

Lead Service Line Replacement

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Why is lead a problem?

Lead can cause a variety of adverse health conditions when people are exposed to it at elevated levels.

Young children, infants, and fetuses are particularly vulnerable to lead because the harm appears to be greater at lower exposures in children than in adults. Lead exposure can harm children's brain development, contributing to lower IQs as well as learning and behavioral problems.

Why is lead service line replacement important?

Even if your community has a water system with effective corrosion control and low drinking water lead levels, LSLs can contribute unpredictable and variable sources of exposure. For homes with LSLs, the service line typically contributes the greatest percentage of lead to the tap. With the reduction of lead in new plumbing material, the next large opportunity for reducing the risk of exposure to lead in drinking water is the removal of LSLs.

How does lead get into drinking water?

Lead can enter drinking water when pipes and plumbing fixtures that contain lead corrode, especially where the water has high acidity or low mineral content.

Drinking Water and Lead

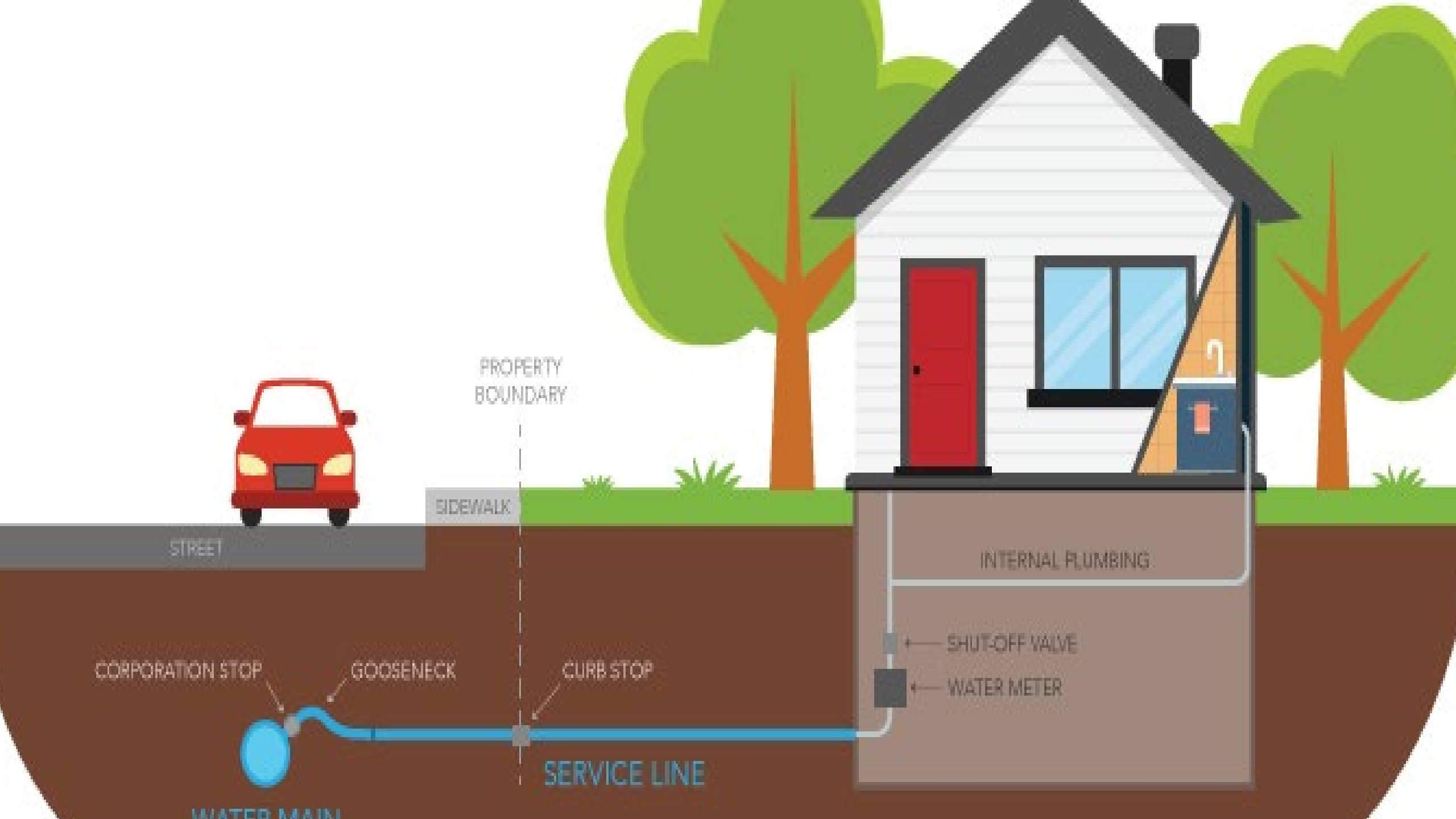
Lead in drinking water can be a serious problem. The crisis in Flint, Michigan has brought this issue to our attention on local, state, and national levels. Corrosion control programs in public water supplies are critical to protecting public health. Water quality practices in the home are also extremely important for homes with lead service lines, lead solder, and brass plumbing fixtures that contain lead.

