LCR Long-term Revisions White Paper

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Background for the Current Lead and Copper Rule Revisions Process

Under the Safe Drinking Water Act (SDWA) EPA sets public health goals and enforceable standards for drinking water quality.[1] The Lead and Copper Rule (LCR) is a treatment technique rule. Instead of setting a maximum contaminant level (MCL) for lead or copper, the rule requires public water systems (PWSs) to take certain actions to minimize lead and copper in drinking water, to reduce water corrosivity and prevent the leaching of these metals from the premise plumbing and drinking water distribution system components and when that isn't enough, to remove lead service lines.

The current rule sets an action level, or concentration, of 0.015 mg/L for lead and 1.3 mg/L for copper. An action level is not the same as an MCL. An MCL is based on health effects; whereas an action level is a screening tool for determining when certain treatment technique actions are needed. Because the LCR is a treatment technique rule, the LCR action level is based on the practical feasibility of reducing lead through controlling corrosion. In the LCR, if the action level is exceeded in more than ten percent of tap water samples collected during any monitoring period (i.e., if the 90th percentile level is greater than the action level), it is not a violation, but triggers other requirements that include water quality parameter monitoring, corrosion control treatment (CCT), source water monitoring/treatment, public education and lead service line replacement (LSLR). The rule also requires States to report the 90th percentile for lead concentrations to EPA's Safe Drinking Water Information System (SDWIS) database for all water systems serving more than 3,300 persons and for those systems serving fewer than 3,300 persons only when the lead action level is exceeded. States only report the 90th percentile for copper concentrations in SDWIS when the copper action level is exceeded in water systems regardless of the size of the service population. Public education requirements ensure that drinking water consumers receive meaningful, timely and useful information that is needed to help them limit their exposure to lead in drinking water.

In early 2004, EPA began a wide-ranging review of the implementation of the LCR to determine if there was a national problem related to elevated levels of lead in drinking water. As part of its national review, EPA collected and analyzed lead concentration data and other information, carried out a review of implementation in States, held four expert workshops to discuss elements of the regulations and worked to understand local and State efforts to monitor for lead in school drinking water, including a national meeting to discuss challenges and needs. EPA released a Drinking Water Lead Reduction Plan (DWLRP) in March 2005. This plan outlined short-term and long-term goals for improving implementation of the LCR. The plan can be found at the following web address:
http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/lead_review.cfm

In 2007, EPA promulgated regulations, which addressed the short-term revisions to the LCR that were identified in the 2005 DWLRP. These requirements enhanced the implementation of the LCR in the areas of monitoring, treatment, LSLR, public education and customer awareness. These revisions better ensured drinking water consumers receive meaningful, timely and useful information needed to help them limit their exposure to lead in drinking water.

EPA has continued to work on the long-term issues that required additional data collection, research, analysis and full stakeholder involvement, which were identified in the 2005 DWLRP and the 2007 rule revisions. This new action is referred to as the LCR Long-term Revisions (LTR) The LCR LTR would apply to all community water systems (CWSs) and non-transient non-community water systems (NTNCWSs). EPA's primary goal for the LCR-LTR is to improve the effectiveness of the corrosion control treatment in reducing exposure to lead and copper and to trigger additional actions that equitably

[1] EPA establishes national primary drinking water regulations (NPDWRs) under SDWA. NPDWRs either establish a feasible maximum contaminant level (MCL) or a treatment technique "to prevent known or anticipated adverse effects on the health of persons to the extent feasible."

reduce the public's exposure to lead and copper when corrosion control treatment alone is not effective. While not inclusive of all potential revisions to the LCR, key categories where revisions are being considered are:

- Sample site selection criteria for lead and copper
- Lead sampling protocols
- Public education for copper
- Measures to ensure optimal corrosion control treatment
- Lead service line replacement

Previous Federal Advisory Committee Involvement

EPA has sought input from Federal Advisory Committees on two previous occasions. The Science Advisory Board (SAB) provides comments to EPA on the quality and relevance of scientific and technical information supporting EPA's national drinking water standards. The Office of Ground Water and Drinking Water (OGWDW) formally requested SAB evaluation of current scientific data to determine whether partial lead service line replacements are effective in reducing lead drinking water levels. The SAB issued their report on September 28, 2011. (See http://yosemite.epa.gov/sab/sabproduct.nsf/0/964CCDB94F4E6216852579190072606F/$File/EPA-SAB-11-015-unsigned.pdf)

EPA also previously consulted with the National Drinking Water Advisory Council (NDWAC) in meetings on July 21-22 and November 18, 2011(see http://water.epa.gov/drink/ndwac/meetingsummaries/index.cfm) and wrote a letter to EPA on December 23, 2011 (see http://water.epa.gov/drink/ndwac/upload/ndwaclettertoepadec2011.pdf).

