

Preparing for the LCRR, Part I: Developing the Service Line Material Inventory

Pacific Northwest Section AWWA – Water 2023 Conference – May 5, 2023



Agenda

1. Lead and Copper Rule Revisions (LCRR)
 - a. Background on Lead and Copper Regulations
 - b. Service Line Material Inventory
2. Guidelines to Develop the Inventory
3. Tools to Develop the Inventory

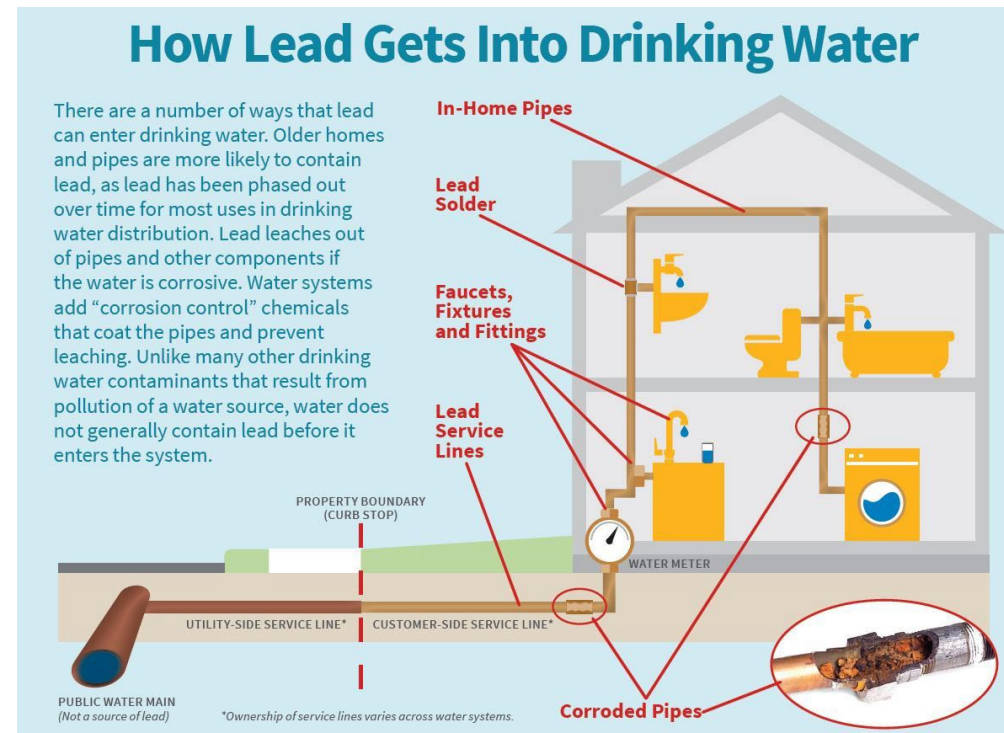
Preparing for the LCRR, Part 1: Developing the Service Line Material Inventory

Background on Lead and Copper Regulations



LCR Background

- Published in June 1991, with many revisions and corrections (2000, 2004, 2007)
- Applies to all Community Water Systems (CWSs) and Non-transient Non-community Water Systems (NTNCWs)
- *“Treatment technique rule”*
 - Lead and copper rarely come from the water
 - Primary source of lead and copper is corrosion products from premise plumbing
 - However, lead and copper release can be minimized with appropriate corrosion control treatment



LCR Background

- *“Treatment technique rule”*
 - Samples are collected from customer taps, not from system-owned infrastructure
 - Action Levels (ALs), not maximum contaminant levels (MCLs)
 - 90th percentiles (P90) of lead and copper concentrations (no more than 10% of the samples can exceed AL)
 - AL exceedances are “calls to action” (additional monitoring, corrosion control treatment, lead service line replacement, public education, etc.)

	Action Level (AL)	Maximum Contaminant Level Goal (MCLG)
Lead	0.015 mg/L (15 µg/L)	0
Copper	1.3 mg/L	1.3 mg/L