What is full LSL replacement?

Full LSL replacement is eliminating all lead pipe from a water main up to the interior plumbing of an individual home and installing new pipe that is lead-free.

Typical Definitions

- **Service Line** – means the pipe from the discharge of the corporation fitting to the customer site piping or to the building plumbing at the first shut-off valve inside the building, or 18 inches inside the building, whichever is shorter.
- **Lead Service Line (LSL)** – means either a service line which is made of lead or any lead pigtail, lead gooseneck, or other lead fitting that is connected to the service line.



Federal Lead Regulations & Lead and Copper Rule

1986 – Lead Ban

1988 – Lead Contamination Control Act

1991 – Lead and Copper Rule

2004 – Lead and Copper Minor Revisions

2007 – Lead and Copper Short-term Revisions

2011 – Reduction of Lead in Drinking Water Act*

* Definition of lead-free changed from weighted lead content of 8% or less to a weighted average of less than 0.25% for surfaces in contact with potable water. The rule became effective in 2014.

Why the concern with LSL?

1986 Federal law prohibited use of materials that were not “lead free” in public water systems. This was done for public health reasons as the goal is safe and reliable drinking water.

Sources of Lead in Drinking Water



BRASS FAUCETS & PLUMBING FIXTURES



**LEAD GOOSENECKS ON GALVANIZED
STEEL SERVICE LINES**



**LEAD SOLDER ON
COPPER PIPES**



**LEAD SERVICE
LINE**

Materials Used in Service Lines



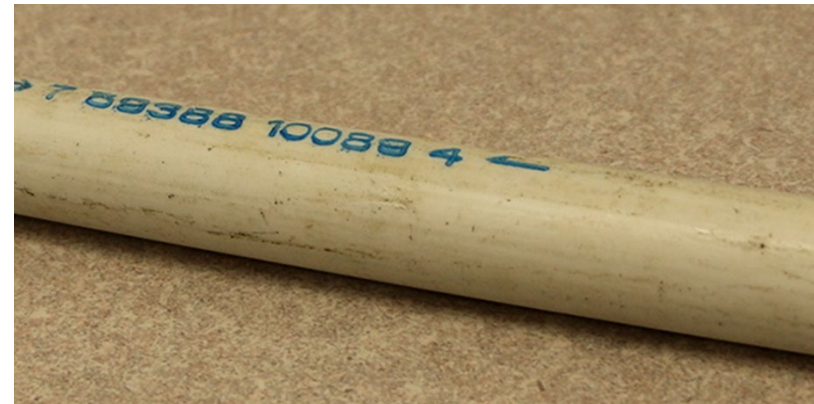
GALVANIZED STEEL (MAGNET STICKS)



LEAD



COPPER



PLASTIC

Particulate and Dissolved Lead

- Particulate: random and unpredictable, caused by physical disturbances, i.e. hydrant flushing, service line replacement, road construction, corrosion, etc
- Dissolved: reasonably well characterized, dependent on water quality, surface area of lead, stagnation time of water

Health Concern

Lead can cause a variety of adverse health conditions when people are exposed to it at elevated levels. Short term exposure can cause interference with red blood cell chemistry and cause delays in normal physical and mental development in babies and young children.

The Lead and Copper Rule

The Lead and Copper Rule (LCR) revisions of June 7, 1991 established an action level of 0.015 mg/l for lead and 1.3 mg/l for copper based on the 90th percentile level of tap water samples. An action level exceedance is not a violation but can trigger other requirements.

Action Level Exceeded

Requires one or more of the following actions:

- water quality monitoring
- corrosion control treatment
- public education
- lead service line replacement.

Federal Requirement to Identify LSL

- Each system shall identify the number of lead service lines in its distribution system based on a materials evaluation.
- The purpose being to identify a pool of targeted tier 1 sampling sites.
- Tier 1 shall consist of single family structures that contain copper pipes with lead solder installed after 1982 or contain lead pipes and/or served by a lead service line.

