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Controlling Lead in Public Drinking Water Supplies

Communities may face a range of issues associated with aging water infrastructure, including elevated lead levels in tap water. Because of lead's toxicity, even at low levels, reducing lead exposures from drinking water and other sources remains a public health priority. Other sources of lead exposure include lead-based paint and contaminated soil and dust from deteriorated lead-based paint. Nationally, the phaseouts of leaded gasoline and lead-based paint, along with regulatory controls and technical changes, have reduced lead exposures. Since the late 1970s, overall blood lead levels in children (ages one to five) have declined an estimated 94%.

Sources of Lead in Drinking Water

Most contaminants, when found in public water supplies, are detected and treated at the water treatment facility. In contrast, lead occurs in tap water after treated water enters the distribution system, where water is corrosive and lead can leach from pipes, plumbing materials, and fixtures (e.g., faucets). Corrosion is a chemical reaction between the water and the plumbing materials. Factors affecting corrosion include the water's acidity, temperature, water use patterns, and the presence or absence of protective coatings of mineral deposits that can accumulate inside pipes, among others. Accordingly, controlling corrosion has been the principal method used to keep lead in tap water.

The presence of leaded pipes and materials in community water systems (CWSs) and homes generally depends on the age of the water system and residences. Before the 1930s, lead pipes were commonly used to extend water service from the water main under the street to a residence or other building inlet. These lead pipes are known as lead service lines (LSLs). Nationwide LSL estimates vary. A 2016 analysis estimated that the number of LSLs nationwide declined from approximately 10 million to 6 million over three decades. EPA estimates that the current number of LSLs may range from 6.3 million to 9.3 million. Leaded plumbing materials (e.g., brass fixtures and copper pipes with lead solder) in buildings, such as child care facilities and residences, can also contribute to lead in drinking water.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) authorizes the U.S. Environmental Protection Agency (EPA) to regulate the quality of water delivered by public water systems (42 U.S.C. §§300f et seq.). Under SDWA, Congress has addressed exposure to lead in drinking water using several approaches, including (1) limiting lead in plumbing materials and fixtures (SDWA §1417) and (2) authorizing EPA to regulate contaminants, such as lead, in public water systems through national primary drinking water regulations (SDWA §1412). Further, Congress amended SDWA to address lead in child care programs and schools and establish a program to remove lead-lined drinking water coolers (SDWA Part F).

Limiting Lead in Plumbing Materials

In 1986, Congress amended SDWA to prohibit the use of plumbing (e.g., pipes or pipe fittings) that were not "lead-free," which was defined at the time as solder and flux with no more than 0.2% lead and pipes with no more than 8% lead (P.L. 99-339). Congress authorized states to enforce these provisions and authorized EPA to withhold a portion of grant funds from a state for failure to enforce.

Congress expanded the lead prohibition to include fixtures in 1996 (P.L. 104-182) and reduced the allowable lead content in "lead-free" plumbing materials in 2011 (P.L. 111-380). *Lead-free* is now defined as no more than 0.25% lead across wetted surfaces of plumbing materials. Many communities and homes may still have pipes and plumbing that contains more lead than is allowed for newer materials.

EPA's Lead and Copper Rule (1991-Present)

SDWA authorizes states to assume primary responsibility for oversight and enforcement of public water system compliance with drinking water regulations. EPA, among other responsibilities, retains oversight authority over state programs. Public water systems can be owned and operated by private or public entities, including municipalities or local governments.

In 1991, EPA issued the Lead and Copper Rule (LCR), which replaced a standard for lead in drinking water of 50 parts per billion (ppb) measured at the treatment plant. Because lead or copper generally enters the water after it leaves the plant, the rule required an initial survey of the materials that comprised a water system's distribution systems. This information enabled systems to target tap-water monitoring at homes and other locations expected to be at high risk of lead contamination. The LCR established *action levels* at 15 ppb for lead and 1,300 ppb for copper. If more than 10% of tap water samples exceed the rule's action level, a CWS is not in violation of the rule, but the water system is required to take *treatment technique* actions, including optimizing corrosion control; public education; water quality parameter monitoring; source water treatment; and, in some cases, LSL replacement.

Under the rule, public water systems are required to optimize and maintain treatment for corrosion control. Usually, corrosion control treatment involves adjusting the water's acidity to mitigate the treated water's potential to leach lead from the distribution system or interior plumbing. Such treatment can provide a cost-effective way to control lead in drinking water, but maintaining control of corrosion is complex, and requires consideration of factors such as source water quality and composition of distribution system and plumbing in individual homes and other

properties. Further, actions to comply with other SDWA drinking water regulations may increase the water's acidity.

