Home

Lead contamination and removal

Arvind S. Patil, Ph.D.
October 13, 2010

Lead contamination has been around for a long time and its reasons are many and complex. Lead bearing minerals in the ground leach out lead, resulting in ground and surface water contamination. This component is actually small compared to lead contamination through man-made causes such as industrial effluents along with the contribution from lead and lead containing alloys in transmission lines and plumbing fixtures. Lead contaminations through the use of lead paint and leaded gasoline in the atmosphere have also been well documented.

Health effects and regulation

The toxic health effects of lead include impaired mental development, reduction in IQ, shorter attention spans and lower birth weights. Exposure to lead is a serious health threat, especially in young children, infants and immuno-compromised persons who tend to absorb more lead than a healthy adult. Like all the so-called heavy metals, lead accumulates in the human body indefinitely.

According to the U.S. Environmental Protection Agency (EPA), ideal ingestion and absorption of lead in humans is zero. Hence, the Maximum Contaminant Goal (MCLG) of lead has been set at zero. The Maximum Contaminant Level (MCL), which is another legally enforceable limit, is set for all contaminants that have significant toxicity and long-term health effects. Because of the complexity of lead contamination and the shortcomings of present technologies to control it cost effectively, EPA has set up a legally binding Action Level (AL) for lead at 15 parts per billion (ppb) with the understanding that as technology and economic considerations allow that level will be lowered towards zero ppb. Due to EPA regulations, water that is provided by water utilities does not normally contain lead greater than 15 ppb.

The Lead Copper Rule

In 1992, EPA promulgated the so-called Lead Copper Rule (LCR) that governed the treatment of drinking water by utilities. Under LCR, water utilities are required to:

1) Reduce lead contamination to less than 15 ppb by controlling the corrosiveness of water

2) If needed, replace the transmission lines that contribute to the elevated levels of lead in drinking water

3) Collect representative water samples at consumers' taps (point-of-use)

4) Monitor water quality parameters for corrosiveness.

Since the promulgation of the Lead Copper Rule, lead levels in drinking water have been significantly reduced in the U.S. Currently, 95 percent of the U.S. population is never exposed to water with a lead content of more than 15 ppb. However, contamination in transmission lines, contribution by plumbing fixtures and contamination at treatment utilities continue to be significant sources of lead contamination. While the contamination may fall below the 15 ppb threshold, it still is a cause for some concern. Recently, the State of California put definitive restrictions on the lead content of household plumbing fixtures.

Certification

In order to meet the MCLG of zero for lead, consumers will have to use some new strategies. One of the best ways to obtain cost-effective protection from lead and many other harmful contaminants is by utilizing point-of-use (POU) devices that are independently certified for effectiveness. Certifying agencies include NSF, WQA, UL and others. All of these agencies follow NSF/ANSI developed standards that are deemed safe and effective. The Joint Committee for Drinking Water Treatment Devices (DWTD) consists of these certifying agencies, manufacturers of treatment devices, state and federal regulatory agencies, academic institutions and users. They deliberate regularly to decide the adequacy of existing standards and to create new standards as circumstances demand.

To ensure that treatment devices protect consumers under all possible conditions encountered in the U.S., Joint Committee requires testing of devices at extreme conditions. That includes source waters that have a pH range of 6 to 9. To make sure that a treatment device will be effective under such a wide range of pH, the Joint Committee, in 1999, required devices to be tested both at pH 6.5 and 8.5 under NSF/ANSI Standard 53, which covered lead along with many other heavy metals. The Maximum Lead Level allowed in this standard was 10 ppb, instead of the EPA Action Level of 15 ppb.

Since then a large number of POU devices have been certified, and it became quite common to find gravity pitchers, faucet mount devices and 10" conventional cartridges for both over-the-counter and under-the-sink devices certified for lead removal according to NSF/ANSI Standard 53. It was indeed a benefit for the consumers to be able to have a certified lead removal claim in the most popular of POU devices — the filter pitcher.

In 2005, during the testing of devices for lead at pH 8.5, the Joint Committee recognized there was a potential for the creation of lead in the form of fine colloidal particles, which the NSF/ANSI Standard 53 did not originally include. Many of the corrosion products found in the water also tended to have particulate lead. A task force created by the Joint Committee worked on this problem and recommended a modification to the Standard 53 that required testing to a new lead challenge solution, which had approximately 25 percent of lead in the form of fine particulate lead as a conservative level. This level was based on the study of past literature and may or may not represent an actual occurrence based on geography. The devices, in order to be certified for lead removal, had to still meet the 10 ppb requirement.

With this modification, many of the gravity action pitcher products had difficulty in meeting this requirement and many manufacturers were forced to withdraw the lead certification for their devices. The other POU products that were made from tightly molded carbon block were often able to meet the new requirement and continued to be offered. Newer technologies have since emerged for the filtering media in pitcher cartridges and now there are NSF/ANSI 53 certified pitcher products available for retail sales with lead removal claims.

Testing

For the protection of all water users and especially for young children and infants, it is appropriate that

consumers use properly certified devices for their drinking water needs. This is the best insurance one can have to take care of any lead that is introduced from excursions in the treatment by utilities, leaching from transmission lines and from home and building plumbing fixtures.

Most of the above discussion pertained to drinking water treated by utilities. For sources of water that do not undergo treatment by utilities, some of these considerations may not apply. In those cases, it is all the more necessary to undertake the analysis of the source water from a qualified chemical laboratory and determine the status of lead and other heavy metals. One can, however, use the same certified POU devices to ensure the safety of drinking water from lead and other contaminants, should the need arise.

Because of the serious and cumulative threat of lead to human health, especially for young children and infants, manufacturers of consumer water treatment devices have put extensive resources into the development of innovations and improvements in the area of lead detection and elimination. And we can expect many new developments in this field in the future. Consumers should keep abreast of this development to further minimize or eliminate the negative effects of lead contamination in their drinking water.

Arvind S. Patil, Ph.D. is the vice president of technology at Ricura Water Technologies LLC — a filtration system and component manufacturer based in Huntersville, North Carolina. Patil is a member of the WQA Science Advisory Council and the NSF Joint Committee on DWTD.