Materials Evaluation

Sources of service line information

- Construction plans and specifications
- As built drawings
- Plumbing codes, permits, plumbers
- Inspection and maintenance records
- Interviews with senior employees, retirees, building and plumbing inspectors, and residents

Sampling for Lead and Copper

Initially systems need to monitor during two consecutive six month periods. When lead and copper action levels are not exceeded the sampling may be reduced to annually and the number of sites to sample may be reduced with State approval.

System size (no. people served)

Large > 50,000

Medium 3,301 – 50,000

Small < 3,300

Number of Sites for Tap Samples

System size (number of people served)	Number of sites (standard monitoring)	Number of sites (reduced monitoring)
>100,000	100	50
10,001 to 100,000	60	30
3,301 to 10,000	40	20
501 to 3,300	20	10
101 to 500	10	5
≤100	5	5

Monitor Every Three Years

- Any water system that maintains the range of values for the water quality control parameters reflecting optimal corrosion control treatment specified by the State during three consecutive years of monitoring may reduce the frequency of monitoring from annually to once every three years if it receives written approval from the State.
- Systems sampling annually or less frequently shall conduct the lead and copper tap sampling during the months of June, July, August, or September unless the State has approved a different sampling period.

Lead Service Line Replacement

Lead service line replacement requirements. Any system exceeding the lead action level after implementation of applicable corrosion control and source water treatment requirements shall complete the lead service line replacement requirements.

Federal LSL Replacement Requirements

Systems that fail to meet the lead action level in tap samples after installing corrosion control and/or source water treatment shall replace lead service lines as follows: Annually at least 7 percent of the initial number of lead service lines in its distribution system.

LSLR

The initial number of lead service lines is the number of lead lines in place at the time the replacement program begins. The system shall identify the initial number of lead service lines in its distribution system, including an identification of the portion(s) owned by the system, based on a materials evaluation.

LSL May Remain.

A system is not required to replace an individual lead service line if the lead concentration in all service line samples from that line is less than or equal to 0.015 mg/L.

LSL Ownership

A water system shall replace that portion of the lead service line that it owns. Where the water system does not own the entire service line, the system shall notify the owner of the line that the system will replace the portion of the service line that it owns and offer to replace the owner's portion of the service line.

Partial LSLR

A system is not required to bear the cost of replacing the privately-owned portion of the line, nor is it required to replace the privately owned portion where the owner chooses not to pay the cost of replacing the privately-owned portion of the line.

Partial LSLR Notice

If the entire length of the service line is not replaced the water system shall give 45 day notice to all residents of all buildings served by the line explaining that they may experience a temporary increase in lead levels in their drinking water, along with guidance on measures consumers can take to minimize exposure to lead.

Sampling requirements for partially replaced service lines.

- The water system shall inform the residents served by the partially replaced service line that the system will, at its expense, collect a sample from each partially-replaced lead service line that is representative of the water in the service line for analysis of lead content. This is to be done within 72 hours of the completion of the partial replacement of the service line.
- The system shall report the sample results to the owner and residents served by the partially replaced service line within three business days of receiving the results.

Where are the lead service lines?

- At the time of the adoption of the [Lead Ban in 1986](#), there were estimated to be [10.2 million lead service lines](#) (LSL) in the United States. There is no national database of all homes with LSL. Individual water utilities may have maps of LSL for their network but no one has a complete nationwide assessment, although the American Water Works Association (AWWA) has performed a survey on the number of LSL in use.*

* National Conference of State Legislatures 2/15/18

Primary locations of LSL

A 2016 survey [by AWWA indicates 6.1 million](#) complete or partial LSLs remain in operation, serving 15 million to 22 million people. Thirty percent of community water systems have some LSLs in their system.

Many of these lines were found in the Northeast, with an equal number being found in the South. The majority of the 6 million LSL still in use are found in the Midwest. Areas with homes built prior to 1960 saw the greatest number of LSLs; the states of New York and New Jersey estimate 80 percent of homes on public water systems have LSLs.*

