Preparing for the Lead and Copper Rule Long-Term Revisions

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The Lead and Copper Rule (LCR), established in 1991, requires utilities to monitor and control lead and copper levels in drinking water. The proposed LCR long-term revisions (LTR) released in 2019 propose sweeping changes to many aspects of the rule, constituting the first major update to the National Primary Drinking Water Regulations in more than a decade, which will impact every water system in the United States.

A number of regulatory changes within the proposed revisions have a deadline of three years for compliance, and with the U.S. Environmental Protection Agency (EPA) committing to publication of the final LCR revisions in September/October 2020, utilities have begun taking proactive steps toward meeting these proposed requirements.

The revisions will significantly alter how utilities implement corrosion control treatment, conduct compliance sampling, manage lead service lines (LSL), and communicate with customers. Understanding the implications of these revisions will allow utilities to plan for continued compliance, and an online interactive tool has been developed to help utilities proactively prepare (https://www.hazenandsawyer.com/infographics/lead-copper-rule-revisions/).

Lead and Copper Tap Sampling Prioritizes Lead Service Lines

The proposed LCR revisions redefine compliance site selection criteria and place a priority on sampling from sites with the highest potential for lead release—those containing LSL. Water systems will need to reevaluate their LCR sample site selection to determine if compliance monitoring locations comply with the proposed tier requirements (Figure 1).

Special Sampling Requirements

The LCR revisions also introduce additional sampling requirements. This proposed regulatory change will require utilities to adopt new protocols for evaluating and mitigating lead release on a site-specific basis (i.e., "find-and-fix"), increasing utility coordination and communication with customers. Utilities will also be required to sample from schools and childcare facilities, where high-risk populations, including children, are present. To meet this requirement, utilities will need to develop a sampling plan for these high-risk locations and develop procedures to communicate both the sampling results and potential actions the locations can take to reduce lead in drinking water.

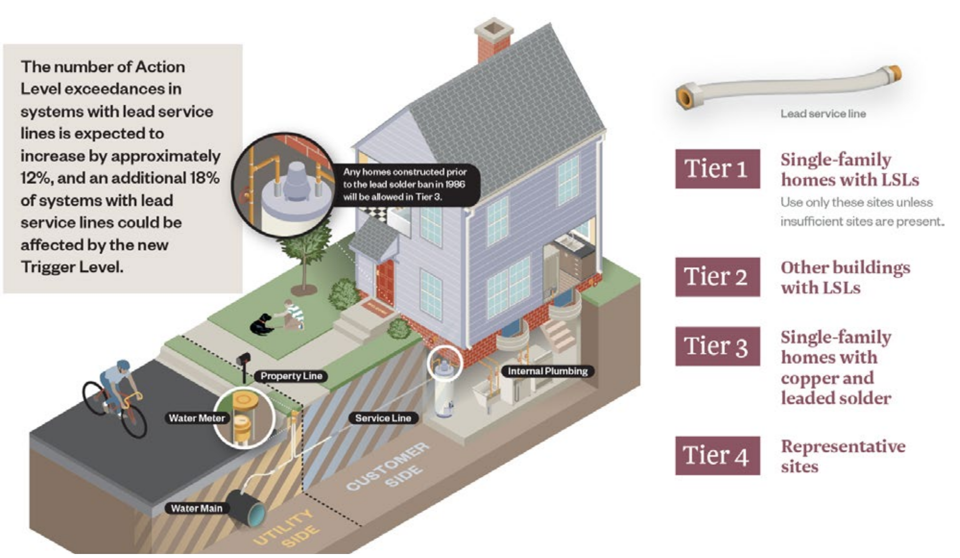

Figure 1. Proposed Tier Requirements

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Trigger-Level Changes Further Protect Public Health

In addition to the current maximum contaminant level goal (MCLG) of zero, and an action level (AL) of 15 parts per bil (ppb) for lead, the revised LCR aims to strengthen corrosion control treatment and further protect public health by establishing a new trigger level (TL) of 10 ppb. Revisions to the LCR define a tiered response of required actions based on the level of exceedance (TL and AL).