From the LCR to the LCRR

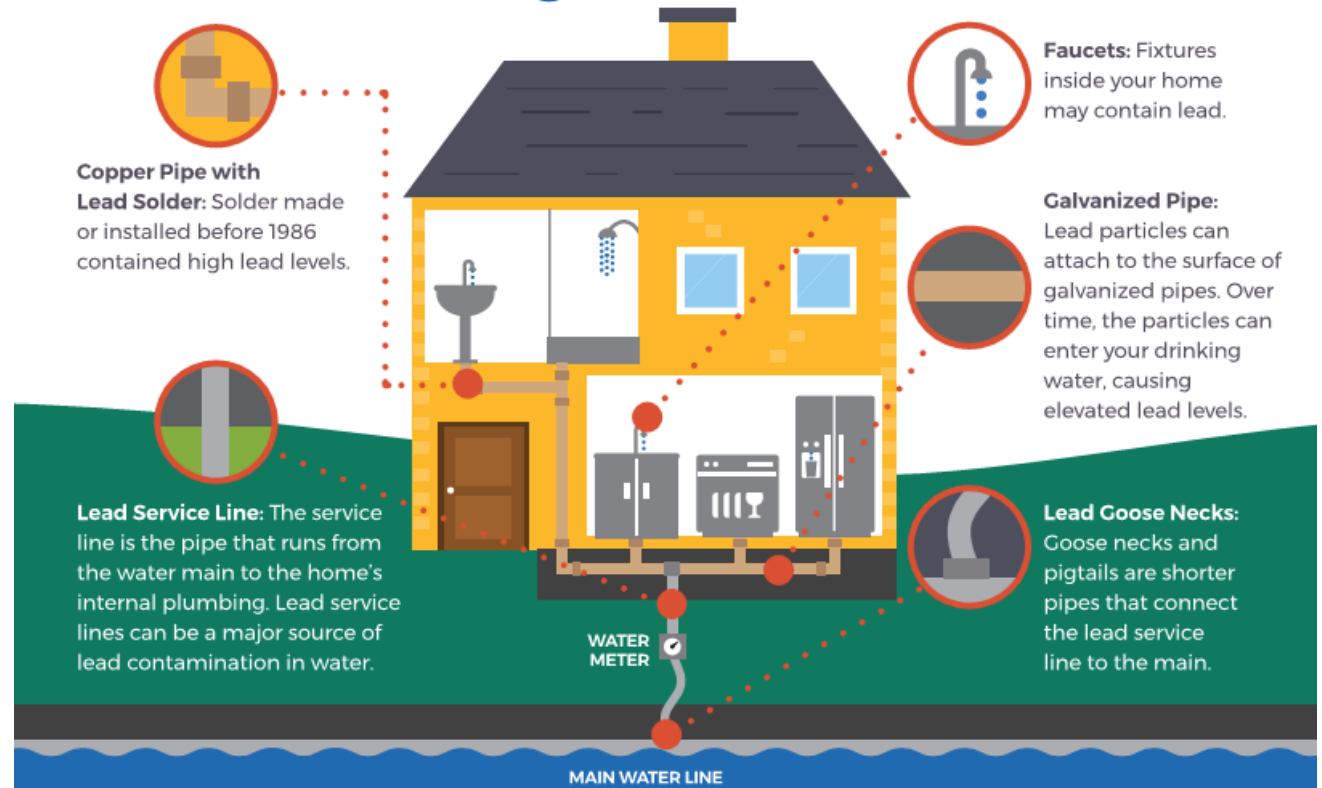


1. June 1991: Publication of the LCR
2. January 2000: Publication of Minor Revisions
3. June 2004: Publication of Minor Corrections
4. 2005: USEPA identified short- and long-term goals for improving the LCR
5. October 2007: Publication of Short-term Revisions
6. 2013: Report from the Small Business Advocacy Review (SBAR) Panel for the Long-Term Revisions to the LCR
7. 2015: Recommendations to EPA from the National Drinking Water Advisory Council (NDWAC) for the Long-Term Revisions to the LCR
8. November 13, 2019: Publication of the proposed LCRR
9. January 15, 2021: Publication of the LCRR
10. June 16, 2021: Publication of the delays to the Effective Date (12/16/2021) and Compliance Date (10/16/2024)
11. December 16, 2021: LCRR Effective Date
12. December 17, 2021: Publication of conclusion review
13. October 16, 2024: LCRR Compliance Date

EPA's Stated Goals for the LCRR

- *“To better protect children at elementary schools and child care facilities”*
- *“Get the lead out of our nation’s drinking water”*
- *“Empower communities through information”*

Sources of **LEAD** in Drinking Water



USEPA

Major Additions and Changes in the LCRR

	Due Before the Compliance Date of October 16, 2024	Due After the Compliance Date of October 16, 2024
Additions	<ul style="list-style-type: none"> • Service line material inventory • Lead service line replacement (LSLR) (plan) • Schools and child care facilities (inventory) 	<ul style="list-style-type: none"> • Trigger Level (TL) for lead: 10 µg/L (0.010 mg/L) • Service line material inventory (update) • Lead sampling at schools and child care facilities • Find-and-fix program
Changes	<ul style="list-style-type: none"> • Customer tap sampling (plan) 	<ul style="list-style-type: none"> • Customer tap sampling • Lead service line (LSL) replacement • Corrosion control study requirements • Public education and customer notification

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LCRR: Lead Service Line Inventory

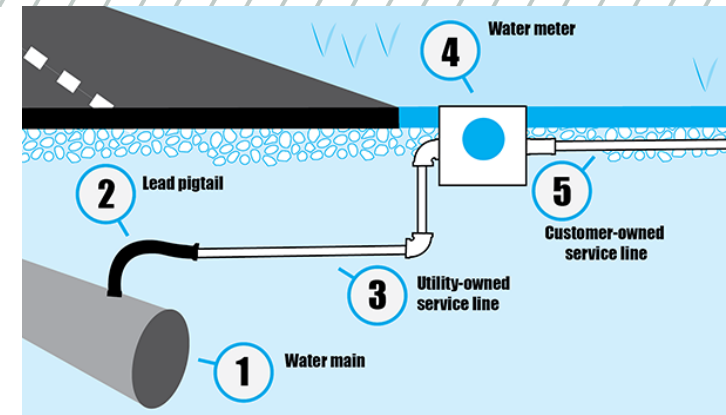


Inventory – Objectives

- Help identify areas most in need of remediation
- Ensure tap sampling pools are targeted to the sites with elevated lead
- Make customers aware of the presence of a LSL, if applicable
- Facilitate replacement of LSLs and improve efficiency of LSLR programs
- Decrease uncertainty in numbers of LSLs U.S. and develop focused actions

