THE LEAD AND COPPER RULE

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Historical Background

The 1986 Safe Drinking Water Act required the use of "lead-free" pipes, solders, pipe fittings or plumbing fixtures in the installation or repair of any public water system or any plumbing in residential or non-residential facilities supplying water for human consumption. Plumbing fittings and fixtures were not formally addressed in the 1986 Amendment and were required to meet "voluntary standards." The term "lead-free" was defined as pipe and brass components containing less than 8% lead and solder less than 0.2% lead. The 1986 Safe Drinking Water Act also called upon the USEPA to develop a testing procedure to regulate the concentration of lead in the water at the consumer's tap.

The 1988 Safe Drinking Water Act Amendments included the Lead Contamination Control Act (LCCA) and were focused on lead contamination of school drinking water supplies. The LCCA required USEPA to publish a guidance document on how to evaluate lead contamination in these supplies. The LCCA also required that EPA identify drinking water cooler brands with lead and non-lead liners, and that all lead-lined coolers be replaced. The USEPA responded to this directive in 1989 with a recommended tap sampling procedure that limited the concentration of lead to 20 ppb in a 250 mL sample, collected after overnight stagnation in the building piping. This was provided as guidance to school districts and was not mandated.

In 1991, the USEPA finalized the Lead and Copper Rule (LCR) in response to the 1986 Safe Drinking Water Act and this rule regulated lead contamination at the consumer's internal tap. The testing procedure specified in the rule involved sampling the first 1 L from the consumer's tap after the water remained in the pipe overnight (minimum of 6 hours) and measuring the total lead concentration. Utility action was triggered when the fraction of the samples with more than 0.015 mg/L of lead was found to be greater than 10% (action level).

The 1996 Safe Drinking Water Act Amendments (1996 SDWA) finalized the current federal legislation on lead in the public water supply. The 1996 Safe Drinking Water Act expanded legislation to include plumbing fittings and fixtures and required that the USEPA issue regulations setting a performance standard that would establish lead leaching levels in fittings used for water intended for human consumption within two years if voluntary standards were not implemented by the industry within the first year. The term "lead free" for plumbing fittings and fixtures would be re-defined by this performance standard. In 1997, the USEPA declared that NSF 61, Section 9 satisfied the 1996 Safe Drinking Water Act requirement that a voluntary standard be established and that USEPA was not required to issue regulations. As a result, plumbing fixtures and fittings that are NSF 61 certified are "lead free" by definition. Section 8 of NSF 61 is used to certify that in-line devices are "lead free" while Section 9 is used for endpoint devices. Inline devices include valves, meters, backflow prevention devices, pressure regulators, and connection devices such as fittings, couplings, meter setters, corporation stops, and curb stops. Endpoint devices include faucets, hot and cold water dispensers, drinking fountains, bubblers and water coolers, and refrigerator ice makers. The 1996 Safe Drinking Water Act made it unlawful for any person to introduce into commerce leaded plumbing components, except for pipe that is used only for manufacturing or industrial processing. The 1996 Safe Drinking Water Act provided a two-year grace period for manufacturers of leaded components and by August 1998 manufacturers were required to comply.

The Lead and Copper Rule

The USEPA's 1991 Lead and Copper Rule (LCR) established maximum contaminant level goals (MCLG) and action levels for lead in U.S. potable waters (USEPA 1991). The MCLG for lead is zero while the action level (AL) is 0.015 mg/L measured in the 90th percentile of the samples. The MCLG for copper is 1.3 mg/L while the Action Level is 1.3 mg/L measured in the 90th percentile of the samples. The 1991 LCR also established sampling and monitoring procedures that U.S. water systems are required to follow. Subsequently, the USEPA made minor revisions and rule clarifications to these sampling and monitoring requirements (USEPA 2000), and in 2007, published additional revisions related to sample collection, treatment changes, customer awareness, and lead service line removal programs.

