



Lead in Drinking Water – What We're Learning from the District of Columbia

There are some interesting questions arising from the recent clamor over high lead levels found in District of Columbia's drinking water.

The recent news that thousands of homes in the District of Columbia (DC) have high lead levels has brought new scrutiny to the well-known contaminant of lead leaching out of solder, water pipes and fixtures. But as a result, we may find new and improved methods of getting lead out of our water.

The drama unfolding in DC includes a flurry of investigations and flying accusations. Anxious homeowners, condo associations, school systems, day care centers and water suppliers are collecting and analyzing hundreds of water samples for lead content. Doctors and nurses are testing hundreds of children and pregnant women for blood lead levels. Regulators, health officials and scientists are pouring over the large amount of data being generated from this problem. Once the dust settles, the drinking water industry may have improved methods of testing for lead and the industry may have even better ways of removing lead from our water.

Where's The Lead?

It's been well known for decades that the element of lead, once commonly used in solder and pipes, poses a health hazard, especially when water treatment renders potable water slightly acidic. This corrosive water chemically reacts with metals in the pipelines, such as lead and copper, leaching hazardous particulates into the water and into our drinking glasses and bottles of baby formula.

The regulatory community's most recent wave of tougher laws targeting the hazards of lead occurred in the 1970s and 1980s. Among these laws is the Environmental Protection Agency's (EPA) Safe Drinking Water Act which in 1988 banned the use of lead solder (defined as containing more than 8 percent lead) from being newly installed in public water systems. However, lead pipe and solder installed prior to 1988 could remain as long as they were monitored and remained below "safe" levels. The latter instance is a more common occurrence in older cities such as the District of Columbia.

Health Effects

Of course, the "safe" level of lead in drinking water continues to be debated by the medical community. High exposure to lead in humans is known to be toxic to the kidneys and nervous system. Especially susceptible, are children under the age of six. These children absorb lead more readily than adults and their vulnerable mental faculties can be silently damaged by lead before they have fully developed.

High levels of lead in the bloodstream, more than 50 micrograms of lead per deciliter of blood ($\mu\text{g}/\text{dl}$), have been known for years to produce lead poisoning with noticeable physical and mental symptoms. As early as the 1940s, the medical community linked even lower levels of blood lead (25 $\mu\text{g}/\text{dl}$) with ill health concerns such as a child's ability to learn.

Continued research confirmed these effect of lead exposures, and by the late 1970s, lead was eliminated in indoor paints and in gasoline additives. However, dusts from deteriorating lead paint in older housing and soil contamination from decades of auto emissions continue to be the major exposure pathways for children today.

EPA Regulation

In 1988 the EPA issued its ban on lead solder and lead service pipelines. At that time, the allowable concentration (maximum contaminant level, or MCL) of lead in drinking water was 50 parts per billion (ppb). But in 1991, the EPA amended its Safe Drinking Water Act with Lead and Copper Rule, which eliminated the 50 ppb MCL for lead, and replaced it with an "action level" of 15 ppb and a maximum contaminant level "goal" (MCLG) of zero for lead.



The action level of 15 ppb was imposed on public water suppliers. It required corrective steps to reduce lead levels in drinking water if periodic samples from various points in a supplier's water distribution system found that the 90th percentile of samples exceeded the 15 ppb action level. Corrective steps a water supplier might then undertake included replacing lead services lines, if present, or adjusting water treatment to reduce the corrosivity of the drinking water.

Point of Use Treatments and Bottled Water

Of course, no matter what suppliers can or cannot do to improve the quality of public water, or even if well water supplies a house, the homeowner can still purchase water purification systems for their kitchen faucets. These "point of use" home water treatment products include activated carbon filters, reverse osmosis units, ultraviolet lamps and distilled water systems.

Other homeowners and consumers have completely switched to bottled water for their drinking needs, and sales are steadily growing across the country. Regulation of these expanding industries includes the Food and Drug Administration (FDA), which monitors the water bottling industry, and non-governmental testing organizations, such as the International Bottled Water Association and the National Sanitation Foundation (NSF International), which tests and certifies home water treatment devices. For devices claiming to filter lead, a treatment device certified by the NSF must reduce 150 ppb of lead down to a level of 10 ppb or less. Other watch-dog and professional organizations include the Water Quality Association (WQA) and the American Water Works Association (AWWA).

What's the Fuss in DC?

The District of Columbia has been in an uproar in recent months when it learned that their public water utility last summer tested 6,118 houses for lead and found water samples in 4,075 houses exceeding 15 ppb of lead. The public notification process began in November 2003. The public at large has now learned that 23,000 of the District's 130,000 single family homes have lead water pipes servicing their houses, and it will be years before all these service lines are replaced. The District also learned that their water utility had been finding high lead levels over the prior three years of annual lead testing.