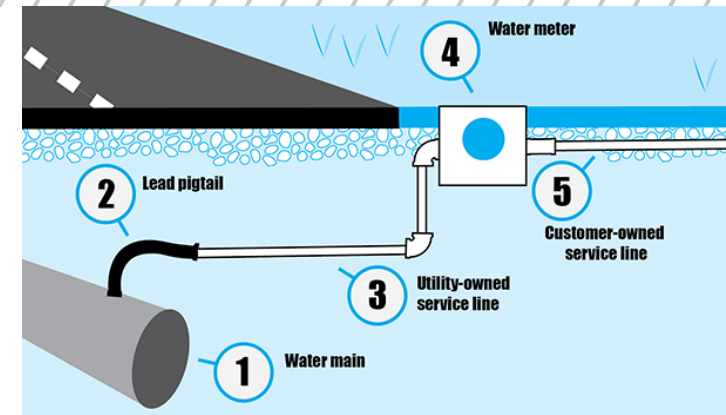
Inventory – Development

- Service line: From the main to the building foundation i.e., system side + owner/customer side
- All systems must develop a service line material inventory (or demonstrate absence of LSLs) by the Compliance Date (October 16, 2024)
- Service lines separated into four categories:
 - Lead service line
 - Non-lead
 - “Lead status unknown service lines”
 - Unknown materials
 - Absence of documented evidence supporting material classification
 - “Galvanized requiring replacement”: Galvanized iron line that is:
 - Downstream of an LSL (currently or in the past)
 - Downstream of a lead status unknown service line (currently)
- (Goosenecks, pigtails and lead connectors are not considered part of LSLs)



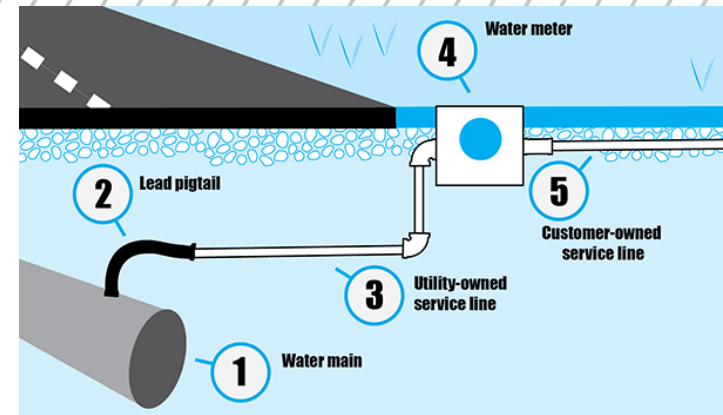
Inventory – Notifications

- Service line material inventory must be made publicly available by the Compliance Date (October 16, 2024)
 - Available online for large systems (>50,000 people)
 - Location identifier:
 - General location identifier is acceptable for LSLs and galvanized requiring replacement
 - Location identifier is not required for lead status unknown service lines
- Systems with LSLs, galvanized requiring replacement or lead status unknown service lines must notify customers within 30 days after completing the inventory, and annually until replaced or identified
 - Demonstrate delivery of notification to Primacy Agency within 10 days



Inventory – Updates

- Service line material inventory must be updated annually or triennially, based on tap sampling frequency, whichever is greater
 - Submit updated inventory within 30 days of the end of each tap sampling monitoring period
 - Updates are no longer needed after a system can verify that it no longer have LSLs or galvanized lines requiring replacement
 - Systems without LSLs do not need to update the inventory (e.g., systems built after state or federal lead ban)
- Unknowns are assumed to be lead until the material is determined



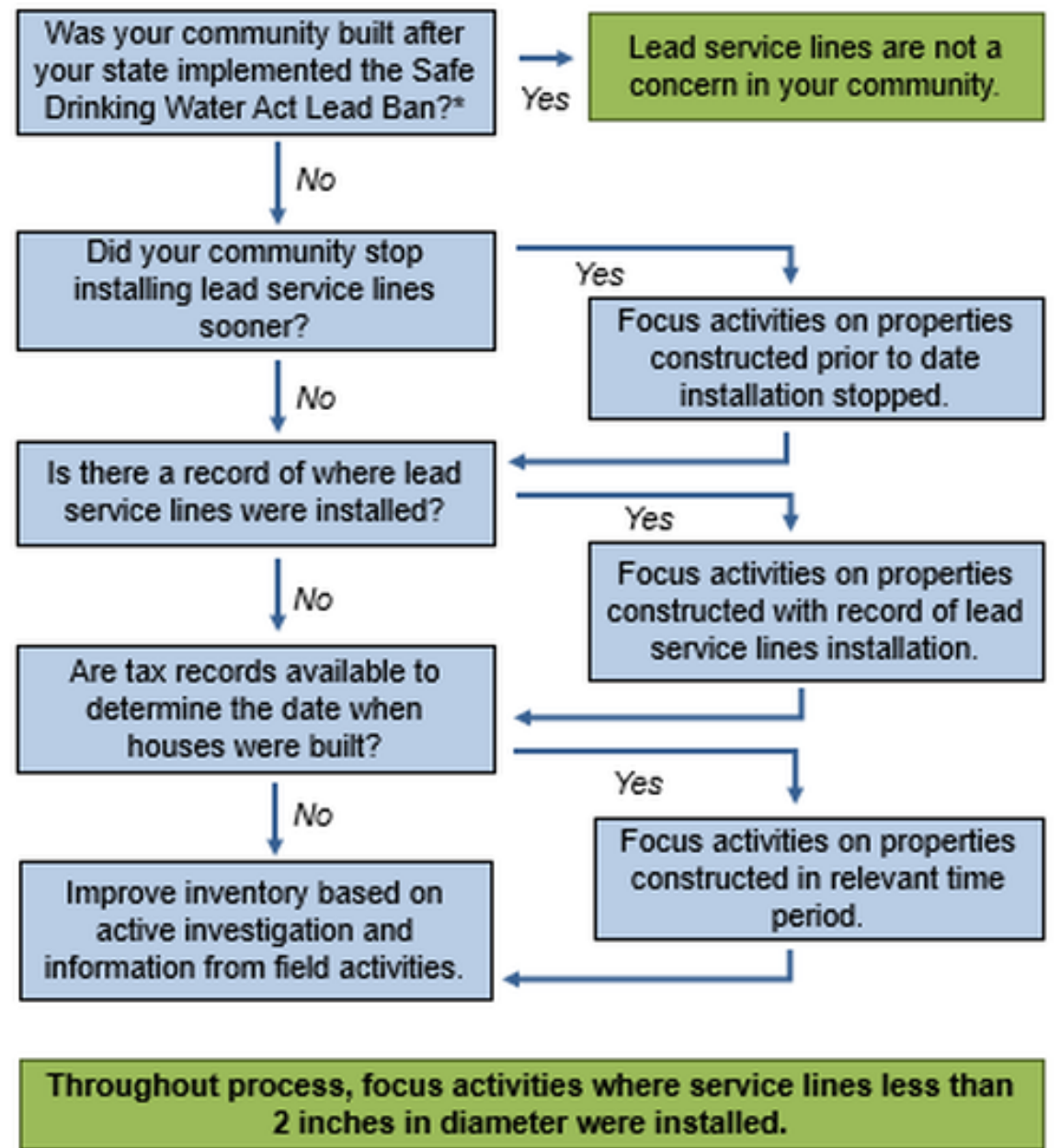
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Guidelines to Prepare the Inventory



