Lead in Drinking Water:
A Permanent Solution for New Jersey

Report of the Jersey Water Works Lead in Drinking Water Task Force

JERSEY WATER WORKS

Smart infrastructure. Strong communities.

Acknowledgments

Jersey Water Works is grateful to The Fund for New Jersey for its generous financial support, which made this report possible.

We thank the Children's Specialized Hospital in New Brunswick for hosting task force meetings.

We extend our gratitude to the Jersey Water Works Steering Committee, which guided the task force's direction and provided helpful feedback.

We thank New Jersey Future and its staff, who secured the funding, facilitated the task force, and produced this report:

- Gary Brune, Policy Manager, served as both the lead author of the report and staff to the task force. He facilitated the task force's extensive deliberations as well as individual members' contributions to the report. He also coordinated background research.
- Chris Sturm, Managing Director of Policy and Water, conceived and managed this project and made significant contributions to the report.
- Emily Eckart, Manager of Communications and Development, edited and designed the report with the assistance of Julia McBride, Program Assistant.
- Interns Will Parker and Emily Simroth conducted research and writing that was integral to the task force's work.

Special thanks go to our consultants, who provided invaluable policy and technical guidance on lead in drinking water and solutions from cities and states across the country:

- Tom Neltner, Chemicals Policy Director, and Lindsay McCormick, Program Manager, Chemicals and Health, at the Environmental Defense Fund.
- Dan Van Abs, Associate Professor of Practice for Water, Society, and the Environment at Rutgers University. Dan also served as task force liaison to the Jersey Water Works Steering Committee.

Thank you to the Green and Healthy Homes Initiative for underwriting the printing of this report.

ABOUT JERSEY WATER WORKS

JERSEY WATER WORKS
Smart infrastructure. Strong communities.

Jersey Water Works is a collaborative effort of many diverse organizations and individuals who embrace the common purpose of transforming New Jersey's inadequate water infrastructure by investing in sustainable, cost-effective solutions that provide communities with clean water and waterways; healthier, safer neighborhoods; local jobs; flood and climate resilience; and economic growth.
Learn more and join the collaborative at jerseywaterworks.org.

Contents

View this report online at jerseywaterworks.org/LeadReport. Additional information is available in the online Appendix at jerseywaterworks.org/LeadReportAppendix.

Jersey Water Works
Lead in Drinking Water Task Force

Christopher Daggett
Task Force Chair
Former Commissioner, New Jersey Department of Environmental Protection
Former Regional Administrator, U.S. Environmental Protection Agency

Kareem Adeem
Acting Director, Department of Water and Sewer Utilities, City of Newark

Christine Ash
Chief, Drinking Water and Groundwater Protection
U.S. Environmental Protection Agency, Region 2

Joseph Bella
Executive Director
Passaic Valley Water Commission

Staci Berger
President and Chief Executive Officer, Housing and Community Development Network of New Jersey

Laureen Boles
Director, New Jersey Environmental Justice Alliance

Peter Chen
Policy Counsel, Advocates for Children of New Jersey

Olumuyiwa Falajiki
Supervisor of Certification, Lead Abatement Unit, New Jersey Department of Community Affairs

Michael Furrey
Owner, Agra Environmental and Laboratory Services

Patricia Gardner
Director, Division of Water Supply and Geoscience, New Jersey Department of Environmental Protection

Amy Goldsmith
State Director, Clean Water Action

Monique Griffith
Director of Health and Human Services, East Orange, New Jersey

Ishiya Hayes
Fellow, John S. Watson Institute for Public Policy, New Jersey Urban Mayors Association, Thomas Edison State University

Chris Huber
Special Assistant to the Commissioner
New Jersey Department of Education

Michael Kammer
Bureau Chief, Division of Water
New Jersey Board of Public Utilities

Vineeta Kapahi
Community Strategies Fellow
East Trenton Collaborative

Cate Klinger
Director, National Campaign to End Lead Poisoning, Green and Healthy Homes Initiative

Andy Kricun*
Executive Director, Camden County Municipal Utilities Authority

Kristi MacDonald
Director of Science
Raritan Headwaters Association

Joe Myers
Committeeman, City of Bordentown
Vice President and Chief Operating Officer, Cooper's Ferry Partnership

Doug O'Malley
Executive Director
Environment New Jersey

Joseph Pargola
Assistant Director, Office of Policy and Regulatory Development, New Jersey Department of Children and Families

Elyse Pivnick
Senior Director of Environmental Health Policy, Isles

Shereen Semple
Director, Office of Local Public Health
New Jersey Department of Health

Tom Shroba*
Vice President of Operations
New Jersey American Water

David Smith
Chief Engineer, Trenton Water Works (served after Sept. 13, 2019)
Shing-Fu Hsueh, Director, Trenton Water Works (served until Sept. 13, 2019)

Chris Sturm
Managing Director of Policy and Water, New Jersey Future

Robert Tucker
Retired Scientist, New Jersey Department of Environmental Protection

Dan Van Abs*
Associate Professor of Practice for Water, Society, and the Environment
Rutgers University

Lucy Vandenberg
Senior Program Officer
The Fund for New Jersey

Disclaimer: Participation by task force members does not necessarily constitute individual or organizational endorsement of every recommendation. The state and federal government representatives took part to help inform the discussions and ensure technical accuracy. Their participation does not constitute individual or organizational endorsement of every recommendation.

** Member of the Jersey Water Works Steering Committee*

A Call to Action

Fellow New Jerseyans,

Every person in New Jersey deserves a safe, healthy environment that nurtures their full potential. Recent events have forced us to confront the fact that lead exposure thwarts this basic goal, even though its dangers have been well-documented for decades, to the detriment of children, their families, and all society.

To address the risk from lead in water, Jersey Water Works, with support from the Fund for New Jersey, convened a 30-member task force of representatives from local, state, and federal governments; water utilities; academia; environmental and public health groups; and community organizations. The group's efforts build on those of many others, most recently the Green and Healthy Homes Initiative's New Jersey Lead Poisoning Prevention Action Plan of 2018.

Since December 2018, the task force has worked to determine the practical, cost-effective, equitable, and permanent solutions that will ensure people across the state can access drinking water free from the risks of lead.

New Jersey can virtually eliminate lead in drinking water in 10 years through the actions outlined in this report. The recommendations start with a holistic state-level campaign to address lead from all sources: water, paint, and soil. The report then lays out a package of legislation that would simultaneously require and empower water utilities to replace dangerous lead pipes regardless of ownership. It also identifies the important state agency regulations, outreach programs, and transparency measures to ensure safe drinking water in homes, schools, and child care facilities. These actions should be complemented by other efforts to address lead exposure and improve water infrastructure.

Our primary focus is on young children. We know that the solution will be costly, and the timeframe ambitious, but it is a one-time investment that will result in long-term savings in health care and special education that will exceed the initial investment. Committed public officials, water utility leaders, and citizens can make these solutions a reality.

I'm proud to have collaborated with such a diverse and dedicated group of task force members. In order to get a head start on this work, individual members and their organizations have already made commitments to action. I hope every public official, community group, environmental organization, and water provider in New Jersey will make similar commitments.

Together, we can remove lead from drinking water.

Chris Daggett
Chair, Jersey Water Works Lead in Drinking Water Task Force
October 2019

Executive Summary

Most New Jersey residents take for granted that their tap water is healthy and safe. Federal and state regulations require drinking water utilities to test for nearly 100 primary contaminants and report the results annually; violations are unusual.

Unfortunately, however, one contaminant – lead – has proven to be a stubborn exception. Increased scrutiny following the Flint, Michigan crisis revealed that in communities nationwide, lead in pipes and plumbing continues to leach into drinking water, even though water from treatment plants is virtually lead-free.

New Jersey's problem is statewide. As of August 2019, 104 water systems in rural, suburban, and urban areas reported having lead service lines for some portion of their customers. This number will grow. In addition, many homes and apartments have internal pipes and/or fixtures containing lead.

Lead threatens human health, especially in children. Although paint is the leading source of lead exposure, water is also prominent, especially for infants fed with formula made with tap water that contains lead.

Jersey Water Works created the Lead in Drinking Water Task Force because despite clear knowledge of the risks, problems, and solutions, lead in water remains a significant threat to public health. Over the past year, 30 experts with diverse perspectives came together to develop a comprehensive set of solutions.

ABOUT THIS REPORT

This report lays out 19 interdependent actions which, as a package, can virtually eliminate lead in water within 10 years. The report recognizes that drinking water utilities are on the front lines and need funding solutions and other tools from state government. State government must also strengthen its regulations and requirements. Child care facilities and schools face distinct challenges that need tailored solutions. The report calls for high-level state leadership to elevate the issue and ensure inter-agency coordination. While the federal government should play a larger role, the task force does not assume it will.

The report recommends the permanent solution of removing the primary source of lead in water: lead service lines (LSLs), the hose-sized pipes that connect water mains under streets to homes and smaller apartment buildings. A comprehensive legislative package can require water utilities to run accelerated, efficient 10-year LSL replacement programs that offer no-cost, mandatory upgrades to property owners.

Supporting legislation would provide two types of funding solutions. Most New Jersey water customers are served by utilities that can afford to replace LSLs over a 10-year period with modest rate increases. These utilities must be authorized to do so. Some low-income water utilities will not be able to fund LSL replacement without exorbitant rate increases. State subsidies must assist those communities.

Unfortunately, the exact number and location of LSLs is not yet known. The best estimates suggest there are 350,000 LSLs statewide; an investment of approximately $2 billion will be required to replace them over 10 years. A state subsidy worth $500 million would thus cover 25% of replacement costs. These funds could be raised through borrowing, possibly backed by a small fee imposed on water utilities or water users.

What about homes that have lead plumbing and fixtures? Once LSLs are removed, state regulations and training must be strengthened to ensure more effective corrosion

control at water treatment plants to minimize lead leaching. Proper use of in-home filters and/or flushing offers additional layers of protection that community education efforts can promote, along with gradual replacement of plumbing fixtures.

Underlying all of these solutions is awareness and transparency. Local officials and property owners fear that public knowledge of a lead issue will lower the value of their community or home. But the problem can't be solved when its source is hidden from view. Online maps showing the number and location of LSLs, statewide LSL inventories, and disclosure to homebuyers and renters are needed in the short term to get us to a lead-free water future in the long term.

The Lead in Drinking Water Task Force concludes that, while the solution is costly, it is a one-time investment that New Jersey must afford. Long-term cost reductions in health care, special education, and lifetime earning potential will far exceed the investment. Though we lack precise records, we know enough to get started, and we know how to obtain the missing information to complete the work. This is a problem we can — and must — solve.

Recommended Actions in Brief

ACTION 1: Coordinate a state-level campaign for a lead-free New Jersey.

ACTION 2: Permanently replace lead service lines (LSLs) in 10 years through a comprehensive, interdependent legislative package.

ACTION 3: Create a 10-year funding program for LSL replacement.

ACTION 4: Enact protective rules and programs to ensure safe drinking water.

ACTION 5: Ensure quality water in child care facilities and schools.

1 COORDINATE A STATE-LEVEL CAMPAIGN FOR A LEAD-FREE NEW JERSEY.

Given the serious public health impact of exposure to lead in water, paint, and soil; its broad reach into many New Jersey communities; and the ongoing need to raise awareness, a comprehensive state campaign would maximize efficiency and ensure that all residents can adequately protect themselves.

1.1 Declare lead to be a public health threat. (executive order)
To create a sense of urgency and to help support difficult decisions, the governor should declare, preferably through an executive order, that lead exposure constitutes an immediate and long-term threat to public health.

1.2 Coordinate state efforts across agencies. (executive order)
To maximize efficiency, the governor should appoint an official in the governor's office who would be empowered to resolve lead-related issues across state agencies, including the Department of Environmental Protection (DEP), Department of Health (DOH), Department of Community Affairs (DCA), Department of Children and Families (DCF), Department of Education (DOE), Board of Public Utilities (BPU), and the Division of Rate Counsel (DRC).

2 PERMANENTLY REPLACE LEAD SERVICE LINES (LSLS) IN 10 YEARS THROUGH A COMPREHENSIVE, INTERDEPENDENT LEGISLATIVE PACKAGE.

Since lead service lines are responsible for approximately 50-75% of lead-in-water contamination, and interim measures like corrosion control and filters are not fail-safe, LSLs must be replaced. A comprehensive legislative package should require water utilities to run a 10-year LSL replacement program that offers no-cost, mandatory upgrades to property owners. Supporting legislation would require accurate LSL inventories, disclosure of the presence of lead pipes in homes at the point of sale and rental, and adequate funding solutions.

2.1 Require LSL disclosure at home sale and rental. (legislation)
Require identification and disclosure of LSLs and visible indoor plumbing at the time of home sale/transfer and rental along with other sources of lead contamination (e.g., paint, soil). Include mechanisms to ensure compliance, such as municipal use of the certificate of occupancy and, for landlords, certificate of habitability and fines.

2.2 Require LSL inventories with annual updates. (legislation)
Mandate that water utilities prepare preliminary inventories of utility-owned LSLs, service lines located under private property, and related lead components in the water distribution system within two years. Require annual updates thereafter. Require DEP to publish summary data and water utilities to post property-specific information. Indemnify municipalities and water utilities against lawsuits based on imperfect inventory data.

2.3 Require water utilities to fully replace LSLs within 10 years. (legislation)
Create a statewide program that requires water utilities to fully replace LSLs within 10 years, and ensure enforcement mechanisms are put in place. Ban partial LSL replacement except in limited circumstances.

2.4 Offer LSL replacement to all property owners at no cost. (legislation)
Require water utilities to offer property owners replacement of the portion of the line under their property at no cost wherever the utility is engaged in water main replacement or rehabilitation or replacement of utility-owned LSLs.

2.5 Ensure property owner participation in the no-cost program. (legislation)
To ensure widespread LSL replacement, require property owner participation in utility programs to replace LSLs at no cost. Require local or state penalties for non-compliance or authorize utility replacement without property owner permission.

