems. In particular, lead can affect children's brain development, resulting in reduced intelligence quotient (IQ), behavioral changes such as reduced attention span and increased antisocial behavior, and reduced educational attainment.

Lead exposure also causes anemia, hypertension, renal impairment, immunotoxicity and toxicity to the reproductive organs. The neurological and behavioral effects of lead are believed to be irreversible."

Lead and calcium are chemically very similar, making lead a competitor at the cellular level capable of disrupting many different bodily systems.²⁴ In your neurological system, it may disrupt neurons that use calcium to transmit information. The presence of lead will cause some neurons to fire more and decrease the signals in others.

This may alter neurological development in the brains of children who have absorbed lead from their environment. Other research has demonstrated that lead:^{25,26}

Generates superoxide and hydrogen peroxide, which in turn reacts with nitric oxide and produces peroxynitrites

Stimulates vascular smooth muscle cell proliferation and phenotypic transformation

Disturbs vascular smooth muscle calcium signaling

Modifies vascular response to vasoactive antagonists

Raises plasminogen activator inhibitor-1 production

Suppresses proteoglycan production

Causes endothelial injury

Impedes endothelial repair

Inhibits angiogenesis

Promotes inflammation

Strategies to Reduce Lead Exposure and Detoxify

Beyond soil, common sources of lead exposure include drinking water, lead-based paint and imported goods such as children's toys, cosmetics and pottery. To protect yourself and your family, consider the following strategies:

- **Lead paint** — If your home was built before 1978, get it inspected and have any lead-based paint removed by a certified professional as the dust is highly toxic. For more information on this, see the U.S. EPA's "Lead-Based Paint Resources" page.²⁷
- **Test your water** — Millions of older water service lines across the U.S. are made from lead and could be carrying contaminated water into your home daily. Your safest and most economical choice to get lead out of your water supply is to use a high-quality filter rated for lead removal. Use filtered cold water for drinking or cooking. Never cook or mix infant formula using unfiltered hot water from the tap.
- **Consider household objects** — For information about lead-containing products and recalls, see the Consumer Products Safety Commission's website.²⁸
- **Get a blood lead test for yourself and your children** — Ideally, all children should be tested at ages 1 and 2, and again at ages 3 and 4 if you live in an older home. It's also recommended to test your child's level whenever there's concern about exposure. Also get yourself tested for lead, especially if your doctor suspects you have heart disease. A level of 3.5 mcg/dL or higher is considered dangerous.²⁹

If your levels are elevated, eliminating lead from your body can be a long and arduous process, and it must be done carefully to avoid creating more harm in the process. While

chelation therapy using edetate disodium (EDTA) may lower the risk of cardiovascular events, it has its own risks. A far safer and more readily available alternative is **N-acetylcysteine (NAC)**, which is a precursor to glutathione that your body uses for efficient detoxification.

Sources and References

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