Lead Service Line (LSL) Replacement

Examples from Other States and Cities

This document identifies lead service line replacement policies, actions, and investments in other states and cities. Together, these examples provide a broad sense of how others have addressed this problem, the policy innovations they pursued, the time required, and the known or projected cost.

State Examples:

Excerpted from the Lead Service Line Replacement Collaborative:
https://www.lslr-collaborative.org/requiring-lsl-replacement.html

California
In 2016, **California** enacted SB-1398 that requires public water systems to provide the following information to the state water board:

- By July 2018, an inventory of known LSLs in use in its distribution system, a timeline to replace these lines, and identified areas that may have LSLs in use.
- By July 2020, for those areas that may have LSLs, a determination of the existence or absence of LSLs in the distribution system and a timeline to replace service lines whose content cannot be determined.

The California Water Board must approve or deny the utility's timeline within 30 days of receipt. If it misses the deadline, the timeline is approved. If denied, the Board and the utility must develop a compromise timeline within 30 days. The requirements only apply to a "user service line" which connects the water main to an individual water meter or service connection. Based on preliminary interpretation, this term does not appear to include the portion of the LSL on private property.

Washington
In 2016, the Governor of **Washington** issued a directive to the state department of health ordering it to prioritize the removal of LSLs and other lead components in water distribution systems when considering a funding proposed through the Drinking Water State Revolving Fund.

Michigan
In June 2018, **Michigan** filed rules overhauling the state's Lead and Copper Rule to accelerate LSL replacement. The rules require full LSL replacement in addition to replacement of galvanized steel lines downstream of a lead pipe, with special provisions for emergency repairs. Community Water Systems must achieve replacement on a schedule averaging 5% per year starting in 2021 totaling not more than 20 years for replacement of all LSLs, unless the system has an alternative plan approved by the state.

City Examples:

Cincinnati, OH

In 2017, Cincinnati enacted three laws that created an innovative legal framework for LSL replacement. Most importantly, LSLs were outlawed and property owners were required to remove their portion of the pipe when Greater Cincinnati Water Works (GCWW) provides notification of pending work on its water mains. (The city also required landlords to disclose the presence of LSLs to prospective tenants and established a fund for donations to assist low income residents in paying the unsubsidized portion of the work.) If the property owner uses GCWW's contractor, the city subsidizes 40% to 50% of the cost of removing privately-owned LSLs (up to $1,500) and the remaining cost may be paid over 5 to 10 years as an assessment on the property tax bill. The goal is to replace all LSLs over 15 years.

For planned LSL replacements, the GCWW considers the following criteria to determine which Cincinnati neighborhoods should be prioritized:

- Children aged six or younger, using U.S. Census Bureau data;
- High blood lead levels in the neighborhood based on Ohio Department of Health data;
- Houses with lead in water test results above the action level of 15 parts per billion;
- Lead branch density per 100 feet of water main;
- Coordinate with other public agency projects, such as road construction.

Denver, CO

In August, 2019, Denver Water proposed to remove all lead service pipes from homes across its metro area, a rare action that could cost between $250 million and $400 million over 15 years for the 50,000 to 90,000 homes that may be affected. (The planning assumption is that a total of 75,000 lead service lines will be replaced.) The effort will be one of the largest lead-removal programs ever implemented, and the pace is far faster than the current rate of replacement, which would have taken over 50 years to complete.

In Denver, LSLs are concentrated in homes built before 1951, and the lines are owned by water customers, not the utility. Nonetheless, Denver Water will pay the full cost of the replacements at an estimated average cost of $5,000 per line. The utility plans to increase water rates to support the work. In recent years, rates have increased by an annual average of 3 percent, but the LSL program may require increases averaging 4% to 5% as the average annual number of LSLs removed rises from approximately 1,200 to a projected 5,000.

The utility will aggressively construct an accurate LSL inventory by examining historical records and through field investigations, including visual inspections in the home or through potholing, water testing, and feedback from an outreach effort to customers. It will also build a predictive model based on its knowledge of the pipe materials that were used in certain time periods. The results will be shared with the public through an online map. Residents that have known or suspected LSLs will be provided with filters certified to remove lead until six months after the utility replaces the pipe. Existing corrosion control treatment will be enhanced by increasing the

current pH of the water and maintaining a steady alkalinity level. The utility will pay the capital cost from water rates, bonds, and the sale of new water system connections.