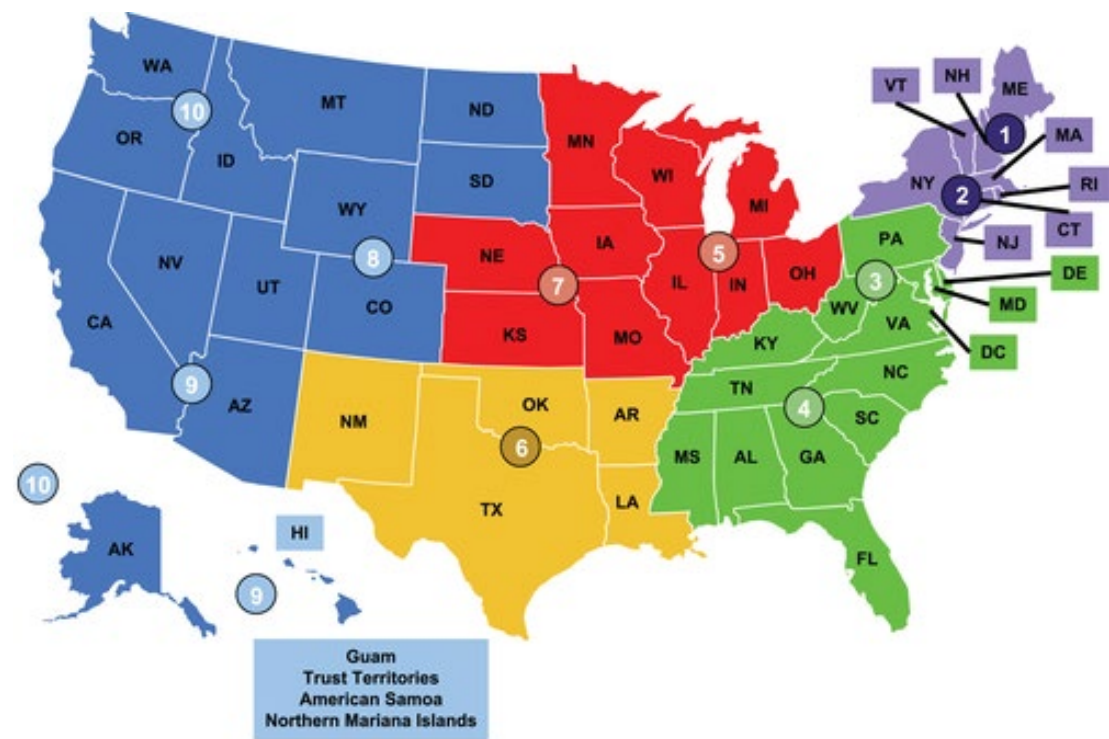
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National Conference of State Legislatures 2/15/18

Estimated number of LSLs nationally and by EPA Region group*

* cornwell, April 2016, AWWA

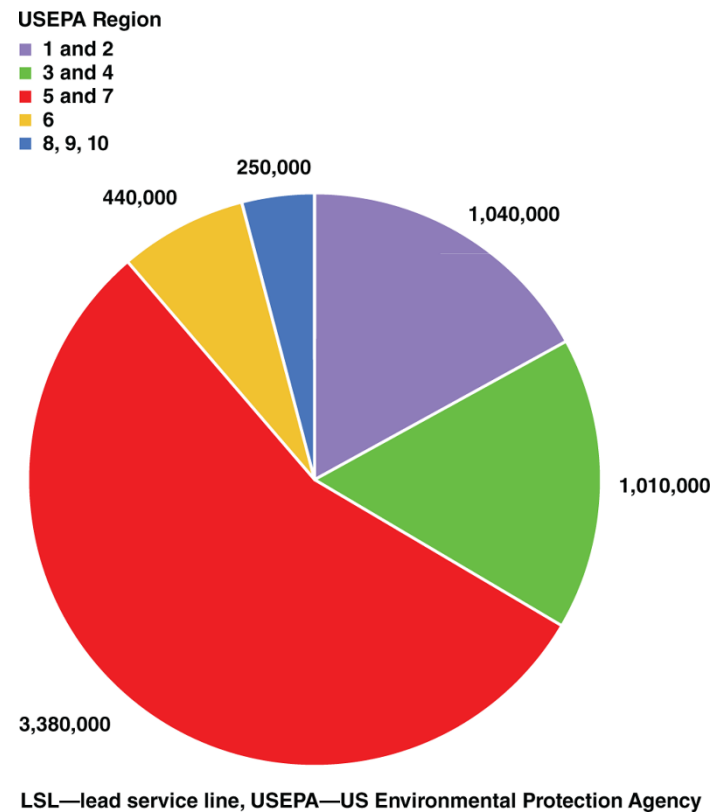
EPA Region Group	Population Served and Number of LSLs			
	<10,000	10,000- 50,000	>50,000	Total
Regions 1 and 2	10,000	870,000	160,000	1,040,000
Regions 3 and 4	60,000	420,000	520,000	1,010,000
Regions 5 and 7	460,000	940,000	1,980,000	3,380,000
Region 6	80,000	340,000	20,000	440,000
Regions 8, 9, 10	120,000	10,000	130,000	250,000
Total	730,000	2,580,000	2,810,000	6,120,000

National Survey of Lead Service Line Occurrence



USEPA—US Environmental Protection Agency
Regional groups used in this study: Regions 1 and 2; 3 and 4; 5 and 7; 6; and 8, 9, and 10. Puerto Rico (Region 10) is not included in this map.