Approximately 10 percent of systems that participated in a 2019 corrosion control treatment survey (Figure 2) reported historical 90th percentile lead levels between 10 and 15 ppb and would be affected by the proposed TL (Arnold, Rosenfeldt et al., 2020).

Corrosion Control Treatment Becomes High Priority

According to the proposed revisions, utilities will be required to conduct a corrosion control study if either the lead TL or AL is exceeded. Utilities may also be required to conduct a corrosion control study prior to a source water or treatment change, or if EPA or a state regulatory agency deems the utility's current corrosion control treatment not optimal.

Based on the new requirements of the proposed LCR revisions, the number of systems needing to evaluate corrosion control treatment is expected to increase substantially. Nearly 20 percent of systems that currently meet the AL could exceed the TL and require a corrosion control study. When corrosion control testing is required, the proposed LCR revisions require the use of pipe loops for evaluating various corrosion control techniques (coupon testing is no longer an acceptable test method).

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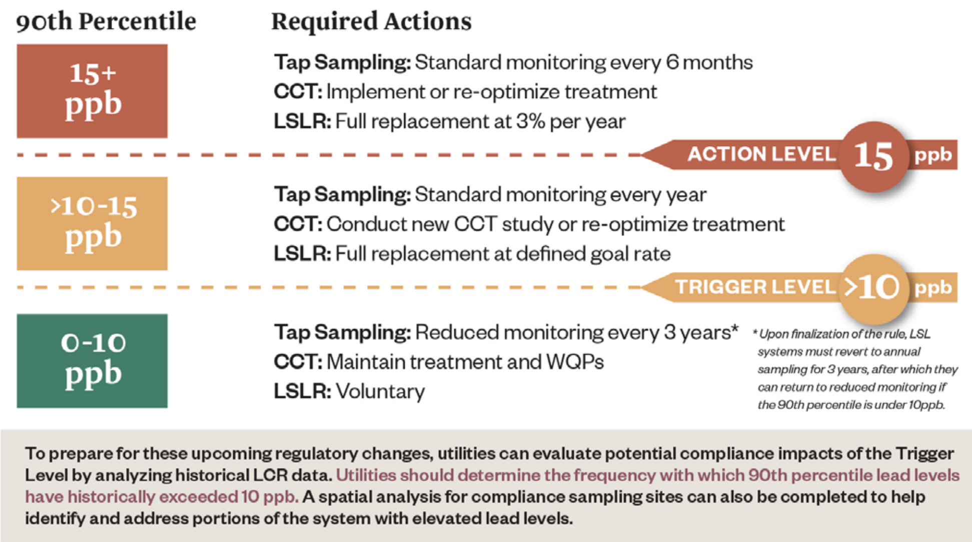

Figure 2. Corrosion Control Treatment Survey Results

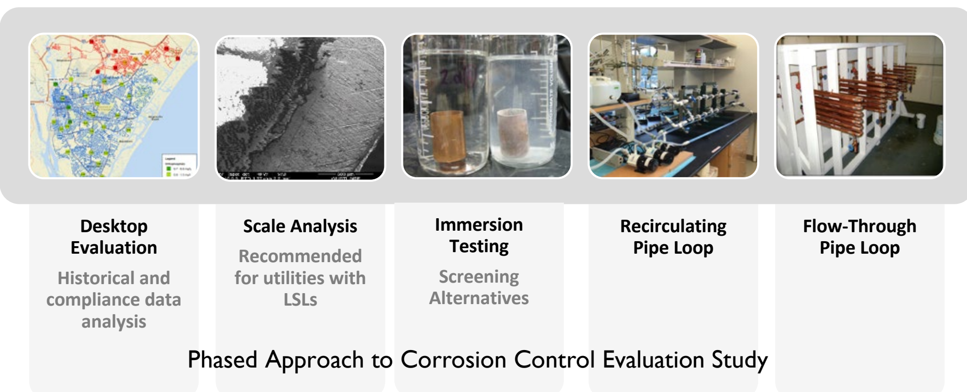

Figure 3. Corrosion Control Strategies

Using standard ESRI GIS products, the service line inventory map can be integrated with custom data collection applications on mobile devices for use in the field to record service line materials. The platform provides efficient data management for utilities and easy public access, which is required in the revisions.