Inventory Guidance

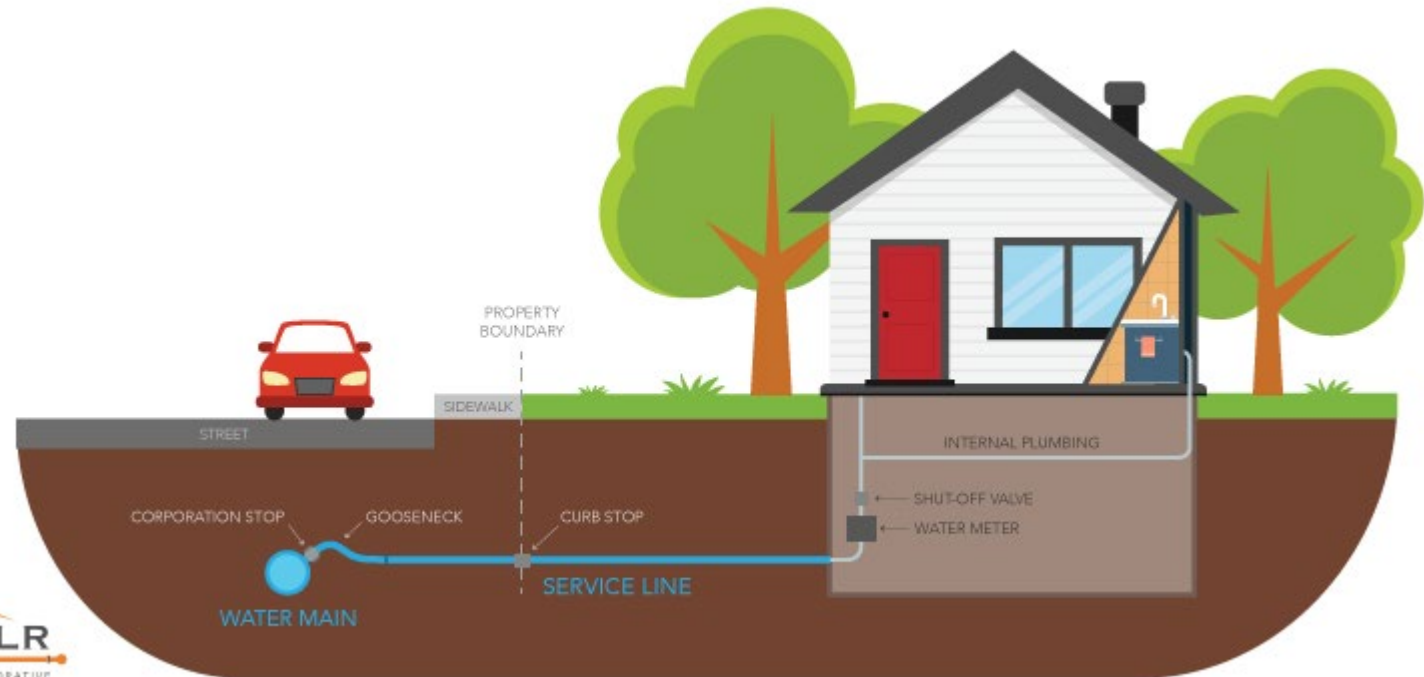
- Lead Service Line Replacement Collaborative (LSLR Collaborative)
 - Preparing an Inventory: Where do we Start?
 - <https://www.lslr-collaborative.org/preparing-an-inventory-where-do-we-start.html>



*The federal Lead Ban was effective June 19, 1986, but individual states may not have implemented state-specific regulations for 1 – 2 years.

Inventory Tools Per LCRR

- *All construction and plumbing codes, permits, and existing records or other documentation*
- *All water system records: Distribution system maps and drawings, historical records on each service connection, meter installation records, historical capital improvement or master plans, and standard operating procedures*
- *All inspections and records of the distribution system*
- *Any resource, information, or identification method provided or required by the Primacy Agency*
- *Other methods if approved by the Primacy Agency*



ASDWA

- State Implementation Framework for the Lead Service Line Inventory Requirements under EPA’s LCRR (February 2022)
- Templates for CWSs and NTNCWSs
- Content
 - Information states need to determine and disseminate decisions
 - **Information for water systems, with lists of potential sources of information**
 - Contents of the inventory and compliance requirements
 - **Updates to the inventory and refining the inventory**
 - Non-lead certifications
 - Private property access
 - Public dissemination of inventory information
 - Additional resources
- As a prequel for EPA’s guidance document
- <https://www.asdwa.org/lead-and-copper-rule-lcr/>

