

CAUSES AND EFFECTS OF LEAD IN DRINKING WATER – GETTING THE LEAD OUT

PENN STATE HEALTH & COLLEGE OF MEDICINE
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BACKGROUND

Lead service lines are defined as the portion of the water distribution system that is connected from the water main in the street to the customer's residence or business.

- Lead service pipes have been used since the time of the Roman Empire.
- Between 1900 and 1950, most cities installed lead water pipes due to the durability of lead pipes which can last 75 to 100 years or more.
- The U. S. Environmental Protection Agency (EPA) estimates that 6-10 million lead service lines are currently in use in the United States.
- Other surveys estimate 12 million or more.



BACKGROUND - Continued

- Lead service lines are more likely to be found in homes built before 1986.
- Even homes without lead service lines can have lead occurring from brass or chrome-plated brass faucets and internal plumbing with lead solder.
- In 1986, the Safe Drinking Water Act mandated “lead-free” solder be used.
- After 2014, manufacturers of faucets, valves and other plumbing fixtures were required to use reduced lead levels in their products.



Health Effects of Lead - Continued

**IT IS NOW RECOGNIZED THAT
LEAD DOES NOT BELONG IN
DRINKING WATER SYSTEMS
OR RESIDENTIAL PIPING AND
FIXTURES.**



Health Effects of Lead

- Lead is a neurotoxin with no safe level in the human body.
- In the cells of the human body, lead mimics the mineral calcium. As such, lead can be absorbed or ingested and create health issues impacting normal functions in:
 - Bones
 - Teeth
 - Blood
 - Liver
 - Kidneys
 - Brain
- Adults are at risk for high blood pressure and cardiovascular disease due to lead exposure.



Health Effects of Lead – Continued

- Lead is particularly toxic to fetuses, infants and young children.
- Bottle-fed infants given formula made with drinking water are at significantly higher risk for developmental impairment.



How Does Lead Occur in Drinking Water?

- Lead gets into drinking water when lead pipes and lead-containing fixtures corrode – allowing lead to dissolve or flake into the drinking water.
- Even though lead may be present in the drinking water, it is odorless and tasteless and can be present in very clear drinking water.
- Numerous factors impact the degree to which lead corrosion can occur, including:
 - Water temperature
 - The amount of time drinking water remains stagnant in the pipes
 - The age of the pipes
 - The wear of the plumbing fixtures
 - Whether adequate corrosion control treatment has been utilized



Lead Crisis in the United States

- 2016 – Flint, Michigan
 - Focused attention on high lead levels in drinking water
 - Catastrophic failure at all levels of government including city, state and federal
 - Government agencies allowed the city of Flint, Michigan to change its source of drinking water without properly treating the water to control corrosion in the distribution system
 - The change was made solely to reduce the costs of providing drinking water

- Benton Harbor, Michigan was found to have excessive lead levels in the drinking water systems
 - The lead occurrence incidents were ignored until the Flint, Michigan crisis sparked public outrage
 - Lead remediation actions were implemented



Lead Crisis in the United States - Continued

- Washington, DC
 - Changed its disinfection system from chlorine to chloramines without consideration of the impact such a change would have on corrosion control - resulting in elevated levels of lead in the drinking water

- 2016 – Pittsburgh, Pennsylvania
 - Failed lead testing, exceeding the 15 ppb federal lead threshold by almost 1.5 times.
 - Cost saving changes made to chemical treatment resulted in failed corrosion treatment
 - By adding a corrosion inhibitor, orthophosphate, in 2022 the water system was able to achieve a 90th Percentile lead result of 4.42 ppb in samples collected from homes with lead service lines.
 - As part of its Community Lead Response, Pittsburgh continues to replace all lead service lines.



Scope of the Lead Occurrence in the U. S.

- EPA has estimated that there are currently 6 to 10 million lead service lines across the United States.
- The National Resources Defense Fund (NRDF) estimates that as many as 12 million lead service pipes are carrying water to the homes of 22 million people or more.
- In Pennsylvania, the estimated number of lead service lines is 160,000 to approximately 330,000.
- By 2024, water systems will have conducted a total lead service line inventory of their systems so that the true scope of the occurrence of lead service lines will be determined.