2016 National Survey of Lead Service Line Occurrence



Replace the 6 M LSL*

- Why: Reduce children's exposure to lead.
- Consensus is DO IT!
- The Challenge: funding the replacement on private property
- Legal authority question: spending public money on private property
- Partial replacement: inefficient and can exacerbate exposure to lead
- A study of 13 states with 2/3s of LSL found no barriers to use of public funds to replace LSLs on private property, the assumption is other states have similar laws and policies
- Some states have provided grant funds to do the work
- Some states allow the use of the EPA capitalized RLF money for LSLR on private property

*

Environmental Defense Fund, Tom Nelter, J.D., April 2, 2019

Michigan LSL RLF Eligibility

- Replacement of lead service lines
- Replacement on private property
- Purchase of related easements
- Collecting field information
- Homeowner education and coordination

Lansing, Michigan Lead Service Line Replacement

- The following slides present the process and procedures used by the Board of Water & Light in Lansing, Michigan to replace their lead service lines. The replacement started in the 1990's and was completed in 2016. The total number replaced was 12,720.
- The major LSLR was from 2004 – 2016 when 12,150 were removed. The cost of the LSLR during the last 10 years of the removal was approximately \$44,500,000, for an average cost of \$3700 per LSLR.
- In Lansing the utility owned the full service line from the transmission main in the public right of way to inside the home at the water meters location, most meters were inside of homes.

LBWL Water Construction Standard

SERVICE LINE REPLACEMENT TRENCHLESS - CABLE PULLING METHOD

- Application: Replacement of existing service lines with a new copper tube service line using a trenchless construction technique which replaces the old service using the existing route.
- Service line replacement is performed with the expectation that the existing service line will be removed. This Standard references construction techniques that replace the service line using the existing route. A cone shaped tool sometimes called a "pulling block", locks onto the trailing end of the service pipe. The cone plus the pipe is pulled from the ground by a cable passing through the pipe and attached to the cone. The replacement pipe is simultaneously pulled in behind the cone. This technique cannot be used if the service pipe is; 1) Looped 2) Badly clogged so that the cable cannot pass through 3) Service is encased in concrete (excluding basement wall) 4) Existing utilities interfere with a straight line pull 5) If the ground is extremely hard and dry.
- Generally, service section lengths greater than 60' cannot be replaced using this technique.

The Process

The process begins by shutting off the curb stop to prevent any water in the system from entering the customers premises. This is especially important to minimize the transfer of any lead particulate into the service or the customer's household piping during the excavation of the corporation at the main.



Once the curb stop has been closed the work can then be divided into two different work groups. The first work group can then enter the premises and disconnect the service from the meter assembly.

The second work group can then begin the excavation process at the main to expose the corporation fitting.



Excavation can be accomplished with either a backhoe or by using a vacuum excavator. The advantage of the excavator is that it can minimize the potential risk to other utilities that can be difficult to locate or may have been miss-marked.



course there is always a lot of
digging that must be done as
1. Once the corporation is
closed the water is shut off at
that location as well. It is
important that the excavation of
the main and the corporation be
controlled to prevent water or
sewage from entering the corporation
the new service once it is
called.



Meanwhile inside.....

While the excavation continues outside the employee inside the residence begins the disconnection of the lead service and preparing the new copper for installation. We are also replacing the water meter at the same time since we already have access to the property.



One of the most important steps in getting the new copper line ready for installation is the sealing of the new service before it is pulled. The end of the copper pipe is covered with electrical tape. The pulling sock is then placed over the end of the copper pipe. Within the pulling sock is a small rubber ball that is pressed against the taped end of the pipe to further prevent any potential particulate from entering the new copper service during installation.



Once the corporation is exposed, the excavation then moves to the curb stop. The curb stop is removed by cutting the lead line on both sides of the curb stop. Then a line is run through the lead line from the curb stop to the inside and a 3/8" steel cable is pulled back through the service.



the copper pipe is then connected to the pulling harness and the harness is connected to the steel cable. Using the backhoe, the lead service is pulled out of the ground from the basement to the curb stop.



Once the copper pipe is visible in the curb stop excavation, the process stops to allow the cable to be removed from the backhoe and it is then rethreaded through the portion of the lead service line between the curb stop and the corporation. The backhoe then pulls the copper line through to the corporation excavation. From there the new copper service is attached to the corporation.



Once the copper is attached to the corporation then the copper line is cut in the curb stop excavation and a new curb stop is installed.



Final Step

We then provided a set of flushing instructions to the property owner for continued flushing of the premise plumbing, with each tap flushed for 5 minutes before moving to the next tap downstream from the meter. If the customer requests it, a filter will be provided to them for use for the next 3 months as an added precaution.



