Allowable Lead Content for Underground Service Line Valves and Fittings

White Paper

Mueller Co.

Reliable Connections™

Overview

Potable water treatment plants spend millions of dollars each year on filters, chemicals and aeration to purify the surface waters and ground waters of the United States and rid tap water of harmful contaminants. However, municipal water systems can only guarantee the purity of water up to the service connection. It is important that service lines from the supply pipeline (i.e. water main) to the end user are composed of materials that protect the integrity of the water. A water main is the primary pipeline that conveys potable water from a purification plant to customers. It is often located beneath a street with supply pipes (service lines) that connect to residences/businesses. A simple and low-cost method of eliminating lead, one of the most harmful pollutants, from tap water is to use low lead brass fittings in the service lines. This paper will discuss the need for low lead service fittings, review the terms “no lead,” “low lead” and “lead-free,” and examine some of the principal protection choices for water service pipeline systems.

A Wake Up Call

In 2014, Flint, Michigan switched its water source from Lake Huron to the Flint River. The ensuing crisis regarding the town’s drinking water highlighted a lingering problem with the nation’s potable water pipelines.

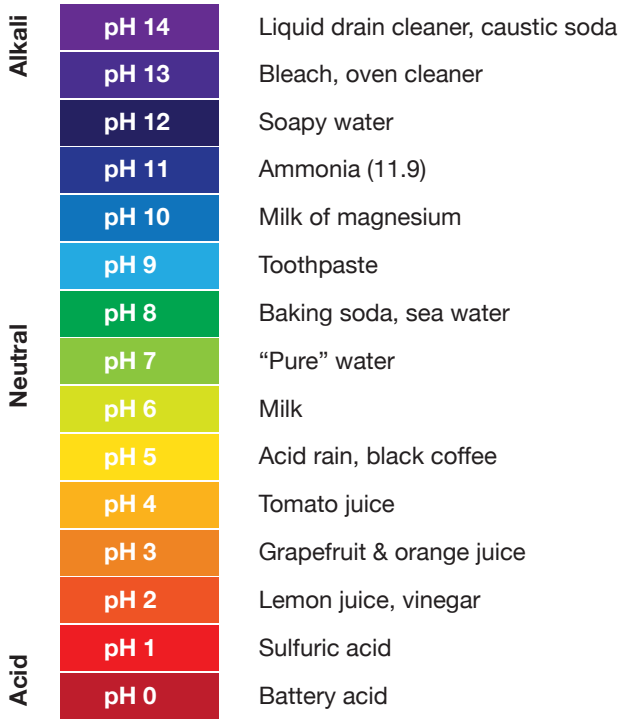
Until the 1950s, lead was commonly used for household plumbing systems and service lines. In 1986, the US Environmental Protection Agency (EPA) recognized the dangers of lead acting, in effect, as a neurotoxin and mandated that and new solder, service lines and plumbing be “lead-free.” At that time, “lead-free” was defined as containing less than 0.2% in solder and 8% in pipes or fixtures. In 2014, section 1417 of the Safe Drinking Water Act redefined “lead-free” as 0.25% lead for pipes, pipe fittings, plumbing fittings and fixtures. The hidden problem in these regulations is that neither applies to water lines constructed before 1986.

For adults, excessive amounts of lead may cause anemia, high blood pressure, stroke, kidney disease or brain damage. Children absorb the element more quickly than adults because their bodies are still growing. The effects of lead in children can include premature birth or low birth weight, hearing loss, behavioral problems, seizures, learning disabilities, lower IQ and brain damage.

Where Does the Lead Come From?

If water at the main is relatively free of contaminants, why does water from the tap sometimes contain high levels of lead? The answer is in the piping system carrying water from the main to the faucet. In older homes, this system may consist of pipe, solder, fittings and fixtures which often contain more lead than is now allowable because of their date of manufacture or installation.

Different factors cause lead to leach from metal components into the water. Factors such as water PH levels, calcium carbonate content and water hardness/softness, separately or in combination, can create corrosive water. In general, as water corrosivity increases, the amount of lead leached into the water can increase.



Soft water is usually more corrosive than hard water, and water with a PH of 7 or less and low in calcium carbonate will leach more lead than alkaline water with a PH higher than 7 and high in calcium carbonate. Water temperature also plays a role; warm water is more corrosive than cold water.