Figure 4. Distribution System Service-Line Inventory

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This form of testing is more labor- and time-intensive, and utilities will need to plan accordingly. Systems will also be required to evaluate specific orthophosphate doses (1 mg/L and 3 mg/L) as orthophosphate (PO_4), which is expected to push systems to use higher PO_4 doses than historical norms. Many utilities are now taking proactive steps toward compliance with the LCR revisions by evaluating and optimizing their current corrosion control strategies (Figure 3). A phased approach to this may include a desktop evaluation, scale analysis of harvested LSL, immersion testing for screening alternatives, and pipe loop studies.

Developing Lead Service-Line Inventories

When present, LSL are typically the primary source of lead in drinking water. The first step in understanding and addressing LSL risks is to determine their locations in the system. The proposed LCR revisions require all water systems to develop a publicly available inventory of all publicly and privately owned service lines in the distribution system (Figure 4), which must be submitted within three years. For large systems, the service-line inventory must be posted to a publicly available website in electronic format (interactive maps are recommended due to ease of use for customers).

Systems will be required to submit annual notification letters to all customers with LSL, or service lines of unknown material. While many systems have unknown service-line materials (often historically assumed to be nonlead), the LCR revisions will require such materials to presumptively be lead. By improving the accuracy of the inventory to reduce unknown materials, the burden of regulatory requirements associated with LSL notifications and required LSL replacement can be alleviated.

To prepare for inventory development, systems can review historical records about local LSL use and analyze property data to identify portions of the system more likely to contain LSL. Utilities with paper records of service-line installation dates or materials should review or digitize these records.

While the LCR revisions do not explicitly require service-line identification, utilities may benefit from developing procedures for this identification in the field. As unknown service lines will be presumed to be LSL for compliance purposes, utilities will need strategies to systematically identify service lines to reduce the number of unknowns in the system over time.

Expansion of Lead Service-Line Replacement

The proposed LCR revisions aim to accelerate the removal of sources of lead in drinking water by expanding full LSL replacement (LSLR) requirements and mitigating the potential for lead exposure during the replacement process.

Systems with unknown or LSL will be required to develop a LSLR plan to establish how a utility intends to perform LSLR within the system, for voluntary or mandatory replacements, in response to a TL or AL exceedance. The LCR revisions require utilities to establish a goal rate for LSLR and identify methods that they will use to fund the replacements as part of the LSLR plan.

Systems exceeding the TL or AL at the 90th percentile will be required to replace full LSL, including privately owned portions, at a specified rate. In this scenario, partial LSL replacements do not count toward replacement-rate requirements, and customer coordination is critical to encourage customer acceptance of private LSLR. Annual notifications to customers with LSL may also increase the number of private LSLR. When notified of a private LSLR, the water system has 45 days to replace the public LSL.

Forward-Thinking Utilities Can Proactively Prepare

The revisions will significantly expand utility responsibilities associated with privately owned infrastructure issues through the proposed "find-and-fix" provisions, private service-line inventory, and full LSLR requirements. They will also further expand public outreach and education needs through more-frequent customer contact and annual service-line notification letters.

The revisions will drive a major change in the ways that utilities communicate and coordinate with customers about lead in drinking water. Utilities can proactively prepare for continued compliance by assessing TL impact; evaluating corrosion control treatment; developing a framework for service-line tracking, identification, and replacement; and identifying communication strategies (Figure 5).

Case Study: Proactive Corrosion Control Treatment Evaluation of Blended Waters

As the regional wholesale water supplier for the southwest coast of Florida, Peace River Manasota Regional Water Supply Authority (PRMRWSA) provides treated surface water to over 900,000 customers, including several local governments (Figure 6). In some cases, the water supplied to these governments may be blended with local groundwater resources.