EPA continues to require input on the feasibility and cost effectiveness of potential revisions to the Lead and Copper Rule. Therefore, EPA is convening a NDWAC working group to consider several key questions for the LCR LTR, taking into consideration previous input.

Key Issues for Consideration

EPA's goal for the LCR-LTR is to improve the effectiveness of corrosion control treatment in reducing exposure to lead and copper and to trigger additional actions that equitably reduce the public's exposure to lead and copper when corrosion control treatment alone is not effective. Lead and copper are present in plumbing materials and water distribution system components throughout the United States. Therefore, treating the water to make it less likely to corrode lead and copper from these materials remains the most cost effective way to reduce exposure to these metals. However, because corrosion control is not always effective, the LCR must compel additional actions in those systems that cannot sufficiently reduce lead and copper levels. Those actions should provide equitable protection to all of the consumers. In making these improvements, EPA seeks to advance the goal of environmental justice, which is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income. The following is a description of key issues and questions for which EPA seeks stakeholder input in achieving these goals. This document is meant to lay the initial foundation for the stakeholder process, with more detailed technical information and questions likely to be raised during future working group meetings.

A. Sample Site Selection Criteria

Goals/objectives of rule change: In the preamble to the LCR in 1991, EPA wrote that it believes, "…that the requirement to collect samples from locations that are most likely to have high concentrations of lead and copper in drinking water is reasonable and necessary given the nature of the problem of corrosion…" Thus, the goal of the LCR sample site selection criteria is to target locations with high-risk lead and copper in drinking water systems in a cost-effective manner. Selection and use of the highest risk sites is important, because the number of samples collected is relatively small and contaminant levels can vary between systems and sites based on water quality and distribution system and usage characteristics. Targeting these locations helps ensure that appropriate action is taken if a lead or copper problem is identified in the system.

Background Information

The 1991 LCR established a tiering system for prioritizing the selection of sampling sites based on the likelihood of the sites to release elevated levels of lead and copper; for lead, sites with lead service lines (LSLs), lead pipes, or copper pipes with lead solder; for copper, copper pipes with lead solder. The figure below outlines the current rule requirements.