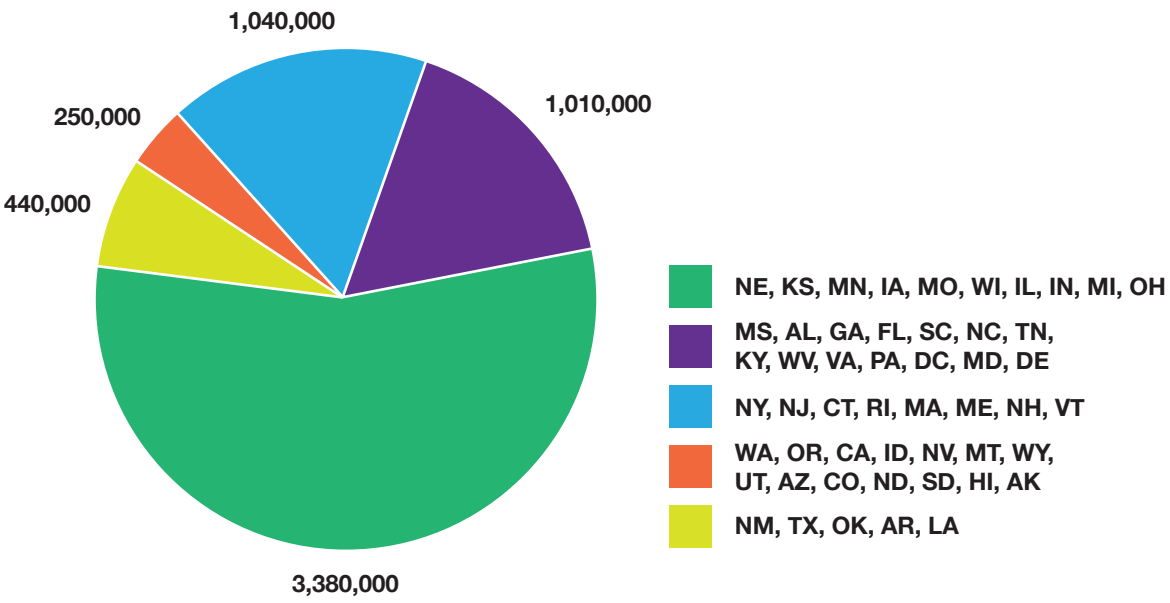
For homeowners living in municipalities that properly treat the water supply against the corrosive elements that enter groundwater and surface water sources, there may not be much of a problem. For other communities, or in circumstances where there is a change in water source or treatment as in Flint, the resultant rise in lead levels can be disastrous.

The Role of Low Lead Brass Service Fittings

As aging service pipelines are being replaced with copper, PVC, and polyethylene pipes, there is a growing need for fittings that conform to the strict requirements of American Water Works Association (AWWA) C-800 and NSF/ANSI Standards 61 and 372. In 2016, the AWWA published an analysis that estimated there are still over six million lead service lines (either full or partial) in the United States. This analysis, based on two AWWA-sponsored surveys conducted in 2011 and 2013, revealed that anywhere from 15 to 22 million people receive their water via these lead service lines (LSLs). Approximately 30% of the community water systems (CWSs) surveyed disclosed that there were some LSLs within their distribution systems.

Utilities and property owners are working to comply with the AWWA and the National Drinking Water Advisory Council (NDWAC) to eventually eliminate lead from all service lines. This will mean the replacement of miles of pipe, solder and fittings. Besides the billions of dollars in conversion costs involved, there is another consideration - the inconvenience of service interruptions and traffic problems caused when working near water mains.

National LSL Estimate by USEPA Regional Group



Proper Terminology

The following three terms have been used interchangeably in the water distribution industry although technically they are not exactly the same:

"No Lead" – This term has no regulatory meaning, as it is not defined in any regulations or standards pertaining to water works service brass. It is a misnomer often used in place of "Lead-Free" when discussing service brass. At this point, even though the lead level is negligible, no service brass is completely free of lead.

"Low Lead" – As defined by the Federal Safe Drinking Water Act (FSDWA) amended in 1986, is any product containing less than 8% lead.

"Lead Free" – Is defined by the Federal Bill S.3874- (Jan 2014) "as not containing more than 0.02% lead when used with respect to solder and flux; and not more than a weighted average of 0.25% lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures."