Sampling and Monitoring Requirements -- Lead sampling. The number of lead sampling sites that must be analyzed to comply with the LCR varies by the size of the population served by the water system. Under standard monitoring procedures, samples must be taken twice every six months from consumers' cold water kitchen taps after the water in the plumbing has experienced a stagnation period of six hours minimum. However, a water system can apply for a reduced number of monitoring sites and a lower sampling frequency if it maintains very low levels of lead or meets stringent water quality specifications. The standard and reduced numbers of sampling sites are listed in Table 1. The requirements for reduced monitoring are listed in Table 2.

Table 1: Required Sampling Sites for Lead and Copper Monitoring

Population served	Required number of sampling sites	
	Standard	Reduced
>100,000	100	50
50,001 – 100,000	60	30
10,001 – 50,000	60	30
3,301 – 10,000	40	20
501 – 3,300	20	10
101 – 500	10	5
≤100	5	5

Source: USEPA 1991

Sample collection and monitoring must occur at sites that have a high risk of lead levels in the drinking water. To ensure this would happen, sites are assigned priorities for usage depending on their characteristics. If there are not enough residences in the Tiers to meet the sampling site requirements, the balance of the sampling sites will be at residences that have plumbing that is representative of the system.

Sampling and Monitoring Requirements -- Water quality parameters. In addition to monitoring for lead, water systems may also be required to monitor the following water constituents and characteristics at every entry point into the distribution system and at the high-risk sites within the distribution system:

pH, alkalinity, calcium, conductivity (initial monitoring only), temperature (initial monitoring only), orthophosphate or silica (only if such corrosion inhibitors are used).

The number of sampling sites required for monitoring these water quality parameters is shown in Table 3. The standard sampling frequency is twice every six months for water systems with service populations >50,000 people and for smaller systems with lead levels at the sample taps that exceed the Action Level.

Table 2: Requirements for Reduced Lead Monitoring	
Reduced sampling frequency	Water system requirements for reduced sampling frequency and sites
Annual	A system of any size that meets Optimal Water Quality Parameter (OWQP) specifications for 2 consecutive 6-month monitoring periods, or Serves ≤50,000 and measured lead and copper are less than their respective ALs for 2 consecutive 6-month monitoring periods.
Triennially	A system of any size that meets OWQP specifications for 3 consecutive years of monitoring, or a system of any size that has 90th percentile lead levels ≤0.005 mg/L and 90th percentile copper levels ≤0.65 mg/L for 2 consecutive 6-month periods, or a system of any that size that can demonstrate that the difference between the 90th percentile lead level at the sample tap and the highest lead concentration in its source water is ≤0.005 mg/L for 2 consecutive 6-month periods, or Serves ≤50,000 and measured lead and copper are less than their respective ALs for 3 consecutive years of monitoring.
Once every nine years	Serves ≤3,300, has 90th percentile lead levels ≤0.005 mg/L, and the system is free of lead lines, pipes, and soldered pipe joints; leaded brass or bronze alloy fixtures; and plastic lines and pipes containing lead.
Notes: OWQP are specific ranges or minimums determined by states for each water quality parameter. *Source: USEPA 1991, USEPA 2000*	

Table 3: Lead and Copper Rule Compliance Monitoring Site Tiers		
Tier	Description	Note
1	Single-family residential houses with a lead service line or with lead-soldered plumbing that was installed after 1982.	Water system must collect samples from this tier.
2	Multi-family residences or other types of building with the same plumbing characteristics as Tier 1 houses.	Tier 2 residences are used only if a water system does not have enough Tier 1 residences to meet the required number of sampling sites.
3	Single-family residences with lead-soldered copper plumbing installed before 1983.	Tier 3 residences can only be used if a water system does not have enough Tier 1 or 2 residences to meet the required number of sampling sites.
Source: USEPA 1991, USEPA 2000		

Table 4: Required Sampling Sites for Lead and Copper Rule Water Quality Parameters		
Population served	Required number of sampling sites[1,2]	
	Standard	Reduced
>100,000	25	10
50,001 – 100,000	10	7
10,001 – 50,000	10	7
3,301 – 10,000	3	3
501 – 3,300	2	2
101 – 500	1	1
<100	1	1

