Northeast-Midwest Institute Response to the U.S. EPA Lead and Copper Rule Revisions White Paper

In October 2016, The U.S. EPA released a White Paper summarizing key issues that should be addressed through the forthcoming revision of the Lead and Copper Rule (LCR), as well as potential elements under consideration for the revised rule. The Northeast-Midwest Institute (NEMWI) supports all the major concepts outlined in the White Paper for the LCR revisions, including the focus on minimizing exposure to lead in drinking water, clear and enforceable requirements, transparency, environmental justice, children's health, and integrating drinking water with cross-media lead reduction efforts. We applaud EPA on its intent to require full lead service line removal and increase the LCR's focus on public health protection.

To improve the LCR's effectiveness in protecting public health, the NEMWI offers a number of recommendations for greater specificity in the areas discussed in EPA's White Paper. One overarching recommendation warrants bringing forward: We strongly recommend that EPA revise a core principle underpinning the LCR, which is the mindset regarding corrosion control. EPA's White Paper states that further action is needed to address lead in drinking water "when corrosion control alone is not sufficient" (p. 7). Yet we already know that corrosion control alone is not sufficient to protect people from lead in drinking water. While corrosion control is an effective and essential tool for reducing lead exposure through drinking water, it is not infallible. Chronic and acute lead exposure can occur even when a PWS meets the lead action level (LAL) through CCT; therefore, CCT alone never can be assumed sufficient to protect public health. The revised LCR must be built on this fundamental concept. Additional proactive measures, including ongoing surveillance for lead in drinking water and aggressive public education, are critical for protecting public health and preventing further catastrophic lead exposures such as those that happened in Washington, DC and in Flint, MI. While EPA's White Paper recommends these measures, we recommend greater specificity as discussed below, alongside acknowledging that CCT alone never can be a sufficient remedy for public health protection.

The revised LCR should be driven by the imperative to protect public health, and built around the following critical objectives:

1. **Identify risk and inform high-risk homes**. Public water systems (PWSs) must be required to develop comprehensive service line inventories and notify all customers who have a confirmed or suspected lead service line (full or partial).
2. **Control risk and inform customers of basic prevention strategies**. PWSs must be required to implement OCCT and regularly educate all customers on how to minimize their exposure to lead in drinking water.
3. **Remove lead service lines**. PWSs must be required to initiate full lead service line replacement programs with mandatory and aggressive deadlines for implementation.

4. **Verify**. PWSs must be required to conduct annual compliance sampling according to a mandatory sampling plan to verify that OCCT and LSLR are performing as expected and reducing exposure to lead in drinking water.

The majority of the NDWAC recommendations, which are reiterated in the paper, outline broad concepts that should be incorporated into the revised LCR. Each of these recommendations requires additional specifications that we believe EPA must achieve through the rule development process to make them meaningful, enforceable, and protective of public health. The remainder of this paper addresses those additional specifications for each of the key issues and potential elements in EPA's White Paper.

Lead Service Line Replacement (LSLR)

Getting the lead out—in particular, the full removal of all lead service lines—must be the primary goal of the revised LCR. NEMWI supports the NDWAC LSLR program elements presented in the White Paper, with the following additions.

Service line inventory accuracy. Accurate and comprehensive service line inventories are essential for developing comprehensive and effective lead service line replacement programs, including lead components such as goosenecks and pigtails. While customers wait for their turn as part of a full LSLR program, they must be told as quickly as possible whether they have a lead service line, so they can take appropriate steps onsite to minimize their exposure until the LSL is replaced. EPA must identify criteria for verifying the accuracy and thoroughness of service line inventories. If a comprehensive service line inventory is not available, each customer with a potential lead service line or an unknown service line must be assumed to have a lead service line until the material for the entire length is identified or the service line is replaced. In addition, NEMWI requests that EPA establish a research priority to develop LSL detection technology that can be used to minimize service line disruption and accelerate LSL replacement programs by correctly identifying non-lead materials.

LSL replacement program planning. Full LSL replacement programs must have concrete and enforceable deadlines that are part of the regulatory language. If there is an exception for homeowners who refuse to participate in a LSLR program, that exception must be explicitly and narrowly defined in the regulatory language with associated requirements for annual communication to the affected homes regarding ongoing risk of exposure to lead in drinking water. Similarly the revised LCR must prohibit partial LSL replacement, with exceptions explicitly and narrowly defined.

Standard operating procedures (SOPs) and preventative measures. NEMWI supports the recommendation for SOPs that define operations that disturb LSLs and practices to minimize disturbance and customer exposure to lead. These SOPs must include mandatory notification to consumers affected by those disturbances. The revised LCR should include proactive, preventative measures for protecting consumers: all homes with LSL replacements must receive filters, option to sample, and clear and effective flushing recommendations.