Three copper alloys are allowed by ANSI/AWWA Standard C800 Section 4.1.2 for castings that will be in contact with potable water. They are as follows:

Material Composition of ANSI/AWWA Standard C800 Section 4.1.2 Allowable Copper Alloys

CDA 83600 (85-5-5-5)	85% copper, 5% tin, 5% lead, 5% zinc (does not meet maximum lead criteria of s.3874 or NSF61 Annex G)	This material is the industry standard 85-5-5-5 and **does not** meet the maximum lead criteria of S.3874 or NSF 61 Annex G.** This material is also in accordance with the chemical and mechanical requirements of ASTM B584.
CDA 89520 (Envirobrass II)	86% copper, 5.5% tin, 5% zinc, 2% bismuth, 1% selenium, 0.25% lead (max) with trace elements iron, sulphur, aluminum, silicon	This material is called Envirobrass II and meets the maximum lead content of S.3874 and NSF 61 Annex G. This material is also in accordance with the chemical and mechanical requirements of ASTM B584.
CDA 89833 (Federalloy I)	88.5% copper, 5% tin, 3% zinc, 2.2% bismuth, 1% nickel, 0.09% lead (max) with trace elements iron, antimony, aluminum, silicon	This material is called Federalloy I and meets the maximum lead content of S.3874 and NSF 61 Annex G. This material is also in accordance with the chemical and mechanical requirements of ASTM B584.
CDA 89836	89% copper, 5.5% tin, 2.5% bismuth, 3% zinc	This material is in accordance with the chemical and mechanical requirements of ASTM B584

** The requirements of NSF61 and the revised SDWA apply to assemblies, not materials. Companies can still utilize 836 components provided the weighted average of all the other wetted surfaces drops overall average below .25%.

Mueller® Low Lead Brass Service Fittings

Mueller Co. offers a wide variety of service brass fittings that are both AWWA C-800 and FSDWA-compliant. Their castings that come in contact with potable water are poured from CDA 89833 (Federalloy I) and meet the maximum lead requirements of both standards. Because there is a possibility of trace amounts of lead in the ingot (.09% maximum), Mueller Co. refers to it as "low lead" rather than "lead-free" or "no lead."

Additional advantages of these proven low-lead fittings are the different types of connections designed to fit most of the pipe and tubing used in service lines. The connection types include:

- MUELLER 110® Compression Connection
- MUELLER INSTA-TITE® Connection
- Mueller Pack Joint Connection
- MUELLER GRIP Connection
- Copper Flare Connection
- Threaded Connection

The Mueller 110 Compression Connection adds significant benefits to low lead brass fittings:

- High Resistance to Pull-Out
- Fast Installation
- A Visual Means to Check for Proper Tightness

These advantages translate into quick, secure, trouble-free installations, and that results in projects with shorter timelines, fewer service interruptions and less traffic disruptions.

Short Term and Long Term Remedies

There are several ways that municipalities and residents can reduce the levels of lead in their drinking water. The first step is to get tap water tested for lead. While water quality is constantly monitored at a water treatment plant, this may not accurately reflect the lead levels of water coming from a tap.

Consumers can also use water filters or filtration systems, but these require frequent changes of filters.

Another way to reduce lead contamination is for residents to run the cold water for at least two minutes when using the tap for the first time after six hours. Hot water should never be used for drinking or cooking purposes.

One of the least expensive fixes is to replace old fixtures with new, compliant faucets.

However, none of these short-term remedies by homeowners address the basic problem.

Municipal water systems can and do attempt to keep lead levels low by chemically altering the PH or other factors of the water in order to render it less corrosive. This treatment is not always successful and in some cases is impossible, as in the case of the additive orthophosphate, which might not be compatible with some wastewater treatment systems.

Flint River water was treated with increasing levels of chlorine when fecal coliform bacteria and other disease-causing organisms were detected in the water. In October 2014, the General Motors plant in Flint stopped using the city water supply and switched to Lake Huron water (purchased from Flint Township) due to concerns about high levels of chlorine corroding metal engine parts. Even though Flint River water was found to be 19 times more corrosive than water from Lake Huron, the Michigan Department of Environmental Quality was not correctly treating it with an anti-corrosive agent. Lead from the aging service lines began to leach into the drinking water of Flint homes and businesses.

The best solution is to eliminate lead in all service lines and interior plumbing materials, as partial service line replacement often does not reduce lead levels in tap water. In fact, partial line replacement may actually worsen the problem, especially in the short term.

