

Get the Lead Out

WHAT YOU DON'T KNOW CAN HURT YOU

“If you want to know about the effects of lead exposure over a lifetime, the amount of lead circulating in the blood may not be the most relevant measure,” says Brian Schwartz, a professor of environmental health science at Johns Hopkins University.

Blood levels represent your average exposure during the last three or four months, he notes. “They’re used mainly because they’re easy, convenient, and cheap to measure.”

It’s far more revealing to look at the amount of lead in your bones. That’s where your body deposits 90 to 95 percent of the lead it has absorbed over the years.

In Schwartz’s Baltimore Memory Study, which is tracking 1,000 men and women in their 50s, 60s, and 70s, the average bone lead level of the participants is 19 parts per million (ppm).

“To put that into context,” says Schwartz, “we’ve also studied about 1,000 former lead workers in New Jersey who haven’t worked with lead for at least two decades. Their average bone lead level is about 15 ppm.”

In other words, older residents of Baltimore—from all socioeconomic and racial groups—who were merely exposed to lead from paint, gasoline, and plumbing have at least as much lead in their bones as people in their 50s who once worked with the metal.

“By contrast, people who are now in their 20s and 30s grew up at a time when there was much less lead in the food they ate, the water they drank, and the air they breathed,” Schwartz points out. They have little or no lead in their bones.

of lead in their bones were nearly twice as likely to be diagnosed with high blood pressure over a six-year period as men with the lowest bone lead levels, according to the Normative Aging Study, which looked at 833 veterans living in the Boston area.² The same researchers found similar results in women.³

■ **Kidney function.** The kidneys filter toxins and other harmful compounds out of the blood. In the Normative Aging Study, that ability deteriorated earlier and faster in men with higher

levels of lead in their blood.⁴ The researchers found a faster decline even in men with modest lead levels—10 micrograms per deciliter, which is above optimal but not high.

“High levels of lead could push someone with compromised renal function into dialysis,” warns Harvard’s Howard Hu, who is a professor of occupational and environmental medicine. “The effect of lead on the kidney is 15 times worse in individuals who have Type 2 diabetes. And diabetics with

Lead is toxic to just about every tissue in the body. And it doesn’t just do its damage when you breathe, eat, or drink it.

Over the years, “stored lead can be released back out of the bones and possibly cause more damage in the body,” Schwartz notes. The half-life of lead in the tibia (the larger of the two lower leg bones) is about 25 years, which means it takes that long to release half of the lead stored there.

“That’s especially significant for some middle-aged and older women who have osteoporosis,” says Schwartz. “As their bones thin and lose calcium and other minerals, the lead is released into their blood and is circulated throughout the body.”

In a recent study, women aged 40 to 59 who had gone through menopause had blood lead levels that were 25 to 30 percent higher than women of the same age who hadn’t yet undergone menopause.¹ And the less dense their bones were, the more lead they had in their blood.

“Preventing bone loss may lessen or prevent this exposure to lead,” says study co-author Ellen Silbergeld of Johns Hopkins.

Heavy Metal

Lead is linked to a host of potential health problems.

“We don’t know that high levels of lead in the bones will cut years off your life,” says Schwartz. “But it might decrease the quality of your life.”

■ **Blood pressure.** “Lead increases your risk of hypertension,” says Schwartz. Men with the highest levels

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kidney disease are a huge cost to the nation in terms of Medicare payments for dialysis.”

■ **Cognitive function.** “Lead accelerates declines in memory and mental abilities,” says Hu. In the Normative Aging Study, men with the most lead in their bones were twice as likely to score lower on the Mini Mental Status Examination as those with the least lead.⁵ The exam tests memory, awareness, and mental agility.

Scores deteriorated four times faster over a six-year period in men with the highest lead levels. And those men were more likely to score below 24 points out of a possible 30.

“The 24 score is important,” Hu points out, “because that’s the screening cutoff that clinicians often use for sending somebody to the neurologist to be assessed for dementia and Alzheimer’s.”

“I can’t say that lead is a cause of Alzheimer’s,” cautions Hu. “But it seems to be a risk factor for cognitive declines that could push some people over the edge into more of the clinically senile state.”