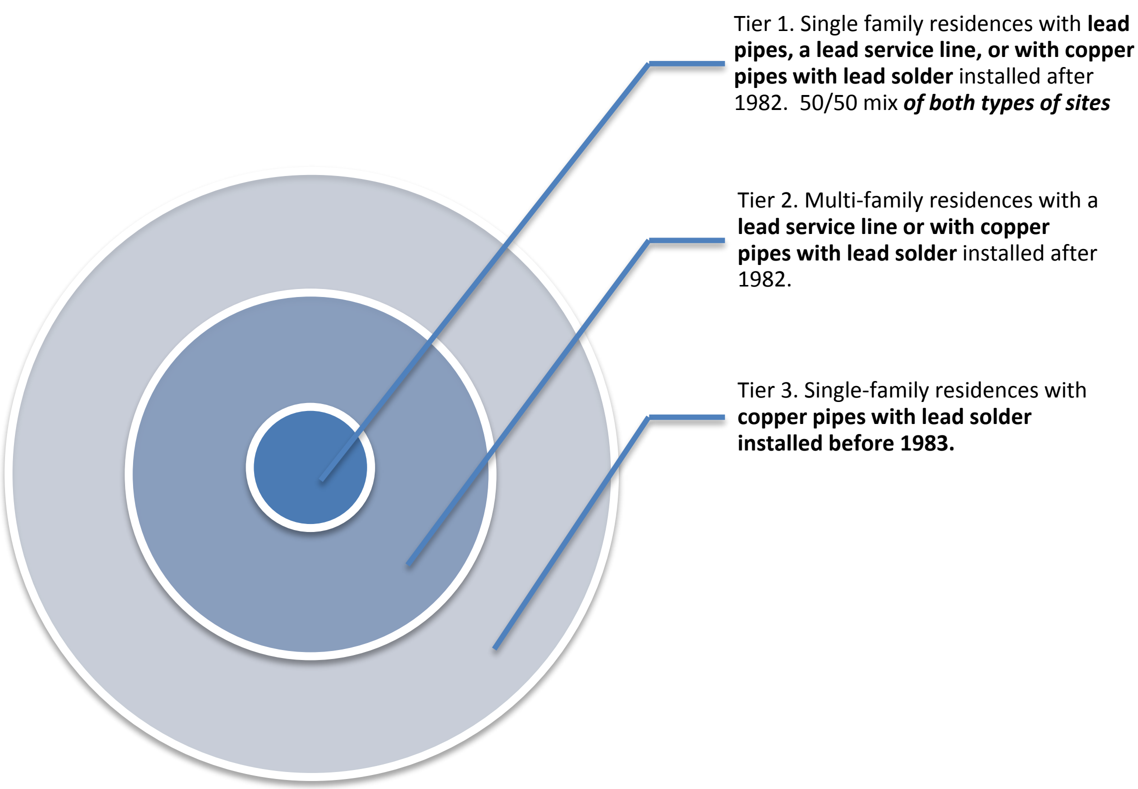

Figure 1: Current Site Selection (tiering) Structure

Although EPA made short-term revisions to the LCR in order to address some implementation issues in January 2000 (65 CFR 1950) and October 2007 (72 CFR 57781), the Agency has not revised the tiering criteria since the rule was promulgated in 1991. New information exists regarding lead and copper release patterns, which raises the question of whether the current sample site selection criteria should be revised. Key points include:

Lead

- Full and partial LSLs represent the greatest source of lead to drinking water. Public lead service line replacement (PLSLRs) are frequently associated with short-term elevated drinking water lead levels, that tend to gradually stabilize overtime, sometimes at levels below and sometimes at levels similar to those observed prior to the replacement. The current criteria do not solely prioritize sampling from LSLs (full or partial).
- Over twenty years have passed since lead solder was banned in all jurisdictions. Because lead release from solder decreases with time, these sites now are likely to be releasing levels of lead comparable to contributions by brass plumbing components and interior pipe corrosion byproduct scales.
- Studies have shown that much higher lead levels are frequently found in water in contact with lead service lines.
- Lead has been shown to accumulate in corrosion scales or deposits formed in premise plumbing, downstream of LSLs and can be released sporadically, often in response to treatment changes or line disturbances.

Copper

Since 1991, a large body of published corrosion literature on copper has shown that copper and lead release patterns differ. The original LCR sample site selection criteria for copper no longer targets highest-risk copper, since these sites have now aged. Water chemistry and pipe age play a more dominant role than what was originally thought for copper release.

- Corrosion can occur in copper plumbing of any age. However, in the presence of certain water qualities, copper levels in excess of the action level are most likely to occur in newly constructed homes and buildings with copper plumbing, or at sites that have been recently renovated with new copper plumbing. Corrosion of new copper pipes is not a problem for many water systems. It is limited to water systems that have water quality aggressive to copper.

- Water chemistry characteristics that contribute to copper release also can vary in different zones within a distribution system as well as between different systems with respect to aggressiveness to copper.

Lead and Copper

- Differences exist between lead and copper release patterns in water systems.

- Water chemistry variations within the water distribution system vary temporally and spatially. This phenomenon affects the site selection for lead, as well as copper. In order to capture high-risk sites, it is important that sampling reflect zones where water quality is aggressive to these contaminants.

- Research since the 1991 rule indicates that brass and other metallic premise plumbing materials may be a more significant immediate and long-term source of lead and copper in drinking water than originally believed, especially in newer homes.

EPA is evaluating whether the sampling sites as outlined in 1991 are still the appropriate sites to monitor to assess the effectiveness of corrosion control treatment for both lead and copper. EPA is revisiting these criteria to examine whether they target the sites most likely to leach elevated levels of lead and copper and, thus, serve as good indicators of whether corrosion control treatment is needed or has been optimized. Selection and use of the highest risk sites is important, since the number of samples collected is relatively small, contaminant levels can vary between systems and sites (water quality, plumbing configuration(s) and usage patterns contribute to variations in lead and copper levels). Public health protection is the main goal of the LCR, but because the LCR is a treatment technique rule, sites are selected to assess performance of systems' corrosion control treatment not to assess exposures.

- In order to better target each contaminant, EPA is considering revising the site selection criteria to create two separate tiering structures, one for systems with LSLs and another for systems without LSLs.
- EPA also is evaluating whether to monitor at separate sites for copper. EPA is considering requiring PWSs to conduct copper monitoring at separate sampling sites with new copper piping, which are likely to have elevated copper levels.
- EPA also is considering allowing a copper monitoring waiver which would allow systems with water qualities not considered aggressive to copper to eliminate copper monitoring. This copper waiver could reduce costs for systems that can demonstrate water qualities which are unlikely to leach copper (e.g. a system that provides no disinfection or oxidation treatment and meets a specific pH criterion; or a system with disinfection and/or oxidation treatments that has water quality parameters within the specified pH and alkalinity ranges).