3 CREATE A 10-YEAR FUNDING PROGRAM FOR LSL REPLACEMENT.

LSL replacements are estimated to cost between $5,000-6,700 each. Two kinds of funding solutions are needed. The first authorizes utilities to use rate revenues for LSL replacement, even though a portion of the line may be under private property. The second provides state funds to water utilities for which the necessary rate increases would impose undue hardship on ratepayers.

3.1 Authorize rate recovery across service areas. (legislation)
Authorize investor-owned and publicly-owned utilities to use rate recovery to fund replacement of LSLs located under private property during the 10-year program period.

3.2 Provide a state subsidy to water utilities with the greatest need. (legislation)
Provide state funds to utilities that have significant lead in drinking water issues and can demonstrate that the 10-year LSL replacement mandate would impose undue hardship on their customer base. Options for raising state funds include a fee on all water customers dedicated to support state debt, a state bond without a revenue source, or a recurring state appropriation.

4 ENACT PROTECTIVE RULES AND PROGRAMS TO ENSURE SAFE DRINKING WATER.

In many New Jersey communities, the threat from lead in water also involves indoor lead plumbing, including pipes, fixtures, and soldered connections. The solution to keeping people safe involves a combination of actions: regulatory changes to strengthen existing protective measures implemented by water utilities, a revamped approach to public communications, and further research on the level of exposure that should prompt action to protect public health.

4.1 Strengthen DEP drinking water regulations. (regulation)
Amend the state Lead and Copper Rule (LCR) to improve water sampling (e.g., expand the number and frequency of samples), broaden review of water quality parameters to verify the effectiveness of corrosion control treatment, require provision of water filters for homes with lead in water test results above the LCR limit (currently 15 parts per billion), strengthen training and licensing requirements for water system operators, and accelerate public education.

4.2 Make state home inspection and improvement programs holistic. (policy/budget)
Cross-train and certify inspectors to assess lead contamination of dust, water, and soil along with weatherization in a single visit. Build similar capacity among community health workers and home visitors. Fund holistic remediation.

4.3 Educate at-risk populations through a network of community organizations and local health agencies. (policy/budget)
Provide lead-related information for distribution by local community organizations, service providers, and local health agencies. Provide grants for collaborative communication efforts and door-to-door canvassing in cities with high lead exceedances.

4.4 Research health-based thresholds and expanded blood testing. (research)
Study expansion of required blood testing to include pregnant women and infants. Engage DEP's Drinking Water Quality Institute to review national studies and consider the advisability of adopting: 1) a state standard for lead in water that is lower than the existing federal threshold of 15 parts per billion; 2) a health-based household action level for lead in water; and 3) an appropriate standard for child care facilities.

Left: A lead gooseneck. The gooseneck connects the water main to the service line (see "Lead in Homes" on page 10). Goosenecks were used during the early 1900s to connect rigid service pipes in order to deliver water. Photo courtesy of the Lead Service Line Replacement Collaborative. **Right:** A staff member conducts lead in water testing with portable meters at a child care facility in Chicago. Photo taken by Dana Scruggs Photography and used courtesy of the Environmental Defense Fund.

5 ENSURE QUALITY WATER IN CHILD CARE FACILITIES AND SCHOOLS.

Because young children are particularly vulnerable to the pernicious effects of lead, exposure in child care facilities and schools is a serious concern. This is particularly true of children who are fed with formula mixed with lead-tainted water. Since the effects of lead often last a lifetime, it is vitally important that these facilities provide high-quality water.

5.1 Coordinate and refine testing cycles. (regulation and/or legislation)
Reduce the current six-year sampling cycle for schools to match DCF's three-year cycle for child care facilities, 25% of which reside in school buildings. For child care facilities and schools that are served by a public water system, do not have an LSL, and have a strong and stable record of lead-free water, suspend testing requirements unless they change water sources or reconstruct their indoor plumbing. Employ periodic spot inspections as a failsafe over the long term.

5.2 Publish electronic databases of lead test results. (policy)
Create statewide databases of lead in water test results received by DCF and DOE. Include all test results (positive and negative). Publicize the laboratory results for all lead in water samples as required by current regulation. Create a data portal for future testing cycles to ensure consistent data.

5.3 Improve water safety at facilities run by family child care providers. (policy)
Using elevated blood lead level results from pre-K children, identify facilities operated by family child care providers that may have contributed to these levels. Test for drinking water lead levels and, where significant lead levels are found, prioritize LSL replacement and encourage or support a full evaluation of indoor plumbing. Expand local outreach to all family child care providers regarding the dangers of lead.

5.4 Require drinking water management plans. (regulation)
Require state-licensed child care facilities to file drinking water management plans with DCF to identify how lead in water problems flagged by testing will be remediated. If family child care providers receive financial assistance, extend this requirement to them as well.

5.5 Research financial assistance to child care facilities. (budget and research)
Study whether there is a need for state financial assistance to state-licensed child care facilities and voluntarily-registered family child care providers to ensure safe drinking water.

5.6 Maximize the health impact of the $100 million Securing Our Children's Future grant program. (DOE policy)
Adopt program guidelines that:

- Prioritize schools in fiscally-distressed municipalities with a high proportion of children with elevated blood lead levels.
- Define eligible costs to include high-impact, low-cost projects such as lead service line removal, replacement of easily-accessible plumbing and fixtures/fountains, and automated flushing. The cost of "sequential" testing to pinpoint lead sources within indoor plumbing, which is vital to selecting the most effective set of remedial projects, should also be an eligible cost.
- Require school districts to submit a drinking water management plan that details the remediation process and projects.

Background

How lead in water harms New Jersey's children

In 1786, having observed for more than 60 years that people became poisoned from exposure to known sources of lead, Benjamin Franklin wrote that he was astonished "…how long a useful Truth may be known, and exist, before it is generally receiv'd and practis'd on."

Unfortunately, lead poisoning has persisted over the centuries. The story is both compelling and complex. The complexity stems, in part, from the many sources of lead exposure, most prominently lead paint but also lead in water and soil (see "Pathways of Lead Exposure" on page 18). The U.S. Environmental Protection Agency (EPA) estimates that 20% of total lead exposure is attributable to drinking water. That share can rise to 40-60% in infants who drink formula made with tap water containing lead. However, the relative contribution and harm from each source varies among individuals.

New Jersey's urban areas tend to have the greatest proportion of children with elevated BLLs, including Irvington (7.6%), East Orange (7.0%), Atlantic City (6.5%), Trenton (6.4%), Newark (5.2%), Paterson (4.8%), and Plainfield (4.2%).

Over the past half-century, significant progress has been made as federal prohibitions on lead in gasoline (beginning in 1973), paint (1978), pipes and solder (1986), food cans (1995), and other products drove blood lead levels (BLL) down sharply across the country. During that time, however, a broad consensus emerged among scientists: even a relatively small degree of lead exposure can unleash pernicious effects. The impact is particularly harsh on young children, who face lifelong learning and development issues (e.g., decreased IQ, lower academic achievement, difficulty in organizing actions and coordinating fine movements) and behavioral problems (e.g., attention deficit hyperactivity disorder, aggression, delinquency), as well as pregnant women (miscarriage, reduced fetal growth, low birth weight) and nursing mothers. Blood pressure problems, heart and kidney disease, and anemia are common among people with moderate exposure.

In response, the Centers for Disease Control (CDC) and Prevention gradually lowered the BLL it considered "elevated" from 60 micrograms/deciliter (µg/dL) in the mid-1960s to 10 µg/dL in 1991 and ultimately to its current level of 5 µg/dL in 2012, which New Jersey's Department of Health adopted in 2017. Subsequent research by the American Academy of Pediatrics and other organizations has indicated that even lead levels below 5 µg/dL may be cause for concern.

Children of lower socioeconomic backgrounds living in older cities are more likely to suffer from lead poisoning. Due to housing occupancy patterns nationwide, "non-Hispanic Black children are close to three times as likely, and Latino children two times as likely, to have elevated BLLs as compared to Caucasian children."[1] That pattern holds true in New Jersey. Blood test results taken in fiscal year 2017 identified blood levels above the 5 µg/dL standard in 4,697 New Jersey children (2.8% of the total tested) up to age six, the group most susceptible to the effects of lead. A total of 59% of these children were concentrated in four counties: Essex, Hudson, Passaic, and Union.[2] New Jersey's urban areas tend to have the greatest proportion of children with elevated BLLs, including Irvington (7.6%), East Orange (7.0%), Atlantic City (6.5%), Trenton (6.4%), Newark (5.2%), Paterson (4.8%), and Plainfield (4.2%).[3] Though the problem is statewide, lead exposure clearly harms children in some communities more than others.

LEAD CONTAMINATION FROM DRINKING WATER

Lead is rarely, if ever, present in source water or the water delivered by a treatment plant. The primary source is the lead service line (LSL), which carries drinking water from the water main into buildings. That pipe accounts for an estimated 50-75% of total lead exposure from water.[4] Typically, the LSL is partly owned by the water utility (from the curb to the water main under the street) and partly located beneath private property (from the home to the curb — see "Lead in Homes" on page 10). Though not peculiar to New Jersey, this arrangement complicates remedial actions and poses cost, legal, and equity issues.

Lead can also be present in indoor plumbing, including fixtures and lead solder connections. As lead pipe and solder was not outlawed by Congress until 1986, and fixtures were manufactured with some degree of lead through 2014, older homes are the primary concern. Locating the lead source in plumbing, and determining the best remedial option if pipes are not easily accessible, can be quite challenging. While corrosion control treatment (CCT) of the water and in-building filters can be useful tools for removing lead, they can fail in unpredictable ways. If the building is served by an LSL, the risk is elevated considerably. Replacing the LSL provides a permanent solution for the highest risk source, and any remaining lead from internal plumbing then can be managed by corrosion control, proper flushing, timely replacement of filters, and gradual replacement of internal plumbing fixtures.

Lead enters drinking water by gradually leaching from the LSL or indoor lead plumbing, particularly while the water sits stagnantly in the pipe. To reduce water corrosivity, which promotes leaching, many water utilities apply CCT, which forms a protective coating inside the pipe. Implementation is complicated, however, due in part to the wide variability in source water characteristics and distribution system components across New Jersey's 583 water utilities. Also, CCT effectiveness can be compromised by adjustments to other water treatment processes (e.g., disinfection). Close monitoring of water parameters such as pH is required.

Exposure to lead in water occurs in three primary structures: homes/apartments, child care facilities, and schools, yet LSLs play a prominent role only in the first two. Because lead is typically found only in small diameter pipes, schools usually do not have lead service lines; their primary lead source is indoor plumbing and devices such as drinking fountains or faucets.

CONCENTRATION IN COMMUNITIES WITH OLDER HOMES

Many LSLs were installed prior to 1940, when they were prized for their malleability as field crews navigated tight spaces in the water distribution system. Water utility records on these aged assets are often incomplete or non-existent. While a national study from the American Water Works Association suggests that New Jersey has 350,000 LSLs (fifth largest in the country), detailed inventories must be compiled to determine a more exact number.

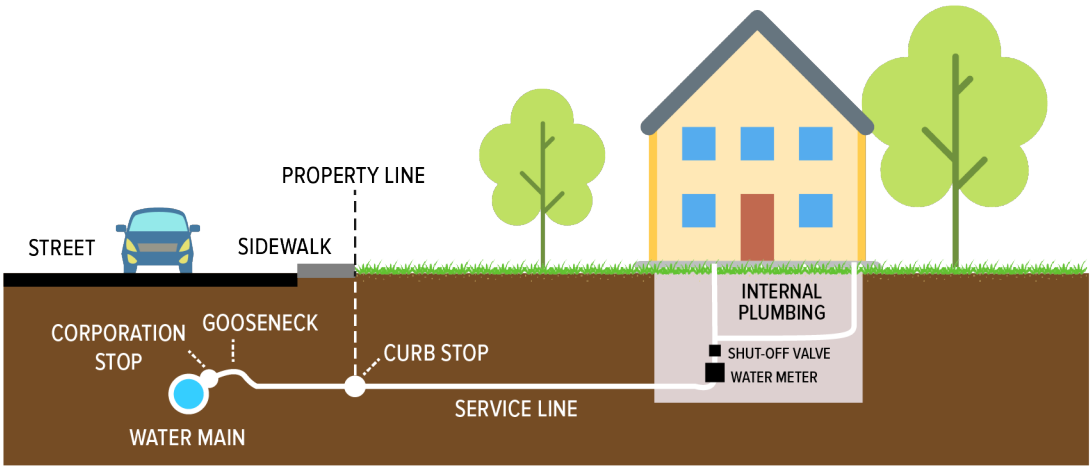
Nearly 20% of New Jersey housing units (i.e., 678,716 of 3.6 million total units) were constructed prior to 1940 (see "New Jersey Housing Units by Year Built" on page 12). Such housing is scattered across the state in older towns, and even in older neighborhoods in affluent suburbs, but the largest numbers are found in the state's major cities which, not coincidentally, also are home to the highest proportion of children with elevated BLLs (see "Median Age of Housing in New Jersey's 10 Largest Cities" on page 12).

A STATEWIDE PROBLEM

Several factors confirm that lead in water is a statewide problem. For example, approximately one-third of the state's drinking water systems apply CCT and, as of 2017, 383 school districts across rural, suburban, and urban areas reported at least one water tap testing positive for lead.

The number of water utilities reporting LSLs is another key measure. As of August 2019, 104 water systems indicated the presence of just over 161,000 LSLs, exposing some portion of just over 5 million residents who live in these service areas (see "Estimated Intensity of Lead Service Lines in NJ" on page 11). The LSL inventory is dynamic, as water systems may update the

Lead in Homes



The water distribution system has mutiple components, including the gooseneck (a curved connection from the water main) and the service line to the building. Lead leaches into tap water from lead services lines, goosenecks, and internal plumbing. Based on a graphic from the Lead Service Line Replacement Collaborative.