EPA's Guidance for Developing and Maintaining a Service Line Inventory (August 2022)

– Content

- Elements of the inventory
- Inventory planning
- Historical records review
- Investigation methods
- Developing and updating the inventory
- Public accessibility

– Guidance for small systems' inventories expected soon

– Historical records

- Previous material evaluation
- Construction, plumbing codes, records
- Water system records
- Inspections and records of the DS

– Investigation methods

- Visual inspection, including CCTV
- Water quality sampling
- Excavation
- Predictive modeling
- Emerging methods

OHA Statistical Guidelines for Inventory (March 2023)

- Accepted methods to categorize service lines
 - Records
 - Installation date: Pipes installed after January 1, 1986 can be categorized as non-lead
 - Service line size: Service lines ≥ 2 in can be categorized as non-lead
 - Customer data: Must be supported by photos and documentation
 - Statistical analysis: Random sampling of a number of unknown service lines
- OHA's spreadsheet and reporting instructions to submit the inventory
- <https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/RULES/Pages/LCRR.aspx>

Preparing for the LCRR, Part 1: Developing the Service Line Material Inventory

Tools to Prepare the Inventory



Inventory Tools

- Installation date vs. lead ban
- Service line diameter
- Visual inspection
- Scratch and magnet tests
- Self-identification/reporting by customers
- Sequential tap water sampling
- Closed-circuit television inspection (CCTV)
- Statistical analysis or predictive modeling
- Interpolation
- Excavation
- Emerging methods

- Typically, a combination of tools is needed
- *“No convenient methodology is currently commercially available that is capable of directly identifying all buried LSLs”*
(Bukhari et al. 2020 “Lead Service Line Identification Techniques”, WRF 4693)
- Acceptance of interpolation is state specific

Inventory Tools – Records Review

- Utility records, plumbing codes, ordinances
- Distribution system maps, drawings, as-built drawings
- Physical location relative to confirmed LSLs
- Year and construction records with respect to lead ban
- Tap cards from initial service installation (date, location, and possibly pipe material installed)
- Plans from water main installation, rehabilitation, and/or replacement
- Service/repair tickets
- Plumbing permits and permit amendments
- Institutional knowledge

WS 129 Rev. B (9-81)
100M-1026057 (82) 346

CITY OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER SUPPLY

HOUSE SERVICES ORDER
PERMIT NO. _____
INSP. NO. _____

SEC.	BLOCK	LOT
	1479	8
WARD	DIST.	PLOT

BOROUGH BROOKLYN

LOCATION 1334 BROADWAY

INSERT 3/4" TAP ON 20" MAIN. READY _____ M.

INSERT _____ PLUG ON _____ MAIN. READY _____ M.

INSPECT SERVICE PIPE _____ READY _____ M.

SPECIAL ORDERS

Main drawback: Low accuracy

- Based on historic information only
- Limited by data availability and completeness
- Inconsistent records
- May be outdated

KIND AND SIZE OF SERVICE PIPE { NEW 1" copper }
NEW SERVICE LENGTH 40' IS CURB COCK AND BOX SET ? _____ KIND AND MAKE _____
OPENING SIDEWALK OR ROADWAY _____ FOR BUILDING PURPOSES _____
VIOLATIONS _____ RE-EXAMINED _____ VIOL. REMOVED _____
REMARKS: Transferred service old abandoned 12" s/s Bdwg to new 20" w/s Bdwg

I CERTIFY THAT THE ABOVE REPORT IS CORRECT. TAPPER/INSPECTOR

PENALTY FOR FALSIFICATION
Falsification of any statement made herein is an offense punishable by a fine or imprisonment or both. (N.Y.C. Adm. Code, Sec. 1151-9.0)

Print: Henry Roszkowski
Sign: Henry Roszkowski

Inventory Tools – Customer-Driven Data

- Information volunteered by customers
 - Historical records
 - Scratch and magnet tests
 - Photos
- Also:
 - Construction year and records
 - Plans and drawings
 - Information found during service/repair

How to check your water service line material

The City's water mains are not made of lead. However, the water service line running from the water main to your home may be made of lead or steel, which may break.

Lead can also be found in older brass fixtures and valves and in old solder or epoxy, where pipes are joined.

You can test the water service line where it connects to the water main in your basement.

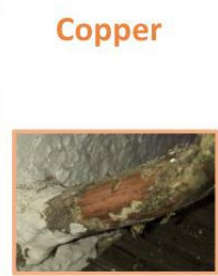
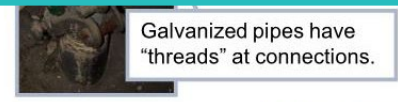
For any questions about lead in your water:
 Call our hotline at 215.685.6300. Our staff will provide information on water testing, safety tips and replacement options.

Possible Pipe Materials

- Lead
- Copper
- Galvanized Steel
- Plastic

Main drawbacks:

- Customer may not have information about the SL
- SL may not be visible from the basement
- Customer data may not be reliable



Copper



Brass has "threads".



Lead is dull, very soft, and will turn a shiny silver color when scratched.

Magnets will **ONLY** stick to steel. They will **NOT** stick to lead or copper.

A licensed and insured plumber can inspect your pipes and other plumbing for lead or steel. Replacing an older brass faucet or valve may be a simple way to reduce the lead in water.