Discussion questions:

- How should sample site selection criteria be developed to capture the highest risk sites for both lead and copper in a simple, health protective and cost effective way? Is the knowledge base on both lead and copper sufficient to confidently respond to the question?
- At what sites should lead and/or copper samples be taken to be representative of the greatest release for each contaminant?
- Should sampling for lead and copper occur at separate sites? If so, what could the potential sampling scheme look like?
- What are the cost implications of developing separate sampling sites
- Should the sample site selection criteria for LSL systems and non-LSL systems differ to prioritize sampling from locations likely to demonstrate the greatest release for each contaminant? If so, what would that sample site selection criteria look like?
- How many samples for each contaminant would be needed to be statistically significant?
- What age copper piping should be sampled in order to capture the greatest likelihood of copper release?
- In what ways could evaluating water quality parameters from all systems be used to help identify systems with zones of water quality aggressive to copper? For lead?
- Would taking copper samples from pipe rigs (with copper the same age as in the distribution system) be useful in helping to reduce sampling burden for large systems? If so, how and how should the data be used to determine action level compliance?
- What might copper waiver conditions look like, including water quality and non-water quality based conditions?
- How many systems can consistently meet water quality parameters, showing that water is not aggressive to copper, to obtain a copper waiver?

- How could water quality parameter data be used to accurately assess which systems are likely to need copper monitoring and which do not?
  - How might these data be used to develop copper monitoring waivers for systems meeting specific water quality criteria?
  - Do you have or know of data that EPA could consider to develop such waivers

B. Lead Sampling Protocol

Goals/objectives of rule change: Establish procedures that will result in a PWS having a set of samples that will assess the corrosivity of the water being provided and/or to indicate if the corrosion control is effective in reducing lead and/or copper corrosion from LSLs and plumbing materials.

Background

The current LCR contains a single sampling procedure for both sites with lead service lines and sites with lead-soldered copper pipes. A one-liter first draw sample (no water wasted prior to drawing the sample) is taken after a minimum six-hour stagnation time. The current sampling protocol allows residents to collect the first-draw samples.

Lead Service Line Sampling

EPA analyzed data from a number of studies where sequential samples were taken at the same site to generate a profile (i.e. several consecutive liters of water were taken and analyzed until water that had been in contact with the LSL was reached) and found that the first draw sample may underestimate the amount of lead that can be in samples in contact with the LSL. Where they are present, LSLs (full or partial) are the greatest source of lead in the distribution system. EPA is considering different sampling procedure options for sites with a partial or fully intact LSL to better assess the amount of lead contributed by lead service lines and, thus, whether further action is needed to reduce the corrosivity of the water.

One service line sampling approach is to collect and discard a specific number of liters prior to taking (using a fresh bottle) a one-liter sample representative of the service line. The sampling instructions would be the same for all sites in the sampling pool. A challenge to this approach is determining the specific number of liters to collect and waste to get a representative sample, since plumbing configurations and service line lengths will vary across sites.

Another service line sampling approach is to collect a series of sequential samples at each site in the sampling pool to identify the liter containing the highest lead at the site (an initial profile) and use that site-specific identified liter for subsequent monitoring and compliance purposes. In subsequent monitoring periods, the number of liters to get to that sample would be wasted before the one-liter service line sample for that site would be collected in a new sample bottle. The volume of water being wasted prior to sample collection will vary among sites under this approach. This approach seeks to balance obtaining site-specific samples while reducing analytical costs since sequential sampling to identify the liter containing the highest lead would be conducted one time at each location and when new sampling sites were added to the pool. An important consideration with this approach would be whether the added complexity could be appropriately managed by the public and drinking water utilities to ensure reproducible results.

The logistics of sampling present other challenges, e.g. in working with homeowners to collect service line samples.

Aerators

Another sampling instruction issue is the inclusion of recommendations to remove the aerator and clean it before the start of the stagnation period. EPA issued guidance on October 20, 2006 indicating that PWSs should not recommend that customers remove or clean aerators before or during the collection of tap samples for lead. While removal and cleaning of the aerator is advisable on a regular basis, if customers are only encouraged to remove and clean aerators prior to drawing a sample for lead, the system could fail to identify the typically available contribution of lead from that tap and thus fail to take additional actions needed to reduce exposure to lead in drinking water.

