



EPA's Final Lead and Copper Rule Improvements Technical Fact Sheet: Calculating Service Line Replacements October 2024

This fact sheet is intended to assist water systems with lead, galvanized requiring replacement (GRR), and/or unknown service lines in understanding how they can comply with the service line replacement rate requirements of the final Lead and Copper Rule Improvements (LCRI).

What are the service line replacement rate requirements?

The LCRI requires water systems to fully replace lead and GRR service lines that are under the water system's control within 10 years, with limited exceptions. A lead or GRR service line is counted as fully replaced only when the entire length of the service line (both customer side and system side) is categorized as non-lead. Water systems must replace lead and GRR service lines at an average annual replacement rate of 10 percent calculated across a cumulative period unless (1) the State determines the system can replace all lead and GRR service lines in less than 10 years or (2) the water system is using a [deferred deadline](#) and associated replacement rate that the State periodically evaluates as the fastest feasible rate for the system. Water systems must start the mandatory service line replacement programs no later than November 1, 2027; however, the replacement rate must be assessed at the end of program year 3 (i.e., December 31, 2030) and annually thereafter.

Which service lines must be replaced?

Water systems must fully replace ***all lead and GRR service lines under their control*** unless the replacement would result in a partial lead service line. If a system encounters a lead connector when replacing a lead or GRR service line, the system must also replace the lead connector. A service line is under the water system's control wherever the water system has access (e.g., legal access, physical access) to conduct full service line replacement.

What does access mean?

The final LCRI does not establish the criteria for determining whether a water system has access to conduct full service line replacement because that will depend on the specific situation. For example, there may be State or local laws governing the water system's ability to conduct replacements on private property. There may also be State or local laws requiring consent of the property owner prior to replacement. In this case, the water system would not have access to conduct a full service line replacement without the property owner's consent. Water systems must identify any applicable State or local laws or water tariff agreement requirements to gain access to conduct full service line replacement in the service line replacement plan.

If property owner consent is required for access, water systems must make a "reasonable effort" to obtain this consent. Under the LCRI, a "reasonable effort" is at least 4 attempts to engage the property owner using at least 2 different communication methods (e.g., in-person conversation, phone call, text message, email, written letter, postcard, or door hanger).

How does the system assess the cumulative average annual replacement rate?

Water systems are required to replace service lines at a ***cumulative average annual replacement rate*** of at least 10 percent that is assessed starting at the end of program year 3 (i.e., December 31, 2030) and annually thereafter. The number of lead and GRR service lines replaced each year contribute to the system's replacement rate. States may require a system to replace service lines at a faster rate that the state has determined is feasible. A small percentage of water systems with a high proportion of lead and GRR service lines may be eligible to use a deferred deadline (please see EPA's [deferred deadline fact sheet](#) for additional information).

Below is a 3-step process to determine the system's cumulative average annual replacement rate and compare this rate to the minimum replacement rate:

- Step 1: Calculate the replacement pool
- Step 2: Determine the cumulative number of lead and GRR service lines replaced
- Step 3: Calculate the cumulative average annual replacement rate and compare it to the minimum required rate

Step 1: Calculate the replacement pool

Calculate the replacement pool by adding the total number of lead, GRR, and unknown service lines in the baseline inventory submitted by November 1, 2027. Each entire service line (including both system- and customer-owned portions) counts only once for purposes of calculating the replacement pool.

Does the replacement pool change over time? Service line inventories may change over time as unknown service lines are investigated. Table 1 below provides the requirements for updating replacement pools at the beginning of each program year in response to annual updates to service line inventories.

Table 1: Requirements for Updating the Replacement Pool

Change to the Service Line Inventory	Required Change to the Replacement Pool		
	<i>Add</i>	<i>Remain</i>	<i>Subtract</i>
Unknown service lines found to be non-lead			X
Unknown service lines found to be lead or GRR		X	
Non-lead service lines found to be lead or GRR	X		
Lead or GRR service lines found to be non-lead			X
Replaced lead or GRR lines		X	
Service lines that are not under the control of the water system		X	

As shown in the last row in Table 1, replaced service lines and service lines that are not under the control of the water system ***must remain*** in the replacement pool to assure systems continue to replace lines at a rate that assures completion at the earliest feasible deadline. EPA recognizes that control is not static, and service lines can come under the control of the system at any time as circumstances change.



Keep In Mind:

Water systems must use the **current year's replacement pool**, which is based on the current year's updated inventory, to assess the replacement rate for that program year.

Step 2: Determine the cumulative number of replaced lead and GRR service lines

For each program year, calculate the total number of lead and GRR service lines that have been fully replaced. Full replacement means that the entire length of the service line (both the system and customer side) is categorized as non-lead as a result of the replacement. Full replacement can be achieved by replacing the entire service line or by replacing one portion of the line if the other portion is already non-lead (e.g., replacing a customer-owned lead service line when the system-owned service line is non-lead). Add the total number of lead and GRR service lines replaced thus far in the program to calculate the cumulative total.

Water systems must replace lead connectors when they are encountered if under the control of the water system, but replacing connectors does not count towards service line replacement rate.

Step 3: Calculate the cumulative average annual replacement rate and compare it to the minimum required rate

Calculate the **cumulative average annual replacement rate** by:

- Divide the cumulative number of service lines replaced that resulted in full service line replacement (from Step 2) by the number of service lines in the replacement pool for that year (from Step 1), and then
- Divide that number by the number of program years completed thus far.