Inventory Tools – Scratch and Magnet Tests

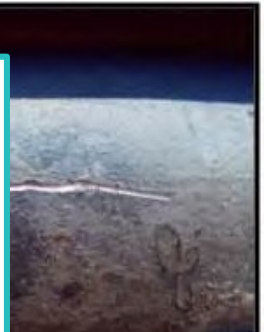
- Scratch test: Key, coin, or other sharp metal objects to scratch the outer surface of the pipe
 - Lead = Easy to scratch + Silver and shiny
- Magnet test
 - Magnet sticks = Galvanized or iron
 - Magnet does not stick = Lead or copper



<https://apps.npr.org/find-lead-pipes-in-your-home/en/>

Main drawbacks

- Inform only the segments of service line that can be reached
- May not be able to access the customer-side of the service line



Types of water pipes

Follow the guidance below or contact a licensed plumber to determine the material of your water pipes. To identify the material of your service pipe material on private property, check your household water service connection, typically located in the basement.

Homeowners should identify and replace old household pipes, particularly galvanized plumbing and sources of lead. The type of household plumbing can vary throughout your household.

Lead

A dull, silver-gray color that is easily scratched with a coin. Use a magnet - strong magnets will not cling to lead pipes.

Galvanized

A dull, silver-gray color. Use a magnet - strong magnets will typically cling to galvanized pipes.

Copper

The color of a copper penny.

Plastic

White, rigid pipe that is joined to water supply piping with a clamp.

Inventory Tools – Visual Inspection

- Curb box
- Meter pit
- Home point of entry



Greater Cincinnati Water Works



Denver Water field crews or its contractors may inspect the pipe at the main water shut-off valve inside the property to help determine the type of material. Visual inspection will be arranged with the property owner in advance. Photo credit: Denver Water.

Inventory Tools – Water Quality Sampling

- Alternative sampling strategies
 - Sequential/profile sampling
 - Long and short stagnation
 - Random day-time sampling
- Alternative analytical methods
 - Anodic Stripping Voltammetry (ASV): Electrolytic method (e.g., Palintest’s Kemio Heavy Metals)
 - Fluorochrome-conjugated DNA molecules cleaved in the presence of lead (e.g., ANDalyze)

Main drawbacks:

- Can be inconclusive
- Results may be impacted by corrosion control treatment because lead levels need to be sufficiently high
- System-specific threshold (water source, treatment processes, water quality, infrastructure, etc.)
- Alternative analytical methods may be impacted by particulate lead
- Requires significant public education

Bosscher 2020, 17th Annual EPA Drinking Water Workshop: Small Systems Challenges and Solutions

Inventory Tools – CCTV Inspection

- Widely used in the wastewater industry
- Visual inspection of exterior or interior surface of a service line

Main advantage

- Provides visual observation

Main drawbacks

- Difficult to identify material
- Limited by access, corrosion, and scale build-ups



Lead Service Line



Non-Lead Service Line

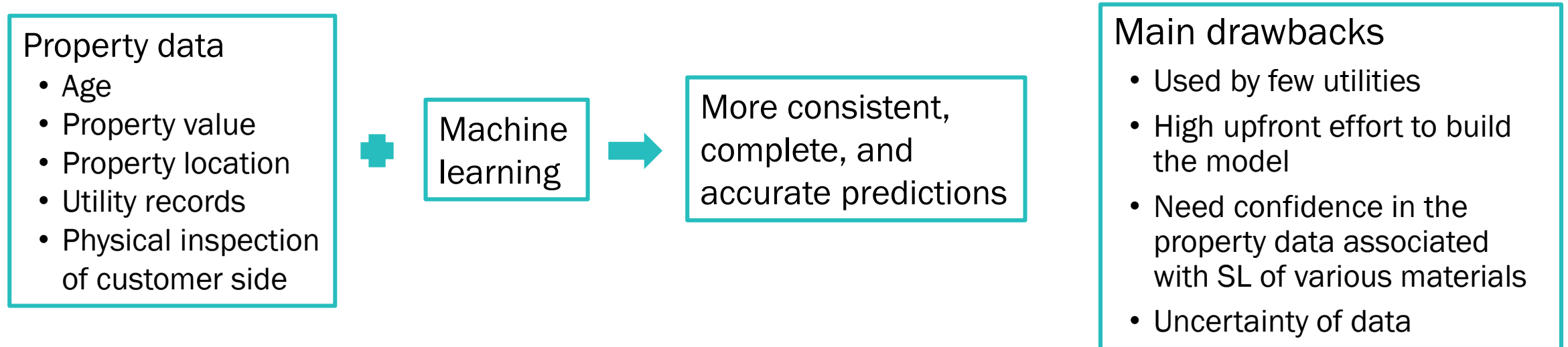


Unable to Determine

Pittsburgh, PA (Bolenbaugh 2018 AWWA ACE)

Inventory Tools – Predictive Modeling

- *“Geospatial approach that uses an artificial intelligence algorithm (or machine learning) to predict the likelihood that a residence has an LSL based on neighboring field data (i.e., house inspection) and secondary information (i.e., construction year and water system records)”*
- Holistic data-driven approach:



Inventory Tools – Interpolation

- In homogenous neighborhoods
- Limited number of visual/physical inspections
 - Must be randomized sample sets
- Common factors that distinguish one area from another
 - Close vicinity
 - Same construction year
 - Same contractors
 - Lists of material available

Inventory Tools – Interpolation

- Oregon Health Authority (OHA):
 - [Statistical Guidance for Evaluating Service Lines \(March 2023\)](#)
 - Must first use other approved methodologies to categorize service lines
 - If lead is not found, then a statistical approach may be used
 - Randomly generated list of unknown lines to be physically inspected
 - <1,500 lines: Must physically verify $\geq 20\%$ of total number of unknowns
 - $\geq 1,500$ lines: Must physically verify enough lines to demonstrate a minimum of 95% statistical confidence level
 - ≥ 1 point inspection on public side + ≥ 1 point on customer side
 - Record methods used for physical inspection
- California (draft): 20% in each area where LSLs are not expected, with adjustment based on findings

