UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
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REPLY TO THE ATTENTION OF
WG-15J

JUN 1 1 2019

Steve Elmore, Director
Bureau of Drinking Water and Groundwater
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison, Wisconsin 53707-7921

Subject: Reiteration/Clarification on Technical Recommendations regarding Corrosion Control Treatment and Lead and Copper Rule Implementation

Dear Mr. Elmore:

In response to a request by Wisconsin Department of Natural Resources (WDNR), U.S. EPA Region 5 is providing this letter to summarize and clarify several technical recommendations regarding corrosion control treatment (CCT) and Lead and Copper Rule (LCR) implementation.

As you know, reducing lead exposure, including from drinking water, is a national priority. The LCR was structured to provide States with appropriate flexibility and State authorities to be able to address statewide and system-specific issues. Water systems and primacy agencies seeking to reduce lead exposure from drinking water sources can use these flexibilities and authorities to address issues highlighted by science and research that has become available since the original LCR was promulgated in 1991. For example, many studies that have been conducted since 1991 have identified the first-draw compliance sampling may not provide data representative of lead concentrations within lead service lines (LSL). LSLs are the largest source of lead in drinking water when present.[1,2] In communities where sequential samples or other samples reflecting the LSL have been collected, data shows that first draw samples can significantly underestimate peak lead levels at LSL sites.[3,4] Consequently, additional protective actions may be appropriate

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1 Sandvig A, Kwan P, Kirmeyer G, Maynard B, Mast D, Trussell RR, Trussel S, Cantor A, Prescott A (2008). Contribution of Service Line and Plumbing Fixtures to Lead and Copper Rule Compliance Issues. AWWA Research Foundation.

2 EPA Infographic: Lead in Drinking Water. August 2017. https://www.epa.gov/sites/production/files/2017-08/documents/epa_lead_in_drinking_water_final_8.21.17.pdf

3 Science Advisory Board, U.S. Environmental Protection Agency, "Evaluation of the Effectiveness of Partial Lead Service Line Replacements," transmitted to Lisa Jackson, EPA Administrator, September 28, 2011.

4 Other representative research publications include:

for communities with LSLs. Diagnostic sampling such as sequential sampling may be beneficial to evaluate the need for CCT and also to evaluate the adequacy of existing CCT.[5] Furthermore, numerous studies show that fully flushed samples (e.g., collected after running water 3 to 5 minutes or more) at LSL sites often have detectable lead concentrations, even at systems implementing CCT. Fully flushed samples at LSL sites may have lead concentrations above 5 parts per billion (ppb) or even above 15 ppb.[3,4] This data demonstrates that lead is frequently present in drinking water at homes and other structures with LSLs, even when CCT has been installed and is being maintained.

EPA included the flexibilities and State authorities in the LCR so that water systems and the primacy agency can make adjustments based on recent science and recommendations when completing the specific CCT steps in the LCR. The additional scientific information and EPA guidance can help States and systems achieve the required minimization of lead levels. It can also guide actions to be taken by small and medium systems following an action level exceedance and by small and medium systems with LSLs and no treatment in place. The LCR requires systems that have installed CCT to continue to operate and maintain the treatment, including maintaining water quality parameters (WQP) at or above minimum values or within ranges established by the primacy agency (§141.81(b) and §141.82(g)). During 2018 training for state LCR staff, EPA also recommended incorporating periodic review of LCR compliance into the state's routine oversight of water systems; this may include the following activities:

- Review of lead and copper monitoring sites and monitoring results, evaluation of CCT treatment, and review of WQP monitoring data during sanitary surveys
- Evaluation of potential impacts to CCT during plan review prior to a long-term source water or treatment change
- Periodic reevaluation of systems previously deemed to have optimized CCT under §141.81(b)(1) or (b)(3), to ensure the systems continue to minimize lead levels at the tap[6]