Understanding the challenges in maintaining stable water quality and controlling corrosion in regions where blending occurs, PRMRWSA has taken a proactive approach to corrosion control and has begun preparing for the proposed LCR revisions.

In 2019, PRMRWSA initiated an update of its regional water supply plan, which includes identification of new water supply sources and pipeline projects that will expand the regional transmission system. New water sources and input locations would require a review of corrosion control, and to prepare for the extensive LCR revisions proposed in November 2019, PRMRWSA has taken a proactive approach looking at the future needs of the region.

The first step in this evaluation identified the current performance of the lead and copper corrosion control within each customer system and then compared the compatibility of each strategy to neighboring member governments, where the opportunity to exchange water existed. The evaluation also considered impacts of implementing a regional corrosion control strategy to understand the costs and benefits of a unified strategy across the PRMRWSA region.

All PRMRWSA member governments have consistently met the 90th percentile LCR AL. Historical 90th percentile lead levels within the system range between 0.7 and 6 ppb, and historical 90th percentile copper levels range between 0.04 and 0.51 mg/L.

The PRMRWSA region is expected to need additional water supply to meet future demands. In areas where the water sources are mixed, there is an opportunity for different corrosion control strategies to interact, which could present challenges in meeting the lead and copper requirements.

Some of the concerns and issues that may arise when blending differing corrosion control strategies are:

- Differing pH regimes that are not optimal for the corrosion inhibitor in use.
- Mixing of different inhibitor chemicals in an interface zone.
- Variability of water quality conditions.

Fluctuations in water quality can cause existing legacy scales within pipes to become unstable and result in a substantial release of lead and copper into drinking water.

Although lead and copper levels have historically been below AL, as blending zones expand with rising future water usage and alternate water sources, distribution system blending patterns have the potential to affect corrosion control, driving the need for a unified regional corrosion control strategy.

As a part of its planning effort and proactive philosophy, PRMRWSA investigated strategies to address blending concerns, including the implementation of a general

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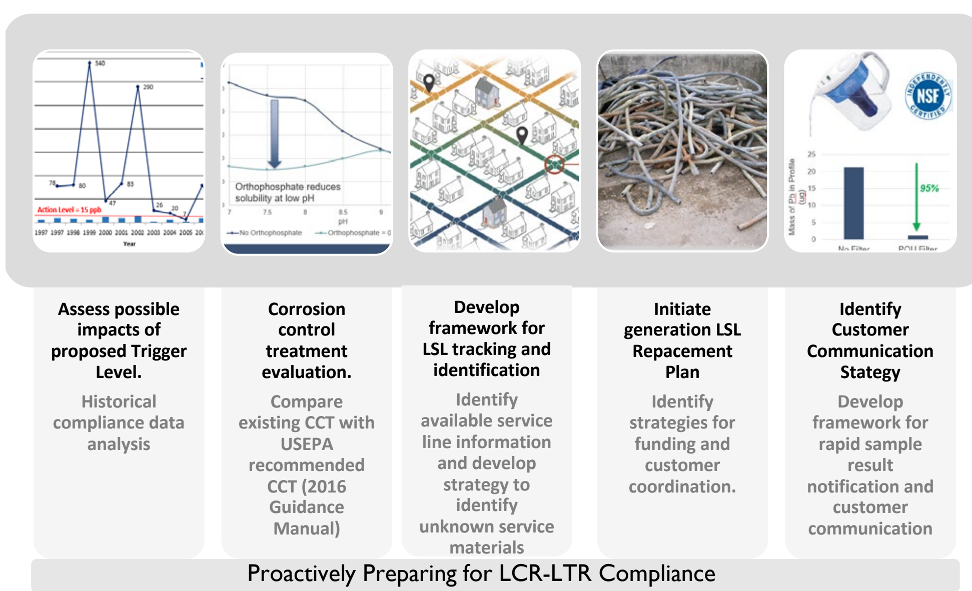

Figure 5. Preparing for Lead and Copper Rule Compliance

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regional corrosion control strategy across all member governments, in lieu of the current practice of individual strategies practiced by each utility.