Lead – Safe Drinking Water Regulation

- January, 2021 – EPA published the Safe Drinking Water Lead and Copper Rule Revisions (LCRR).
 - First major update to the Lead and Copper Rule (LCR) in nearly 30 years.

- Requires water systems to conduct a total lead service line inventory of their systems by 2024.
 - The inventories must be made public, and
 - Include the location of lead service lines

- LCRR requires improved sampling techniques based on better science to reduce or eliminate the under-estimation of lead occurring in drinking water:
 - **Includes a “fifth liter” sampling requirement to capture lead originating from lead service lines**
 - **A sampler must draw four liters of water before collecting a test sample to ensure that the water being tested is coming from the service line and not the premise plumbing in the building**
 - **Sampling requirements also preclude flushing, as well as cleaning or removing the screen or aerator that covers the faucet before initiating sampling collection.**



Safe Drinking Water Regulation - Continued

- Establishes a new threshold (action level) of 10 ppb.
 - If exceeded, triggers a rapid implementation of corrosion control treatment.
 - Before water systems can implement corrosion control treatment they will be required to complete a corrosion control study to identify the best corrosion treatment option.
 - Previously, water systems were allowed 4 years to implement corrosion control if the threshold of 15 ppb was exceeded.
 - Water systems that already have corrosion control treatment will be required to **optimize** corrosion control treatment.
 - Water systems that exceed the 10 ppb threshold will also be required to start a system-wide lead line replacement program.



Safe Drinking Water Regulation - Continued

- Requires more instances where the entire lead service line is replaced.
 - Previously, the LCR provided loopholes that allowed water systems to replace only 1 percent of water systems when the action level was exceeded.
 - Water systems must fully replace at least 3 percent of lead service lines every year when 10 percent of the sampling levels are above 15 ppb.
 - Further, water systems will be required to replace the water system-owned portion of the lead service line whenever a customer chooses to replace their customer-owned portion of the lead service line.
 - Moreover, partial lead service line replacement, which can result in short-termed spikes in lead levels, will not be allowed under the LCRR. .



Safe Drinking Water Regulation - Continued

- LCRR requires timely notification, within 3 days, to home occupants, If a lead sampling result at a home is over 15 ppb.
 - Required in order to reduce lead exposure immediately.
 - Sample tap results below 15 ppb must be given to the home occupants within 30 days.

- In the event a water system has a system-wide lead action level exceedance, all water system customers must be notified within 24 hours and provided educational materials within 60 days.



Paying for Lead Service Line Replacement

- Several federal funding resources are available for states, local and tribal governments, as well as water utilities to assist communities and support lead service line replacement:
 - **EPA' s Drinking Water Revolving Loan Fund**
 - **The Water Infrastructure Improvements for the Nation Act (WIIN) Grants**
 - **Water Infrastructure Improvements and Innovation Act (WFIA) Financing Program**
 - **Housing and Urban Development (HUD) Community Development Block Grants**



How to Reduce Your Lead Exposure and Remove Lead from Your Drinking Water

- **DO NOT DRINK WARM OR HOT TAP WATER, USE ONLY COLD TAP WATER FOR DRINKING AND COOKING PURPOSES.**
 - Warm or hot tap water is more likely to contain elevated levels of lead.
- **DO NOT BOIL WATER TO REDUCE OR REMOVE LEAD.**
 - Boiling will concentrate the lead content.
- **Before using tap water, flush stagnant water from the pipes. Run the faucet for a few minutes or more (usually, until the water changes in temperature, becoming colder).**
- **Clean faucet screens or aerators frequently.**



How to Reduce Your Lead Exposure and Remove Lead from Your Drinking Water

- **IF YOU USE A HOME WATER FILTER SYSTEM, BE SURE THAT IT IS CERTIFIED BY THE NATIONAL SANITATION FOUNDATION (NSF) OR THE WATER QUALITY ASSOCIATION (WQA).**
- **THE FILTER SHOULD BE CERTIFIED TO REMOVE LEAD AND MEET STANDARD 53.**
- **BE CERTAIN TO REPLACE FILTERS ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS. FILTERS THAT ARE NOT REPLACED WHEN FOULED CAN ALLOW LEAD TO BE SLOUGHED OFF FROM THE FILTER INTO THE DRINKING WATER.**



QUESTIONS





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