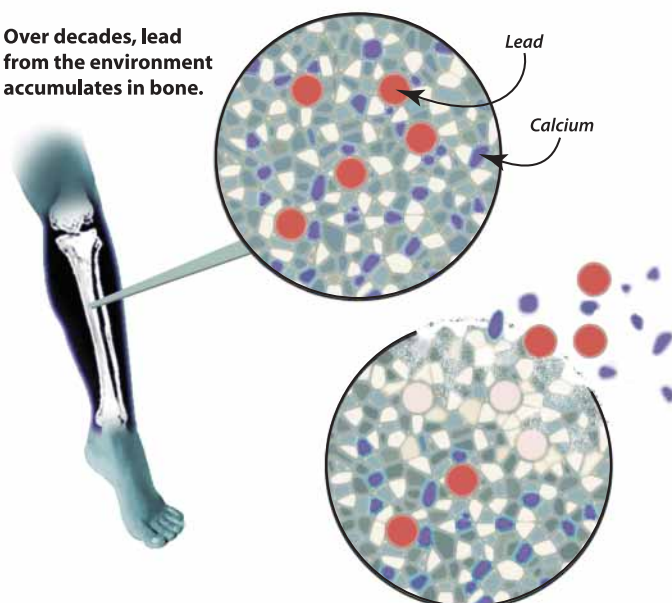
In the Johns Hopkins studies of lead workers, “we call it ‘accelerated aging,’” says Brian Schwartz. “When we look at the impact on cognitive function, we find that high levels of lead in bone are equivalent to three to six more years of aging in the brain.”

“In the Baltimore Memory Study we’re trying to see if something similar is happening in the general population,” he adds, “since they have bone lead levels just as high as the lead workers.”

■ **Cataracts.** “Lead accumulation is a major risk factor for developing cataracts,” says Hu. In the Normative Aging Study, men with the most lead in their tibias were three times more likely to develop cataracts as men with the least lead.⁶

“Lead accelerates oxidative damage, binds to proteins, and also causes changes in calcium balance, all of

Over decades, lead from the environment accumulates in bone.



As bones lose calcium through aging and osteoporosis, lead is released into the blood.

which can affect the clarity of the lens,” Hu explains.

Gulp!

While there’s far less lead in the environment today than there was 30 years ago, the U.S. isn’t exactly a lead-free zone. Young children can still get it if they eat peeling or chipped lead-based paint, and everyone can get it from contaminated drinking water.

“About 15 percent of the homes in the U.S. probably have enough lead contamination in their drinking water for us to be concerned about its effect on the health of both children and adults,” says Richard Maas, co-director of the Environmental Quality Institute at the University of North Carolina at Asheville.

“We’ve tested the water in over 130,000 homes and we see problems all over the country,” says Maas. “We would be hard put to find any town where the incidence of lead contamination is so low that households don’t need to get their water tested.”

That’s true even if your local water utility tells you otherwise.

“When your water utility sends you a letter saying that you don’t need to worry because your water doesn’t exceed the action level for lead, that’s

often dangerously misleading,” says Maas.

Fourteen years ago, the U.S. Environmental Protection Agency (EPA) set an “action level” of 15 parts per billion (ppb) for lead in water. That meant that if at least 11 of 100 samples exceeded 15 ppb, the utility had to reduce the lead in its water.

“The first thing to understand is that this 15 ppb level was never intended to be a health standard,” says Maas. “When you pin the EPA down, they’ll admit that it’s not a standard based on any health effects that occur only at 15 ppb and higher.”

In other words, an action level of 15 parts per billion doesn’t mean that water with 14 ppb or 13 ppb of lead is safe.

Maas knows firsthand how the EPA set the action level for lead.

“In 1990, when the EPA was told by Congress to control the lead in drinking water, the agency wanted to identify those utilities with the most corrosive water,” he recalls.

Water that’s corrosive is more likely to draw lead out of pipes. If the EPA was going to force utilities to spend hundreds of millions of dollars on additives that coat the inside of pipes and other corrosion treatments, it wanted to target the systems with the worst problems.

“So the EPA came to our Institute and asked where they would have to set the level for lead in drinking water so that about 25 percent of the utilities in the U.S. would exceed it,” Maas explains. “We went through our data on 100,000 homes and told them 15 parts per billion.”