****Important Notice****

The portion of your water service line that was made of lead has been replaced with copper.

Lead Service Line Replaced: _____ (Date)

Precautions were taken to prevent any lead from being released into your water supply when your new copper service line was installed. However, please take the following steps to flush any lead that could possibly be present in your home plumbing after the replacement.

Flushing Instructions

1. Remove faucet aerators from all cold water taps in the home.
2. Beginning at the faucet nearest to the meter, fully open the cold water tap, flush for 5 minutes, and shut off before moving to the next faucet.
3. Repeat this procedure at the remaining faucets throughout the home from the lowest level to the last faucet on the top floor. Be sure to run water in bathtubs and showers as well as faucets.
4. Until after the flushing is complete, do not consume tap water, open hot water faucets, or use icemaker or filtered water dispenser.
5. Clean the inside of your aerators before reinstalling on the faucet.

These flushing instructions are an additional method to ensure that any lead is removed from your home's water supply. As a final precaution you may also wish to use a home filter (NSF/ANSI 53) for the next 3 months at faucets used for drinking and cooking, particularly if you are pregnant or have children under age six. The BWL will be glad to provide a filter free of charge. You may wish to contact a licensed plumber if you need help following these instructions or installing a water filter.

If you have any questions, please contact the BWL's Water Quality Administrator, Angie Goodman at 517-702-7059.



LBWL Water Construction Standard

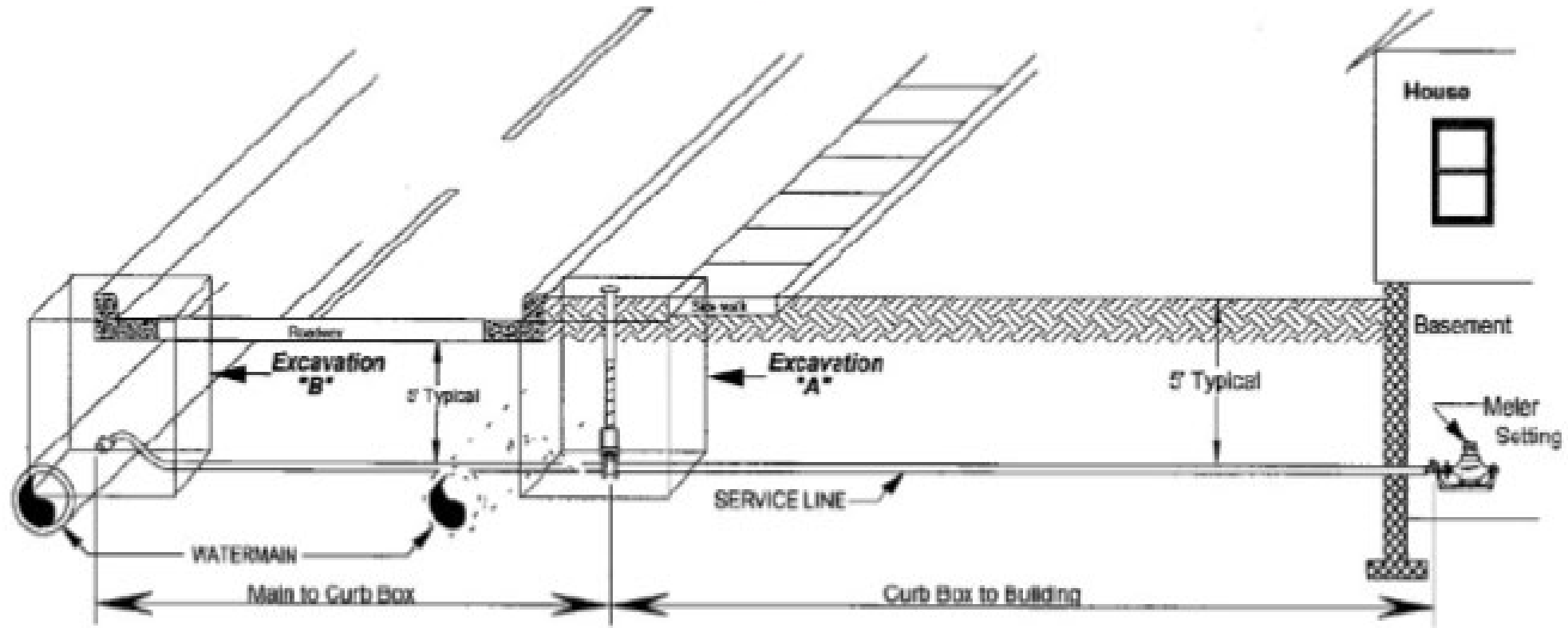
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 - 1) Looped
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 - 3) Service is encased in concrete (excluding basement wall)
 - 4) Existing utilities interfere with a straight line pull
 - 5) If the ground is extremely hard and dry.
- Generally, service section lengths greater than 60' cannot be replaced using this technique

GENERAL INSTALLATION NOTES

- Complete all staking requirements prior to installation.
- Make appropriate customer notifications and close curb stop prior to any excavation.
- Replace all 5/8" & 3/4" galvanized iron or lead services with a 3/4" copper tube service.
- Replace all 1" galvanized iron or lead services with 1" copper tube service.
- Meter set and meter installation shall be performed by Utility personnel only.