Denver Water plans to schedule LSL replacements based on a number of risk-based factors to address health equity, including:

- Public health considerations (e.g., odds ratio for childhood lead poisoning);
- Areas where filter adoption (the rate at which customers properly install filters) is low;
- Critical, "lead sensitive" customers (e.g., child care, primary schools, nursing facilities);
- Age-related considerations (e.g., probability of children under 5 years, adults over 70 years, or women of childbearing age); and
- Social economic factors (e.g., under federal poverty level).

The city presented this plan as an alternative to the Colorado Department of Public Health and Environment's original order in 2018 which would have required Denver Water to add orthophosphate to its drinking water to improve corrosion control and reduce lead leaching. Because orthophosphate is a fertilizer nutrient, that action could have exacerbated existing water quality problems that affect the greater Denver region, including algae blooms. (I.e., Denver Water would have paid to add orthophosphates to control lead in drinking water and surrounding wastewater plants subsequently would have paid to remove it from the effluent.)

Federal and state regulatory agencies must approve the plan.

https://denverwatertap.org/2019/07/01/denver-water-state-and-federal-agencies-consider-next-steps-on-lead/

Madison, WI
In 2000, Madison became the first city in the country to adopt a policy supporting full replacement of both the utility and privately-owned LSLs. By 2012, it became the first city in the country to fully eliminate its lead service lines.

While the city finished slightly past its initial goal of replacing all lead service lines in 10 years, it had a strong beginning, replacing 80% of its 8,000 existing lead service lines by 2006. The total cost was $15.5m, excluding the customer cost share. Of the 8,000 LSLs, only 5,600 (70%) involved replacement of LSLs located under private property, as many residents had replaced their lines by the time the program began.

The city's initial application for a rate increase was rejected by the Wisconsin Public Service Commission on the grounds that it would be "...unreasonably and unjustly discriminatory if public program dollars generated through utility rates were to be authorized as a subsidy to furnish a direct benefit to an exclusive group of private property owners." In response, the city substituted municipal revenue (i.e., fees charged to cell phone companies for renting space on city-owned water towers). By 2012, all 8,000 existing LSLs had been replaced at a cost to the

city of $15.5m (excluding the customer cost share). (Of the 8,000, only 5,600 involved replacement of customer-owned LSLs, and many residents had replaced their lines by the time the program began.) Under the program, the city reimbursed half of the cost of replacing privately-owned LSLs up to a maximum of $1,500 per installation, and recalcitrants were subjected to fines ranging from $50 to $1000 per day.

In 2018, state legislation (Act 137) authorized water utilities to provide financial assistance to property owners for removal of privately-owned LSLs. The municipality were required to enact an ordinance that supports that action and mandates the elimination of the privately-owned LSL. The law also required the water utility to ensure that its portion of the line was either simultaneously removed or verified as lead-free. It was also required to obtain approval from the Commission that its proposed plan is not unjust, unreasonable or unfairly discriminatory.

Green Bay, WI

Since 1990, the Green Bay Water Utility has been replacing lead service lines as its budget allowed. However, in the summer of 2016, the city passed an ordinance accelerating the replacement program. The ordinance set a goal of 10 years for full LSL replacement, but Green Bay Water Utility has a stated goal of removing all LSLs by the end of 2020.

The city had a total of 35,700 LSLs when it started the program in 1990. As of June, 2019, less than 2 percent of its water customers were still served by an LSL. Since pace was accelerated beginning in 2016, the number of utility-owned LSLs was reduced from nearly 1,800 to 445 and the number of LSLs located under private property was reduced to only 22.

The program cost was largely funded through $800,000 in principal forgiveness from the state's two-year LSL replacement program plus revenue from the city's stadium agreement.