Pre-stagnation Flushing

A third sampling instruction issue for service line samples is pre-stagnation flushing and what that means with respect to whether the sample was in contact with the faucet and interior plumbing or with the lead service line. Some systems' sampling instructions recommend flushing the tap for an extended period of time (5 minutes or longer) prior to the start of the minimum six-hour stagnation time. Concerns about this practice include whether it leads to biasing the sample downward (e.g. by flushing particulates). One approach would be to prohibit recommendations on pre-stagnation flushing in the sampling instructions. EPA is looking for input on other alternatives that best represent the water in the service line.

Number of Required Sample Sites

The number of sample sites in the current LCR varies by the size of the system and monitoring frequency. The number of sites range from 5 to 100 under standard monitoring and from 5 to 50 under reduced monitoring. Each sample is analyzed for both lead and copper. The distribution of sample sites is not addressed in the current LCR. A sampling protocol that better represents the contribution of the service line to lead levels in the water may allow a reduction in the number of sites that need to be monitored to assess the effectiveness of corrosion control in lead service line systems.

The number of sample sites needed to target high-risk sites (and to assess corrosion control for those systems using CCT) should be considered for systems with and without LSLs. Sampling sites that better represent the contribution of copper may necessitate separate sampling sites and perhaps a different number of samples, for lead and copper, rather than a single sample being analyzed for both contaminants. LSL samples may not adequately reflect copper levels because of limited contact with copper; however, it may be possible to assess the effectiveness of corrosion control solely by the lead levels from the service line samples.

Another issue is that a water system may have a variety of water sources within its system and the sampling sites as they are currently configured may not be able to capture all the water quality variability (which affects lead and copper corrosion) within the distribution system. Thus, it may require more specific targeting of sampling sites to assess over all corrosion control effectiveness given this variability.

While there are a variety of factors that can influence the number of sampling sites necessary to assess the effectiveness of corrosion control in an individual system, the LCR does need to have baseline monitoring for all classes of systems for effective rule implementation.

Discussion questions:

- For locations with LSLs, what does a cost-effective lead sampling procedure look like that captures lead where concentrations are likely highest?
    - Who should collect samples? The PWS? The homeowner/resident? If the latter, how can the procedure be reliably executed? How can instructions to homeowners/residents be as clear and easy to follow as possible?
    - Should aerator removal be addressed? If so, how?
    - What are the pros and cons of addressing pre-stagnation flushing of pipes? How should this issue be addressed, if at all? What is the best way to represent the water in the service line?
    - What are the advantages/disadvantages of a single prescriptive liter versus a site-specific sequential sampling approach?
    - Under what conditions could OCCT be based on the lead results from the lead service line samples?
- What is an appropriate number of samples to be collected by a water system to capture the highest risk lead and copper sites in the distribution system and, where CCT is in place that will indicate if the corrosion control is effective in reducing lead? In reducing copper?
    - How important is the size of the PWS population in determining this number?
    - How much does geographic distribution of samples matter, particularly with respect to non-homogenous water quality and non-homogeneous construction distribution?

C. Public Education for Copper

Goals/objectives of rule change: To improve the health of consumers by motivating consumers to take actions in reducing exposure to copper in drinking water in systems with elevated copper levels.

Background

While corrosion can occur to copper plumbing of any age, in certain water qualities copper levels in excess of the action level are most likely to occur in newly constructed homes and buildings with copper plumbing, or at sites that have been recently renovated with new copper plumbing. Corrosion of new copper pipes is not a problem for many water systems. It is limited to water systems that have water quality that is aggressive to copper. The health effects of copper are nausea and vomiting (short-term) and there may be liver damage and possible nervous system effects in sensitive subpopulations (e.g. individuals with Wilson's disease). Both the maximum contaminant level goal (MCLG) and action level for copper (1.3 mg/L) were established based on the prevention of acute nausea as a result of elevated copper levels in drinking water. EPA recommends that individuals with Wilson's disease should consult their personal physician if the levels of copper in their water exceed the action level. Infants fed formula prepared with copper-tainted tap water consume a higher amount of tap water on a per body weight basis than adults, which may increase their risk for an adverse response.

Currently, there are no public education materials[2] or informational statements[3] provided on the health risks of copper exposure, or steps consumers can take to reduce their risk of exposure. EPA is evaluating whether materials should be provided to consumers to address potential exposures to copper in premise plumbing. EPA is also evaluating the target audience for any materials that might be developed. The Agency is considering requiring copper public education materials for systems exceeding the copper action level and/or a brief informational statement to consumers served by systems which have water quality aggressive to copper.

Outreach materials[4] could explain the potential health effects of elevated copper, the likelihood of copper levels being higher at newly built homes and buildings where water quality is aggressive to copper and actions that the consumer can take to reduce their exposure to copper.