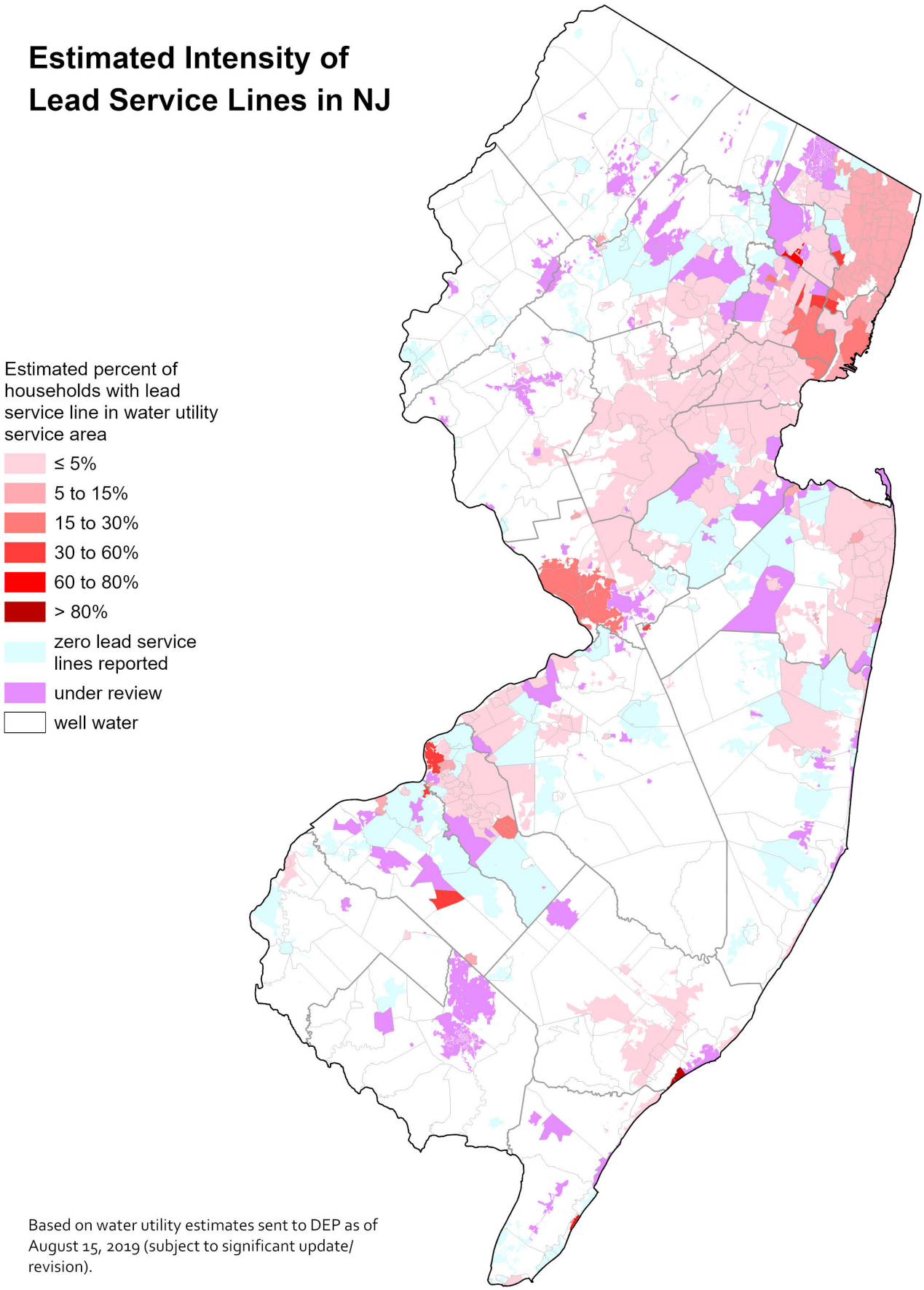
inventory at any time based on their field operations. The number of systems reporting LSLs is expected to grow as DEP finalizes its review of the information in hand and as water systems refine their estimates, particularly for LSLs located under private property, which may be significantly understated.

A national effort to remove LSLs from the homes of children born in 2018 would cost $2 billion but would yield $2.7 billion in future benefits, or about $1.33 per dollar invested.

A majority of households in many of the state's urban centers are renters. When considered as a group, 73% of households in Newark, Jersey City, Paterson, Trenton, Camden, Passaic, Atlantic City, Irvington, East Orange, and New Brunswick (each of which has a high proportion of children with elevated BLLs) are tenants. Landlords' willingness to replace LSLs, and to properly disclose the presence of lead in rental units, is vital to success.

With average installation costs ranging from $5,000 to $6,700 per line,[5, 6] total LSL replacement in New Jersey could cost between $1.75 and $2.3 billion. Other estimates peg the total cost at $3 billion. Replacement would produce a powerful set of benefits, primarily in increased lifetime earnings/tax revenue and decreased costs for health, special education, and crime control. In a 2017 study, the Pew Charitable Trusts concluded that a national effort to remove LSLs from the homes of children born in 2018 would cost $2 billion but would yield $2.7 billion in future benefits, or about $1.33 per dollar invested.[7] Long-term studies have established a strong association between preschool blood lead levels and social issues such as increased crime, decreased graduation rates, and premature births.[8, 9, 10] With every year that lead remains in place, all of these costs quietly persist and grow.

Estimated Intensity of Lead Service Lines in NJ



Based on water utility estimates sent to DEP as of August 15, 2019 (subject to significant update/ revision).

The Jersey Water Works Lead in Drinking Water Task Force

Many LSLs were installed prior to 1940, and nearly 20% of New Jersey housing units were constructed prior to 1940. The largest numbers are found in the state's major cities which, not coincidentally, also are home to the highest proportion of children with elevated BLLs. As shown below, two-thirds of New Jersey's housing was built in 1979 or earlier. Based on median year built, New Jersey's housing stock is the sixth oldest in the country.

NEW JERSEY HOUSING UNITS BY YEAR BUILT

Year Built	Number of Units	Percentage
2014 or later	61,622	1.7
2010 to 2013	60,589	1.67
2000 to 2009	315,919	8.73
1990 to 1999	349,568	9.66
1980 to 1989	423,304	11.7
1970 to 1979	451,114	12.47
1960 to 1969	485,984	13.44
1950 to 1959	533,610	14.75
1940 to 1949	255,465	7.06
1939 or earlier	678,716	18.77
Total: 1979 or earlier	2,404,889	66.5
Total: all years	3,615,891	100

This chart includes the count of housing units, not of structures within which units reside. A single structure can contain multiple housing units (e.g., multi-dwellings such as duplexes or apartment buildings). Source: U.S. Census Bureau, American Community Survey 1-Year Estimates, 2017.

MEDIAN AGE OF HOUSING IN NEW JERSEY'S 10 LARGEST CITIES

City	Popluation	Typical Home Built
Newark	283,000	1958
Jersey City	265,000	1954
Paterson	147,000	1954
Elizabeth	128,000	1955
Clifton	89,000	1953
Trenton	84,000	1942
Camden	72,000	1947
Passaic	70,000	1947
Union City	70,000	1957
Bayonne	66,000	1947

Source: U.S. Census Bureau, American Community Survey 5-year estimates, 2014.

Task Force Process

Diverse participants work across sectors

In 2018, the Fund for New Jersey (FFNJ) and New Jersey Health Initiatives (NJHI) announced the release of the New Jersey Lead Poisoning Prevention Action Plan, a comprehensive overview of lead exposure in the Garden State prepared by the Green and Healthy Homes Initiative (GHHI).

This Jersey Water Works report, which is also supported by FFNJ, builds on GHHI's action plan by providing detailed policy recommendations to dramatically reduce the risk from lead in drinking water, a key source of lead exposure that is under scrutiny across the country. The Lead in Drinking Water Task Force was organized under the auspices of Jersey Water Works (JWW), a 500-member collaborative. Since 2015, JWW has employed a cross-sector approach to tackle the formidable challenge of making our water systems a foundational asset for economic growth and thriving, just communities. The task force assembled 30 members representing water utilities, community and advocacy organizations, government agencies, research scientists, and academia. This group was selected with one goal in mind: to provide a diverse set of viewpoints and expert advice on a subject that is both complicated and, from a public health standpoint, compelling. Staff support was provided by New Jersey Future.

From December 2018 through September 2019, the group met five times. Under the leadership of Chairman Chris Daggett, the discussion forum encouraged members to identify key problems, challenge assumptions, and seek consensus on a comprehensive set of solutions.

Recognizing that various members possessed a wide array of in-depth knowledge on different aspects of the lead in drinking water problem, Jersey Water Works' first task was to provide a background paper to establish a common foundation for the entire group. To provide technical advice and insight into new developments in other states and cities, New Jersey Future arranged a contract with a national expert from the Environmental Defense Fund.

Seeking a full understanding of the state's existing programs, regulatory structure, and financial challenges, New Jersey Future arranged interviews with key staff from numerous state agencies, including DEP, BPU, DCF, the Division of Rate Counsel, and New Jersey Water Bank. To provide depth on key issues, such as lead service lines and the overriding federal Lead and Copper Rule, state agency representatives, water utility staff, and the Environmental Defense Fund made formal presentations to the task force. Accompanying discussion sessions enabled task force members to clarify key points that helped shape the final recommendations.

Each task force session included consideration of new ideas from other states and cities, including the unique approach to lead in schools undertaken by the City of Chicago's public school system, the State of Illinois' plan for regulating child care facilities, and lead service line replacement programs in places like Madison, Wisconsin and Denver, Colorado.

To identify the highest and best use of the $100 million in state bonds approved for water infrastructure improvements in New Jersey schools by the Securing Our Children's Future Bond Act, NJ Spotlight hosted a public forum in February 2019. In June 2019, the DEP and DOE jointly convened a stakeholder event to gather comments.

All of this input was considered as the task force divided into subcommittees that identified policy proposals in five areas: Communications/Transparency, Lead Service Line

(LSL) Replacement, Regulatory/Protective Issues, Child Care and School Facilities, and Financial Resources. Each subcommittee was headed by a chairperson whose main goal was to cultivate effective, powerful ideas that could be broadly supported by the full group.

GUIDING PRINCIPLES

Task force members reviewed draft proposals according to whether they contributed to a comprehensive solution that would be:

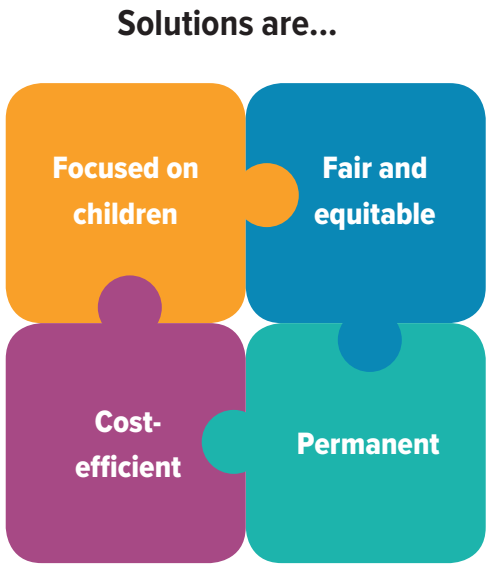
- Focused on children
- Fair and equitable
- Permanent
- Cost-efficient

Importantly, the solutions also emphasized a holistic approach. The success of the task force will not be judged solely on solving the lead in drinking water problem, but also in its sensitivity to the larger issues of lead in paint, soil, and other exposure sources.

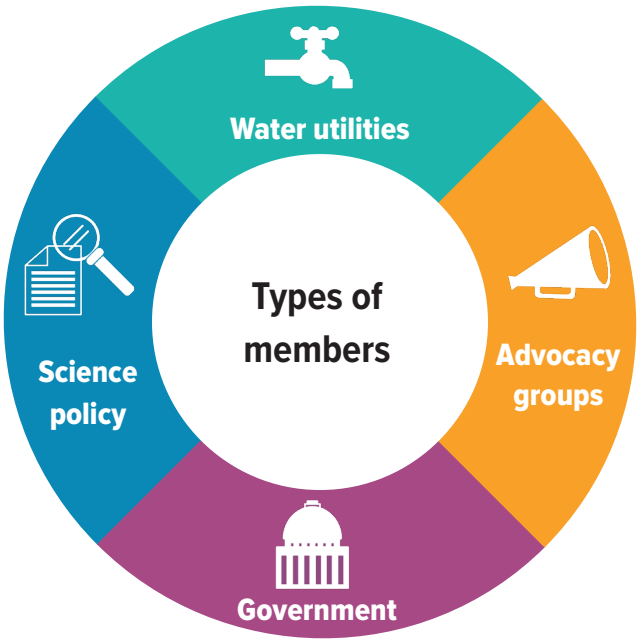
Before the recommendations were finalized, they were presented to the Jersey Water Works Steering Committee and its Asset Management and Finance Committee for comment. Draft proposals were also presented to the staff of the governor's office and legislative leadership.

This collaborative, consensus-building approach, and the emphasis on equity, fairness, efficiency, and effectiveness that guided this document, will hopefully strengthen its impact on public debate of this key issue.

GUIDING PRINCIPLES



TASK FORCE MEMBERS



Policy Recommendations

New Jersey needs practical, cost-effective, equitable, and permanent solutions to address the statewide problem of lead in drinking water. In this section, five action areas and 19 interdependent recommendations are presented. Together, they will virtually eliminate lead in drinking water in 10 years.

1 COORDINATE A STATE-LEVEL CAMPAIGN FOR A LEAD-FREE NEW JERSEY.

Given the serious public health impact of exposure to lead in water, paint, and soil; its broad reach into many New Jersey communities; and the ongoing need to raise awareness; a comprehensive state campaign would maximize efficiency and ensure that all residents can adequately protect themselves.

THE CHALLENGE

The health, social, and community impacts of lead have been known for decades. They include damage to the brains of children as well as adult health. The impacts are permanent, and ongoing research shows that there is no safe lead level in blood.

Despite growing technical knowledge regarding the effects of lead from soil, household dust, and paint chips, we have not been successful in comprehensively mitigating these threats. The identification of lead in drinking water, such as in Flint, Michigan, only increases the need to address lead exposures from all sources. This report focuses on lead in drinking water but recognizes that all sources of lead exposure are of grave concern.