[1]*Sampling is required only for systems serving >50,000 people or systems serving <50,000 people that have lead and/or copper levels in excess of the AL.*
[2]*Number of sites for standard and reduced monitoring is in addition to every entry point to the distribution system.*
Source: USEPA 1991, USEPA 2000

Treatment Techniques. All systems serving >50,000 people are required to install optimal corrosion control treatment. The only exceptions are 1) those systems that have completed treatment steps prior to December 7, 1992 that are equivalent to those described in the 1991 LCR; and 2) those systems that can demonstrate that the difference between the 90th percentile lead level at the sample tap and the highest lead concentration in its source water≤0.005 mg/L for two consecutive six -month periods. Water systems with service populations≤50,000 are required to implement corrosion control tre atment if lead or copper levels exceed the Action Level.

Systems exceeding the Action Level have 24 months to install a state-designated corrosion control treatment process. After installation, the water system must conduct two consecutive six-month periods of follow-up monitoring. The state will set the OWQPs for the following parameters after these monitoring periods are completed:

pH, Alkalinity. Calcium (if carbonate stabilization is used), Orthophosphate (if a phosphate-containing inhibitor is used), Silica (if a silica-containing inhibitor is used)

OWQPs represent the conditions which water systems must maintain in the distribution system in order to most effectively minimize lead levels at users' taps. Systems operating their treatment processes within their respective OWQPs are considered to be "optimized" with respect to distribution system corrosion control.

In addition, these systems must also sample the source water(s) and make a recommendation as to whether or not lead treatment is required. If the state requires, source water treatment, in addition to the corrosion control treatment, must be installed within 24 months of the Action Level exceedence. Systems with service populations≤50,000 can stop the source water treatment if both lead and copper levels are below their respective Action Levels for two consecutive six-month monitoring periods.

Lead Service Line Replacement. Lead service line replacement (LSLR) is required if the system has lead service line and continues to have lead levels in excess of the Action Level after a corrosion control and/or a source water treatment process has been installed. The USEPA-required schedule for lead service line replacement is 7% of lead service lines per year, although individual states can require an accelerated

schedule. Lead service line replacement can be discontinued once the lead levels at the taps are below the Action Level for two consecutive six-month monitoring periods.

There are two types of lead service line replacement, partial and full. A water system can monitor the lead levels in the lead service line to determine if the lead service line requires replacement. If lead levels are ≤0.015 mg/L, then the lead service line does not require replacement and counts as a replaced line. A lead service line replacement will be required if the lead service line lead levels are >0.015 mg/L.

Monitoring can stop once a full lead service line replacement is conducted. For a partial lead service line replacement, a water sample representative of the water in the remaining portion of the lead service line needs to be collected 72 hours after the replacement. The results of this sample must be mailed to the building owner and residents (if different) within three days of receipt of the results by the water system.

2007 Revisions to the LCR

The USEPA reviewed the implementation of the Lead and Copper Rule (LCR), to determine if additional guidance or changes to the regulation might be needed. In March, 2005, they announced a "Drinking Water Lead Reduction Plan' to clarify specific areas of the rule and associated guidance materials. There were four specific areas of the LCR that were reviewed and included in a final rule published October 10, 2007 (USEPA 2007). First, the revisions clarified sample collection procedures relating to the number of samples that should be collected and the number of sites that should be sampled. Secondly, it required utilities to gain approval from their primacy agency for any changes in treatment or source water that could increase corrosion of lead. Thirdly, utilities were required to provide lead level monitoring results to homeowners, and finally, the revisions added a requirement that previously 'tested-out" lead service lines must be reconsidered if a utility is re-triggered into lead service line replacement.

References

USEPA. 1991. "Drinking Water Regulations; Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper; Final Rule." 40 CFR, parts 141 and 142. *56 Federal Register No. 110*, June 7, 1991`

USEPA. 1992. *Lead and Copper Rule Guidance Manual. Volume II: Corrosion Control Treatment.* Office of Water. EPA 811-B-92-002.

USEPA. 2000. Drinking Water Regulations; Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper; Final Rule. 40 CFR, Parts 9, 141, and 142. *65 Federal Register No. 8*, January 12, 2000

see also

http://www.epa.gov/safewater/lcrmr/index.html