The following are key elements that EPA is considering for a public education requirement for copper in the event of a copper action level exceedance:

(1) Explanation of what copper is, the possible sources of copper in drinking water and how copper enters drinking water;
(2) Explanation of copper health effects;
(3) Steps the consumer can take to reduce their exposure to copper in drinking water;
(4) Explanation of why there are elevated levels of copper in the system's drinking water (if known) and what the water system is doing to reduce the copper levels in homes/buildings in the area; and
(5) Explanation of the likelihood of concern related to copper leaching from copper pipes in homes/buildings in the area.
(6) Explanation of what other plumbing materials are available for use in water qualities aggressive to copper, that a builder or consumer might choose to reduce their exposure to undesirable levels of copper in the water.

Discussion questions:

- Are there aesthetic warning signals of copper corrosion in drinking water and, if so, what are they and what recommendations should be given to consumers to help them avoid the health effects of copper through consumption of drinking water?
- Should copper public education materials be included in the LCR using the same basic structure as the public education materials for a lead action level exceedance?
- Should different types of outreach materials to consumers with different content be required depending on whether or not the copper action level is exceeded? If so, what information should be included (e.g., public education for an action level exceedance, informational statement about copper if an action level is not exceeded)?
- If copper public education materials or informational statements are required, what should the delivery frequency be?

[2] These "public education materials" may be delivered to all consumers in the distribution system when the public water system has exceeded the copper action level. The mechanism of delivery could be similar to the way consumers are educated about lead after a lead action level exceedance.
[3] The term "informational statements" describes educational materials that would be delivered to consumers in the distribution system when systems have water quality that is aggressive to copper but delivery would not be based on exceeding the copper action level.
[4] The term "outreach materials" is a general term used to describe any materials that are distributed to the public.

- If public education is not required for copper action level exceedances, should EPA require systems to deliver outreach materials/informational statement to consumers who visit or live in a newly/recently built or renovated building/dwelling with new copper piping?
  - Should systems be required to identify newly/recently built or renovated building/dwelling with new copper piping?
  - Should systems be required to work with local inspection services to incorporate the outreach materials or informational statement into building/dwelling occupancy permits?
  - How much and what kind of direction should be provided by EPA with respect to public education materials or informational statements?
- If a water system demonstrates water quality aggressive to copper, should those consumers receive informational statements about copper? If so, what information should be included?

D. Measures to Ensure Optimal Corrosion Control Treatment

Goals/objectives of rule change: Enhance the process for systems to improve the effectiveness of their corrosion control treatment; ensure adequate incentives for optimization and provide greater clarity about treatment optimization.

Background information

The Lead and Copper Rule requires systems to install optimized corrosion control treatment (OCCT) while insuring that the treatment does not cause the water system to violate any NPDWRs. Since the promulgation of the LCR and the initial optimization of corrosion control, systems have faced the ongoing challenge of continuing to maintain optimal corrosion control while making necessary adjustments to treatment processes or system operations unrelated to corrosion control to comply with other NPDWRs. The current optimization process includes requirements for systems to:

- Conduct monitoring
- Conduct a CCT study (if required by the State)
- Obtain State designated OCCT
- Adjust existing CCT
- Conduct follow-up monitoring
- Obtain State review of installation of CCT and designation of optimal water quality parameters (OWQPs)
- Operate the treatment in compliance with OWQPs

Research has shown that there are many factors that can affect lead and copper levels. Maintaining OCCT can be challenging; therefore EPA is evaluating a number of revisions to the corrosion control requirements that make targeted improvements to the current process:

- Expand scope of study for systems with LSLs to include a system-wide assessment of factors that may limit the effectiveness of the CCT or the ability of the system to optimize their treatment. Allow the State and/or EPA to tailor study requirements for systems without LSLs. LSLs contribute about 50-70% of the total mass of lead at consumer’s taps. To a lesser extent, premise plumbing contributes about 20-35% of total lead mass measured at the tap and meters contribute less than that..

- Consistent with international experience, require systems using orthophosphate to evaluate higher doses and those systems not using orthophosphate to study its use for their system.
- Revise steps and deadlines for corrosion control treatment.
- Allow Non Transient Non Community Water Systems (NTNCWSs) serving fewer than 10,000 people the option of installing Point of Use (POU) treatment units in lieu of having to install CCT as a potentially more effective mechanism to reduce lead exposures in these systems.