State governments play a critical role in implementing, and in some cases strengthening, federal requirements to mitigate lead poisoning. They also work with local agencies and other prevention partners. With responsibilities spread across multiple agencies, central coordination is needed to identify gaps, resolve conflicts, and ensure efficiency. For example, Trenton Water Works' (TWW) LSL replacement program has been impeded by its lack of authority to collect a special assessment cost share from property owners for LSLs that reside under private property located in surrounding towns served by TWW (e.g., Ewing, Hamilton).* Such issues require state-level coordination between the DCA, DEP, municipalities, and the water utility.

* *Throughout this report, lead service lines will be referenced in two ways: those that are owned by the water utility and the portion that resides under private property. The latter acknowledges that ownership of LSLs under private property is the subject of ongoing analysis and review, and therefore it is not appropriate to generically describe them as "customer-owned."*

Perhaps most importantly, only high-level leadership can ensure that combined state government efforts result in positive outcomes at the level of individuals — especially children — and their families and communities.

WHAT HAS BEEN ACCOMPLISHED TO DATE

Lead policy issues are currently managed by several departments in New Jersey (see table below). These agencies operated numerous lead-related programs prior to the Flint, Michigan crisis, and in the years that followed, several new programs were developed. Some of the efforts of the DEP, New Jersey Water Bank, BPU, Division of Rate Counsel, DOE, and DCF are noted elsewhere in this report.

As noted in the DOH's 2017 report on Childhood Lead Exposure in New Jersey, over the past 20 years, the number of children in New Jersey who have been tested for lead has increased twenty-fold and the number with elevated blood lead levels has been reduced by approximately 50%.

In 2017, the DOH adopted regulatory amendments that halved the state's blood action level from 10 to 5 micrograms per deciliter (µg/dL), mirroring the federal Centers for Disease Control (CDC) and Prevention's recommendation. If the CDC lowers its blood lead reference level in the future, New Jersey will lower its level accordingly. DOH also amended its regulations to trigger case management and environmental investigation at the lower 5 µg/dLlevel.

Several state agencies have informally worked together to coordinate efforts on the lead in water issue. One example is the New Jersey Interagency Task Force on the Prevention of Lead Poisoning. The task force, which focuses on certain aspects of the lead issue, brings together agencies from all levels of government as well as nonprofit organizations and community groups.

GOVERNMENT AGENCIES AND THEIR ROLES

	The Department of Health (DOH) oversees lead training and certification, permits for work involving lead-based paint, and the state's childhood lead poisoning prevention program, including policy for testing children's blood.
	The Department of Environmental Protection (DEP) oversees lead in drinking water, including implementation of the state and federal Lead and Copper Rule (LCR) as well as monitoring of schools that have their own water supply system (e.g., well water).
	The New Jersey Water Bank provides subsidized loans and grants for lead service line replacement.
	The Department of Education (DOE) oversees testing for lead in drinking water at all public schools, regardless of their drinking water source.
	The Department of Children and Families (DCF) Office of Licensing oversees testing for lead in drinking water at child care facilities.
	The Department of Community Affairs (DCA) regulates housing issues relating to lead, including certification of lead abatement and lead evaluation contractors.
	The Board of Public Utilities (BPU) regulates rates charged by investor-owned water utilities and a few publicly-owned utilities, based on justified expenditures.
	The Division of Rate Counsel protects consumers by monitoring rate cases and other matters relating to investor-owned utilities regulated by the BPU.

RECOMMENDATIONS

1.1 DECLARE LEAD TO BE A PUBLIC HEALTH THREAT. (EXECUTIVE ORDER)

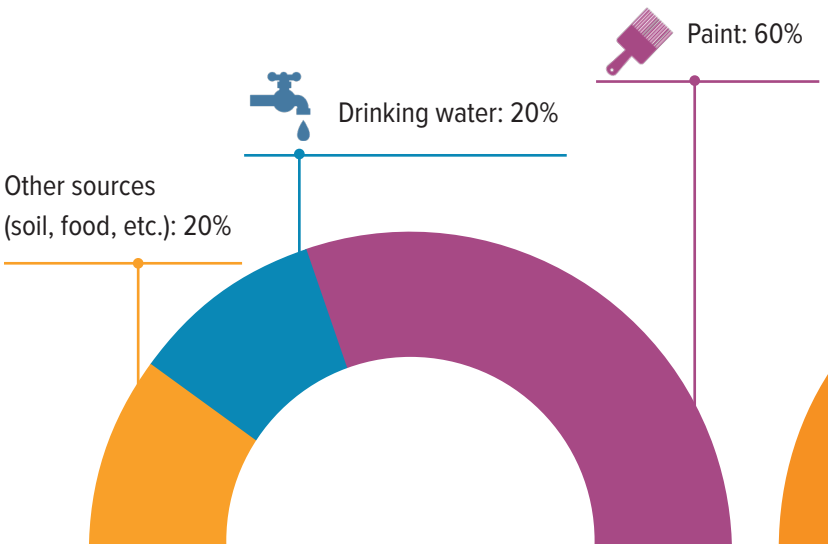
Drastically reducing lead exposures in New Jersey is an ambitious task that requires leadership and bold action. To muster support for the difficult decisions that are required, and to alert those who do not realize the extent of the problem, a wake-up call must be issued to highlight the urgency of the situation.

The State of New Jersey, preferably through an executive order by the governor, should declare lead contamination from paint, soil, and water (including lead service lines) to be a public health threat. Consistent with that designation, the executive order should call on state agencies to address the sources of lead exposure, prioritize actions in environmental justice communities with the most affected children, and generally coordinate their efforts.

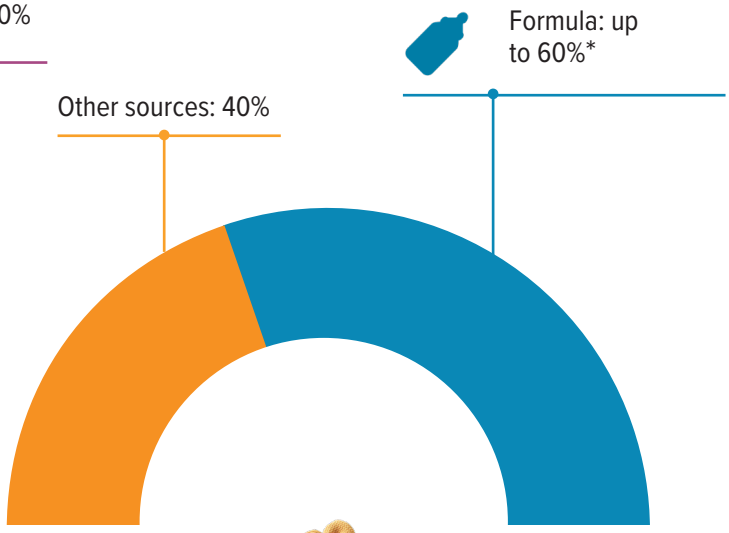
To clarify, this is not a request to declare a public health emergency, as this is not a case of requiring additional powers to form a proper response. Key actions to address the problem are already underway. Rather, the declaration of a public health threat would rightfully bring attention to the issue and ensure the most efficient approach across the state.

PATHWAYS OF LEAD EXPOSURE

Pathways of exposure for the general public



Pathways of exposure for infants



*Made with lead-contaminated water

1.2 COORDINATE STATE EFFORTS ACROSS AGENCIES. (EXECUTIVE ORDER)

To improve communication and coordination on lead policy issues, the state should appoint an official, ideally housed in the governor's office, to oversee lead-related issues and coordinate the departments. This "lead ombudsman" should address the following areas of concern:

- **Data sharing.** Presently, state agencies are not required to share data or coordinate key activities such as service delivery, enforcement, or budget requests relating to lead exposure. Patient confidentiality concerns are an important factor in how lead-related data may be shared. However, given the numerous agencies involved in the lead issue, and the central role that data plays in evaluating programs and allocating resources, an ombudsman could identify new initiatives that would maximize efficiency, including the possible linking of existing databases across departments. Such measures could be established through the issuance of a memorandum of agreement, as other states and cities have done.
- **Interagency task force on lead poisoning.** Better cross-agency coordination is key to maximizing efficiency in addressing various forms of lead poisoning. A lead ombudsman should create an interagency group to establish best practices and a "lead across all policies" approach.
- **Defining "lead-free."** The current disjointed approach to addressing the environmental sources of lead in New Jersey has resulted in an incomplete definition of "lead safe" regarding properties and exposure. DEP, DCA and DOH should jointly define common definitions that include lead in water and paint (see section 2.1 for a suggested approach).
- **Holistic home inspection.** The ombudsman would help coordinate holistic lead inspection training so inspectors can comprehensively assess lead in paint, water, and soil in a single visit (see section 4.2).
- **Expedite lead remediation projects and resolve conflicts**. The ombudsman would intercede between water utilities and governmental agencies, or between the agencies themselves, to resolve regulatory and operational issues that impede program implementation. In some cases, this may include professional (e.g., legal) advice.

Left: Photo from the U.S. Environmental Protection Agency. **Top right:** The Newark skyline. Newark has a high concentration of lead service lines. **Bottom right:** Lead service line replacement in Newark. Photo courtesy of Agra Environmental and Laboratory Services.

2 PERMANENTLY REPLACE LEAD SERVICE LINES (LSLS) IN 10 YEARS THROUGH A COMPREHENSIVE, INTERDEPENDENT LEGISLATIVE PACKAGE.

Since lead service lines are responsible for approximately 50-75% of lead-in-water contamination, and interim measures like corrosion control and filters are not fail-safe, LSLs must be replaced. A comprehensive legislative package should require water utilities to run a 10-year LSL replacement program that offers no-cost, mandatory upgrades to property owners. Supporting legislation would require accurate LSL inventories, disclosure of the presence of lead pipes in homes at the point of sale and rental, and adequate funding solutions.

THE CHALLENGE

Historically, most states and cities have been slow to embrace the costly replacement of lead service lines (LSLs), which account for an estimated 50-75% of lead in drinking water. Consistent with the federal Lead and Copper Rule, communities have relied on corrosion control treatment (CCT) and, in some cases, filters. LSL replacement was a last resort, typically when CCT became ineffective in a particular water system.

Unfortunately, these measures are not always reliable. CCT depends upon complex water chemistry and can fail in unpredictable ways, while the performance of in-home filters depends upon proper installation and maintenance and may be compromised if the lead concentration is too high (see the online Appendix for detail on filters). If properly implemented, however, experts agree that, once the entire lead service line is removed, any lead that leaches from indoor plumbing can be managed by three layers of protection: CCT, in-home filters, and water flushing. A fourth layer, replacing plumbing fixtures such as faucets, also may be viable.

Lead remediation is further complicated by ownership and location. Most LSLs include a portion owned by the water utility and a portion located beneath private property. Though the removal cost can be cut by nearly a third by methodically replacing all LSLs across entire neighborhoods, success depends upon participation by the property owner, which can be spotty, particularly if a large cost share is required. Reluctance among landlords is troubling, since most urban residents are tenants who are not well-positioned to demand action.

Historically, when water customers refused to cooperate with a water utility offer to replace the LSL portion beneath their property, utilities replaced their own portion of the service line in an action termed "partial replacement." However, partial LSL replacement can significantly increase lead exposure in the short term by jostling lead fragments loose into the drinking water. In the long term, the customer still risks exposure from the remaining LSL. Today, most utilities are reluctant to do partial replacements. (Note: If the current or future water customer ultimately decides to hire their own contractor to replace the LSL, the cost would be significantly higher.)

WHAT HAS BEEN ACCOMPLISHED TO DATE

Other states (PA, DE, CT, NY) and cities (Philadelphia, Washington DC, Cincinnati) have adopted broad disclosure policies for lead in water when a home is sold or rented, including LSLs, lead-bearing plumbing, and in some cases, test exceedances. A detailed review of such disclosure policies can be found in the online Appendix.

Lead service lines account for an estimated 50-75% of lead in drinking water.

Some cities have either completed or mandated comprehensive LSL replacement, including pipes located under private property (see the online Appendix). According to the Environmental Defense Fund, seven communities have completely eliminated LSLs.* The City of Madison, WI completely replaced all of its estimated 8,000 lead service lines in 12 years. The City of Denver,

Three pipes (left to right): A copper pipe, a corroded lead pipe, and a lead pipe that has been treated with phosphate corrosion inhibitors to reduce the risk of lead leaching into the drinking water. Photo courtesy of Passaic Valley Water Commission.

**According to the Environmental Defense Fund, the seven cities that have successfully replaced all of their LSLs are Framington and Springfield in MA; Lansing, MI; Madison, WI; Medford, OR; Sioux Falls, SD; and Spokane, WA. For more information, see www.edf.org/health/recognizing-efforts-replace-lead-service-lines#completed.*

CO recently announced a 15-year plan, subject to EPA approval, to replace an estimated 75,000 LSLs. States have been active as well, including Michigan, which crafted a comprehensive long-term plan requiring complete LSL replacement in 20 years.

In New Jersey, several water utilities have launched LSL replacement programs, including the Passaic Valley Water Commission, the City of Newark's Department of Water and Sewer Utilities, Trenton Water Works, New Jersey American Water and SUEZ. Customer participation and private cost-share requirements have proven to be significant hurdles, particularly for low-income property owners.