The equation for the cumulative average annual replacement rate is:

$$\left(\frac{\text{cumulative \# of service lines replaced}}{\text{\# of service lines in replacement pool}} \right) \div \text{\# of program years completed thus far}$$

What if the required replacement deadline is shorter than 10 years, or the system has a deferred deadline?

For a shortened deadline, the required cumulative average annual replacement rate is determined by dividing 100 by the replacement deadline (in years).

- For example, if the State sets a shortened replacement deadline of 8 years, the required cumulative average annual replacement rate is $100/8 = 12.5\%$.

For a deferred deadline, the required cumulative average annual replacement rate is determined by dividing 100 by the number of years needed to achieve replacing 39 annual replacements per 1,000 service connections. For more information, see the [deferred deadline fact sheet](#).

Example: Assessing the replacement rate starting on the next page walks through Steps 1 through 3 for a hypothetical system.

Example: Assessing the replacement rate

This example walks through the steps for assessing the replacement rate. The water system in this example is required to meet the cumulative average annual replacement rate of at least 10 percent starting at the end of program year 3 (December 31, 2030). Table 2 provides a summary of data and calculations described in each step.

Table 2: Example Replacement Program Data through Year 4 for a Hypothetical System

Service Line Replacement Program Data						Calculations	
Program Year	Date Range	SLs in the Replacement Pool	Unknown SLs Identified as Non-Lead	Lead and GRR SLs Replaced Each Year	Cumulative Number of SLs Replaced	Cumulative Average Annual Replacement Rate	Is G ≥ 10%
A	B	C	D	E	F	G = F/C/A	H
1	November 1, 2027 – Dec 31, 2028	5,500	275	400	400		
2	Jan 1, 2029 - Dec 31, 2029	5,225	25	700	1,100		
3	Jan 1, 2030 - Dec 31, 2030	5,200	50	800	1,900	12.2%	Yes
4	Jan 1, 2031 - Dec 31, 2031	5,150	0	450	2,350	11.4%	Yes

Acronyms: GRR = galvanized requiring replacement; SL = service line.

Step ①: Calculate the replacement pool

In program year 1, the system had 3,000 lead service lines, 1,500 GRR service lines, 1,000 unknown service lines in the LCRI baseline inventory for a total of 5,500 service lines in the replacement pool.

The system continued investigating unknown lines and determined that a total of 300 unknown lines were non-lead by the beginning of program year 3. During year 3, they identified an additional 50 unknown lines as non-lead. See Columns C and D in Table 2. The system did not find any non-lead service lines that were lead or GRR during this time period.

The system updated the replacement pool each year to remove the unknown lines found to be non-lead. The results are:

- 5,500 – 300 unknown identified as non-lead = 5,200 service lines in the replacement pool at the beginning of program year 3.
- 5,200 – 50 unknown lines identified as non-lead = 5,150 service lines in the replacement pool at the beginning of program year 4.

Step ②: Determine the cumulative number of replaced lead and GRR service lines

This hypothetical system replaced between 400 and 800 lead and GRR service lines each year during the first four program years as shown in Column E in Table 2. They replaced fewer in the first program year due to contractor issues and fewer in the fourth year due to a temporary disruption in the program. The system replaced a high number of service lines in program years 2 and 3. The cumulative number of service lines replaced as shown in Column F was:

- 1,900 replaced lead/GRR service lines in program year 3.
- 2,350 replaced lead/GRR service lines in program year 4.

Step ③: Calculate the cumulative average replacement rate and compare it to the minimum required rate

The cumulative average replacement rate must be calculated for program years 3 and 4. See Columns G and H in Table 2.

To assess the rate at the end of **year 3**:

$$\left(\frac{1,900 \text{ service lines replaced}}{5,200 \text{ service lines in replacement pool}} \right) \div 3 \text{ program years} = 0.122 \text{ or } 12.2\%$$

Is the system replacing at a rate of 10% or more? Yes, the cumulative average replacement rate of 12.2 % is greater than 10%.

To assess the rate at the end of **year 4**:

$$\left(\frac{2,350 \text{ service lines replaced}}{5,150 \text{ service lines in replacement pool}} \right) \div 4 \text{ program years} = 0.114 \text{ or } 11.4\%$$

Is the system replacing at a rate of 10% or more? Yes, the cumulative average replacement rate of 11.4% is greater than 10%.

What if there are services lines not under my control?

If a water system is unable to gain access to conduct a full service line replacement, the water system is not required to replace any portion of the service line because the service line is not under the control of the water system and the rule prohibits partial lead service line replacements with some exceptions. Water systems must continue to annually publish the addresses of those service lines in the publicly accessible inventory, deliver annual notification of service line material to the consumer, and make a reasonable effort to gain access to conduct full service line replacement when the property changes ownership.

By January 30 after the end of each replacement program year, water systems must submit to the State documentation of reasons for each service line not replaced due to lack of access. Where property owner consent is required by State or local law, water systems must also submit to the State documentation of each reasonable effort (all four or more attempts) made where the system was not able to obtain consent for full service line replacement. Water systems must also replace the service line should they gain control, such as if the customer provides access.

What if a system gains access to service lines after the replacement program has begun?

If a water system gains access to a large number of service lines after the program has already begun, such as if a State or local law is passed or modified which provides access, the system must then replace these newly controlled service lines. If the replacement of these service lines prior to the replacement deadline would result in more than 39 annual replacements per 1,000 service connections, the water system will be eligible for a deferred replacement deadline according to the existing deferred deadline provisions. For more information, please see the [deferred deadline factsheet](#).

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