“If that action level is anywhere near any kind of health standard,” says Maas, “it’s totally by coincidence.”

“The second point to remember,” he adds, “is that just because your local utility says that its water doesn’t exceed the action level for lead, that doesn’t really tell you anything about the levels in your own household.” It just means

that if the utility did the testing the way it's supposed to—and that's a big if—no more than 10 percent of its customers had lead levels over 15 ppb.

"But we know from all the testing we've done that if the 11th highest sample in a water district is 10 ppb, for example," says Maas, "then it's still very likely that the highest home out of the 100 they tested is probably 150 ppb." The next-highest family probably has about 85 ppb, the third highest probably 60-something, and so on down to where the 11th highest is 10 ppb, he adds.

"The action level wasn't exceeded, but you've still got 10 percent of homes with high lead levels. And those families are just out of luck. What's more, there's just no telling from these tests if you're one of them."

And you can't always trust water utilities to properly test their water for lead, says Maas. "They have tremendous motivation to try to game the system."

Utilities are supposed to sample water from 100 customers who they suspect have high lead levels. If the 11th highest one contains more than 15 ppb, the utility has to notify all its customers that it's a high-risk system and that the customers should consider getting their water tested for lead. The company will have to spend millions of dollars to make its water less corrosive, and it will have to keep testing homes.

"It's nothing but money and bad publicity for them if that 11th highest sample is 15 parts per billion or more," says Maas. But if it's just 14 ppb, then they don't have to spend any of that money and don't have to endure that bad publicity. "In fact, they can send out a letter to their customers saying everything is hunky-dory, which is often wrong."

The temptation to cheat is apparently too hard to resist for some water companies. The *Washington Post* reported last October that dozens of utilities around the country, including those in Philadelphia, New York, and Boston, were manipulating the results of their lead testing, in some cases by discarding results from samples they knew to be high.



Test, Don't Taste

"S ince you cannot see, taste, or smell lead dissolved in water, testing is the only sure way of telling whether or not there are harmful quantities of lead in your drinking water," says the U.S. Environmental Protection Agency.

"You should be particularly suspicious if your home has lead pipes (lead is a dull gray metal that is soft enough to be easily scratched with a house key)," says the EPA, or "if you see signs of corrosion (frequent leaks, rust-colored water, stained dishes or laundry)."

Testing is especially important in high-rise buildings, where running the water for a minute or more might not get rid of enough lead, says the EPA.

Your local water authority or health department should have a list of certified laboratories. You can also look under "Laboratories" in the yellow pages. You should have two samples tested—a "first draw" (taken first thing in the morning) and a "fully flushed" sample (taken after you've run the water for one minute). Expect to pay between \$20 and \$200, says the EPA.

A cheaper alternative: you can get the test for \$17 from the non-profit Clean Water Lead Testing Inc.—a certified lab run by the Environmental Quality Institute at the University of North Carolina at Asheville that has tested 130,000 homes in North America for lead.

The lab sends you two small plastic vials, a shipping envelope, and a short questionnaire about your house and its plumbing system. Follow the directions for filling the vials with your drinking water, fill out the questionnaire, and mail it all back. Within a couple of weeks you'll receive a report showing the level of lead in your first draw of water in the morning and how much remains after running the line for one minute.

"Once you do that," says the Institute's Richard Maas, "you've empowered yourself with all the information you need to protect yourself from lead in your household drinking water."

To order a test kit, go to www.leadtesting.org/orderonline.htm or send a check for \$17 (payable to CWLTI) to Clean Water Lead Testing Inc., University of North Carolina at Asheville, One University Heights, Asheville, NC 28804-3299.

An additional 274 utilities, which together serve 11.5 million people, have reported unsafe lead levels since 2000. Few companies have been fined or held accountable by the EPA.

"It's time to reconsider whether water utilities can be trusted with this crucial responsibility of protecting the public," former EPA drinking water chief Jim Elder told the *Post*. "I fear for the safety of our nation's drinking water."

Plumbing the Depths

Lead builds up in plumbing systems when water sits. "The good news is that most of the time you can flush it down to a safe level, if not completely out, by running the line for one minute," says Maas.