Extrapolating from a 2016 national survey of water utilities, the American Water Works Association (AWWA) estimates that New Jersey has 350,000 LSLs, the fifth largest among states. As evidenced in the map on page 11, these pipes are spread across the state. In 2018, DEP surveyed water utilities regarding LSLs on public and private property. As of August 2019, the responses from 104 utilities totalled just over 161,000 LSLs. While 329 (56%) of the state's 583 public community water systems reported no LSLs, data gaps exist:

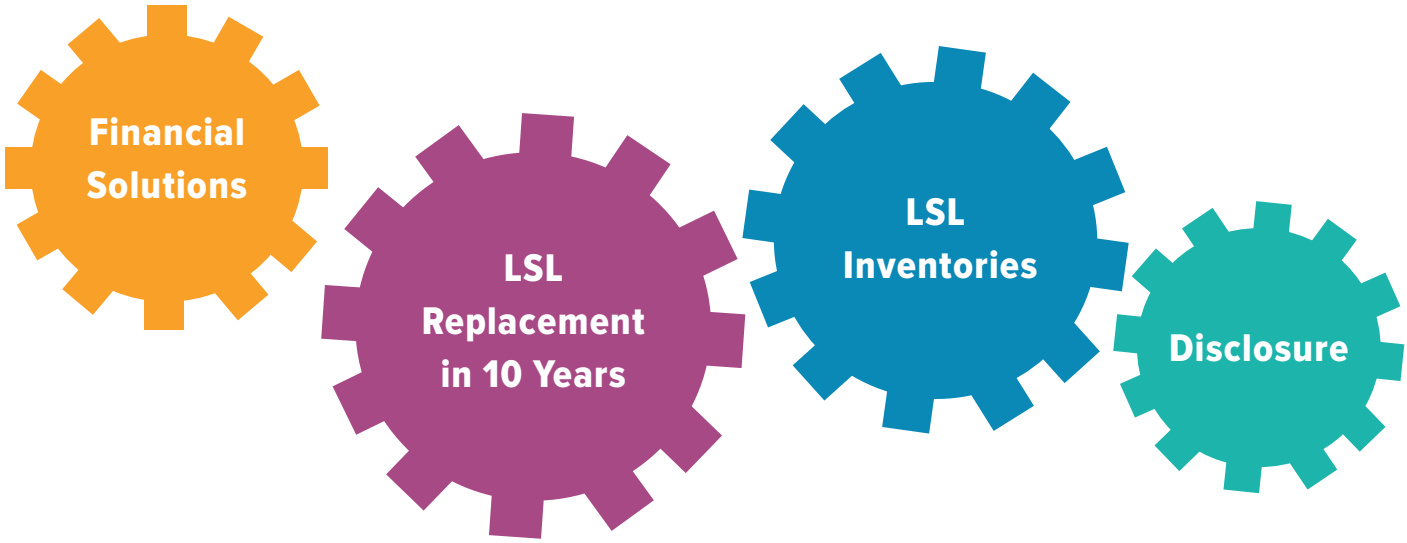
- Of the 104 utilities reporting LSLs, 47 reported a known set of LSLs and 57 reported a mix of known and unknown LSLs.
- 71 utilities reported they have no information.
- 79 utilities have submitted plans that are still under evaluation by DEP.

DEP expects that many utilities will uncover additional LSLs as they continue to work on LSL inventories and replacement. This is particularly true of partial LSLs located under private property which, based on anecdotal evidence, seem to be significantly understated. For example, while SUEZ-Hackensack reported the highest number of known or suspected LSLs to DEP (38,145), they also estimated 153,000 LSLs under private property of "unknown" composition.*

**DEP counts partial LSL replacements against the federal Lead and Copper Rule requirement that water utilities facing lead exceedances replace 7% of their LSLs per year until they return to compliance. However, that entry remains on DEP's LSL survey until both the utility-owned service line and the portion under private property are replaced at that location.*

RECOMMENDATIONS

All of the recommended actions in this section require authorizing legislation, and each one relies on the others for its success. An LSL replacement program would be doomed to fail without corresponding LSL inventories, disclosure to residents, and financial resources. It is vital that legislative initiatives not be approached in a piecemeal fashion but rather be considered as a single, comprehensive package.



Each recommendation in this section depends upon successful enactment of the others.

2.1 REQUIRE LSL DISCLOSURE AT HOME SALE AND RENTAL. (LEGISLATION)

The disclosure of lead hazard information to prospective homebuyers and tenants is absolutely vital. The authorizing legislation should be comprehensive and holistic (i.e., lead in water, paint, and soil). If so, disclosure of lead in drinking water would protect public health and incentivize property owners to respond to water utility offers to replace LSLs.

Require disclosure during the real estate transaction process. Presently, prior to sale, transfer, or rental, property owners may receive one of three certificates based on an evaluation of the presence of lead paint. Under N.J.A.C. 5:17, a "lead free" certificate indicates that there is no lead paint in the entire building; a "lead free interior" certificate indicates that there is no lead paint on interior surfaces; and a "lead hazard free" certificate indicates that there are no lead hazards, even if lead paint exists deep within the walls.

The affected state agencies (e.g., DCA, DEP, and DOH) should work together to identify how best to expand existing regulations beyond lead paint to include lead in water without creating undue administrative complexity. For one possible approach, see the table on the following page. Unless the property owner possesses one of these certificates, the sale or transfer of real property and the turnover of rental properties should trigger an inspection and disclosure of all sources of lead. The seller/landlord would bear the cost of that inspection.

ONE POSSIBLE APPROACH FOR REQUIRING LSL DISCLOSURE

Existing regulation (NJAC 5:17)	Proposed regulation
"Lead Free" = no lead paint in building	• "Lead Free" = building is free of all lead paint, LSL, and indoor lead plumbing • "Lead Pipe Free" = no LSL or indoor lead plumbing
"Lead Free Interior" = no lead paint on interior surfaces "Lead Hazard Free" = no potential exposure to lead dust, soil, or paint	No substantive change. Keep current language.

The inspection results would be captured on a standard form developed by DCA that the buyer/tenant must review, as doing so enables each party to make an informed decision. For the homebuyer, the information would be noted as an attachment to the purchase contract and should be provided at least 10 days in advance of closing. For the renter, it would be disclosed in the rental application. Water utilities would not establish a new account for a homebuyer if a LSL is present and the property owner has rejected or not responded to the utility's offer to replace the line.

Certificates would be issued by the local health agency, DCA, or a certified lead evaluation contractor. Remediation of a known LSL or indoor lead plumbing would remain a negotiable item on home sales and rental units.

Prioritize disclosure of interior lead pipes and LSLs. In addition to a new "lead pipe free" certificate, the water-related portion of the proposed lead disclosure legislation should include:

- *Exemption of recently built properties.* Exempt real property built on a new lot after 1986 (when Congress outlawed lead pipes/solder) from the onsite inspection process. (Redeveloped properties would not be exempt, since they could have an LSL.)
- *Notification of property owners of known LSLs.* Annually, water utilities should inform affected property owners of known LSLs, including utility-owned pipes and those located beneath private property, as doing so helps prevent a property owner from claiming ignorance on the subject when selling or renting a home. (Note: Under common law in New Jersey, a seller or landlord can be held liable for not disclosing information about the condition of a property that may impact public health.) Rental households that are responsible for water utility bills should also be notified.
- *Enforcement.* To ensure compliance with disclosure requirements, municipalities should strongly consider their existing certificate of occupancy (home ownership) and the certificate of habitability (property rentals) as tools. Enforcement would fall to local building construction and permitting staff and/or DCA, depending on the municipality. To protect tenants, fines should be imposed on recalcitrant landlords.

Lead free housing registry. Many homes are currently inspected in response to child lead exposure. Those blood lead test results are not disclosed due to health privacy regulations. However, lead testing that is home-related, not child-related, is not protected by health-based confidentiality. In those cases, LSL data should be public information. To increase transparency, the past effort to establish a statewide "lead safe" database should be revived and renamed. The site should identify properties with lead certificates, those in violation of lead certification regulations, and applicable results from LSL inventories.

2.2 REQUIRE LSL INVENTORIES WITH ANNUAL UPDATES. (LEGISLATION)

Enact legislation mandating that water utilities create/update an LSL inventory. It should be:

- **Comprehensive**. Include both utility-owned LSLs and related lead components in the water distribution system, as well as pipes beneath private property (if known) and data on any partial LSLs. Regional utilities would summarize LSLs by municipality.
- **Consistent**. All utilities should collect information on the same categories:
    - Lead service lines
    - Lead gooseneck connections
    - Any other lead components (e.g., galvanized pipe with a lead gooseneck) in the distribution system that conveys water from the water main to the residence
    - Known non-lead materials (e.g., ductile iron, PVC)
    - Unknown — indicates that the composition of a service line is unknown. Inventories also may include information on internal plumbing and fittings.
- **Routinely updated**. Require a preliminary inventory followed by annual updates:
    - A preliminary inventory should be completed within two years from the date of enactment, based on records and other readily available information.
    - Water utilities should update the preliminary inventory at least annually with data from various sources, including field work, property owner inspections, and LSL replacements. This effort should continue until DEP confirms that no LSLs remain.
    - "An annual report, if part of a regular reporting requirement, will focus attention on making steady progress in replacing LSLs and in resolving the identity of unknown service lines."[11]
- **Shared with state government**. Through the Water Quality Accountability Act, require annual reporting of summary information to DEP (i.e., LSLs in each category — see https://www.state.nj.us/dep/watersupply/g_reg-wqaa.html). To monitor progress, DEP should file a biennial summary with the governor and legislature.
- **Transparent**.
    - Require a central, electronic database at DEP that provides a summary of the inventory results by municipality and utility. A small state appropriation may be needed to support related database development work and updates.
    - Require water utilities to publish location-specific inventory results to help protect residents and prompt property owners to remove LSLs.
- **Indemnification**. Since the inventory will be imperfect for several years, water systems and municipalities should be indemnified from liability lawsuits for any inadvertent errors (i.e., inaccurate/missing data) but not for deliberate errors. Utilities should maintain an updated schedule and the database should list appropriate disclaimers.

2.3 EMPOWER WATER UTILITIES TO COMPLETELY REPLACE LSLS WITHIN 10 YEARS. (LEGISLATION)

A statewide effort to replace LSLs will be a lengthy undertaking. Having a long-range plan in place will help prompt action and gauge progress.

State legislation should create a 10-year LSL replacement program. Supported by the declaration of lead as a major public health threat, achieving the timeline would depend upon strong public understanding and transparency, the provision of financial resources, and a legal mandate with an effective enforcement mechanism.

The program would have the following features:

- **Ban on lead service lines**. Enact a state law that bans LSLs and requires utilities to remove them over a 10-year period, but only when the utility or a plumbing code official notifies the property owner. Enforcement against customers would be triggered when a water utility seeks to remove the LSL beneath private property, either as part of a special effort or as part of the regular improvement of water mains (see section 2.5 regarding potential approaches to enforcement). Viewing LSLs as a legal liability and public health threat should prompt property owners to participate.
- **Comprehensive replacement**. In the face of customer intransigence, some water utilities have replaced only the LSL portion that they own (i.e., partial replacement). As noted earlier in this report, this approach can temporarily worsen the level of lead in water by releasing lead fragments within the pipe. To protect public health, each LSL replacement project must address both the utility-owned LSL and the service line beneath private property. (The latter may include "orphaned" LSLs that remained in service under private property following partial replacements.) The utility must ensure that both line portions are either simultaneously removed or verified as lead-free. Partial replacement should only be permitted in limited exceptions (e.g., emergencies and homes that are abandoned or deemed unsafe).

A methodical, neighborhood-by-neighborhood approach to replacing LSLs can reduce the cost by 25-30% versus removing the same pipes in a scattered fashion.

Since the federal Lead and Copper Rule (LCR) requires water systems with action level exceedances to replace seven percent of their LSLs annually until compliance is restored, the implication of a ban on partial LSLs should be coordinated with the EPA. (A federal rule change is probably required.) Legislation should also limit or remove liability for water utilities when a full LSL replacement is unachievable due to recalcitrant landowners.

- **Deadlines**. To provide time to establish the necessary financing and regulatory programs, legislation authorizing the 10-year period should commence 18 months after enactment. During the 10-year period, the main priority should be the complete elimination of LSLs, and galvanized pipe (that has a lead gooseneck) should be a secondary priority. DEP should have flexibility to negotiate alternative deadlines through a Safe Drinking Water Act permit or Administrative Consent Order if a utility demonstrates that the 10-year deadline is not achievable. To gauge progress, DEP's regulations should establish interim milestones and public reporting on progress.

2.4 OFFER NO-COST LSL REPLACEMENT TO ALL PROPERTY OWNERS. (LEGISLATION)

In New Jersey, cost share requirements on private property owners for LSL replacements have posed a significant hurdle to participation, particularly among low-income property owners.

State legislation should require utilities to make a "no-cost" offer to property owners to replace the portion of the line that runs under their property in coordination with planned water main work, a utility LSL replacement program, or where the property owner would be excessively burdened (i.e., owner agrees to LSL removal after the utility already completed work in the neighborhood). The offer should highlight the benefits of replacement:

- Safer drinking water.
- No cost to the property owner if they move forward within a certain timeframe while the utility is working in their neighborhood. (Note that the cost of LSL replacement would be shared by ratepayers and/or taxpayers.)
- Standard replacement methods (including turf and plantings) will be funded. Property owners with special requests (e.g., trenchless replacement) should pay the added cost.
- Ancillary benefits, including water conservation from reduced leakage from old lead pipes. (A Passaic Valley Water Commission study, which estimates that the average LSL leaks 47 gallons of water per day, projects the total value of water saved from reduced leakage across its service area to be approximately $500,000 per year.)
- Increased home value.

Warranty. After the LSL is installed, the water utility should provide a warranty on workmanship. The warranty length could be determined by the Board of Public Utilities or based on the one-year period in place in Indiana.*

2.5 ENSURE PROPERTY OWNER PARTICIPATION IN THE NO-COST PROGRAM. (LEGISLATION)

Given the extensive presence of LSLs beneath private property in New Jersey, the willingness of property owners to provide access to their property is vital to success. Additionally, there are significant economies of scale. Based on results in other states (e.g., Indiana), a methodical, neighborhood-by-neighborhood approach to replacing all LSLs can reduce the cost by 25-30% versus removing the same pipes in a scattered fashion.

Statewide legislation should establish penalties for any property owner who rejects the water utility's no-cost offer to replace the LSL. Options include:

- Legislation authorizing water utilities to replace LSLs under private property without the need to obtain property owner agreement, in order to protect public health.
- Posting the address and owner of the parcel on the water utility's website.
- Legislation mandating that municipalities enforce participation and access to private property through action by the courts.
- Financial penalties. For example, in Plymouth, Massachusetts, customers are denied a free meter upgrade unless they agree to replace their LSL; anyone who refuses a new meter is charged a quarterly fee of $125 to offset the utility's cost of continuing the traditional "walk-around" service (i.e., field staff reading meters in person).
- If the customer persistently refuses the water utility's LSL replacement offer, the municipality could block the future sale of the home until the matter is resolved.

