VILLAGE OF
FRANKFORT
EST • 1855

A Review of the USEPA Lead and Copper Rule in the Village of Frankfort

Zachary Brown, AICP, CFM

May 24, 2016

*Disclaimer: This paper was written to provide a broad overview of the USEPA lead and copper rule as it applies to the Village of Frankfort and does not address the intricacy of every aspect of the regulations. Those interested in understanding the entirety of the regulations as they apply nationwide may find a complete copy of the regulations here: http://www.ecfr.gov/cgi-bin/text-idx?SID=531617f923c3de2cbf5d12ae4663f56d&mc=true&node=sp40.23.141.i&rgn=div6.

Introduction

On June 7th, 1991 the United States Environmental Protection Agency adopted the Lead and Copper Rule (56 FR 26460 – 26564), also known as LCR. The purpose of the regulation is to protect the public health by minimizing levels of lead (Pb) and copper (Cu) within public drinking water supplies. The regulations contained in the LCR apply to all community water systems (CWS) and non-transient non-community water systems (NTNCWS) within the United States. The LCR establishes an action level (AL) of 15 parts per billion (ppb) for lead and 1.3 parts per million (ppm) for copper based upon the 90th percentile of tap water samples taken throughout the water system. Exceeding the action level does not necessarily constitute a violation but can trigger additional EPA requirements including public education, increased lead and copper testing frequency, corrosion control treatment, and source water monitoring. A violation occurs when a public water supply test result exceeds the action level and the public water supply fails to perform the subsequent actions prescribed by the LCR.

The Village of Frankfort has complied with all requirements of the LCR since 1991 and performs lead and copper samples on a triennial basis at 30 locations throughout the community. The results of each test are provided to the homeowner regardless of whether or not an exceedance is found. In 2008 the Village of Frankfort's 90th percentile for lead levels exceeded the action level of 15 parts per billion by 10.54 parts per billion (90th percentile = 25.54 ppb). Although not a violation this exceedance triggered requirements for public education and increased lead testing frequency. Quarterly lead testing occurred in 2009 and did not produce 90th percentile results above the action level of 15 ppb. In 2010 the Village of Frankfort returned to triennial testing for lead and copper and has not had further exceedances since. The source

of the increased lead level in 2008 was ultimately traced to an improperly obtained sample that was sourced from an outside spigot as opposed to an interior kitchen or bathroom tap as required by the LCR.

This paper will provide an in depth review of the lead and copper rule as it pertains to the Village of Frankfort including review of testing frequency, testing sites, testing procedures, and analysis of testing results.

Background

Lead has been used by humans for over 5,000 years and during that time span production and use of lead has dramatically increased from 10 tons per year to over 1,000,000 tons per year (Brown, Margolis 2012). Given its malleable and corrosive resistant nature lead was often used in drinking water service lines, as solder in household piping, and in plumbing fixtures themselves. As the adverse health effects of lead exposure became more widely known the use of lead began to gradually decline starting with the phasing out of leaded gas in 1975, the ban on lead paint in 1978, and the ban on lead solder in plumbing systems in 1986.

In 1989 the United States Environmental Protection Agency began a pilot public education program in Raleigh, North Carolina on lead in drinking water. The objective of the pilot program was to determine the level of effort necessary to effectively reach consumers and determine if describing the potential effects of lead consumption and methods of reducing lead exposure were effective. This pilot program was the precursor to the lead and copper rule (LCR) which was adopted in 1991 and subsequently revised in 2000, 2004, and 2007. The LCR sets a maximum drinking water contaminant level of zero for lead and 1.3 ppm for copper and an action level of 15 ppb for lead and 1.3 ppm for copper. The LCR replaced the previous lead

limitation of 50 ppb measured at the point of entry to the distribution system which in the case of Frankfort was its ten wells.

Source of Lead in Drinking Water

The Village of Frankfort regularly tests its ten wells for lead to confirm that any lead detected at a sample site does not originate from the groundwater. Frankfort's wells were most recently tested in May of 2016 and all ten wells were negative for lead contamination. The most common sources of lead in drinking water are lead service lines, chrome plated brass faucets and fixtures with lead solder, and copper pipes with lead solder in single family homes. The Safe Drinking Water Act was amended in 1986 to include limitations on the amount of lead content that can be used in plumbing and fixtures and as a result homes built prior to 1986 are more likely to contain lead pipes, fixtures, and solder. Because these sources of lead are not part of the public water supply but rather owned by individual homeowners mandating their removal is difficult.