"Because we've done so many tests, I can tell you what's likely to happen," he adds. "If the first draw in the morning is over 10 parts per billion, then in 80 percent of the cases the second draw after a minute of running the water will be no more than 3 ppb. So, it's a pretty good solution for most households."

But running the water may not get lead levels low enough and some households may need to use a filter:

■ **Lead service lines.** About two percent of U.S. residences have lead service lines that bring water in from the street. Many are in older East Coast cities like New York, Boston, and Washington, D.C. "If you have one," says Maas, "running the water for a minute or more probably isn't going to work. It's iffy at best."

■ **Lead from solder.** "Until it was banned in 1988, 50-percent-lead solder was used for joints in copper plumbing systems," Maas explains. "So if your home was built before 1988, which is over three-quarters of the homes in the U.S., you definitely have that to worry about."

■ **Lead from brass.** Another major source of lead: leaded

brass components of the plumbing system that come in contact with water. The brass is five to seven percent lead, which is "enough to put quite a bit of lead in the water, depending on how corrosive the water is," cautions Maas.

Since most of the lead in faucet fixtures was banned in 1997, "if your faucet was purchased since then, there's a 95 percent chance that it doesn't have lead in it," says Maas. "But if it was purchased before 1997, it is virtually sure to have lead in it."

Filter, Filter on the Wall

Even if you have a lead problem that can be solved by running the water for a minute, "most people eventually will turn to using a water filter," says Maas, "because flushing gets to be a nuisance after a while."

Another reason for getting a water filter: since lead quickly builds up in water that sits, if you have a lead problem, "you really need to flush the line every single time you use the water," says Maas.

"We've found that if you take water that's been sitting in the pipes overnight for eight hours, about 75 percent of the lead in it built up in the first two

hours." More disturbing: "About 25 percent of the lead was deposited in the first 10 minutes."

So if your water is contaminated with lead, you may need to run the line for a minute or more every time you use it. A water filter might be more convenient.

(Lead isn't easily absorbed through the skin, so bathing or showering shouldn't pose any problems, says Johns Hopkins's Ellen Silbergeld. Neither does using water to brush your teeth with.)

Which brand of filter is best? As long as the filter claims to get rid of lead, it doesn't matter.

"We've tested hundreds of brands of water filters over the years, not only for our own research but also on behalf of companies who want to compare their products with their competitors' products," says Maas. "If a product claims to remove lead, then it's almost certainly quite effective at removing lead."

How often should you change cartridges or filters?

"We find that they last longer than their manufacturers say they do," says Maas. "They want to sell more cartridges and more filters, as you can imagine."

So if you follow the manufacturer's instructions for changing filters, you may be spending a little more money than you need to, but you'll be safe.

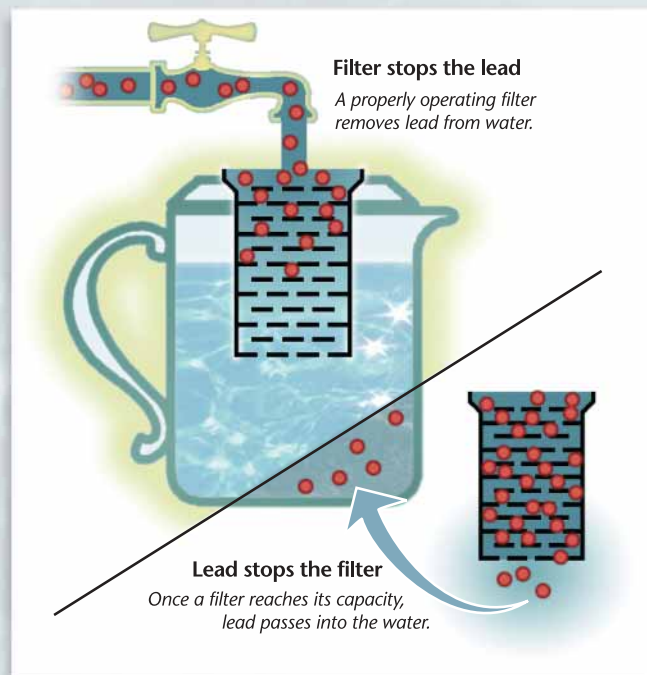
"The bad news," says Maas, "is that somewhere between 55 and 70 percent of the water filters out there are no longer removing lead because their owners have gone months or years past the manufacturers' recommendations."