**State of Indiana's proposed worksmanship warranty: "In consideration for performing the work to install the customer service line at company's cost and the company's agreement to provide a 12-month limited worksmanship warranty, customer agrees to indemnify, release, and hold harmless the company and its affiliates and agents from and against all claims, liability, and costs ("claims") resulting from acts and omissions of the company and/or its approved subcontractors in installing the customer service line."*

An Environmental Defense Fund staff member conducts lead in water testing with portable meters at a child care facility in Chicago. Photo taken by Dana Scruggs Photography and used courtesy of the Environmental Defense Fund.

3 CREATE A 10-YEAR FUNDING PROGRAM FOR LSL REPLACEMENT.

LSL replacements are estimated to cost between $5,000-6,700 each. Two kinds of funding solutions are needed. The first authorizes utilities to use rate revenues for LSL replacement, even though a portion of the line may be under private property. The second provides state funds to water utilities for which the necessary rate increases would impose undue hardship on ratepayers.

THE CHALLENGE

Assuming the AWWA's estimate of 350,000 LSLs in New Jersey, and assuming an average installation cost of $5,000 to $6,700, the cost of replacing all of the state's LSLs would range from $1.75 to $2.3 billion. Other estimates peg the cost at $3 billion. The true cost will not be known until the work is done, but these estimates provide a solid starting point.

There are several options for funding LSL replacement. The most obvious, using utility rate revenues, faces three obstacles.

First, investor-owned water utilities have not been permitted to spend rate revenues to replace the portion of LSLs that resides under private property. As part of a rate increase request filed in 2017, New Jersey American Water (NJAW) sought to recover $440,000 in costs relating to a pilot program for the removal of LSLs located under private property. The Board of Public Utilities (BPU) referred the case to the Office of Administrative Law (OAL), where the Division of Rate Counsel objected on the grounds that rate revenue should not be spent on assets that the water utility does not own. In 2018, NJAW withdrew its request and suspended the program. The

OAL decision left all parties "free to take any positions that they choose concerning other customer-owned lead service line costs in any future proceeding."[12] (In 2019, SUEZ-Hackensack filed for rate recovery for its LSL replacement plan. That submission is pending before OAL.)

Second, rate increases are likely to be modest for some water utilities and significant for others, especially those with a high concentration of LSLs. Rate increases in low-income areas would exacerbate existing water affordability issues, and the resulting fiscal stress could inhibit comprehensive LSL replacement. Moreover, there are no federal grants available for this purpose and the New Jersey Water Bank is extremely limited in its ability to dedicate additional funds.

Finally, lead is but one of many water infrastructure challenges facing New Jersey communities. Financial solutions to address lead in water must be made in the context of a broader set of needs, including:

- Aging water and sewer systems that leak treated drinking water, which swells sewage volumes with groundwater and causes water or sewer breaks requiring costly emergency repairs.
- Combined sewer overflows in 21 communities, requiring billions of dollars for state-mandated upgrades starting in 2020.
- New regulatory requirements to address emerging contaminants including per- and poly-fluoroalkyl substances (PFAS).
- Water and sewer system improvements to address climate impacts (e.g., sea level rise).
- Needed upgrades to inadequate stormwater systems that exacerbate harmful algal blooms, water pollution, and localized flooding.

WHAT HAS BEEN ACCOMPLISHED TO DATE

Two state-level initiatives have addressed financing needs:

In 2018, the New Jersey Water Bank provided $30 million of low-income financing, including principal forgiveness funds, that covered 90% of the cost of LSL replacement. As of fiscal year 2019, $9 million had been formally lent to the City of Newark. Requests are pending for all the remaining $21 million, and final allocations will be made based on program eligibility, extent of lead exceedances, and construction readiness.

In August 2018, a new law authorized a local special assessment on property owners to help water utilities fund LSL replacement.

RECOMMENDATIONS

To support the proposed LSL replacement program, two complementary financial solutions are recommended: rate recovery by water utilities and a state-financed subsidy program.

3.1 AUTHORIZE RATE RECOVERY ACROSS SERVICE AREAS. (LEGISLATION)

Rate revenues are the source of funds for approximately 95% of water and sewer utility expenses, including capital improvements. Rates are not typically used to improve water infrastructure relating to private property; however, given the public health threat of lead in water, other states (e.g., IN, PA, MI) have authorized rate recovery to remediate such LSLs.

Recognizing the unique nature of this situation, legislation would authorize both investor- and publicly-owned drinking water utilities to pursue rate recovery to replace LSLs located under private property during the 10-year plan period.*

**Municipal water utilities are presently authorized to do this, but including both types of water systems in the legislation would clearly indicate the legislature's intent.*

Even though the LSLs located under private property would be replaced by the water utilities, they would not become part of the utilities' asset base. Also, the utilities should be authorized to recover only the actual cost of the LSL replacements through their rates, including any costs of borrowing. Similar to other capital projects that address a portion of a water system, utilities would spread the rate increase for LSL replacement across their entire rate base.*

Rate increases may disproportionately burden low-income customers for whom water rates may already be unaffordable. Similar to current authorizations for seniors and veterans, utilities should be authorized to provide affordability assistance to low-income customers.

3.2 PROVIDE A STATE SUBSIDY TO WATER UTILITIES WITH THE GREATEST NEED. (LEGISLATION)

The complete removal of LSLs across New Jersey will be an expensive undertaking, and there is an important role for state assistance. Many of the affected water utilities and municipalities are fiscally distressed and are at their borrowing limits, unable to access private markets. They would face unsustainable, unaffordable rate increases to support full LSL replacement.

State legislation should create a 10-year subsidy program that enables all communities to replace their LSLs regardless of fiscal constraints. The program structure is outlined below.

Target funds at the water utility level. Subsidies should be provided to utilities, and not directly to low-income property owners. Means-tested programs are more time consuming and administratively complex, and the high degree of property owner engagement required would likely impede a methodical approach to replacing LSLs across entire neighborhoods, which is crucial to maximizing efficiency.

Establish program eligibility. The eligibility requirement for a water utility to qualify for a state subsidy would be determined based on a combination of factors that gauge fiscal capacity and relative need:

- **Cost to ratepayers**. The estimated rate increase needed to replace all LSLs within 10 years, which is a function of the percentage of known or suspected LSLs in the water utility's service area and the composition of its rate base.
- **Affordability**. The number of residential water customers who would pay more than a certain percentage of their income on water rates.
- **Lead exceedances**. Prioritize water systems that have action level exceedances (ALEs).

For example, if the rate increase required to fully address the LSL problem in a community with lead exceedances and/or a significant percentage of LSLs exceeds a certain threshold (e.g., 5%), and if that rate increase would make water rates unaffordable for more than a certain percentage of the population, that community would be eligible for the subsidy.

Each water utility that applies for the subsidy should be evaluated by DEP to verify that it is properly operating and maintaining its system and is following basic asset management practices, as currently required by the New Jersey Environmental Infrastructure Finance Program and the Water Quality Accountability Act.

Calibrate the amount of assistance based on need. A range of subsidy funds could be based on the magnitude of community need. Very poor communities with a high number of LSLs could get grants covering the full LSL replacement cost, while other communities with significant LSLs could receive grants covering part of the cost, enough to keep the required rate increase below the thresholds noted above.

* *Replacement of utility-owned service lines is included in Distribution System Improvement Charge (DSIC) programs for utilities regulated by the BPU. Since the replacement of the lead service line located under private property would be completed with the utility-owned portion, other states (e.g., PA, IN) have included this work in their DSIC type programs.*

Funding options. There are three options for generating the state funds for an LSL replacement grant program:

- State appropriation (i.e., pay as you go).
- State bonding, without a revenue source.
- State bonding with a specified funding source, such as a water surcharge, to fund repayments.

Each option has pros and cons:

- A state appropriation requires no interest payments and avoids potential public criticism of a new fee. However, given the state's fiscal constraints, it will be difficult to raise the funds needed for a 10-year replacement program through the state budget.
- A new state bond issue would also avoid public criticism of a new fee, but would require voter approval if structured as a general obligation bond, which could be difficult to achieve given the state's low credit rating and limited borrowing capacity. The annual repayments could be spread over 30 years, which would create a smaller immediate impact on the state budget than a 10-year pay-as-you-go option.
- A dedicated bond-repayment mechanism such as a surcharge on all water bills could provide a new, dedicated funding source outside of the state budget process. A surcharge could be structured either as a fee that utilities pay for source water, which they can then pass on to customers, or as a fee on every customer's bill similar to the existing societal benefits charge on energy bills. The fee could be used as the basis for borrowing. If the water fee were imposed for 30 years to cover debt service payments and spread across all water customers, the annual fee would be relatively low (see example below). Political support may be challenging, however, given the state's high-cost status. If the borrowing were done through the New Jersey Water Bank (New Jersey's State Revolving Fund), voter approval would not be required.

Program structure. Regardless of the funding source, voters would be asked to approve a constitutional amendment to ensure that the funds are not diverted. The program would follow the financial assistance model employed by the New Jersey Water Bank, with DEP retaining its role of determining project eligibility and certifying project completion and the New Jersey Infrastructure Bank accepting applications, overseeing contractual requirements, and managing and disbursing the funds. Utilities would apply for funds once their preliminary LSL inventory is completed.

Magnitude of a subsidy program. Unfortunately, not all of the information on LSLs that is needed to calculate the total cost of a state subsidy program is available. Though LSL inventories are constantly updated, a complete picture will not be available for many years. However, the data needed to roughly estimate the fiscal capacity of individual utilities is available and can be used. An example is offered below for purposes of illustration.

A state bond issuance of $500 million could provide a full subsidy for approximately 25% (i.e., 88,000) of the estimated 350,000 LSLs in New Jersey. If the $500 million bond had a term of 30 years and an interest rate of 5%, it would require annual debt service payment of approximately $32 million. This amount could be covered in two ways:

- Payment from the state's general fund of $32 million in debt service for the next 30 years.
- A surcharge of approximately $12 per year or $1 per month on each water customer for the next 30 years. (Note that this amount could be revised by increasing contributions from commercial water users.)

4 ENACT PROTECTIVE RULES AND PROGRAMS TO ENSURE SAFE DRINKING WATER.

In many New Jersey communities, the threat from lead in water also involves indoor lead plumbing, including pipes, fixtures, and soldered connections. The solution to keeping people safe involves a combination of actions: regulatory changes to strengthen existing protective measures implemented by water utilities, a revamped approach to public communications, and further research on the level of exposure that should prompt action to protect public health.

THE CHALLENGE

The federal Lead and Copper Rule (LCR), which forms the basic regulatory framework for the lead in water issue in all states, was adopted in 1991. Other than modest amendments in 2000 and 2007, the rule has not been updated. Since then, lead in drinking water crises emerged in Flint, Michigan and Washington, D.C. and significant changes occurred in treatment technology and scientific understanding of the dangers posed by relatively small exposures to lead.

Initially, the LCR had a significant impact as utilities adopted corrosion control treatments (CCT) that sharply reduced lead in drinking water. However, the LCR treated LSL removal as a last resort — something to pursue when all else failed. We now know that CCT, while important, is not a sufficient long-term solution. The risk from lead

pipes, especially when disturbed, is too significant. The LCR remains complex and reactive, compelling action in many systems only after widespread public health threats have been identified through exceedance of the federal action level. The rule is not integrated with other evidence such as elevated blood lead levels. The failure to modernize and strengthen the LCR increases the risk to public health. While the EPA plans to propose new amendments later this year, adoption may take years.

Because the LCR is a "technology technique" rule, its action limit of 15 ppb at the 90th percentile is primarily designed to gauge the effectiveness of CCT. Though often confusing to residents and public officials, that limit is not a health-based standard representing a safe level of human exposure, but instead is a standard above which action is required to reduce lead concentrations. The rule provides significant discretion in water utilities' assessment of how to optimize CCT, which can result in lack of clarity between utilities and regulatory agencies, and its sampling regimen may not be protective for all service areas. Under the LCR, some households may incur very high lead in water readings without triggering an action level exceedance simply because they represent less than 10% of samples (see 90th percentile section of action 4.1).

Drinking water for schools presents different risks and dynamics than those for homes, and yet the LCR has a very limited focus on those facilities. Federal monitoring requirements focus on single-family homes, not apartment buildings, schools, child care facilities, and large facilities. DEP only regulates the small number of schools that have their own water supply.

WHAT HAS BEEN ACCOMPLISHED TO DATE

DEP has strengthened its regulatory role in a variety of ways including the following:

- To ensure that water quality conditions are adequately assessed, DEP increased monitoring requirements. For example, as of January 2017, large water systems (i.e., more than 50,000 customers) were returned to standard monitoring (i.e., every six months). Many of these systems were subsequently granted a reduction to annual monitoring following two consecutive six-month periods of compliance.
- DEP sets optimal water quality parameters for individual water systems and actively monitors compliance with CCT schedules.

RECOMMENDATIONS

The recommendations listed below are designed to ensure that people are adequately protected from lead exposure in buildings throughout their community, including their homes and businesses.

4.1 STRENGTHEN DEP DRINKING WATER REGULATIONS. (REGULATION)

State Lead and Copper Rule. New Jersey's existing regulatory framework is based on the federal LCR, the provisions of which DEP incorporated by reference when it accepted delegation of authority from EPA. To address the regulatory issues below, however, it is recommended that New Jersey adopt its own version of the rule, which is permissible if the provisions are at least as strict as the LCR.

Sequential sampling. Under the federal LCR, lead in water is presently tested through "first draw" sampling of water at the tap. This approach may not accurately assess lead exposure in a given household since it does not gauge the amount of lead that resides in different portions of the plumbing, including the LSL, which is located a distance from the tap. Sequential sampling requires multiple, timed samples to gain a more accurate profile. Though somewhat more expensive and less practical (i.e., due to inconsistencies

across water customers who take the samples), sequential sampling should be selectively applied based on criteria established by DEP. For example, using sequential sampling in homes with known lead exceedances (or as part of an elevated blood lead level investigation) may help pinpoint the source of the problem.