Number of Unknown Service Lines	Number to Physically Inspect
Fewer than 1,500	20% of unknown lines
1,500	306
1,600	310
1,700	314
1,800	317
1,900	320
2,000	322
2,200	327
2,400	331
2,600	335
2,800	338
3,000	341
3,500	346
4,000	351
4,500	354
5,000	357
6,000	361
7,000	364
8,000	367
9,000	368
10,000	370
15,000	375
20,000	377
30,000	379
40,000	381
60,000	382
90,000	383
225,000 or more	384

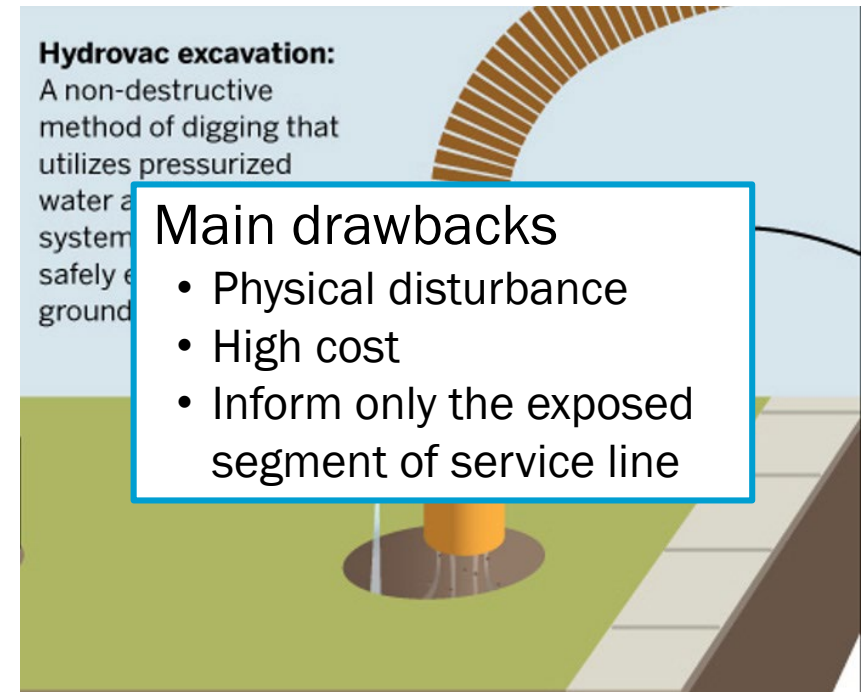
Inventory Tools – Excavation

– Potholing

- Backhoe or hand tools to dig a hole to expose a segment of the service line

– Vacuum excavation

- High-velocity, high-pressure air to break up the soil
- Hydro-excavation: high-velocity, high-pressure water to break up the soil



<https://www.mlive.com/>

Inventory Tools – Electrical Resistance

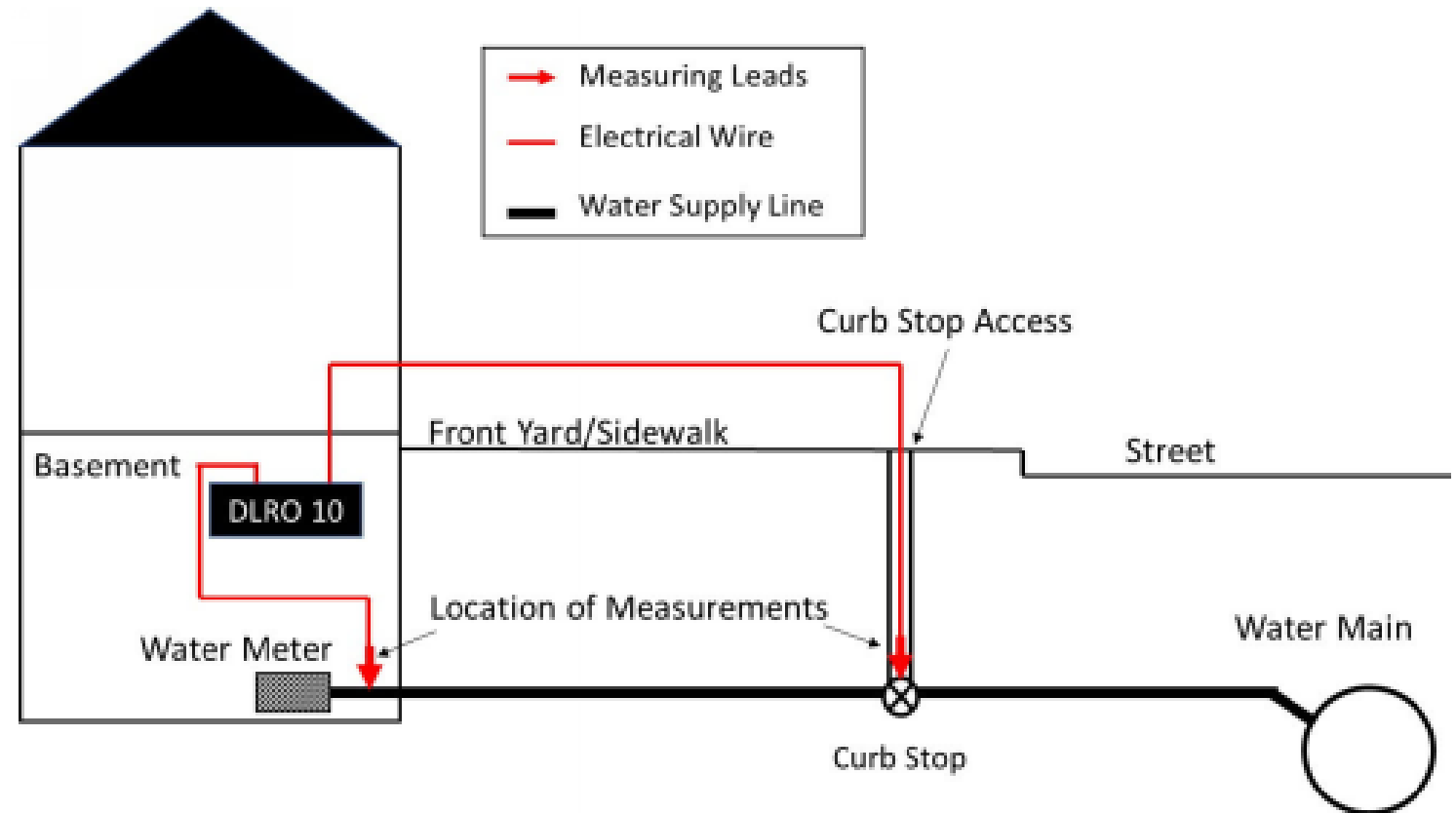
- Digital low-resistance ohmmeter (DLRO) to measure electrical resistance
- Distinguish between lead and copper pipes