Two theories as to why lead levels in tap water often rise following the completion of partial service line replacements are noted in “Economics of Lead Pipe Replacement,” a 1992 UK Department of the Environment report. During the replacement process of the municipal portion of lead service lines, lead-bearing pipe scale that coats the inside of lines can be physically disturbed and end up as lead particulates in tap water. Another possibility stated by the report is that “partial replacements using copper piping can result in the creation of a galvanic cell.” Subsequent galvanic corrosion might occur causing the release of lead into the water.

Galvanic corrosion, also called bimetallic corrosion, is an electrochemical process in which two dissimilar metals are in contact and both are immersed in an electrolyte. In the case of partial service line replacement, where copper pipes have been joined to lead pipes, the lead is more anodic and therefore is more susceptible to galvanic corrosion.

A 2012 CDC report concluded that “Partial lead service line replacement has been associated with short-term increases in lead levels in drinking water.” The report added that partial line replacement “has not been found to decrease risk for BLLs ≥5 µg/dL in children.”

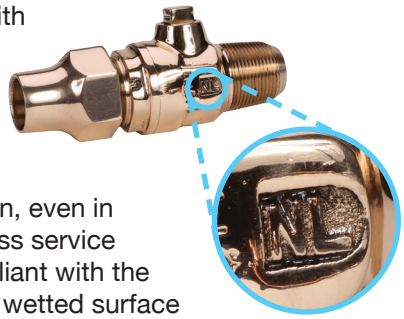
The Lead and Copper Rule (LCR) published by the EPA in 1991 and updated in 2000 and 2007 mandates that in at least 90% of a water supply, lead levels must not exceed 15 parts per billion (ppb) and copper concentrations must not exceed (an action level of) 1.3 parts per million (PPM). The LCR requires water utilities to conduct lead and copper sampling of tap water. This allows utilities to determine what actions must be taken in order to reduce the public’s exposure to toxic levels of lead and copper. If corrosion controls enacted in response to the testing do not reduce lead levels, the Federal Safe Drinking Water Act requires that public water systems begin replacing their lead service lines at a rate of seven percent every year.

Proposed New Requirements to RLDWA

A recent announcement by the Environmental Protection Agency indicates that it intends to make revisions to regulations within the Reduction of Lead in Drinking Water Act of 2011. The proposed conforming changes are two-fold: manufacturers will be required to mark products and packaging as “lead-free”, and manufacturers and importers will require either third party or self-certification of product compliance.

Concerned that non-compliant products, plumbing products that do not meet the current definition of lead-free, may inadvertently be installed in potable water systems, the EPA is planning to require the marking of lead-free products, as well as package labeling. This would ensure that even if packaging is discarded before installation, contractors or inspectors would be able to identify products that are safe for potable water use.

The second portion of the EPA proposal would require manufacturers with 100 or more employees, or importers representing manufacturers with 100 or more employees, to obtain ANSI accredited, third-party certification that products are compliant with the current EPA definition of lead-free. For manufacturers with fewer than 100 employees or importers representing manufacturers with fewer than 100 employees, compliance would require certification by a third party, ANSI accredited body or self-certification.



Mueller® low lead brass products are marked “NL” for easy identification, even in situ, when packaging is not available. Additionally, Mueller low lead brass service fittings are UL (Underwriters Laboratories) tested and certified as compliant with the RLDWA definition of lead-free, which is a maximum lead content of the wetted surface not to exceed 0.25%.

While some manufacturers may have to retool, repackage or undergo certification in order to comply with the proposed revisions to the RLDWA of 2011, the low lead brass service fittings produced by Mueller Co. not only conform to current EPA standards for use with potable water systems, they already adhere to the proposed additional regulations.

Summary

In order to protect the health of millions of residents in the United States, it is essential that the lead-containing products in all service pipelines be replaced with low lead pipe, fittings, solder, flux and fixtures. Low lead service fittings are only one portion of the replacement components that will be needed to refurbish lead water service lines. Mueller Co. manufactures low lead brass service fittings that are not only in compliance with all applicable standards and acts but also offer quick and accurate

installation. Mueller low lead brass service fittings would allow for the most efficient replacement methods with the highest quality components.

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Mueller Co., LLC is a subsidiary of Mueller Water Products, Inc. (NYSE:MWA), a leading manufacturer and marketer of products and services used in the transmission, distribution and measurement of water in North America. Our broad product and service portfolio includes engineered valves, fire hydrants, metering products and systems, leak detection and pipe condition assessment. We help municipalities increase operational efficiencies, improve customer service and prioritize capital spending. Visit us at muellercompany.com

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