The United States EPA publication "Basic Information About Lead in Drinking Water" notes that there are a number of factors that are involved in the extent to which lead enters drinking water in a home including:

1. *The chemistry of the water (acidity and alkalinity) and the types and amounts of minerals in the water;*
2. *The amount of lead it comes into contact with;*
3. *The temperature of the water;*
4. *The amount of wear in the pipes;*
5. *How long the water stays in pipes; and*
6. *The presence of protective scales or coatings inside the plumbing materials;*

In accordance with the corrosion control treatment requirements of the LCR the Village of Frankfort adds phosphates to the public water supply which act as a corrosion inhibitor. While phosphates help reduce the corrosive nature of the water and address point #1of the USEPA above, it does not address points #2 through #6 which also impact the extent to which lead enters the water in a home.

Testing Frequency

The Village of Frankfort began sampling for lead and copper in accordance with the LCR on July 1, 1992. Samples were subsequently taken at six month intervals until 1993. The LCR includes parameters by which a public water supply may reduce the frequency of its lead and copper testing if it can demonstrate continued compliance with the prescribed action levels. Having met the lead and copper action levels for two consecutive six-month periods, in 1993 Frankfort was permitted to reduce its sampling to an annual basis. The LCR allows for even further reduction of testing frequency where action levels are met for three consecutive years. In 1994 the Village of Frankfort was permitted to reduce its testing frequency to a triennial basis, where it has remained since. The only exception to the triennial testing occurred in 2009 when the Village conducted quarterly tests following a 2008 exceedance of the lead action level.

Testing Sites

The lead and copper rule states that “the sampling sites selected for a community water system's sampling pool shall consist of single family structures that contain copper pipes with lead solder installed after 1982, contain lead pipes, and / or are served by a lead service line” (56 FR 26548). If an insufficient number of sampling sites exist a public water supply may select sample sites that are “representative” of the plumbing materials commonly found at other sites

throughout the system. The USEPA notes that "any water system whose distribution system contains lead service lines shall draw 50 percent of the samples it collects during each monitoring period from sites that contain lead pipes, or copper pipes with lead solder, and 50 percent of the samples from sites served by a lead service line" (56 FR 26548). Because some homes in the "old town" area of Frankfort were determined at the time of program creation to have lead service lines 50% of Frankfort's sampling sites must be homes with lead service lines.

The number of sample sites is dependent upon the number of customers served. Because Frankfort serves between 10,001 and 100,000 customers the number of standard monitoring sites is 60. As with testing frequency the LCR also includes parameters by which a public water supply may reduce the number of testing sites when lead and copper action levels are met for two consecutive six month periods. As a result of the Village's two initial samples taken in 1992 being compliant with the action levels for lead and copper, the number of required test sites was reduced from 60 to 30 where it has remained since.

Testing Procedures

The USEPA notes that "each first-draw tap sample for lead and copper shall be one liter in volume and have stood motionless in the plumbing system of each sampling site for at least six hours. First-draw samples from residential housing shall be collected from the cold water kitchen tap or bathroom sink tap" (56 FR 26548). The Village is required to utilize the same sampling sites each year as the LCR notes that "A water system shall collect each first draw tap sample from the same sampling site from which it collected a previous sample. If, for any reason, the water system cannot gain entry to a sampling site in order to collect a follow-up tap sample, the system may collect the follow-up tap sample from another sampling site in its

sampling pool as long as the new site meets the same targeting criteria, and is within reasonable proximity of the original site" (56 FR 26548).

In the case of the 2008 exceedance for lead the Village employee was unable to obtain access to the home and instead of utilizing an alternative site took a sample from the outside spigot. In many cases the outside spigot is connected to the home's plumbing in the area near where the lead service enters the home and as such often registers higher level of lead. Samples are not permitted to be taken in this area as the higher lead readings are generally not representative of water being used for consumption.