There are two generalized options for a regional strategy, including:

- Adjustment of the pH and/or alkalinity/dissolved inorganic carbon (DIC).
- Corrosion inhibitor chemical addition, which generally requires target pH ranges for optimization, so it may include pH control chemicals.

A unified regional strategy would eliminate mixing zone concerns and address potential issues with corrosion control strategy compatibilities. Additionally, this approach could present some shared-cost opportunities for chemical purchases, although it may require operational changes by some utilities for parameters (such as pH) to maintain compatibility, depending on the corrosion control strategy selected.

Currently, because the current corrosion control strategies have been effective, all the member governments are eligible for reduced triennial monitoring. If a new corrosion control strategy were implemented, state and federal rules may require the utilities to resume standard LCR compliance monitoring, which would increase the frequency and number of samples required for compliance sampling, as well as reporting requirements for each utility. Implementing an optimal corrosion control treatment strategy, however, may reduce the potential for a TL exceedance under the LCR revisions that would also trigger annual standard monitoring.

As PRMRWSA (and its member governments) are currently in compliance with LCR requirements, its staff is monitoring both anticipated future water requirements and the proposed LCR revisions before recommending wholesale changes in regional corrosion control strategy. This approach is prudent, as it would minimize increases in compliance sampling by changing the corrosion control strategy in conjunction with the LCR revision implementation timetable.

Additional Impacts of Proposed Revisions

The LCR revisions are intended to improve the effectiveness of corrosion control and reduce exposure to lead. Based on the proposed changes, systems will need to implement lead sampling in all schools and childcare facilities. As proposed, the LCR revisions specify changes to water quality parameter (WQP) monitoring requirements, and sampling locations that would now include point of connection (POC). With sampling required at the POC, the evaluation of compatibility and blending of different control strategies within the PRMRWSA system will be important.

Future water needs in the region will lead to different source contributions to each system and may lead to future water quality requirements that could drive treatment changes at both the Peace River facility and at individual member government facilities. Should the proposed language for the LCR revisions remain largely unchanged, there are opportunities for substantial impacts to PRMRWSA and its member governments.

Under the LCR revisions, sample site locations for both the wholesale supplier and the member governments may change. Changing sample locations will pose additional challenges for water utilities, including finding willing and able participants. If triggered by the new levels, the regional water systems will be required to evaluate specific orthophosphate doses of 1 mg/L and 3 mg/L as PO_4. Calcium hardness adjustment would no longer be an acceptable corrosion control treatment strategy, which essentially curtails the use of the Langelier Stability Index (LSI) as a corrosion control technique in many Florida systems.

Because most of the population growth in Florida has occurred in very recent decades, and mostly in subdivisions, LSL are not commonly found in these newer water systems. Nonetheless, development of a service-line inventory documenting publicly and privately owned service-line materials will be required.

Figure 6. Peace River Manasota Regional Water Supply Authority Treatment Facility

Conclusion

The LCR revisions are expected to have significant impacts on systems throughout Florida and across the U.S. The PRMRWSA provides an example of proactive planning for long-term corrosion control strategies, which can be especially complex in situations with multiple water sources, interconnected systems, and distribution system blending of different water quality conditions. Changes to tap sample site selection and sampling procedures increase the risk of lead levels exceeding the proposed TL.

Many systems may benefit from a proactive corrosion control evaluation to understand potential TL impacts and develop strategies to reduce the risk of a TL exceedance. The extent of regulatory impacts will depend significantly on the presence of lead service lines or unknown service-line materials, which places a greater regulatory burden on utilities; however, it's anticipated that all systems will need to develop a service-line inventory and begin tracking service-line materials—a new paradigm under the proposed rule.

Despite the anticipated regulatory impacts on utilities and state regulatory agencies, working deliberately toward compliance with the LCR revisions will further minimize lead and copper levels in drinking water and promote public health.

Reference

- Arnold, R.; Rosenfeldt, B.; Rhoades, J.; Owen, C.; Becker, W. "Evolving Utility Practices and Experiences with Corrosion Control: Results from a U.S. Survey." *Journal AWWA*. 2020.