Determining whether treatment is optimized can be challenging, given the variety among systems in their distribution system composition, water qualities and other circumstances. One idea under consideration is the addition of a system-wide assessment as part of the mandatory CCT study requirements for systems with LSLs. This is intended to ensure the studies are comprehensive and that the proposed treatment addresses any existing or anticipated water quality, treatment or operational issues that may interfere with or limit the effectiveness of the corrosion control optimization or re-optimization.

While some changes are well understood for their potential to adversely affect lead and copper levels, such as fluctuations or changes in pH or alkalinity, others are more complex and involve factors like the quantity and type of disinfectant used or the chemical composition of the protective scales within the lead service lines. In a system-wide assessment, a water system will evaluate the variability of water quality throughout the distribution system due to differences in source water quality within distinct hydraulic boundaries, different or variable residence times and multiple types of distribution system materials. Revisions to the study elements would also target key parameters that are known to affect or limit the effectiveness of CCT generally, such as the variability of pH and alkalinity, as well as more system-specific water quality or process control parameters. Since the promulgation of the original LCR, research has confirmed the most effective treatments for optimization of corrosion control are pH/alkalinity adjustment and the use of orthophosphate. Consequently, EPA is considering removal of the requirement for systems to study calcium hardness adjustment as a potential option for optimizing corrosion control, along with the associated mandatory monitoring for calcium, conductivity and water temperature. EPA is also considering more specific requirements for systems that are currently not using orthophosphate to study the use of orthophosphate and for systems using orthophosphate to study the use of higher dosages of orthophosphate. EPA will consider alternatives to orthophosphate where appropriate and effective to reduce the waste water discharge burden of phosphorous in those areas sensitive to phosphorous release.

A key provision of the LCR requires water systems to sample for State approved OWQPs. OWQPs are measurable indicators that help systems determine if they are maintaining optimal CCT. Corrosion control treatment techniques are means specified in the rule, such as pH/alkalinity adjustment and the addition of corrosion inhibitors (e.g., orthophosphate) that promote the formation of insoluble scales that prevent lead from leaching from pipes into the drinking water. Having proper OWQPs is the method by which EPA, States and water systems know whether water characteristics are in the ideal range (determined through CCT optimization studies) for their corrosion control methods.

After water systems recommend OWQPs, it is up to the States to approve them. Currently, OWQP ranges may not be set as tightly as needed to effectively control lead corrosion for those systems that continue to exceed the lead action level. EPA is evaluating whether to require systems exceeding the lead action level to re-optimize CCT, before being triggered into LSLR and if that re-optimization process should be well-defined.

Under the current LCR, a system that exceeds an action level is required to install CCT, but may cease conducting lead and copper tap and WQP monitoring while it is evaluating and installing CCT. Regular monitoring during this timeframe may provide additional information to the systems and States to ensure the proper treatment is installed and fully optimized.

EPA is considering designating lead service line systems that have optimized or re-optimized corrosion control for lead to also be deemed to have optimized corrosion control for copper.

Discussion questions:

- How can LCR requirements be structured to encourage optimal corrosion control treatment and retain enforceability?
- How can existing OWQP monitoring requirements be strengthened while retaining implementability? What is the most effective way for reducing lead exposure?
- What are the challenges to optimizing corrosion control treatment?
- What are some of the lessons learned from implementing corrosion control treatment?

E. Lead Service Line Replacement

Goals/objectives of rule change: Remove sources of lead in the distribution system; encourage optimization of CCT to prevent lead leaching; address environmental justice concerns associated with LSLR; and maintain and enhance enforceability of the LCR.

Background

Under the current LCR, water systems that exceed the lead action level after the installation of CCT and/or source water treatment must annually replace at least seven percent of the initial number of LSLs in their distribution system. To meet the seven percent annual LSLR requirement, systems can do full or partial LSLRs or “test out” a LSL if all samples from it are at or below the lead action level (*i.e.*, a “tested-out” line is not physically replaced, but is still counted as such for the seven percent LSLR requirement). A concern with “test outs” is they may not reliably reflect the lead levels in the water because they only represent a single snap shot in time. Under the current LCR, systems must replace the portion of the LSL they own/control. Where a system does not own/control the entire LSL, it must offer to replace the owner’s portion at his or her expense. If the owner elects not to have his or her portion replaced, then the system is not required to replace the privately-owned portion. This results in a PLSLR.

One of the challenges of full LSLR versus PLSLR is environmental and public health equity among customers of different economic means and home ownership status.