• Advantages

- Fast, simple, and low cost

• Main drawbacks

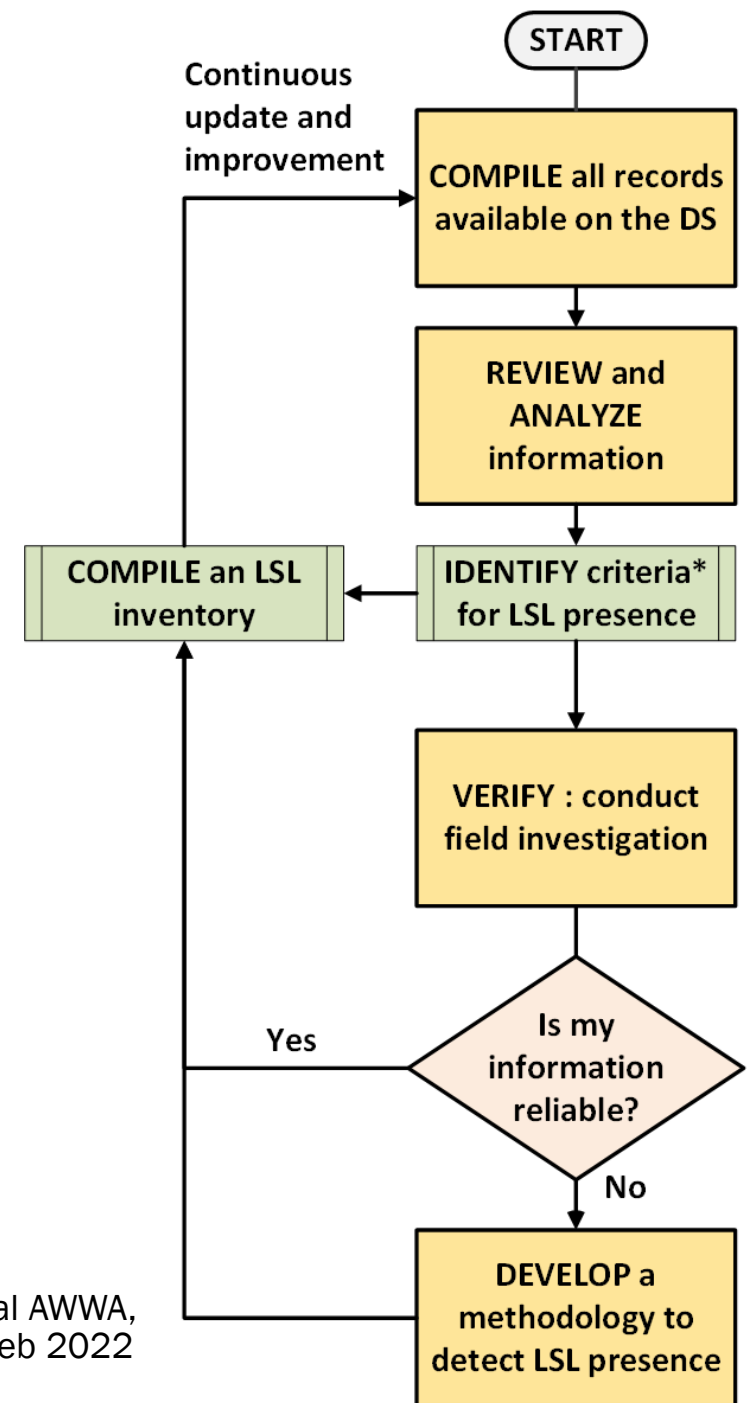
- Cannot insert testing leads in some access pipes
- Poor electrical connection due to corrosion or debris on the pipe surface



Jallouli 2020 "Evaluation of Lead Pipe Detection by Electrical Resistance Measurement" WRF 4698

Utility Experience

- Start with a needs assessment
 - What do you know about your SL materials
- Gather available information
 - Lead bans (federal, state, local)
 - LSL Replacement Collaborative
 - EPA or state guidance
 - Records, inspection reports, etc.
- Several tools will likely be required;
Not all tools are applicable to all systems
- Tools that can serve other purposes (CCTV, model)
- Multi-point verification methods to ensure data quality and confidence in data
- Iterative process to improve methodology, finetune inventory, and decrease uncertainty



Journal AWWA,
Jan/Feb 2022

Thank you!

Questions?

Hélène Baribeau, PhD, PE

HBaribeau@AQUALity.us

714.488.0496



Damon Roth, PE, BCEE

Brown and Caldwell

Droth1@BrwnCald.com

206.749.2232

Brown AND Caldwell :