Homeowners of untested houses were provided information on ordering free test kits that promised results in 30 days. For those with high lead levels, the water supplier informed consumers to flush their taps for one or two minutes upon first use of the day. But in February, the District utility in consultation with the EPA changed the guidance to a 10-minute flush. The District and the EPA realized that in many of the homes with lead service lines, the lead level in water flushed for one minute was even high than the first draw from the tap in the morning. The 10-minute flush could be achieved by taking a shower and/or flushing a toilet before using a faucet. After the shower and/or toilet flush, the faucet should be opened for one minute prior to using the water for drinking or cooking.

The District utility also advised all pregnant and breastfeeding woman and children under age six, who live in homes with lead service lines, not to drink unfiltered tap water and have their blood tested.

In addition to the large numbers of water testing by homeowners and the water utility; schools, day care centers, restaurants, businesses, condominiums, apartment owners and federal buildings have all been ordering lead tests of their facilities. Laboratories are being deluged with samples; therefore, analytical results are being delayed. The District advises owners of large building not to worry, because these structures were constructed with larger copper service lines. Their only concern should be the lead-soldered components in their building's plumbing, such as water coolers, drinking fountains and brass faucets (which are still allowed legally to contain small amounts of lead). In these buildings, the hazard is greatest if the faucet is not used for long periods of time and the stagnant water slowly collects dissolved lead from the plumbing fixtures. For these situations, the one-minute flush should suffice to reduce any lead concentration.



Has there really been lead exposure from public water in DC? What are the blood lead levels?

The District's Department of Health has been providing free blood lead screening to children under six and pregnant women, plus periodic lead screenings for the public at large. The Department of Health has published results of their blood screening through April 13. Of 1,513 children under age six tested, 25 had high lead levels (10 µg/dl or high). Of these 25 children, 10 had lead service lines to their homes and 15 had copper service lines. To date, 15 of these children with elevated blood lead levels have had their homes investigated by the Health Department. Some of the children lived in houses with lead service lines, but all had other sources of lead in paint, dust and/or soil, all exceeding EPA guidelines.

Quirky Test Results

As some DC homeowners are seeing, their lead service lines replaced by the water utility, some are getting unexpected tests results of lead, before and after the pipe replacement. In some cases, lead levels were actually higher after the copper pipes were installed.

In some cases, officials have theorized that the disturbances occurring to the adjacent pipes during the replacement will break off coatings of sediments that have built up along the pipe interiors. These coatings can actually prevent hazardous lead particles from leaching out of lead-containing components. When sediments are knocked off during the pipeline replacement work, there often occurs a spike in lead levels that last for days to months.

In other cases, the utility has informed homeowners that the city would only be able to replace the lead service line between the main water pipe in the street up to the homeowner's property line. The portion of the service line extending into the homeowners yard to the house connection could only be replaced at the expense of the homeowner. If the homeowner doesn't pay the estimated \$2,000.00 for this additional work, part of the lead service line will remain.

Is DC an Anomaly?

One aspect of the water treatment in DC that may explain why the lead testing has only been showing high levels for the past couple years is the utility's change in water treatment chemicals in 2000. During that time the District utility changed its disinfection treatment from pure chlorine to chloramines. The change occurred because chlorine compounds were increasingly being tied to increase cancer risk. However, the chloramines disinfection rendered the drinking water slightly more corrosive and susceptible to lead leaching. District and EPA officials have now developed a strategy to reduce corrosivity by introducing a new treatment using orthophosphates to reduce the corrosivity.

DC's Corrective Action Plan

The water treatment adjustment will be phased in beginning June 1, and if the initial sector of the city achieves satisfactory results while maintaining good taste and appearance, the treatment will be expanded to the rest of the city.

Meanwhile, the city is accelerating lead service line replacements. The city had originally budgeted approximately 1,100 replacements this year in conjunction with road projects with the Department of Transportation (DOT). Recently, they have received additional emergency funds from the District and EPA and will add 500 more service lines to this year's schedule. DC is also considering no-interest loans to homeowners to pay for those lead service lines that extend onto the homeowner's property.

The District and its water utility also gratefully received donations of 22,000 home water filters from both Brita Products Company (10,000 water filtration pitchers) and Proctor & Gamble Company (12,000 pitchers and faucet water filtration systems) each with a six months' supply of replacement filters. The district utility is also continuing to provide water testing kits to homeowners. By mid-April, the utility had issued 24,500 water testing kits, and of these about 14,500 have been returned and forwarded for analysis.