Digging Deep – Searching Decades of National Records to Find Lead Service Lines and Goosenecks

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Agenda

• Why are we talking about lead service lines (LSLs)?
  – Brief health background
  – Washington Governor’s Directive 16-06
  – LSL Inventory Requirements from other states

• How to develop LSL Inventory?
  – Historic survey data

• LSL occurrence estimates
  – 2011 and 2013 AWWA Surveys
  – Recent state surveys
Health Effects of Lead

**ADULTS**
- **Brain**
  - Memory loss, lack of concentration, headaches, irritability, depression
- **Body**
  - Fatigue, joint and muscle pain
- **Cardiovascular**
  - High blood pressure
- **Digestive system**
  - Constipation, nausea and poor appetite
- **Kidneys**
  - Abnormal function and damage
- **Nervous system**
  - Damage including numbness and pain in the extremities
- **Reproductive system**
  - Men: Decreased sex drive and sperm count, and sperm abnormalities.
  - Women: Spontaneous miscarriage

**CHILDREN**
- **Brain**
  - Behavior problems, lower IQ, hearing loss, learning disabilities
- **Body**
  - Decreased bone and muscle growth
- **Kidneys**
  - Damage
- **Blood**
  - Anemia
- **Nervous system**
  - Damage
Lead Exposures and Pathways

HOME
- Paint
- Lead pipes
- Lead solder
- Consumer products
- Hobbies
- Imported cosmetics
- Traditional remedies

OUTDOOR
- Soil
- Job take-home
- Leaded gas residue
- Industrial emissions
- Ammunitions
- Aircraft

**Rates for ingested lead only, ATSDR.**

AIR
DUST
SOIL
WATER
FOOD

40-70% absorption*

Ingestion

5-20% absorption

Inhalation
Lead in Water—LCR has lowered exposure
Lead Service Lines – A Persistent Risk

• Even with corrosion control treatment, there is a risk any time that lead-bearing materials contact drinking water

• NDWAC recommendations to USEPA include proactive lead service line (LSL) replacement programs
  • LSLs are not the only lead-bearing plumbing materials, but do comprise the largest source of lead by mass in contact with drinking water
Signed May 2, 2016.

Comprehensive approach to lead exposure directed at state agencies to work on:

1. School Rule—review potential revisions; focus on lead exposure.
2. Lead Rental Inspection and Registry Program
4. Blood lead monitoring program—system improvements.
6. **Lead service lines and other lead components.**
7. Work with federal partners to support efforts to reduce lead exposure.
Governor’s Directive 16-06: Item 6

Requires DOH to:
• Work with each water system to identify all lead service lines and lead components within two years.

• Work with stakeholders to develop policy and budgetary proposals with a goal of removing all lead service lines and lead service components in water systems within 15 years.
LSL Inventory Requirements

• Michigan (R 325.11604(c))
  • Preliminary distribution system materials inventory (including service lines) required by January 1, 2020
  • Verified distribution system materials inventory (including service lines) required by January 1, 2025

• Ohio (3745-81-86.9)
  • Community water systems shall identify and map areas of the system that are known or likely to contain lead service lines ...
LSL Inventory Requirements (continued)

• California (SB-1398)
  • By July 1, 2018 a public water system shall compile an inventory of known lead user service lines in its distribution system and identify areas that may have lead user service lines …
  • By July 1, 2020 a public water system with areas that may have lead user service lines in use in its distribution system shall
    • Determine the existence or absence of lead user service lines
    • Provide a timeline to the board for replacement of user service lines whose content cannot be determined
LSL Inventory Data Sources
How to Start with LSL Inventory

https://www.lslrcollaborative.org/preparing-an-inventory-where-do-we-start.html
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Sources of Data to Assess If/When LSLs Were Installed

1922 – Municipal Journal & Public Works
1985 – USEPA Plumbing Materials and Drinking Water Quality Seminar
1988 – AwwaRF Questionnaire in Economics of Corrosion Control (EES 1990)
The Manual of American Water-Works

Intended to be a complete collection of water-works information.

Contains information regarding service line materials approved/used by many utilities.

McKEEPSORT, Allegheny Co. (Pop., 8,012; est., 22,000.) At junction of Monongahela and Youghiogheny rivers. 315 ft. above sea, on hilly ground rising to height of 300 ft. above rivers. Manufactures steel, w. i. pipe, sheet-iron. Settled in 1796; incorp. borough in ’42; and its limits were extended ’47 and ’73. Has sewers and electric lights.


Water Supply.—Youghiogheny river, pumping to reservoir. Well was dug on the bank of river, 25 ft. in diam., 30 ft. deep, in bottom of which 26 perforated 4-in. c. l. pipes are driven 10 ft. into saturated gravel. A 20-in. c. l. pipe connected well with engine-house.

Pumping Machinery.—Dy. cap., 8,000,000 galls.; two 1,000,000-gall. Worthington dup., high-pressure, and 5,000,000 pump erected in ’88. Natural gas is used for fuel. A 1-in. pipe leads from the surface of the reservoir to the engine-house. When reservoir is full water flows through pipe, and by automatic arrangement blows steam whistle as signal to stop pumps.