Testing Results

In reviewing lead and copper test results the EPA considers the action level as opposed to the maximum contaminant level. In the case of lead the action level is exceeded when more than 10% of the samples exceed 15 ppb (i.e. the 90th percentile is greater than 15 ppb). The copper action level is exceeded when more than 10% of the sample results exceed 1.3 ppm (i.e. the 90th percentile is greater than 1.3 ppm). Appendix C of the The Illinois EPA Sample Collectors Handbook notes that the procedure for determining the 90th percentile value is as follows:

Step 1: Place lead results in ascending order (from lowest to highest value).

Step 2: Assign each sample a number, 1 for lowest value.

Step 3: Multiply the total number of samples by 0.9.

Step 4: Compare the answer to Step 3, the 90th percentile level, to the action level of 15 parts per billion. If your 90th percentile value is higher than 0.015 parts per billion, you have an exceedance.

Repeat this procedure for copper sample results, except compare the 90th percentile copper level against its action level of 1.3 parts per million . If your 90th percentile value is greater than 1.3 parts per million, you have an exceedance.

The example to the right illustrates how the 90th percentile is calculated for a public water supply where 30 water samples are collected. In this example the 90th percentile sample rank is the 27th sample (i.e. 30 samples x .90 = 27). In this example the action level for lead is not exceeded as the 27th sample for lead does not exceed 15 parts per billion. Samples 28 through 30 can be above the action level and not result in an exceedance so long as the 90th percentile number is below 15 ppb. The same process would be repeated for copper as the 90th percentile for lead and copper are calculated separately.

Sample Rank	Sample Value (ppb)
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	1
13	1
14	1
15	3
16	3
17	3
18	5
19	5
20	5
21	7
22	7
23	7
24	9
25	9
26	9
27 (90th percentile)	**10**
28	12
29	16
30	18

The Village of Frankfort occasionally takes additional lead and copper samples at the requests of its utility customers or for investigatory purposes. If / when the Village takes additional samples beyond the 30 currently required those sample results must be counted in the calculation of the 90th percentile and as such the 27th sample rank may not always constitute the 90th percentile. Investigatory samples may be disqualified from

counting towards the 90th percentile calculation if a letter explaining the nature of the investigatory testing is sent to the EPA along with the sample results.

Within 10 days of the close of each sampling period the Village of Frankfort is required to provide the EPA with the results of all lead and copper testing and the 90th percentile lead and copper concentrations. Within 30 days of receiving the results Frankfort is required to notify each individual homeowner of the results regardless of whether or not the sample exceeded the action level for lead or copper. The results of Frankfort's triennial lead and copper test are also published in its annual water quality report which is distributed to all utility customers.

Conclusion

Lead contamination is a serious and complex issue and one that the Village of Frankfort Utility Department does not take lightly. Frankfort is committed to keeping its drinking water safe and takes hundreds of samples each year to ensure its water is free from all contaminants including lead and copper. While the LCR only requires Frankfort to sample for lead and copper every three years Frankfort goes above and beyond by testing its source water for lead and copper and individual homes at the request of its utility customers on an annual basis. Frankfort is also in the process of developing public education material to better inform its utility customers on the sources of lead in their homes and how to correct the issue should elevated lead levels be detected. Through these efforts Frankfort hopes to have an informed customer base with continued clean and safe drinking water for consumption.

References

(Bonnett, Lisa). "Illinois Environmental Protection Agency Sample Collectors Handbook". Retrieved from http://www.epa.state.il.us/water/compliance/drinking-water/collectors-handbook/sample-collectors-handbook.pdf

(Brown, Mary Jean and Stephen, Margolis). "Lead in Drinking Water and Human Blood Lead Levels in the United States". Centers For Disease Control and Prevention, August 10, 2014. Retrieved from: http://www.cdc.gov/mmwr/preview/mmwrhtml/su6104a1.htm

Title 40, Chapter I, Subchapter D, Part 141, Subpart I – Control of Lead and Copper, 56 FR 26548, June 7, 1991. Retrieved from http://www.ecfr.gov/cgi-bin/text-idx?SID=531617f923c3de2cbf5d12ae4663f56d&mc=true&node=sp40.23.141.i&rgn=div6

(USEPA). "Lead and Copper Rule: A Quick Reference Guide". June, 2008. Retrieved from: http://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=60001N8P.txt

(USEPA). "Lead in Drinking Water Regulation: Public Education Guidance". Retrieved from: http://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10058E4.txt