Water quality parameters. The federal LCR requires that certain water quality parameters (e.g., pH, alkalinity) be monitored to determine the best CCT option for a given water system and to verify its ongoing effectiveness. Following an action level exceedance, this data can help utilities identify appropriate treatment changes. It can also provide an early warning of other possible issues.

The following recommendations would increase the effectiveness of water testing:

- Expand testing of water quality parameters, including interpretation of the resulting data for individual water systems.
- Review the criteria used to judge CCT effectiveness. (For example, pressure gradients, which may affect water movement in a system, could alter water chemistry.)

Number, location, and frequency of water testing. Currently, the water sampling period for utilities can vary, as it may involve either standard, annual, or triennial testing. The standard monitoring period is six months, and the number of samples is based on the size of the water utility. For example, the largest water utilities (population of 100,000 or more) must take a minimum of 100 lead and copper samples each period from vulnerable locations (i.e., those in the LCR's highest tier categories) while medium-sized utilities (population range of 10,000-100,000) must take at least 60 samples. While this approach may be appropriate for small and medium water utilities, it is inadequate for larger systems. For example, two of the state's investor-owned water utilities serve over 50 different municipalities. In such instances, spreading the minimum 100 samples across such a wide service area does not accurately represent lead levels in each community. For example, some communities may have only two or fewer sampling sites, a situation that could affect the calculation of an action level exceedance (ALE) (see narrative below regarding the 90th percentile system). Similar concerns exist with water quality parameter sampling, where only 25 samples are presently required for large systems. Finally, an increase in testing frequency may be appropriate in water systems experiencing a prolonged lead exceedance.

DEP regulations should be revised to increase the number of water samples required, with particular focus on the state's largest water systems, and to provide the department with broader latitude to increase testing frequency to protect public health. The water utilities' selection of sample locations should be reconsidered using the larger sampling size to ensure that high-risk areas (e.g., older housing stock) are properly emphasized and that the sites represent water quality throughout the water system.

90th percentile. Under the federal LCR, determination of whether a water utility has an ALE of lead in water is based on sample readings above the 90th percentile. This statistical tool controls for inconsistencies that accompany decentralized testing by water customers, which is peculiar to lead and copper in water testing. If more than 10% of samples exceed the federal standard of 15 ppb, the ALE requires that system to implement a series of measures, such as CCT adjustments and annual replacement of 7% of LSLs until compliance is restored.

A key concern involves the high levels of lead that may exist within the 10th percentile segment of the test locations without prompting remedial action. Recommendations include:

- Where the average sample results from the top 10th percentile greatly exceed the average results from the 90th percentile sample, the water utility should evaluate system conditions and sampling procedures that may have contributed to the differences. For example, if a system collects 10 samples and only the final sample is significantly higher than the other nine, did that particular customer let the water remain stagnant for several weeks or adversely affect the result in some other way?
- Water utilities should investigate each instance of high lead readings within the 10th percentile segment and provide either point-of-use or in-home filters as a temporary measure or pursue other acceptable industry best practices. Utilities should also determine whether to extend filters to other, similar homes that were not sampled in the affected neighborhoods. If

sites are clustered together, that location should be prioritized for LSL replacement.
- Property owners should continue to bear responsibility to make any improvements to indoor plumbing.

Public education and notification. Under the existing federal LCR, water utilities have 60 days from the end of a monitoring period to issue public education materials in response to an ALE and 30 days from the receipt of lab results to notify individual residents. For example, if it becomes clear during the first month of the standard six-month monitoring period that a service area is on track for an exceedance, an additional seven months could elapse before education materials are distributed to the public. DEP should determine how this process can be accelerated to protect public health.*

Water utilities should issue public education materials annually, regardless of whether there has been a lead exceedance. In addition, the following accelerated requirements, which were adopted in May 2018 by the state of Ohio, should also be considered:

- **Consumer notification.** For exceedances at individual properties, notify the property owner within two business days (as opposed to 30 days) of the receipt of their specific laboratory results. This is typically done by an email or phone call.

For public notification and public education, water utilities should release information when it becomes apparent that the utility is on a path toward an ALE (i.e., do not wait until the end of the standard six-month monitoring period). For example, if a water system is required to collect 100 samples and early results indicate that more than 10% will exceed the 15 ppb action limit, the system would be considered to have an ALE at that time.

- **Public notification.** In Ohio, the general public is notified within two business days of the receipt of laboratory results that indicate a likely ALE in that water system. Methods of notifying the public can include broadcast or social media, email, and hard copy mail.
- **Public education.** Ohio releases public education materials within 30 days of the receipt of laboratory results that flag a water system exceedance. (New Jersey DEP should be permitted to extend the deadline at its discretion.)

If, after reviewing all samples, it becomes apparent that the water system does not in fact have an ALE, the utility may choose to rescind the notice and stop the issuance of the materials.

Improve training of licensed water utility operators. In recent years, a combination of staff retirements and a relatively low pay scale have reduced the number of experienced water system operators. Given the intricate nature of water system operations, this poses a long-term risk. To increase compliance, more extensive operator training should be required, funded at least in part by the state. Training locations should be expanded, particularly in the far northern and southern parts of the state. Finally, the salary compensation for these positions should be revisited. Based on surveys, the median hourly rate for a mid-career water treatment operator (i.e., at least five years of experience) is approximately $19, which is relatively low given the job responsibilities involved.

* *Since customer-requested samples taken from the highest tier must be included in the 90th percentile calculation, and as there is no way to pre-determine the number of those samples, a system's 90th percentile can change over the monitoring period.*

4.2 MAKE STATE HOME INSPECTION AND IMPROVEMENT PROGRAMS HOLISTIC. (POLICY/BUDGET)

A formalized training and certification for holistic lead inspection would include lead dust, soil testing, drinking water, and weatherization, so that all of these components can be assessed in a single inspection. Drinking water is not currently a required component of these inspections. Such an effort would likely require involvement by DEP, DOH, and DCA, and would be coordinated by the new lead ombudsman. A potential model could be the Healthy Homes Assessor certification program, organized by the Green and Healthy Homes Initiative and the Building Performance Institute, which cross-trains inspectors to be both energy auditors and home health/safety assessors.[13] Capacity should also be built among para-professionals (e.g., community health workers, home visitors) as part of their respective home visits.

4.3 EDUCATE AT-RISK POPULATIONS THROUGH A NETWORK OF COMMUNITY ORGANIZATIONS AND LOCAL HEALTH AGENCIES. (POLICY/BUDGET)

Presently, information on various forms of lead exposure and the associated risk factors are produced by many sources, some of which are outdated or inconsistent. The following initiatives would improve the effectiveness of lead in water communications messaging.

- **Explanatory materials.** A state agency, such as DOH, should be funded to produce a definitive set of web-based and print materials in multiple languages on lead hazards for distribution by local health agencies and community organizations to affected residents, pediatricians, and government agencies.
    - To shape these documents, DOH should seek input from DEP and community-based organizations that are actively assisting municipalities.
    - The language in the document should be readily accessible (i.e., devoid of technical jargon and preferably written at a fourth-grade reading level).
    - A subset of materials should be customized for vulnerable populations such as pregnant women, parents of infant children, and tenants.
- **Outreach strategy.** The state should provide modest annual or multi-year grants to improve lead-related education to vulnerable residents, particularly those in high-risk communities (e.g., high percentages of children with elevated blood lead levels).
    - *Community and faith-based organizations with strong local reputations.* Door-to-door canvassing is particularly effective in high-density neighborhoods, with special emphasis on tenants. Community forums and "train the trainer" programs are also effective, low-cost techniques.
    - *Local health agencies.* Outreach to pediatricians and staff in governmental agencies that provide related services.
    - *Master list of physicians.* To spread the word among medical professionals, health insurance companies and medical associations should create a comprehensive list of relevant physicians by specialty (e.g., pediatricians, family doctors).
    - *Collaborative outreach campaigns.* A modest appropriation should be made to support local collaborative pilot efforts involving community organizations, hospitals, medical trade associations, and state and local government agencies to increase their collective strength in addressing lead in cities with high elevated BLLs.
    - *Home visitors.* A low- or no-cost option would require all government agencies, community organizations, and health providers that visit homes to share lead information with their clients and encourage that they test their drinking water for lead. For example, the Maternal Infant and Early Childhood Home Visiting (MIECHV) program funded by the federal Health Resources and Services Administration and administered by DCF visits approximately

7,000 New Jersey households annually, specifically targeting families of young children and pregnant women. Home visits are also performed by local health agencies and community organizations. Lead-related training would be required.

4.4 RESEARCH HEALTH-BASED THRESHOLDS AND EXPANDED BLOOD TESTING. (RESEARCH)

Action level and household action level. While there was consensus about the need to lower the action level from the 15 parts per billion established in the federal LCR in 1991 to protect public health, the Lead in Drinking Water Task Force was reluctant to identify a specific lower level without the backing of a scientific study. The same logic applies to establishing a "household action level" that specifically addresses the degree of exposure to lead in water that would be a significant health concern for an average child.

Both of these questions should be referred by the DEP Commissioner to the New Jersey Drinking Water Quality Institute (DWQI) for a recommendation. The DWQI typically does not perform its own studies but rather reviews those issued by other reputable researchers.

The DWQI review of action levels should include child care facilities. The federal action level of 15 ppb was designed to protect residential areas, not facilities that serve many children under the age of six. In January 2019, the Illinois Department of Children and Family Services amended its regulations to set an action level for child care facilities at 2 ppb.* While a reduced action level could help protect young children in child care facilities, the task force is not aware of a definitive scientific study that presently supports a specific lower level.

The household action level concept is fairly new and as yet untested. EPA is leading research in this area. While the state DWQI should be asked to consider the issue, the task force recommends deferral of any regulatory revisions until EPA, the Centers for Disease Control (CDC) and Prevention, the American Academy of Pediatrics, the National Research Council, or another reputable source of scientific study publishes a definitive recommendation.

Given the health issues at stake, DWQI should seek to expedite its recommendations, and DEP should decide whether to pursue regulations that are more stringent than the federal LCR.

Expanding blood tests for infants and pregnant women. Currently, infants (i.e., up to age one) and pregnant women, two groups that are particularly vulnerable to lead poisoning, are not mandatorily tested in New Jersey for lead. Universal, mandatory testing of either group is not currently recommended by the CDC. DOH should conduct an in-depth, cost/benefit study of testing pregnant women and infants under one year of age and recommend whether or not to change existing testing requirements.

* *The lead level for bottled water as set by the Federal Drug Administration is 5 ppb.*

5 ENSURE QUALITY WATER IN CHILD CARE FACILITIES AND SCHOOLS.

Because young children are particularly vulnerable to the pernicious effects of lead, exposure in child care facilities and schools is a serious concern. This is particularly true of children who are fed with formula mixed with lead-tainted water. Since the effects of lead often last a lifetime, it is vitally important that these facilities provide high-quality water.

THE CHALLENGE

Child care facilities. In New Jersey, there are approximately 4,200 state-licensed child care facilities in operation, representing those serving six or more children under the age of 13 for fewer than 24 hours a day. Beginning in 2017, New Jersey became one of only nine states to require child care facilities to test for lead in water. These facilities were subjected to lead testing and short-term remediation measures through the oversight of the Department of Children and Families (DCF). Through the existing three-year license renewal process or new license applications, state-licensed facilities must test for lead at all drinking water taps and more than 50% of water faucets, and facilities constructed prior to 1978 must complete a lead risk assessment. While remedial action is required if test results exceed the 15 ppb action limit, there is no requirement for longer-term mitigation. That is, bottled water can qualify as a permanent fix. Finally, DCF's new database does not contain comprehensive lead test results for licensed facilities and cannot presently provide a statewide summary.

Additionally, an estimated 1,400 family child care providers are voluntarily registered with DCF, though the total number in existence is thought to be considerably higher. DCF has little interaction with family-run providers beyond the oversight of occasional complaints. Many of

these providers operate in homes that may have lead service lines.

Schools. A 2016 Department of Education (DOE) regulation requires all publicly-funded schools to test all water outlets used for drinking and food preparation and to post the results on the school website. Repeat testing is mandated every six years. If lead exceedances are found, the school district must notify parents and DOE and remove the unsafe fixtures from use. In doing so, New Jersey joined seven other states requiring lead testing in schools.

Testing results in 2017 indicated that lead was widespread across New Jersey schools, with 383 school districts reporting at least one outlet in exceedance of the 15 ppb level.[14] Similar to child care facilities, there is no requirement for long-term remediation, nor is there a central, public-facing database where test results can be examined for all schools.

As most school buildings are served by large-diameter service lines, any lead in water problems are typically caused by internal plumbing, not LSLs.

WHAT HAS BEEN ACCOMPLISHED TO DATE

Schools. In late 2018, New Jersey voters approved the Securing Our Children's Future Bond Act, which provided $100 million in bond funds to address school district water infrastructure problems affecting water quality. In June 2019, DOE and DEP held an invitation-only joint stakeholder session to gather input on the highest and best use of these funds.

Child care facilities. DCF has developed a public-facing website with information on child care facility inspections and operations.

RECOMMENDATIONS

Because young children are particularly vulnerable to the pernicious effects of lead, exposure in child care facilities and schools is a serious concern.

5.1 COORDINATE AND REFINE TESTING CYCLES. (REGULATION AND/OR LEGISLATION)

The recommendations listed below concern regulatory changes in testing requirements.

Testing cycle. Regulations issued in 2016 by the State Board of Education established a six-year testing cycle for publicly funded schools. In 2017, regulations issued by DCF established a three-year testing cycle for licensed child care facilities, which corresponds to the term of a typical license. Roughly 25% of state-licensed child care facilities are located in school buildings.

To increase overall efficiency, the State Board of Education's regulations should be amended to shorten the schools' lead in water testing cycle to three years, matching the requirement for state-licensed child care facilities. To provide time to prepare, this change could be implemented after the end of the current testing cycle for schools (i.e., in 2023) when it would be fully coordinated with the existing cycle for child care facilities.