Minimizing exposure. The White Paper states that "EPA will evaluate how much additional lead exposure reduction can be achieved in removing LSLs from water systems with optimized corrosion

control" (p. 10). The described exposure model must take into consideration that current sampling protocols underestimate lead concentrations in systems with lead service lines (Del Toral et al., 2013) and sporadic lead particulate release from disturbances that is not effectively controlled through corrosion control. This type of lead release can result in harmful acute exposures to lead through drinking water, and EPA analytical methods can underestimate particulate lead present in a water sample (Triantafyllidou et al., 2007).

Improved Optimal Corrosion Control Treatment (CCT) Requirements

CCT re-evaluation. The NDWAC recommends that the LCR should continue to require re-evaluation of CCT when a PWS makes a change in treatment or source water. NEMWI agrees, but we believe this requirement needs substantial strengthening. The EPA must add explicit requirements for the scope, deliverables, and timeline of corrosion control evaluations in the revised LCR, and it must establish penalties for failure to complete these steps. The current requirement is so weak that it is never even cited as a requirement that the Michigan Department of Environmental Quality (MDEQ) skipped in precipitating the Flint Water Crisis. Both the Flint and Washington, DC lead crises arose from failures to complete adequate corrosion control evaluations for source water and/or treatment changes. To keep a closer watch on potential consequences of future source water and treatment changes, EPA should consider requiring the PWS to work with the relevant health department to collect and review public health data prior to, during, and after source water and treatment changes.

Water Quality Parameter Monitoring. The NDWAC recommended continuing to require water quality parameter monitoring to ensure that OCCT is achieving treatment objectives and monitoring is more frequent. However, Cantor (2016) demonstrated that the corrosion model used in the LCR is insufficient for accurately predicting lead release, and that the required water quality parameters are not effective surrogates for lead release. In light of this new research, EPA should reduce the focus on water quality parameter sampling and instead invest that time and effort in effective lead sampling.

OCCT. OCCT is critical for providing a basic level of public health protection. The optimal CCT method depends considerably on the unique water chemistry at each water utility, as well as unique water chemistry within sections of the distribution system. System specific corrosion control studies would be necessary to assure that lead exposure is being reduced as much as feasible via treatment. However, such studies require appropriate expertise, and any time system-specific requirements are established, the opportunities for failing to protect public health increase because every utility is trying to meet a different benchmark. The revised LCR should include provisions for system-specific studies for OCCT that reduce lead release as much as feasible, rather than the current benchmark of 15 ppb. We also recommend a companion research effort to identify universal CCT strategies that reduce risk of exposure to lead in drinking water regardless of source water chemistry that may be capable of simplifying compliance and public health protection in the future.

Universal CCT. NEMWI supports the option EPA is considering to require all systems in the US implement to CCT. CCT should be required at all systems because even if LSLs and lead solder are not present, most brass fixtures still are likely to contain lead because the majority in service were installed prior to 2014. CCT should only be optional if a PWS can demonstrate that there is no lead in their distribution system or households served, including brass fixtures.

Incorporating a Health-Based Benchmark to Strengthen Protection

Rather than waiting for a household action level to be exceeded and then notifying the family and the health department, we recommend shifting the focus to preventing at-risk populations from drinking lead-contaminated water in the first place. This can be done by prioritizing homes of the most vulnerable populations for LSLR, implementing frequent and clear education on using cold water and cleaning aerators, and providing filters or bottled water to people in at-risk homes. The effects of lead exposure are irreversible. Establishing a new household action level will maintain the weaknesses of the existing LCR by providing another way to notify families of lead in the drinking water when it is too late to prevent exposure.

Considering the Potential Role of Point-of-Use Filters

NEMWI supports consideration of point-of-use filters for preventing lead exposure. We recommend that EPA consider requiring PWSs to provide and replenish point-of-use filters at all LSL homes until the full LSL is replaced. In addition to protecting public health, this would provide an incentive to eliminate remaining LSLs.

Further, the revised LCR must include public health interventions as soon as an action level exceedance (ALE) is detected. Under the current rule, an ALE triggers a LSLR program. Because full and proactive LSLR programs will be required in the revised rule, an ALE must trigger some meaningful intervention to notify residents of the risk of lead in their drinking water, including provision of certified filters or provision of bottled water.

