Contaminants

Statistical Guidance for Group A PWS Evaluation of Unknown Service Lines

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Adapted from Oregon Public Health Division and Michigan Department of Environment.

This statistical approach provides a method for Group A public water systems (PWS) to complete a service line inventory, eliminating the need to inspect every unknown* service line. The water system's statistical approach will need to demonstrate a minimum 95 percent level of statistical confidence. A key factor in the success of this strategy is the use of a randomly generated list of unknown service lines to be physically inspected.

Known* service lines are defined as a service line where the pipe materials are categorized using records or other means. **Unknown service lines are defined as a service line of unknown material with no documented material history.*

Identification Process

Before using the statistical approach to identify unknown service lines, the PWS must first use other approved methodologies including records review, post-1986 construction and larger pipe diameters, and optionally, customer data to categorize service lines. If no lead service lines are identified using those methodologies, a statistical approach may be used. Methodologies for identifying service line materials can be found in our *Lead Service Line Inventory Guidance* 331-711 (PDF).

***Note**: If ANY service line (Not connector, gooseneck, or solder) is found to be a lead service line, then the statistical method for determining unknowns may not be able to be used. Contact your ODW Regional Engineer for further guidance.*

Statistical Method

A reliable inventory of potable water service line materials is important for service line replacement planning, effective asset management, and notification of citizens served by lead service lines. Reliability and completeness of service line records can vary both across and within water supplies; therefore, it is important that supplies take steps to verify service line materials and records. Water supplies are not expected to physically verify every service line, but rather a statistically sound subset. To effectively evaluate the accuracy of service line records and/or predict service line materials, a representative, uniformly random number of service lines must be physically verified. Information gathered through random material verification processes provides a:

- Verified estimate of the proportion of each service line material and material configuration across the distribution system, providing a sound basis for planning service line replacement and notification efforts.

- Basis for evaluating the reliability of existing service line material records and identifying areas where additional physical verification or information may be needed. For water supplies with high confidence in existing records, this may serve to demonstrate that records are, in fact, reliable.
- Baseline data set for predicting materials at other locations (in combination with other information).

This random material verification process does NOT provide the:

- Service line material configuration of every building served; or
- Extent to which specific areas of the distribution system may differ from the system-wide average occurrence rate of each service line material.

Step 1: Identify all service lines of unknown material.

Identify all water service lines that could not be categorized using another approved methodology. Determine the total number of these partially or fully unknown service lines.

Step 2: Identify how many service lines must be physically inspected.

- PWS with fewer than 1,500 unknown service lines must physically verify at least 20 percent of the total number of unknown lines.
- PWS with more than 1,500 unknown service lines must physically verify enough lines to reach a minimum 95 percent confidence level. Refer to Table 1.

Step 3: Randomly select service lines for physical inspection.

From the list of unknown service lines identified in Step 1 and the number from Step 2, randomly select service lines to be physically inspected. Selection must be uniformly random and not selected based on any specific criteria that can introduce bias. In other words, each unknown service line must have an equal chance of being chosen for verification.

See Appendix A for an easy way to generate a uniformly random set of service lines for inspection.

***Note**: It may be tempting to introduce "logic" to the site selection process, such as selecting within periods of construction or targeting portions of town. However, doing so can unintentionally bias the data set. Be certain to use a truly random selection method such as the one described in Appendix A.*

Step 4: Conduct a one-point* (or more, if needed) physical inspection.

At least one-point physical identification is required for each portion of unknown service line. If the service line is jointly owned, each portion that is unknown (public and/or customer) must be inspected. Physical identification methods include excavation, potholing, televising, in-home inspections, and must be conducted or overseen by water system personnel. We recommend the actual material observed be recorded for each point. If inspecting near the meter, ensure the observed material is the actual service line and not part of the metering components. Refer to EPA's "Guidance for Developing and Maintaining a Service Line Inventory," Chapter 5, for typical methods of service line identification.

If one or more of the original randomly selected sites cannot be physically inspected, the PWS must replace it by randomly generating a new site using the process described in Appendix A.

**EPA's proposed Lead and Copper Rule Improvements 141.84(5)(ii) specifies "Confirmation of service line material must be done by visual inspection of the pipe exterior at a minimum of two points." "Service line, for the purpose of subpart I of this part only, means a portion of pipe which connects the water main to the building inlet. Where a building is not present, the service line connects the water main to the outlet."*

Step 5: Record results of the physical inspection process.

Using a spreadsheet (or other tracking tool), enter the service line category and material observed at each point. The four service line category types are: lead, non-lead, galvanized requiring replacement and unknown. We recommend using subclassification categories to capture the various material types for the PWS records.

Why a lead connector (gooseneck/pigtail) is not included in the inventory due October 2024, EPA's proposed Lead and Copper Rule Improvements requires inventorying lead connections; therefore, please record any gooseneck or pigtail found during the physical inspection process. A gooseneck or pigtail is a short section of material, typically not exceeding two feet, which can be bent and used for connection between a rigid fitting (corp stop) and the service line piping.

Step 6: Enter results for unknown service lines.

- **For the unknown lines that are inspected for the statistical sampling, record the water system material identification method (physical).** It is recommended the water system list the exact line material type in the inventory spreadsheet.
- **For the unknowns not needing to be inspected, record the material identification method as *statistical* and service line material as *non-lead/other***.

Step 7: Retain identification records.

Create, compile, and retain documentation of all service line identification efforts. We may ask PWSs to produce or submit these records. EPA may require additional verification of this data at a later date.

Table 1

Minimum Number of Service Lines Requiring Physical Inspection	
Number of "Unknown" Service Lines[1]	**Number to Physically Inspect[2]**
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

[1]*For the purposes of this process, this number represents the number of service lines that cannot be categorized from records, installation date, diameter, previous physical inspection, or customer data. If the number of unknowns falls between two values on the chart, either interpolate or round up to the higher number.*

[2]*Uses a confidence level of 95 percent*

Appendix A

Generating a Uniformly Random Set of Service Lines for Inspection

You can use a spreadsheet (such as Microsoft Excel or Google Sheets) to generate a uniformly random set of locations of unknown service lines for inspection using the following Microsoft Excel steps (the same formulas and method work for Google Sheets):

1. In the first column of a spreadsheet, list every unique service line of unknown material. They can be listed by address, service line ID, or other identification method.
2. In the second column, generate uniformly random numbers, so that each service line is associated with a randomly generated number. Follow these steps:
    a. Enter the formula =RAND() into the second column next to each location and press Enter. This generates a number between 0 and 1 for each service line.
    b. Select the second column (the column with the random values) and copy it, using the spreadsheet's **Copy** feature.
    c. With the second column still selected, use the **Paste Special** option to **Paste Values Only** into that same column. This will ensure your random numbers remain static.
    d. Use the **Sort** feature to list the randomly generated numbers from lowest to highest. If the **Sort Warning** appears, select **Expand the Selection**, then **Sort**.
3. Select only the top N service lines, where N is the number requiring inspection. For example, if you need to inspect 20 service lines, select the first 20 service lines on the list. These are the 20 uniformly random service lines to be inspected.

See this brief online tutorial for generating random samples in Microsoft Excel.

For More Information

Visit our Publications and Forms webpage.

Contact our nearest regional office from 8 AM to 5 PM, Monday through Friday.

Eastern Region, Spokane Valley 509-329-2100.

Northwest Region, Kent 253-395-6750.

Southwest Region, Tumwater 360-236-3030.