Excavation at Curb Box and Main

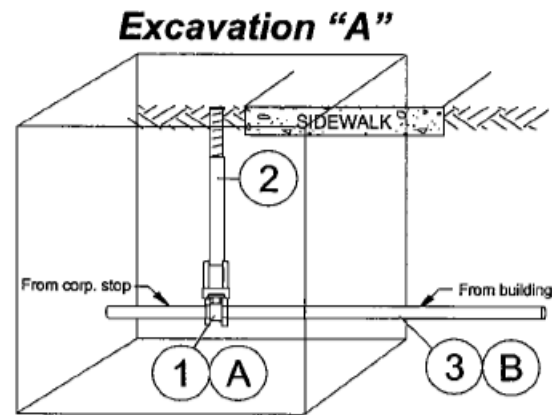


Excavation Procedure

- Excavation "A": Required for complete service replacement. Excavate at "A" to unearth the curb stop. Expose the curb stop and a minimum of 2' of service line in each direction, unless otherwise directed by the Utility Engineer. It is imperative that the material type of the existing service sections be identified. If either of the service line sections (main to curb box I curb box to bldg.) are of non-standard material or construction, they shall be replaced. Control of excavations is required to keep any water or other materials from entering the main tap or the newly installed copper service lead. Follow all trenching or excavation safety precautions.
- Excavation "B": Required for long side service replacement. May not be required when the water main is exposed by excavation "A" (short side)

Excavation “A” detail

Reference Only)



INSTALLATION NOTES: Excavation "A"

A New curb stop & curb box may be required if existing curb stop is
*non-standard or damaged

B Existing service material is to be removed during the service installation. If existing service cannot be removed follow water service abandonment procedure.

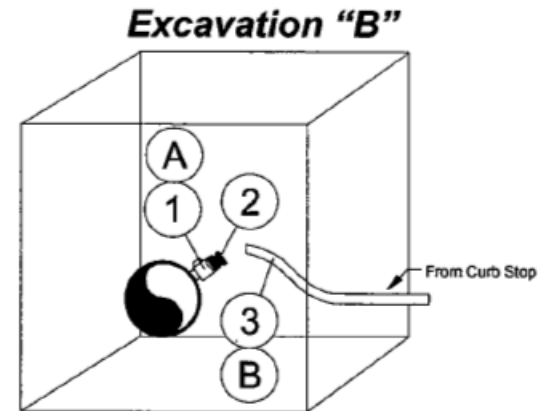
Excavation “B” detail

INSTALLATION NOTES: Excavation “B”

If a new $\frac{3}{4}$ " or 1" tap is required install new tap as per standard AWWA C600 procedures. If a new tap larger than 1" is required install new tap with service saddle.

A – The existing service corporation can be used if it is the correct size for the service being installed. Allowable transitions are $\frac{5}{8}$ " to $\frac{3}{4}$ ", $\frac{3}{4}$ " to 1", 1" to $\frac{3}{4}$ ". $\frac{1}{2}$ " corporation stops shall not be re-used. If new corporation is being installed, abandon the existing corporation stop in the OFF position and cap. Verify that capped tap is not leaking.

B – Existing service material is to be removed during the service installation.



INSTALLATION NOTES: Curb Box to House

- A - Insert the 3/8" wire rope into the existing service pipe pushing it through till it reaches the other pipe end inside the basement. In some instances a smaller fish tape may be used first and the 3/8" rope wire pulled back through attached to the fish tape.
- B - Attach cone or "Push Block" to cable and attach the pulling sock behind that. Secure new copper tubing in pulling sock. Be sure to tape off the new copper service prior to insertion into the pulling sock and make sure that taped off end of the copper service is tight against the rubber ball in the pulling sock. Completely tape off pulling sock to prevent any loose material from entering the new copper service.
- C - Chip out basement or foundation wall around the existing service line to loosen the contact and allow new copper to pull in smoothly.
- D - Pulling equipment may vary. Equipment and procedure shall be approved by the Utility Engineer. The new copper tube service will be pulled in as the old service line is pulled out.