Lansing, MI

At the end of a 12 year campaign, the City of Lansing removed the last of its estimated 12,000 LSLs from the ground at the end of 2016. At that time, it joined Madison, WI as the only two cities in the country to accomplish this feat.

In an important distinction, Lansing owns the entire service line, enabling it to replace the entire LSL without charging the customer. The total estimated cost of $44.5 million reflected savings from an innovative "trenchless" excavation method that accelerated the pace of construction. (Workers cut two squares in the ground at either end of the line, one to expose the water main and service connection and one to access the service box. The lead pipe is then threaded out and a new pipe is slipped in.) While traditional excavation initially cost the city $9,000 for each pipe the new method cost only $3,600 per line.

Over time, the city set aside funds within its base budget for the Board of Water and Light to support the work.

Washington D.C.
The Lead Water Service Line Replacement and Disclosure Amendment Act of 2018 (D.C. Law 22-241) amends the Lead Service Line Priority Replacement Assistance Act of 2004 to require District of Columbia Water and Sewer Authority to:

- Replace lead water service lines on private property, with the consent of the property owner, whenever it is replacing lead water service lines or the nearby water main on public property,
- Establish a payment assistance program for income-eligible residents to assist in paying for the replacement of lead water service lines located on private property if the portion of the water service line on public property is not a lead water service line, and
- Require the District of Columbia Water and Sewer Authority to provide public education about the risks of lead water service lines and, upon request, annual free lead test kits to property owners and lessees of commercial and residential building; and
- Amend the Residential Real Property Seller Disclosure, Funeral Services Date Change, and Public Service Commission Independent Procurement Authority Act of 1998 to require that homeowners disclose if there is lead plumbing on the property or evidence of lead in the water to potential buyers prior to sale.

https://www.nrdc.org/experts/valerie-baron/getting-lead-out-dc-drinking-water - summarizes the new law and its funding:

Pittsburgh, PA
The Pittsburgh Water and Sewer Authority (PWSA) aims to replace all of its remaining lead service lines by 2026. Since July 2016, the utility has replaced 2,800 utility-owned lead lines and nearly 1,400 lead lines located under private property, with approximately 2,000 utility-owned and 1,300 private-related LSL replacements occurring in 2018 alone. PWSA increased its goal for 2019, planning to replace up to 3,400 more lead lines by the end of the year. As of May 2019, PWSA has stated its intent to complete 3,700 utility-owned replacements and 3,100 replacements under private property by June 2020. With this replacement schedule, the utility is well on track to remove the estimated 10,000 remaining LSLs by 2026.

Pittsburgh stopped partial LSL replacements in May 2017, only replacing LSLs for emergency repairs and when the result is a full service line replacement. Pittsburgh offers replacements of the lines located under private property at no cost, and its lead replacement program is supported by grants and loans from the Pennsylvania Infrastructure Authority. PWSA's targets areas with many children under age 6, areas with elevated blood lead levels, and areas with high known amounts of LSLs for LSL replacement.

https://www.post-gazette.com/local/city/2019/01/28/PWSA-Pittsburgh-accelerate-lead-line-replacements-water-health/stories/201901270183
https://apps.pittsburghpa.gov/redtail/images/4758_PWSACurrentsNewsletterJanuary2019-FINAL.pdf
http://lead.pgh2o.com/pwsa-releases-june-2017-lead-compliance-test-results/

https://triblive.com/local/pittsburgh-allegheny/pwsa-steps-up-lead-water-line-replacement-program-in-pittsburgh/

For additional examples of state and community initiatives:
Environmental Defense Fund: Recognition of community and state LSL replacement programs

Lead Filters for Drinking Water

Filters on water faucets and pitchers are often used in response to a lead in drinking water problem. These particular filters are certified to remove not only lead but other water contaminants. While the goal is to ensure that the water is safe to drink, there are several potential issues to be aware of.