Clarify and Strengthen Sampling Requirements

Rigorous sampling requirements. NEMWI agrees with the assertion in EPA's White Paper that the revised LCR must clarify and strengthen LCR sampling requirements. As mentioned previously, the corrosion control model used in the LCR is not sufficient for predicting lead release and the water quality parameters are not effective surrogates (Cantor, 2016). Further, Dore et al. (2016) showed that corrosion scales can vary significantly within a single PWS based on water use, water age, and other factors including partial lead service line replacement. Because OCCT differs based on the specific corrosion scales formed on the pipe surface, and scale can change over time due to differing conditions, it is not realistic to expect that CCT can be optimized at all places in the distribution system at all times. Consequently, scientifically rigorous sampling requirements must serve as the foundation of the LCR.

Sampling practices and frequency. The revised LCR must include requirements for standard sampling protocols that prohibit the problematic practices that have been identified over the past 15 years, including aerator removal, small mouth bottles, and pre-stagnation flushing. Sampling must be an annual event for all water systems. Under current reduced monitoring requirements, children can live through 3 years of potential lead exposure before a lead sampling event can detect whether water quality changes have resulted in conditions that increase lead exposure. The health effects resulting from 3 years of lead exposure are devastating.

Systematic lead sampling. In considering the costs and benefits of any rule option that includes eliminating systematic lead sampling according to a prescriptive scientifically based sampling plan, we must include the primary and secondary costs of a lead crisis such as those experienced in Flint, MI or Washington, DC. Lead must be routinely monitored to ensure that OCCT is performing as designed. Lead

corrosion is system specific and even location specific; the variety of naturally occurring and treated water quality parameters interact for a wide range of corrosion mechanisms. Consequently, the sampling of water quality parameters required in the LCR does not serve as an effective surrogate for lead release in the range of unique water chemistries experienced across the United States (Cantor, 2016; Schock and Lytle, 2011; Schock et al., 1996). Therefore the most effective and accurate measure of potential population exposure to lead, is measurement of lead itself.

Even with aggressive LSLR requirements, many homes will be served by LSLs for many years to come, particularly in cities like Detroit that are estimated to have over 100,000 LSLs. Lead sampling data is essential to ensure that customers are receiving adequate protection while they wait for their lines to be replaced. If no lead sampling data are available, another preventable lead crisis will occur.

EPA should only consider voluntary customer-initiated sampling programs in addition to annual systematic scientific sampling under the revised LCR. A volunteer-only sampling program will not be representative of risk throughout the entire water system, and it will be a self-selected program in which only those paying close attention to outreach materials will participate. In most cases, this type of sampling program will miss populations at greatest risk of lead exposure. The voluntary customer-initiated sampling program described will not be capable of producing scientifically valid results to provide an ongoing source of information to the utility to assess effectiveness of CCT as asserted in EPA's White Paper. Any focus on providing information on household levels for mitigation at individual homes will only divert resources from preventing lead exposure system-wide. Therefore, voluntary sampling programs should be a secondary function of the revised LCR, not a primary function. Any move to a volunteer-only sampling strategy must include a rigorous scientific justification demonstrating its equivalence to the current prescribed sampling requirements under the LCR.

To meet the corrosion control and public health goals of the LCR, the revised sampling program must require a minimum number of samples taken with a single sampling protocol such that the results can be analyzed and detect water quality trends. The sampled sites must either reflect the entire geographic area served by the PWS, such as a random sampling protocol currently in use in the U.K., or they must represent specific risk factors such as Tier 1 sites sampled under the current LCR.

In no circumstances should the revised LCR allow customers to choose their own sampling protocol. The revised LCR should require PWSs to make lead sampling available to customers on request, and information for requesting samples should be made readily available on all literature distributed and on the PWS website.

Alternate sampling strategy. A sampling strategy not considered in EPA's White Paper—one that could solve multiple representation and quality control issues faced under the current LCR sampling protocol—would be the use of filters as a sampling device. In this scenario, a PWS employee installs a water filter on the primary drinking water tap in a LSL home, and the residents continue typical use at that tap. After a designated period, the employee removes the filter and the lead is extracted from the filter media as a composite sample. The mass per volume filtered is calculated and represents potential exposure at the home. This strategy eliminates quality control issues faced when residents collect their own samples; it eliminates snapshot samples that are not representative of typical household use; and it negates the need for first-flush versus samples collected from the LSL. NEWMI recommends that EPA encourage research to enable this sampling strategy.

Sampling at schools. Any sampling requirements for schools as part of the revised LCR should be in addition to and an entirely separate sampling pool from single-family homes targeted under the current LCR. EPA should consider the use of filtered water bottle filling stations in schools and daycares with verification monitoring rather than the endless cycle of school sampling without remediation.