- Del Toral MA, Porter A, Schock M (2013). "Detection and evaluation of elevated lead release from service lines: a field study." Environ Sci Technol 47(16): 9300-9307. Available here: https://www.epa.gov/il/chicago-lead-drinking-water-study
- Cornwell D and Brown R. Evaluation of Lead Sampling Strategies. Water Research Foundation. Report #4569. 2015.
- Lewis, Carrie M.; Couillard, Lon A.; Klappa, Patricia J.; Vandenbush, Terrence D. Lead Water Service Lines: Extensive Sampling and Field Protocol Protect Public Health. Journal - American Water Works Association. January 2017. Volume 109, Number 1, p34-41. Available to AWWA members, here: https://www.awwa.org/publications/journal-awwa/abstract/articleid/63106515.aspx
- Cantor, Abigail F. Optimization of Phosphorus-Based Corrosion Control Chemicals Using a Comprehensive Perspective of Water Quality. Water Research Foundation. Report 4586. November 2017. Available here: http://www.processresearch.net/4586.htm
- Chicago Water Quality Sampling Results. http://www.chicagowaterquality.org/ (accessed 3/28/2019).

[5] Darren A. Lytle, Michael R. Schock, Kory Wait, Kelly Cahalan, Valerie Bosscher, Andrea Porter, Miguel Del Toral. Sequential drinking water sampling as a tool for evaluating lead in Flint, Michigan. Water Research 157 (2019) 40-54.

[6] EPA. Lead and Copper Rule Minor Revisions Implementation Guidance. December 2001. https://www.epa.gov/sites/production/files/2015-09/documents/2001_12_4_lcrmr_guidance_lcrmr_state_implementation_reporting_appendix_b.pdf

- Reevaluation of optimal corrosion control treatment (OCCT) and optimal water quality parameters (OWQP), when there is an action level exceedance or other new information arises, such as distribution system water sampling results (including samples not collected for LCR compliance) showing elevated lead levels and/or variability in water quality.

EPA has included specific language in the LCR to ensure that States have the best tools and information possible to protect public health and to ensure that any system-specific requirements specified by the State using these provisions are enforceable. The LCR includes state authorities to modify OCCT and OWQP determinations (§141.82 (h)) as well as to require systems to repeat CCT steps (§141.81(c)), conduct additional WQP monitoring (§141.82(a)), and provide other information to aid in the state's review of OCCT (§141.82(d)(2)).

Research, including analysis of LSL pipe scale minerals for systems with various water qualities, has shown the importance of system-specific optimization studies, which may include pilot studies with existing lead pipe scales as well as diagnostic sampling, particularly for systems with LSLs.[7,8] System-specific evaluations of OCCT and OWQP should consider the guidance in EPA's Optimal Corrosion Control Treatment Evaluation Technical Recommendations document,[9] including the items listed below.

- The Langelier Saturation Index and other calcium carbonate indices should not be used to evaluate lead or copper control; however, such indices can be useful for evaluating if pH changes will result in excess calcium carbonate precipitation in the system.
- Orthophosphate treatment for controlling lead and copper should target residual concentrations of 0.33 to 1.0 mg/L as P (1.0 to 3.0 mg/L as PO4) at the tap when pH is within the range of 7.2 to 7.8. Higher orthophosphate doses (1.0 – 1.2 mg/L as P, or 3 – 3.5 mg/L as PO4, and higher) may be needed to control lead release from LSLs.
- If pH/Alkalinity/DIC adjustment is selected based on system-specific evaluation, the target pH for OCCT that relies on pH/Alkalinity/DIC Adjustment should be 8.8 to 10. Systems with LSLs that are not using a corrosion inhibitor should consider increasing the pH to 9.0 or greater.
- Due to potential issues with blended phosphates, compared with treatment using orthophosphate alone, EPA recommends a demonstration study, additional monitoring, or both for systems that recommend blended phosphates to control lead release.
- Due to the unique characteristics of each system (e.g., source water, existing treatment processes, distribution system materials), it is critical to evaluate and address potential

[7] Jennifer Tully, Michael K DeSantis, and Michael R. Schock. Water quality-pipe deposit relationships in Midwestern lead pipes. AWWA Water Science. Volume 1, Issue 2. March/April 2019. 1127. https://awwa.onlinelibrary.wiley.com/doi/10.1002/aws2.1127

[8] Daniel J. Williams, Christopher J. Parrett, Michael R. Schock, Christy Muhlen, Peg Donnelly, Darren A. Lytle. Design and Testing of USEPA'S Flint Pipe Rig for Corrosion Control Evaluation. Journal AWWA. Volume 110, Issue 10. October 2018. E16-E37. https://awwa.onlinelibrary.wiley.com/doi/10.1002/awwa.1127

[9] EPA. Optimal Corrosion Control Treatment Evaluation Technical Recommendations document. March 2016. https://www.epa.gov/dwreginfo/optimal-corrosion-control-treatment-evaluation-technical-recommendations

impacts resulting from treatment and/or source water changes prior to making any change.