Force Main.—To reservoir, 1,547 ft. of 16-in. pipe, rising 310 ft. from river.

Reservoir.—Cap., about 6,000,000 galls.; in excavation and embankment, 210 ft. sq. x 20 ft. deep to water line. Bottom covered with 6 ins. of concrete on 12 ins. of puddle, and slopes with 10 ins. of stone blocks in cement on 8 ins. of broken stone, the latter being on 12 ins. of puddle.


Meters, 198. Hydrants, Mathews, 130.

Consumption, 1,000,000 galls. Pressure, 115 lbs.

Municipal Journal & Public Works

1922 – contains tables of information collected from superintendents in nearly 800 cities, including typical service line material used.
The Action of Water on Service Pipes

1924 – contains tabulation of various service pipe materials for 539 cities of the United States
USEPA Plumbing Materials and Drinking Water Quality Seminar

1984 – contains tabulated information on service line material and number of services/goosenecks for 153 cities
## Economics of Internal Corrosion Control

1990 – Contains data from a 1988 survey of ~20 systems.

Lists service material and number service lines

<table>
<thead>
<tr>
<th>Material</th>
<th>Metropolitan Water Dist. of S.C</th>
<th>Philadelphia Water Dept.</th>
<th>Tampa Water Dept.</th>
<th>S Nevada W/Sys</th>
<th>Indianapolis Water Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>10.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ductile Iron</td>
<td>200.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete</td>
<td>275.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3292.0</td>
<td></td>
<td></td>
<td>65.0</td>
<td>200.0</td>
</tr>
</tbody>
</table>

| Year Start     | 1981                            |                          |                   | 1967          | 1937                       |
|                | Required                        |                          |                   | 1945          |                            |
|                | Monitor                         |                          |                   |               |                            |
|                | C Value                         |                          |                   |               |                            |
|                | Year start                      |                          |                   |               |                            |
|                | Pumping cost                    |                          |                   |               |                            |
|                | Record                          |                          |                   |               |                            |
|                | Year start                      |                          |                   |               |                            |
|                | Core Metal %                    |                          |                   |               |                            |
|                | Copper                          | 10–60%                   |                   | NA            |                            |
|                | Plastic                         | 1%                       |                   | 3%            |                            |
|                | Galv                            | 1%                       |                   | 2%            |                            |
|                | Brass Bi                        | 1%                       |                   | 5%            |                            |
|                | Lead                           | 10–30%                   |                   |               |                            |
|                | Other                           |                          |                   |               |                            |
|                | Lead giveaways                  |                          |                   |               |                            |
|                | Number                          |                          |                   |               |                            |
|                | Percent                         | 1–2%                     |                   |               |                            |

**Note:** Data is from a survey conducted in 1988, covering approximately 20 systems. The table above provides a breakdown of service materials and their respective numbers. The data includes a variety of materials such as steel, ductile iron, concrete, plastic, and other materials. The year starts for these systems range from 1981 to 1945, with some entries for number of years since installation or other indicators available.
LSL Occurrence Estimates
LSLs—Number and Location

- **AWWA Estimate (1990)**
  - 3.3 million lead service lines.
  - 6.4 million lead service connections.
  
    (Ref. Weston and EES 1990 Report to AWWA.)

- **EPA Estimate (2015)**
  - 10.5 million lead service lines in 1988.
  - 7.3 million lead service lines (currently).
  
    (Ref. LCRWG Report to NDWAC 8/24/15.)

- **Journal AWWA Estimate (2016)**
  - 6.1 million full or partial lead service lines.
  - 27,000 estimated in Washington State.
  
    (Ref. Cornwell et al. 2/2016.)
Estimate on a state-to-state-basis likely to be inaccurate
Washington State LSL Occurrence

- 2016 LSL and Lead Component Survey
- DOH surveyed 686 systems, representing 90.3% of Group A connections in Washington
- Five systems reported LSLs remaining in use, with 917 total LSLs remaining in service
Indiana LSL Occurrence

• 2016 Journal AWWA estimate of 290,000 LSLs
• Indiana Department of Environmental Management surveyed water systems in 2016 to assess number of LSLs in service
• Estimated 205,557 LSLs based on survey results
  • Survey responses either based on estimates or records, and systems provided an estimate of confidence in estimate or records ranging from 1 to 10
Colorado LSL Occurrence

- 2016 Journal AWWA estimates 58,000 LSLs in Colorado
- Since the 2011 and 2013 surveys were completed, Denver has estimated that 60,000 LSLs remain in distribution system
Summary

• Removal of LSLs is desirable to reduce lead in water
• Several states are requiring development of LSL inventories
  • Anticipate this to be more prevalent in future, possibly required by LCR Long-Term revisions
• Historic records can be a useful source of information for past LSL usage
• Even the latest estimate of LSL occurrence can vary when a system-by-system inventory is performed
Questions?

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