Background

General background on the use of filters is provided below:

- The National Sanitation Foundation (NSF) International certifies filters regarding their ability to remove particulate (e.g., undissolved particles) and soluble (dissolved in water) lead. [1]
    - Some filters are capable of removing either particulate or dissolved lead and some can remove both.
    - All filters have a rated capacity (e.g., 100 to 200 gallons, after which the replaceable filter must be changed).
- Water filters certified by NSF for lead reduction are evaluated using water that contains 150 parts per billion (ppb) of lead, a concentration is 10 times higher than the U.S. EPA action level for lead in drinking water. This level of contaminated water simulates typical use during and beyond the filter's claimed service life cycle. Certification is only confirmed when the product has met all lead reduction requirements and other requirements of the standard. To maintain certification, NSF retests the certified products periodically and audits the manufacturing facilities annually. [2]
- NSF certified water filters reduce lead in drinking water in the following ways:
    - Water dispensers or filters attached to the faucet allow water to flow through adsorption media which captures contaminants such as lead.
    - Contaminants, such as lead, are trapped in the filter and remain inside the filter, reducing their presence in the finished drinking water.
    - Many filters have meters or indicators that show when the filter needs to be replaced. (Manufacturer's specifications should be consulted for details on filter change frequency and filter capacity.)
- Filters are not a "corrosion control" device, but can be useful in reducing the health risks associated with lead exposure, both in water with and without corrosion control.
- The USEPA has performed filter studies in Flint and now Newark, NJ and a final report is pending.

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[1] See "Lead in School Water and Lead Plumbing Pipes," http//www.nsf.org/consumer-resources/water-quality/faucets-plumbing/lead-schools?panel=water-school-lead

[2] National Sanitation Foundation, August 15, 2019 http://www.nsf.org/newsroom/nsf-certified-water-filters-tested-with-water-containing-150-ppb-lead

Potential Concerns

The installation and basic capability of filters can pose problems, the more prominent of which are outlined below:

- Problems may occur due to poor installation, manufacturing defects, failure to follow manufacturers' instructions, heavy use of hot water (which should not be run through a filter), or unusual conditions in the water supply.
- Concern exists over very small lead particles from lead solder or lead service lines. While certified filters remove high amounts of lead, in some unusual situations enough lead passes through certain types of filters so that the treated water contains more than the federal standard of 15 parts per billion of lead.
    - If corrosion control is optimized to strike a balance between silicate, pH and phosphate, the thin coating that is formed from "lead passivation" (i.e., increased pipe resistance to chemical reaction) will prevent leaching, including these small lead particles.
- To determine that a filter achieves a specific target (i.e., lead below 1, 5, 10 or 15 ppb) in a given situation, it should be tested after installation. Even with testing, there is no guarantee that the water will always contain less lead than the target, as influent lead levels vary, as does filter performance.
- Any treatment system needs to be maintained and all filters require periodic replacement. Overused filters can discharge higher concentrations of lead than is entering the filter.
- Certain certified filters are designed to screen only a limited number of gallons of water (e.g., 100) that will be used for drinking and cooking.
- Differences in local water chemistries can affect both the leaching of lead from pipes and the performance of filters.[3]
- The USEPA and NJDEP should research filters further and offer updated regulations or written guidance on their use in private and public water systems.

Filters Certified to Reduce Lead[4]

Several different types of water filters have been certified by NSF for reducing lead in drinking water.

NSF/ANSI Standard 53 reduction claims for drinking water treatment systems:

- Pour-through pitcher/carafe: Water drips through a filter in a water pitcher using gravity.

[3] National Sanitation Foundation, August 15, 2019
http://www.nsf.org/newsroom/nsf-certified-water-filters-tested-with-water-containing-150-ppb-lead

[4] Ibid

- Faucet mount: Mounts on kitchen faucet. Uses diverter to direct water through a filter.
- Counter-top connected to sink faucet: Connects to existing sink faucet through a hose/tubing.
- Plumbed-in to separate tap or to kitchen sink: Installs under a sink; filtered water is usually dispensed through a separate faucet directly to the kitchen sink.
- Refrigerator filter: Installed in your refrigerator and typically dispensed through the refrigerator door.

NSF/ANSI Standard 58 reduction claims for reverse osmosis drinking water treatment systems:

- Reverse Osmosis (RO): Connects to your plumbing under the sink and uses a membrane filter to reduce lead (also can reduce minerals/Total Dissolved Solids).