Differential testing requirements. Rather than using regulation as a blunt instrument that treats all facilities the same, the State of Illinois applies regulatory pressure where it is needed most, varying testing requirements based on the compliance record of child care facilities. DOE and DCF should strongly consider incorporating differential testing requirements:

- *Satisfactory test results*. Schools and child care facilities served by a public water system, with no lead service line, and at least two consecutive, satisfactory monitoring periods (i.e., no drinking water outlets exceeding the action level) would not need to retest unless the water source is changed or the indoor plumbing is altered. Over the long term, spot inspections would be implemented as a failsafe. (As noted in section 4.4, the definition of "lead exceedance action level" is a critical question for this policy.)
- *Lead exceedance***.** In this case, the facility retests six months after remediation and annually thereafter until readings are

compliant over two consecutive monitoring periods.

Management improvements. The following "lessons learned" from the initial testing of schools in 2016-2017 should be addressed by DOE and DCF:

- *Electronic database*. Each department should create an electronic data portal that requires schools and child care facilities to submit testing results in a manner that clearly identifies the type(s) of water outlets that tested positive and their frequency of use.
- *Parental information.* Develop a high-profile information campaign in multiple languages to remind parents of lead exposure risks.
- *Complete lab results*. Current regulations require schools to "make the test results of all water samples publicly available at the school facility and on the district board of education's website." However, in a random sample of 120 school districts that posted their results online, only 73% reported full laboratory results. Some districts provided summary data, and only a few districts reported whether results were above or below 15 ppb.[15] DOE should reinforce these requirements with individual school districts.
- *Follow-up procedure*. Under current law, when New Jersey schools find elevated lead levels in their water, there is no established follow-up procedure to assess the health of the children who drank the contaminated water. DOE should consider whether statutory or regulatory changes should be considered to address this.
- *Test accuracy*. To maximize the accuracy of test results, consider one of two options:
    - Aggressive training of school and child care facility staff who perform the testing.
    - Issuance of a statewide or regional contract(s) to a professional firm with experience in water testing.

5.2 CREATE PUBLIC DATABASES OF LEAD TEST RESULTS. (DCF AND DOE POLICY)

To promote transparency, protect public health, and enable statewide analysis of the lead in water problem, a comprehensive set of lead testing results should be centrally administered and accessible. While DCF recently upgraded its data system (https://childcareexplorer.njccis.com/portal) to reflect health and safety factors, including complaints and inspections for individual child care facilities, lead in water testing results are not easily ascertained. In the case of DOE, no central data system is publicly available.

Both DCF and DOE should create electronic data collection systems that capture all lead test results, even if negative (i.e., lead not present). Data should be publicly available, including a statewide summary. For both agencies, information should be provided on how elevated results were addressed, including drinking water outlets taken out of service and those that were fully remediated, as well as instances where an alternative source of water (e.g., bottled water) was provided. To maximize the accuracy and consistency of data reporting, a data portal should be employed for future testing. A state appropriation is recommended to develop DOE's system. DCF should create a database report showing the current locations of state licensed child care centers and forward it to DEP, which may elect to share it with affected water utilities to help shape their approach to LSL replacement.

5.3 IMPROVE WATER SAFETY AT FACILITIES RUN BY FAMILY CHILD CARE PROVIDERS. (POLICY)

Presently, approximately 1,400 family child care providers are voluntarily registered with DCF. A large, unknown number are unregistered.* As some family-run providers serve more than the maximum five children permitted, they are incentivized to keep a

**This number is down from roughly 4,400 that registered approximately 15 years ago. Contributing factors included the significant expansion of universal pre-kindergarten programs funded by the state, the gradual unionization of service providers, and a general decline in registrations as regulatory requirements increased over time.*

low profile. DCF does not presently exercise regulatory authority over family child care providers, and its limited knowledge of them is primarily drawn from occasional public complaints.

While there are serious health concerns associated with formula-fed infants using lead-contaminated water in child care facilities, increased regulatory oversight could reduce the number of family child care providers that voluntarily register with DCF. Alternatives include:

- Rely on the proposed LSL Replacement Program to remove the dominant source of lead in facilities operated by family child care providers.
- Based on elevated BLLs, identify family child care providers that may pose a threat to children and prioritize them for LSL replacement. Encourage a full evaluation of the facility's indoor plumbing.
- Family-operated child care centers are not required to test and may be unaware of potential lead problems. The City of Boston has begun offering free water testing for such facilities, particularly those in high risk areas. (Consideration could be given to allowing investor-owned utilities to recover their actual cost for such a program.)
- Expand outreach to these providers on the dangers of lead. Existing county resource networks and local health offices could lead this effort using information from DCF's new central database, which includes facilities that have been the source of complaints.

5.4 REQUIRE DRINKING WATER MANAGEMENT PLANS. (REGULATION)

Neither state-licensed child care facilities nor schools in New Jersey are presently required to remediate lead in water. Facilities served by a water utility can simply close off access to the water outlets involved and substitute an alternative water source, such as bottled water. (Note: The federal LCR requires facilities that use well water to remediate.) This temporary solution can linger for years. For example, schools in Camden have been substituting bottled water since 2002.[16]

Child care facilities. It is recommended that state-regulated child care facilities served by a community water system with lead exceedances file a drinking water management plan as a condition of their initial licensing or upon license renewal. This plan, which would outline short- and long-term remediation projects, would be submitted to DCF and published to inform parents.

Schools. See section 5.6 regarding the use of these remediation plans in New Jersey school districts.

5.5 RESEARCH FINANCIAL ASSISTANCE TO CHILD CARE FACILITIES. (BUDGET AND RESEARCH)

Though the lead in water risk is greatest among very young children, and despite the fact that child care facilities are more likely than schools to have a LSL, no state assistance is presently available for those facilities.

Recommendations:

- DCF should publish the statewide results from lead in water testing in state-regulated child care facilities. For analytical purposes, those results could be separately overlaid with community-level data on children's elevated BLLs and known or suspected LSL locations.
- DCF should:
    - Share with water utilities the names and addresses of child care facilities that test positive for lead in water or that have known LSLs (based on section 2.2) so those buildings can be prioritized for LSL replacement.
    - Work with the legislature to consider a separate funding source.

5.6 MAXIMIZE THE HEALTH IMPACT OF THE $100 MILLION SECURING OUR CHILDREN'S FUTURE GRANT PROGRAM (DOE POLICY)

DOE and DEP are actively engaged in a stakeholder process regarding the highest and best use of the $100 million in state funds made available through the Securing Our Children's Future Bond Act to improve school district water infrastructure. Several of the more innovative recommendations listed below, including those on project eligibility, selection (e.g., automated flushing systems), and prioritization as well as diagnostic testing have been implemented to good effect in Chicago's public school system which, similar to New Jersey, has a large, aging set of school buildings with significant lead exposure. For details, see the online Appendix.

Recommendations:

- *Focus funds where they will have the greatest impact on public health.* Recognizing that childhood lead poisoning is particularly acute in older municipalities, many of which are fiscally distressed, the funding distribution should prioritize those municipalities to ensure that the greatest number of lead-exposed students are protected. Potential grants could be divided into three categories, which would be accessed sequentially as long as adequate funds remain (i.e., the second group would be funded only after addressing the needs of the first group, and so on):
    - Projects in school districts in fiscally distressed municipalities with a high proportion of children with elevated blood lead levels.
    - Projects in other school districts with positive lead in water testing results.
    - Reimbursement for lead remediation projects that have already been completed. Funds would only be made available for reimbursement if all other needs in the first two categories had been met.
- *Project/cost eligibility*. To maximize efficiency, priority should be given to projects such as LSL replacement, automated flushing systems, replacement of fixtures, and repair of readily accessible plumbing. The cost of diagnostic (i.e., sequential) water testing, which can confirm the effectiveness of different repairs/replacements and is crucial for ensuring the most efficient use of funds, should be eligible as a capital expense. Major reconstruction of internal plumbing, which is typically very expensive, should be a last resort.
- *Efficient project selection*. Require sequential testing, not just first draw testing, to help pinpoint the likely location of the lead source in school plumbing. For example, Chicago's public schools take five sequential samples at each water outlet. Select projects based on that plumbing profile and re-test after each remedial action to determine if the problem is solved.
- *Prioritize school buildings within selected districts.* Since young children face the greatest potential exposure to lead in water, districts should prioritize their testing and remediation plans as follows:
    - Contamination detected (i.e., buildings with lead exceedances), as judged upon completion of all testing.
    - Kindergarten/elementary schools first, secondary schools second.
    - Age of building.
- *Drinking Water Management Plans (DWMPs)*. School districts should be required to submit DWMPs to DOE indicating their approach to testing and remediation. Funding awards would be contingent upon DEP review of the DWMP.

Conclusion: Next Steps

The 30-member Jersey Water Works Lead in Drinking Water Task Force included members who are sometimes at odds: regulators, utilities, community and environmental advocates, and scientific experts. But over the course of ten months they agreed that, unlike many public health threats, there is a clear strategy for resolving the issue of lead in drinking water.

This report lays out their recommendations: a combination of coordinated state-level legislative, regulatory, and administrative actions that can empower drinking water utilities, municipalities, property owners, and residents to virtually eliminate the threat of lead in drinking water in New Jersey in 10 years.

The report calls for high-level state leadership to elevate the issue of lead poisoning from all sources and ensure inter-agency coordination. The source of lead in homes, schools, and child care centers must be identified and either removed or neutralized.

A comprehensive package of legislation would call on every water utility to replace lead service lines across the state. The effort would involve no-cost offers to property owners along with state-wide financial resources that enable water utilities to work in an efficient, cost-effective manner to get the job done in 10 years. The number and location of lead service lines would be made transparent through utility inventories and real estate disclosures.

Stronger state regulations would protect public health, particularly from lead in indoor plumbing. Corrosion control treatment, historically the first line of defense, would be strengthened across all water utilities. Communications would be improved and community organizations enlisted to spread the word. Holistic policies would address all sources of lead in homes: paint, soil and drinking water. Further study of key issues is also warranted. Specific steps for remediating lead in schools and child care facilities would address children's exposure outside of the home.

Committed public officials, water utility leaders, and citizens can make these solutions a reality, with ongoing support from members of the Jersey Water Works Lead in Drinking Water Task Force. Together, we can ensure that everyone in New Jersey has safe drinking water, an essential ingredient for a healthy life.

ENDNOTES

1 Benfer, E.A., Coffey, E., Gold, A., Hanna-Attisha, M., Lanphear, B.P., et al. (2019). Duty to protect: Enhancing the federal framework to prevent childhood lead poisoning and exposure to environmental harm. Yale Journal of Health Policy, Law and Ethics, 18(2).
2 New Jersey Department of Health (2017). Childhood lead exposure in New Jersey: Annual report SFY201. See Table 3: SFY2017: Number of children (<6 years of age) by BLL and county of residence.
3 New Jersey Department of Health (2017). Childhood lead exposure in New Jersey: Annual report SFY2017, See Table 4: SFY2017: Number of children (<6 years of age) by BLL and municipality of residence.
4 Sandvig, A., Kwan, P., Kirmeyer G., Maynard. B., Mast, D., et al. (2008). Contribution of service line and plumbing fixtures to lead and copper compliance issues. Environmental Protection Agency. Available at https://archive.epa.gov/region03/dclead/web/pdf/91229.pdf. See pages xvi - xvii.
5 American Water Works Association (2018). Addressing questions posed in federation consultation: Long-term Lead and Copper Rule federation consultation.
6 LaFrance, D. (2016). "Together, let's get the lead out." American Water Works Association. Available at https://www.awwa.org/AWWA-Articles/together-lets-get-the-lead-out.
7 Pew Charitable Trusts (2017). 10 policies to prevent and respond to childhood lead exposure. Available at https://www.pewtrusts.org/en/research-and-analysis/reports/2017/08/10-policies-to-prevent-and-respond-to-childhood-lead-exposure.
8 Sampson, R.J. and Winter, A.S. (2018). Poisoned development: Assessing childhood lead exposure as a cause of crime in a birth cohort followed through adolescence. Criminology, 56(2), 269-301.
9 Nevin, R. (2007). Understanding international crime trends: The legacy of preschool lead exposure. Environmental Research, 104(3), 351-336.
10 Wright, J.P., Dietrich, K.N., Ris, M.D., Hornung, R.W., Wessel, S.D., et al. (2008). Association of prenatal and childhood blood lead concentrations with criminal arrests in early adulthood. PLOS Medicine, 5(5).
11 Association of State Drinking Water Administrators (2019). Developing lead service line inventories. Available at https://www.asdwa.org/wp-content/uploads/2019/08/ASDWA_Developing-Lead-Service-Line-Inventories.pdf.
12 "In the Matter of the Petition of New Jersey-American Water Company, Inc., For Approval of Increased Tariff Rates and Charges for Water and Sewer Service, Change in Depreciation Rates and Other Tariff Modifications." BPU Docket No. WR17090985; OAL Docket No. PUC 14251-2017S.
13 Green and Health Homes Initiative. "GHHI & BPI Introduce the Healthy Home Evaluator Credential." Available at https://www.greenandhealthyhomes.org/press_release/ghhi-bpi-introduce-the-healthy-home-evaluator-credential.
14 Sullivan, M., and Lopez, M. (2019). Compliance with mandated testing for lead in drinking water in school districts in New Jersey. Journal of Environmental Health, 82(1), 14-19. See page 16.
15 Sullivan, M., and Lopez, M. (2019). Compliance with mandated testing for lead in drinking water in school districts in New Jersey. Journal of Environmental Health, 82(1), 14-19. See page 16.
16 Gonzalez, S. (2016). "Camden NJ students also drink bottled water because of high lead levels." WNYC News. Available at https://www.wnyc.org/story/camden-nj-students-also-have-drink-bottled-water-after-report-found-high-levels-lead.

JERSEY WATER WORKS

Smart infrastructure. Strong communities.

Jersey Water Works is a collaborative effort of many diverse organizations and individuals who embrace the common purpose of transforming New Jersey's inadequate water infrastructure by investing in sustainable, cost-effective solutions that provide communities with clean water and waterways; healthier, safer neighborhoods; local jobs; flood and climate resilience; and economic growth. Learn more and join the collaborative at jerseywaterworks.org.

@jerseywaterworks @jerseywaterwrks @jerseywaterworks