In 2004, EPA began reviewing the LCR after increased lead levels were detected in the District of Columbia's drinking water after a water treatment change. This review resulted in short-term revisions and clarifications that EPA issued in 2007. The revisions require water systems to notify the state agency (or EPA) if the system plans to change the source or treatment of its water supply. The requirements are intended to ensure that the state and system evaluate the potential impact such changes may have on corrosion control treatment.

Lead and Copper Rule Revisions

In 2015, EPA received recommendations for LCR revisions from the National Drinking Water Advisory Council (NDWAC). NDWAC recommendations included requiring all water systems to establish a proactive LSL replacement program, noting that it would be costly and likely take decades to fully remove all LSLs. As such, NDWAC recognized corrosion control's importance and recommended that EPA revise the rule's action level and requirements for corrosion control treatment and monitoring, among other revisions.

EPA published final Lead and Copper Rule Revisions, or LCRR, in the *Federal Register* on January 15, 2021, with an effective date of March 16, 2021, which was extended until December 16, 2021. EPA also extended the compliance date for water systems to October 16, 2024. The LCRR revises the 1991 LCR, and retains for certain purposes the 1991 LCR's 15 ppb lead action level. Among other changes, the LCRR also establishes a new lead *trigger level* at 10 ppb, based on the 90th percentile of tap water samples. (CRS Report R46794, *Addressing Lead in Drinking Water: The Lead and Copper Rule Revisions (LCRR)*, discusses the LCRR.)

LSLs and LSL Replacement Requirements

Typically, the water system owns the portion of service line that extends from a water main to a residence's property line, a water meter, or a shut-off valve between the main water line and the building, while the remaining portion is owned by the property owner. Under the 1991 LCR, CWSs that have optimized corrosion control and still exceed the lead action level are required to replace at least 7% of their LSLs annually until the action level is not exceeded for two consecutive six-month monitoring periods. In cases when the LSL scheduled for replacement extends past the property line, the 1991 LCR requires public water systems to offer the owners an opportunity to have their portion of the LSL replaced, but the system is not required to pay for the owners' replacement costs for their portions of LSLs.

Under the LCRR, water systems would be required to develop an inventory of LSLs (or demonstrate their absence) within three years of promulgation of the final rule. The LCRR would require water systems with LSLs or service lines of unknown material to periodically update their inventory. CWSs with LSLs would have three years to develop a plan to replace all LSLs in their system. Under the LCRR, if a water system serving more than 10,000 persons exceeded the action level, the system would be required to replace 3% of the LSLs annually based on a two-year rolling average until the action level was not exceeded for four consecutive six-month monitoring periods. Unlike the LCR, the LCRR would not allow water systems to "test out" of the 3% replacement requirement using tap sample results below the action level for two consecutive six-month monitoring periods. Partial LSL replacement would not count toward the 3% replacement rate or replacement goal. The LCRR would require a water system replace its portion of an LSL within 45 days (or 180 days with state notification) of being notified of a customer's intent to replace their LSL portion.

Implementation Challenges

As communities identify options to address lead in water supplies, LSL replacement is often identified as a way to permanently remove a potential pathway of lead exposure or as a way to minimize reliance on corrosion control treatment. LSL replacement raises a number of implementation challenges for water systems and communities. Among others, these challenges include the costs to replace these lines, which may result in partial LSL replacement (i.e., when the water system replaces the LSL portion that it owns and the owner's remaining portion is not replaced).

The costs to replace LSLs can vary widely across localities. According to EPA, the cost of LSL replacement ranges from $1,200 to $12,300 per line. CWSs and individual homeowners may face financial challenges to replace LSLs. In circumstances where the LSL is partially owned by a property owner, under the LCRR, the public water system cannot compel the owner to replace the owner's portion of the LSL. Therefore, if the property owners are unable or unwilling to pay for their portion of the LSL replacement, lead may continue to leach into drinking water from the remaining portions of the LSL. (For sources of federal funding for water infrastructure projects, see CRS Report R46471, *Federally Supported Projects and Programs for Wastewater, Drinking Water, and Water Supply Infrastructure*.)

Related to proactive LSL replacement, America's Water Infrastructure Act of 2018 (P.L. 115-270) amended SDWA Section 1452(a) to require public water systems to include—to the extent practicable—the cost to replace LSLs in future drinking water capital improvements needs surveys. SDWA requires EPA to conduct the survey every four years, and EPA uses the results to determine the allotment among the states for the annual grants for the Drinking Water State Revolving Fund (DWSRF) program. The inclusion of the cost to replace LSLs in the survey may affect state allotments of DWSRF capitalization grants.

Lead in household plumbing can pose further challenges to addressing lead in drinking water. Even with full LSL replacement, interior plumbing or fixtures in buildings may remain a source of lead exposure. If systems undertake proactive LSL replacement, the issues of partial LSL replacement and of leaded interior plumbing or fixtures suggest that water systems may need to maintain corrosion control treatment to prevent lead in tap water.

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