Pitcher Filters[5]

Pitcher filters are only one of several risk reduction options after lead service line replacement. The American Water Works Association (AWWA) Standard C810-17 includes (1) flushing (i.e., running water through) the new or replaced service line immediately after installation, (2) flushing the water lines in the home, and (3) providing instructions to the occupant to flush taps used for drinking or cooking periodically. The standard also recognizes that some situations may warrant using point-of-use filters, or customers may desire to use POU filters.

According to the AWWA, a number of systems have distributed pitcher filters after either exceeding the lead action level or as part of lead service line replacement protocols. To-date, "maintenance" of the pitcher filters in these systems has been limited to the provision of:

(1) instructions to the customer on POU use;
(2) a supply of replacement filters for the pitcher, sufficient for the intended period of performance, and
(3) a point-of-contact at the utility or an allied organization for assistance.

Past experience has identified several challenges:

1. *Confirming delivery to the intended recipient* – When pitchers are left behind by field crews or delivered by third-party providers, there are instances of theft, failure to deliver, failure to deliver in a timely manner, and other issues one would associate with leaving a package on a doorstep.
2. *Adequate supply of NSF certified devices* – At times, the available supply of NSF-certified filter products has been limited. Surges in demand that are unanticipated by the available manufacturers can lead to shortages and delays in filter delivery to the water system (or fulfillment center) for subsequent delivery to customers.

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[5] *American Water Works Association, "Addressing Questions Posed in Federalism Consultation, Long-Term Lead and Copper Rule Federalism Consultation", March 8, 2018*

3. *Potential legal liability for failure of the customer to properly use the device* – It is conceivable that claims could be brought against a water system if a customer failed to adequately maintain the pitcher filter and subsequently claimed an illness was attributable to the water from the pitcher.
4. *Impact on household behavior* – It is not clear to what degree households will take seriously a recommendation to use and properly maintain a pitcher filter.

The AWWA is not aware of any research demonstrating the effectiveness of pitcher filters reflecting actual customer behavior.

Introducing filters as a regulatory requirement creates a new barrier to implementation. With respect to agency oversight of such a requirement, a traceable record to demonstrate delivery of pitchers within the specific criteria included in the rule language would be required. A regulatory requirement to provide filters, therefore, has the unintended impact of creating a new set of bureaucratic requirements that are a distraction and barrier to timely situation-specific risk mitigation.

Plumbed in Point-of-Use (POU) Devices[6]

Requiring water utilities to install and maintain POU devices in customers' homes is an approach for addressing lead from lead service lines in community water systems that would be fraught with difficulties. There are implementation considerations associated with utilizing plumbed-in POU devices beyond the burden imposed by the standard of performance described in EPA's Guidance for Safe Drinking Water Act compliance. They include:

1. Inability to gain access to 100% of homes with lead service lines to install, maintain and monitor filter performance.
2. Liability for harm to customer's property when installing devices (a frequent anticipated risk when installing POU devices on existing faucets and countertops).
3. Personnel safety when installing, maintaining and monitoring filter performance.
4. Inability to assure coordination with customer and consistent, adequate maintenance of the installed device.

A single-choice risk mitigation measure should not be written into regulation. No other federal Safe Drinking Water Act regulation specifies a single-choice treatment option.

Installed POU devices are only a viable solution when the number of homes being treated is manageable and the inhabitants cooperate. As noted previously, EPA guidance for the use of POU devices describes a standard of care that includes proper selection and installation, ongoing maintenance and regular monitoring of performance. Historically, EPA has recognized

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[6] *American Water Works Association, "Addressing Questions Posed in Federalism Consultation, Long-Term Lead and Copper Rule Federalism Consultation", March 8, 2018.*

that this treatment strategy was not a cost-effective risk reduction strategy compared to centralized treatment, other than for very small communities.

For more information:

- American Water Works Association, ”Addressing Questions Posed in Federalism Consultation, Long-Term Lead and Copper Rule Federalism Consultation”, March 8, 2018.
- National Sanitation Foundation, August 15, 2019 http://www.nsf.org/newsroom/nsf-certified-water-filters-tested-with-water-containing-150-ppb-lead.