The LCR requires systems to minimize lead levels at the taps without causing a violation of any other National Primary Drinking Water Regulation. Systems should set the required 'optimal' corrosion inhibitor dose based on the system-specific evaluation and determination of what is anticipated to reliably minimize corrosion. This may necessitate other system changes to achieve simultaneous compliance. The optimal inhibitor dose should not be reduced unless there is a compelling scientific reason (such as the complete removal of LSLs in the entire distribution system), and then only with careful evaluation and monitoring.

In order to assess the need for additional protective actions such as those discussed above, systems will first need to have accurate information regarding the presence and locations of LSLs, on both public and private property. The LCR requires systems to continue to check for LSLs during routine work (see §141.86(a)). In Wisconsin, this may include taking actions to reduce the number of "unknown materials" reported in service line inventories reported by Municipal Community Water Systems to the Wisconsin Public Service Commission.

Accurate LSL inventories are critical for pursuing full LSL replacement throughout the distribution system and for ensuring LCR sampling is conducted at the highest-risk sites. LCR sampling conducted at all LSL sites, particularly those with longer lead pipe segments, is best for determining the highest lead levels within the drinking water system. By sampling in this manner, systems are better informed and thus able to take timely and appropriate corrective actions that will minimize lead levels. Significant reductions in lead in water can be achieved by removing all portions of lead pipe,[10] as well as downstream galvanized pipes,[11] and taking additional protective actions such as following the recently published American Water Works Association standard for LSL replacement which includes not using water during the excavation activities and completing post-replacement flushing.[12]

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[10] The issues with partial LSL Replacement were summarized in: Science Advisory Board, U.S. Environmental Protection Agency, "Evaluation of the Effectiveness of Partial Lead Service Line Replacements," transmitted to Lisa Jackson, EPA Administrator, September 28, 2011. In addition, the following is a recent study on this topic: Deshommes, E, Laroche L, Deveau D, Nour S, and Prévost M (2017). "Short- and Long-Term Lead Release after Partial Lead Service Line Replacements in a Metropolitan Water Distribution System." Environmental Science & Technology.

[11] Galvanized iron pipe (zinc-coated steel) downstream of a LSL can also be a significant source of lead, even if the upstream LSL is removed. Supporting studies:

- Schock, M.R., Cantor, A.F., Triantafyllidou, S., DeSantis, M.K., Scheckel, K.G. 2014. Importance of Pipe Deposits to Lead and Copper Rule Compliance. J. AWWA. 106(7): E336-E349.
- HDR Engineering, 2009. An Analysis of the Correlation between Lead Released from Galvanized Iron Piping and the Contents of Lead in Drinking Water. Prepared for the District of Columbia Water and Sewer Authority. September 2009.
- McFadden, M.; Giani, R.; Kwan, P.; & Reiber, S., 2011. Contributions to Drinking Water Lead From Galvanized Iron Corrosion Scales. Journal AWWA, 103:4:76.
- Clark B. N., Masters S. V. & Edwards M. A. 2015. Lead release to drinking water from galvanized steel pipe coatings. Environmental Engineering Science, 32(8), 713–721.

[12] Flint Technical Support Team Recommendations Regarding FAST Start Program, Service Line Replacement dated Jan. 22, 2018, recommended the incorporation into Flint's LSL replacement program the

If you have any questions, please feel free to contact Andrea Porter of my staff at (312) 886-4427 or Val Bosscher of my staff at (312) 886-6731.

Sincerely,

Kevin Pierard, Chief
Ground Water and Drinking Water Branch

cc: Cathrine Wunderlich, WDNR (via email)
Adam DeWeese, WDNR (via email)

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protective actions in the American Water Works Association (AWWA) Standard ANSI/AWWA C810-17: Replacement and Flushing of Lead Service Lines.