For the LCR, EPA’s current interpretation of the term “control” is limited to what a water system owns. But in the original 1991 LCR EPA established a broad definition of control as it applies to LSLs in the distribution system that included: (1) authority to set standards for construction, repair or maintenance of the line; (2) authority to replace, repair or maintain the service line; or (3) ownership of the line. American Water Works Association challenged EPA’s original definition of control. The court remanded the matter because EPA failed to provide adequate notice and comment on the control definition. In 1996, EPA proposed a revised definition of control. EPA solicited comments regarding the degree to which systems may have the authority to replace the privately-owned portions of LSLs. EPA also solicited comments regarding the option of only requiring replacement of the portion of the LSL owned by the system. In the final rule in 2000, EPA elected to define control as ownership to eliminate confusion and avoid rule implementation delays. Thus, under the current LCR a water system is not required to pay the cost of replacing the portion of the LSL that it does not own.

EPA asked the Science Advisory Board (SAB) to evaluate the current scientific data regarding the effectiveness of PLSLR and the review centered around five issues: (1) associations between PLSLR and blood lead levels in children; (2) lead tap water sampling data before and after PLSLR; (3) comparisons between partial and full LSLR; (4) PLSLR techniques; and (5) the impact of galvanic corrosion.

The SAB found that the quantity and quality of the available data are inadequate to fully determine the effectiveness of PLSLR in reducing drinking water lead concentrations. The small number of studies available had major limitations (small number of samples, limited follow-up sampling, lack of information about the sampling data, limited comparability between studies, etc.) for fully evaluating PLSLR efficacy. Nevertheless, despite these limitations, the SAB concluded that PLSLRs have not been shown to reliably reduce drinking water lead levels in the short-term, ranging from days to months and potentially even longer. Additionally, PLSLR is frequently associated with short-term elevated drinking water lead levels for some period of time after replacement, suggesting the potential for harm, rather than benefit during that time period. The available data suggest that the elevated tap water lead levels tend to increase then gradually stabilize over time following PLSLR, sometimes at levels below and sometimes at levels similar to those observed prior to PLSLR.

The SAB also concluded that in studies comparing full LSLR versus PLSLR, the evaluation periods were too short to fully assess differential reductions in drinking water lead levels. However, the SAB explained that full LSLR appears generally effective in reliably achieving long-term reductions in drinking water lead levels, unlike PLSLR. Both full LSLR and PLSLR generally result in elevated lead levels for a variable period of time after replacement. The limited evidence available suggests that the duration and magnitude of the elevations may be greater with PLSLR than full LSLR.

EPA is contemplating several revisions to mandatory LSLR requirements. Options that would be helpful to evaluate include:

- Delaying mandatory LSLR requirement until after CCT re-optimization.
- Considering an expanded definition of control similar to what was included in the 1991 LCR to facilitate full LSLRs.
- Eliminating the requirement to do a PLSLR when the property owner does not agree to pay for the replacement of the portion of the LSL on private property after the action level has been exceeded. Full LSLR would be required by the LCR if the water system owns the entire LSL, or the property owner agrees to pay for the replacement on the private side or if the water system voluntarily pays the entire cost after the action level has been exceeded.
- Eliminating the “test-out” provision.
- Requiring water systems to provide impacted owners and residents with a NSF/ANSI 53 certified pitcher-filter or other treatment unit that removes lead before the system begins any LSLRs.

Discussion Questions:

- Has the seven percent annual LSLR requirement been an effective part of the LCR and, if so, what has been achieved? How does it impact compliance tracking and enforcement? If PLSLR requirements were to be eliminated, what other options could accomplish similar results?
- Should EPA consider another percentage requirement for LSLRs instead of 7%? If so, what. What would the impact be on incentives for treatment optimization?

- If PLSLRs and “test outs” are no longer allowed, then how might a water system obtain a sufficient number of agreements from owners and residents to achieve full LSLRs at an annual rate of at least seven percent?
- When optimization does not bring lead levels under the action level how should systems reduce exposure from LSLs in a way that protects public health, is feasible and assures equitable protection among the system’s users?
- If EPA requires the public and privately-owned portions of the LSLs to be removed, how would systems go about educating owners and residents about the importance of LSLR once triggered into the mandatory replacement program?
- Would water systems be more likely to achieve greater LSLRs with an expanded definition of control? What would result if EPA does not change the definition of control?
- What are the environmental justice concerns associated with LSLRs? How can an even distribution of benefits be achieved, to avoid either disproportionate health or economic impacts?
- If the definition of control is expanded beyond ownership and the water system is required to replace the entire LSL, including any portion on private property, how can costs be allocated equitably?
- What measures might a PWS and/or its customers employ to address temporarily elevated lead levels during the times of exposure when LSRL and/or reoptimization is occurring?