Disclosure of Information Lead in Drinking Water in Real Estate Transactions

Examples from Other States and Cities

This document outlines the approach that some other states and cities have taken regarding the public disclosure of information on lead in drinking water, including the presence of lead service lines and indoor lead plumbing, at the point of home sale or rental. This information raises awareness of the lead in drinking water issue and enhances the negotiation process on the sale of property and apartment rentals.

Since 1996, federal law has required property owners to disclose the presence of lead paint to potential buyers and renters in buildings that were built prior to 1978, the year lead paint was prohibited. If unaware, the property owner is not required to find out if lead is present.

New Jersey:

In 2017 (and updated in 2019), the Environmental Defense Fund published a national survey of housing disclosure policies in various states that was particularly focused on the release of information on lead service lines. [7] EDF assigned New Jersey an overall rating of "D" based on the degree to which its current policy helps homebuyers make informed decisions.

Unlike most other states, New Jersey does not mandate the disclosure of lead pipes/materials or even general environmental hazards (i.e., substances that may pose a health issue.) New Jersey has a voluntary disclosure form that home sellers can provide information about known conditions affecting water quality of the presence of toxic substances on the property to potential homebuyers.

(Note: though not expressly covered by the EDF survey, New Jersey regulations (NJAC 5:17) presently authorize the issuance of three certificates regarding the presence of lead paint, as outlined below:

- "Lead free" certificate indicating that there is no lead paint in the entire building;
- "Lead free interior" certificate indicating the absence of lead paint on interior surfaces;
- "Lead hazard free" certificate indicating no lead hazards even if lead paint exists within the walls)

Other State Policies:

Disclosure varies considerably among the states. In New Jersey's region, however, New York, Delaware, Connecticut, and Pennsylvania require disclosure of lead pipes at home sale.

[7] https://www.edf.org/sites/default/files/content/LSL-State-Disclosure-Report-Update0319.pdf

Many states have policies that may make it more likely that a residential property owner will disclose the presence of a known LSL to potential homebuyers. The following policies specifically address lead pipes and/or plumbing material.

New York
State property law requires sellers of residential property to complete, sign, and deliver a property condition disclosure statement to the buyer or buyer's agent prior to the signing by the buyer of a binding contract of sale. One of the questions asks, "Is lead plumbing present?" If the answer is yes, the seller must provide the locations of the lead plumbing. Presumably, an LSL on private property would be considered lead plumbing.

Delaware
The Delaware Buyer Protection Act requires home sellers to complete and provide to potential buyers a Seller's Disclosure of Real Property Condition Report. The following questions on the form address lead pipes: "What type of plumbing (copper, lead, cast iron, PVC, polybutylene, galvanized, unknown) is in the house?)" and "Are there any lead hazards? (e.g. lead paint, lead pipes, lead in soil.) If Yes, describe…"

Connecticut
The Connecticut Uniform Property Condition Disclosure Act, requires home sellers to provide a Residential Property Condition Disclosure Report to prospective buyers prior to purchase. A seller must answer "Is lead plumbing present?" and state the location if the answer is yes.

Wisconsin
Wisconsin law requires home sellers to provide potential buyers with a Residential Real Estate Condition Report prior to purchase. A seller must disclose knowledge of "a defect caused by unsafe concentrations of, or unsafe conditions relating to, radon, radium in water supplies, lead in paint, lead in soil, lead in water supplies or the plumbing system."

Illinois
The Illinois Residential Real Property Disclosure Act requires home sellers to provide potential buyers with a Residential Real Property Disclosure Report prior to purchase. The seller must disclose if they are "aware of unsafe concentrations of or conditions relating to lead paint, lead water pipes, lead plumbing pipes, or lead in the soil."

City Policies:

The following communities have policies that support disclosure of lead pipes during real estate transactions:

Philadelphia
In 2017, the Philadelphia Mayor signed a bill amending the City's Health Code to expand required disclosures for lead paint hazards to include lead plumbing components and lead service lines for rental owners. Also, Philadelphia requires the disclosure of information relating to lead for rental units.