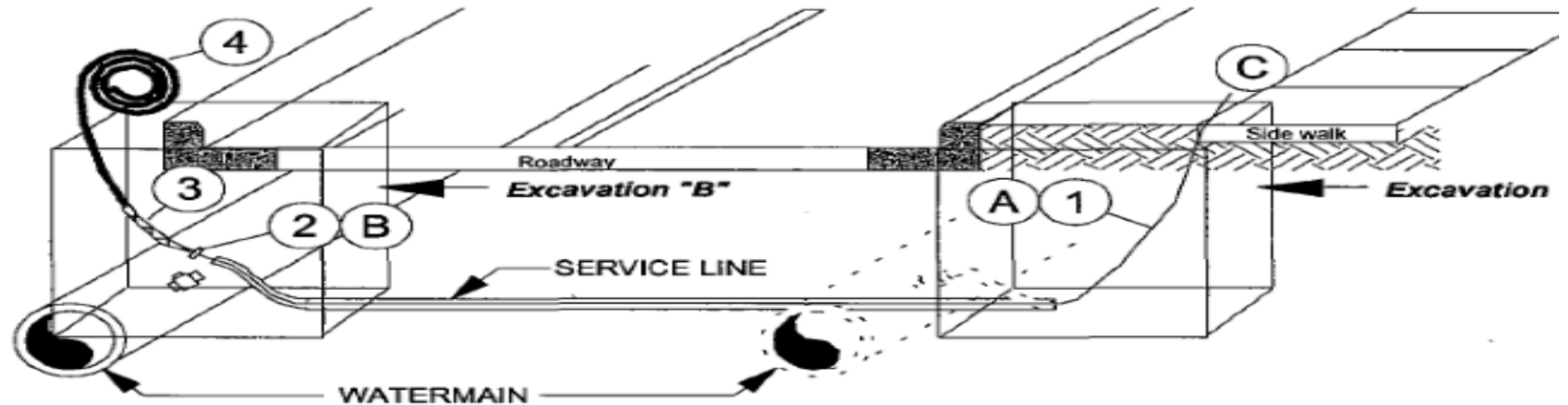
INSTALLATION NOTES: Main to Curb Box

If the water main can be accessed by enlarging Excavation "A", Excavation "B" will not be necessary and the short side service can be removed from the single excavation.

- A - Insert the 3/8" wire rope into the existing service pipe pushing it through till it reaches the other pipe end inside the basement. In some instances a smaller fish tape may be used first and the 3/8" rope wire pulled back through attached to the fish tape.
- B - Attach cone or "Push Block" to cable and attach the pulling sock behind that. Secure new copper tubing in pulling sock. Be sure to tape off the new copper service prior to insertion into the pulling sock and make sure that taped off end of the copper service is tight against the rubber ball in the pulling sock. Completely tape off pulling sock to prevent any loose material from entering the new copper service.
- C - Pulling equipment may vary. Equipment and procedure shall be approved by the Utility Engineer. The new copper tube service will be pulled in as the old service line is pulled out.

In most instances the portion from the curb box to the main may be pulled without redoing the pulling block assembly by simply removing the old service line that was pulled in the first step from the 3/8" wire rope and rethreading the wire rope through the curb box to main section.

Installation Main to Curb Box



MATERIALS FOR SERVICE REPLACEMENT			
REF	ITEM	QTY	DESCRIPTION
①	Non-stock	75'	Wire rope, 3/8", 18,000 lbs.
②	Non-stock	1	Block, cable pulling for "Push" pulls
③	Non-stock	1	Grip, pulling (pulling sock)
④	30-45329 or 30-45345	As Req'd	Tube, Copper, Type K, 3/4" x 60' or Tube, Copper, Type K, 1" x 60'
Curb Box To Building & Main To Curb Box			

FINALIZATION

- Complete connections at main tap and curb stop to new copper service.
- Complete internal connections including installation of new meter assembly as per meter set standards.
- Open new curb stop valve and check for any leaks. Make repairs as necessary.
- Flush new service for 5-7 minutes and provide customer with internal plumbing flushing notice.

Other Methods for LSLR

SLR Methods

Open trench

Directional drilling

www.YouTube.com/watch?v=sMTQJjqF3lg

Pneumatic missile

www.YouTube.com/watch?v=sctNCphZbF0

youtu.be/Jp2bKaDfZQQ

Line splitting

youtu.be/2ZBe6XhpH6s

www.YouTube.com/watch?v=FJZicUzqJD4

Service line pull and replace

www.YouTube.com/watch?v=CtqhioDmt54

Questions

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