Increased Transparency and Information Sharing

Increased transparency and public education are the critical preventative measures for filling the protection gap between LSL replacement and optimal corrosion control. NEMWI supports requirements for conducting a comprehensive service line inventory, making it available to all residents, and making LCR sampling results available to all residents. All residents with LSLs should be proactively notified of their LSLs, provided clear instructions on how to request samples, and given clear instructions on how to minimize their exposure to lead in drinking water. Such notification should also include information on how to proactively schedule their own LSLR, as well as information on financing and financial assistance.

The revised LCR should include a requirement to analyze samples within 10 days of collection and to notify the resident within 48 hours of getting the analysis results, or 24 hours if the sample is greater than 15 ppb. EPA's White Paper considers mandating shorter time frames for providing the public with public health education when high lead levels are detected. It is too late if we wait until high lead levels are detected. Households must be notified proactively whether they have a LSL, and frequent information about good household water use habits to prevent lead exposure must be provided in advance of any known lead exposure event. The LCR must focus more on prevention of exposure, and less on responding once corrosion control fails. Ample evidence exists that both chronic and acute exposures to lead in drinking water do occur when PWSs meet the action level (Triantafyllidou et al., 2007; Brown et al., 2011).

NEWMI recommends that the remainder of the transparency options presented in EPA's White Paper all be adopted as a package. Once the information is collected for compliance, public health protection is only improved by making that information available to the public.

Public Education Requirements

As stated in EPA's White Paper, "The current LCR requires public health education in response to a lead ALE." Again, the revised rule should provide adequate public education such that residents with LSLs can minimize their exposure to lead in drinking water prior to any sampling results that indicate corrosion control is no longer optimized. All public education materials should be clear that the MCLG for lead in drinking water is 0 ppb. No public education materials should imply in any way that 15 ppb is protective of public health.

The national clearinghouse of information about lead in drinking water should include simple, clear instructions on how customers can minimize lead exposure in their homes. Information sheets should be developed to address specific lead risks that may be present in the home: LSLs, pigtails and goosenecks, lead solder, and/or brass fixtures. The revised LCR should require information to be sent to all customers regarding the risks of lead in drinking water, not just new customers. The revised LCR should require notification to all homes with known or suspected LSLs within 1 year of the rule revision. For safety, unknown materials should be assumed to be lead. NEMWI supports a requirement to provide targeted outreach to customers with LSLs, including offers for sampling and participation in a LSLR program.

NEMWI supports requirements for customers to be notified of emergency or planned maintenance that may disrupt LSLs and provide information on actions that can be used to mitigate exposure. Standard operating procedures for other utilities that may disturb LSLs for maintenance of capital improvements must include notification to the residents that their service line may be disturbed, and recommend flushing steps for reducing lead exposure risk. This should also apply to city, county, and state road and highway departments.

Potential Revised Copper Requirements

NEMWI supports the establishment of requirements that address risk of copper corrosion that are in addition to requirements for addressing and minimizing lead risk. A second sampling pool must be identified that targets homes with high risk of copper corrosion. These sites likely will not overlap with sites at high risk for lead.

Conclusion

The Flint water crisis demonstrated that the minor revisions to the LCR following the Washington, DC lead crisis were not sufficient for preventing the same tragedy from repeating. Substantial revisions to the LCR with an emphasis on enforceability are essential for preventing another crisis from happening. A stronger regulation focused on protecting public health is needed to prevent exposure to lead through drinking water.

The revised LCR must include clear, foolproof requirements with associated violations that trigger an appropriate response before there is evidence of system-wide exposure to unsafe water. These requirements must identify risk and inform high-risk homes; control risk and inform customers of basic prevention strategies; remove lead service lines; and verify effectiveness through annual lead compliance sampling.

In addition to the recommendations for improved protection from lead in drinking water recommended in this paper, there are several research areas we recommend exploring to improve our ability to identify and reduce risk from lead in drinking water:

- Service line detection technology to develop detailed and accurate service line inventories that accurately identify buried infrastructure materials and locations.
- Faucet filter cartridges where filter media can be extracted and digested to measure lead collected by the filter.
- Filter regeneration techniques. As the use of filters increases substantially under these recommendations, it will be critical to minimize filter waste and develop recycling and reuse strategies at the household or community level.
- Portable and/or online lead analytical methods.
- Universal CCT strategies that reduce risk of exposure to lead in drinking water regardless of source water chemistry.

The revised rule should be written such that new research developments can be integrated into rule requirements as soon as they are shown to be effective for identifying or reducing risk from lead in drinking water.

Finally, the cost analysis of the LCR revision must accurately reflect the level of protection provided by the requirements. All options are not equal. Rule options that do not address the preventable problems of the past must account for the all costs of incurring a new lead crisis, including the costs of health effects, economic effects, alternative water distribution, and infrastructure replacement.

References

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