Cincinnati
In 2017, the Cincinnati City Council passed Ordinance 0185-2017 requiring landlords to notify tenants if the property is served by an LSL prior to executing a lease.

Washington, D.C.
In January 2019, the Washington, DC City Council passed a new law that requires property owners to disclose the presence of an LSL to potential homebuyers and renters. The city's lead disclosure form is quite comprehensive, including lead-in-water test results, the presence of an LSL or lead plumbing, and past fines.

Both Washington, D.C. and Cincinnati publish detailed, online maps of known and potential LSLs on both public and private property for public review. Location and address information is characterized as "best available"; accuracy is not guaranteed. (Other cities retain that information in a central database but do not publish it.)

Additional general information on lead disclosure can be found at the Lead Service Line Replacement Collaborative site noted below:
https://www.lslr-collaborative.org/helping-consumers.html

Chicago Public Schools
Lead Remediation Case Study

Chicago Public Schools (CPS), which operates 800 buildings (with a median age of 78 years) across 527 campuses, has implemented an aggressive plan to address lead contamination that could be instructive for New Jersey. Based on new state regulations, CPS has set a goal of less than 2 parts per billion (ppb) in all drinking water sources. With full replacement of lead plumbing estimated to cost billions, CPS initiated a pilot program at 25 of its most contaminated buildings that employed innovative “five-sequential” testing and “auto-flushing” practices.

In CPS, five sequential water samples are collected at each drinking water outlet to determine the location where lead is leaching into the water. Based on the rate of water flow, the timed samples provide a profile of lead in water readings in the school, as each sample contains water that sat overnight in a different part of the plumbing system, For example, if the first sample has elevated lead but the following samples do not, the lead likely is coming from the fixture itself. If the first samples are clean but the last samples have elevated lead, the lead likely is emanating from the vertical main water pipe called a “riser” or a horizontal “branch” line.

Based on this information, CPS is able to design specific solutions on a school-by-school basis. CPE avoids major plumbing repairs, which can be very costly, and instead focuses on a menu of other less costly but effective alternatives.

CPS has been particularly innovative in its approach to flushing, or running a water outlet for a short time after a period of inactivity. Flushing can significantly decrease lead levels by removing contaminated water before it is used for drinking or cooking. However, the time period for flushing a particular faucet or fixture depends on where in the plumbing system the lead is leaching into the water.

Recognizing that manual flushing is difficult to implement in a reliable, cost effective way, CPS innovated the use of *automated* flushing systems. CPS employs two computerized devices. Automated riser flushers (installation cost: $3,000-4,000) move water through a building’s main pipes once per day, and Noah flushers (installation cost: $1,000-1,500) automatically flush outlets on a programmable schedule. Schools use a combination of both flushers tailored to their building size, occupancy rate, and the typical usage of each outlet.

Flushing has the additional benefit of improving the effectiveness of corrosion control treatment. By increasing water circulation, flushing better enables orthophosphates to create a coating inside of lead pipes that reduces leaching. In one CPS school where lead levels commonly exceeded 15 ppb, four months of regular flushing improved corrosion control enough that samples taken after a week-long sitting period showed average lead levels of below one ppb.

The success of Chicago's customized, automatic flushing program is best exemplified at Orr Academy, the city's largest high school (i.e., 330,000 square feet with a separate elementary school). Prior to the pilot, the water at this facility had lead levels ranging from 16 ppb (90th percentile) to 25 ppb (95th percentile), with an average of 9.91 ppb. An automatic flushing regime reduced lead levels to an average below 2 ppb at a cost of $28,000.

(Note: The City of Chicago pays for the cost of water on behalf of the Chicago Public School System.)

More Information
https://cps.edu/SiteCollectionDocuments/LeadTesting/R2-WaterQualityTestingProgram.pdf

https://www.drinkingwateralliance.org/single-post/2018/01/16/Chicago-Public-Schools-Invent-New-Water-Quality-Device

https://www.mawc.org/sites/default/files/orr_hs_case_study_-_noah_auto_flushing_system_7_17_2017_cps.pdf