If a filter becomes completely filled with lead, it can't take any more out of your water.

Testing 1, 2

Is there a safe level for lead in water?

"It's hard to set an exact level because any amount of lead causes some neurological damage in a child," says Maas.



But he does offer a rule of thumb: “If your first draw of water in the morning is over 10 parts per billion, you’d want to be doing something about the problem.” Maas estimates that some 15 percent of U.S. households fall into that category.

“For the water you’re going to be drinking all the time and using for cooking,” he adds, “you probably don’t want more than 3 ppb.”

There’s only one way to know if you have a lead problem and whether you can solve it by running the water for

one minute. And that’s to get a two-sample lead test of your household water, says Maas. (See “Test, Don’t Taste,” p. 5.)

If there’s a problem with the first draw, the results of the second will tell you whether purging the line for one minute will reduce the lead level to 3 ppb or less. If it does, you should run the water for a minute every time you use it for drinking or cooking.

Another option, suggests Maas, is to fill a gallon jug in the morning after you’ve run the water for a minute and

to use that water for drinking and cooking during the day. If you’re not willing to do either of those things or if running the water for a minute doesn’t remove enough lead, a water filter is your best bet. 🍃

¹ *Amer. J. Epidemiol.* 160: 901, 2004.

² *Amer. J. Epidemiol.* 153: 164, 2001.

³ *Amer. J. Public Health* 89: 330, 1999.

⁴ *J. Amer. Med. Assoc.* 275: 1177, 1996.

⁵ *Epidemiology* 14: 713, 2003.

⁶ *J. Amer. Med. Assoc.* 292: 2750, 2004.

What to Do

If you’re 50 or older, you probably have a fair amount of lead in your bones. (Don’t bother trying to get tested. Instruments that measure lead levels in bone are currently available only to researchers.) Other than letting the water run and using a water filter, here are some things you can do to protect yourself.

■ **Bones.** When your bones get thinner, they release not just calcium, but lead and other minerals, into your bloodstream. So anything you can do to ward off osteoporosis—getting enough calcium, protein, potassium, and vitamins D and K, and doing plenty of walking or other weight-bearing exercise, for example—might help minimize your exposure to lead. “If you want to prevent lead from being released from your bones, you have to prevent osteoporosis,” says Johns Hopkins’s Brian Schwartz.

■ **High blood pressure.** “Hypertension that’s induced by lead might be particularly amenable to treatment with dietary calcium,” says Harvard’s Howard Hu, who lowered blood levels of lead in breastfeeding women by giving them calcium supplements. Because calcium and lead are metals that are often interchangeable, Hu explains, the body sometimes confuses one with the other. “Keeping calcium levels high might counteract some of the harmful effects of lead in the body,” he speculates. Chalk up another reason to make sure you get enough calcium.

■ **Cataracts.** “Maximizing your intake of fruits and vegetables might mitigate the risk of cataracts,” says Hu. “That’s because their natural antioxidants might suppress some of the oxidative reactions that lead can cause that can contribute to the formation of cataracts.” (In the best study to date, antioxidant *supplements*—vitamins C and E and beta-carotene—didn’t prevent cataracts.) Other ways to lower your risk: don’t smoke, eat leafy green vegetables like spinach and broccoli at least twice a week, eat fish at least once a week, take a multivitamin for insurance, and lose excess weight.

■ **Memory.** “Until we know more about lead’s effect on the brain, it makes sense to try to protect your memory and thinking skills,” says Schwartz. That means keeping your blood pressure low, avoiding diets high in saturated and trans fat, reducing your risk of diabetes by keeping your weight down and your exercise level up, and keeping a lid on homocysteine levels by taking a multivitamin with 100% of the Daily Values for folic acid (400 mcg), vitamin B-6 (2 mg), and vitamin B-12 (6 mcg). Brain-challenging activities like crossword puzzles, reading, and square dancing may also help.

■ **At the faucet.** Use only cold tap water for drinking, cooking, and making baby formula. Hot water is likely to leach more lead out of pipes.