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Fifth Liter Sampling:
EPA's Newly-Mandated Technique for Sampling Lead in Drinking Water

The method of sampling tap drinking water for lead is crucial for providing accurate information about water quality, and different methods can lead to different results. For example, false negatives may occur when lead is not detected because the water used for the sample was not actually in contact with an existing lead service line (LSL).

To increase sampling accuracy for buildings with a LSL, the lead and copper rule revisions (LCRR) adopted by the Environmental Protection Agency (EPA) in December 2021 newly require that a fifth liter sample be taken in addition to first liter draws (i.e., water that first emerges after opening the tap). **Based on recent data from Michigan, which recently assumed a lead role on this issue, the combined use of first and fifth liter samples detects nearly three times as many exceedances of the EPA's 15 ppb lead action level (i.e., the threshold that prompts water utilities to formally respond) versus the sole use of first liter samples.**

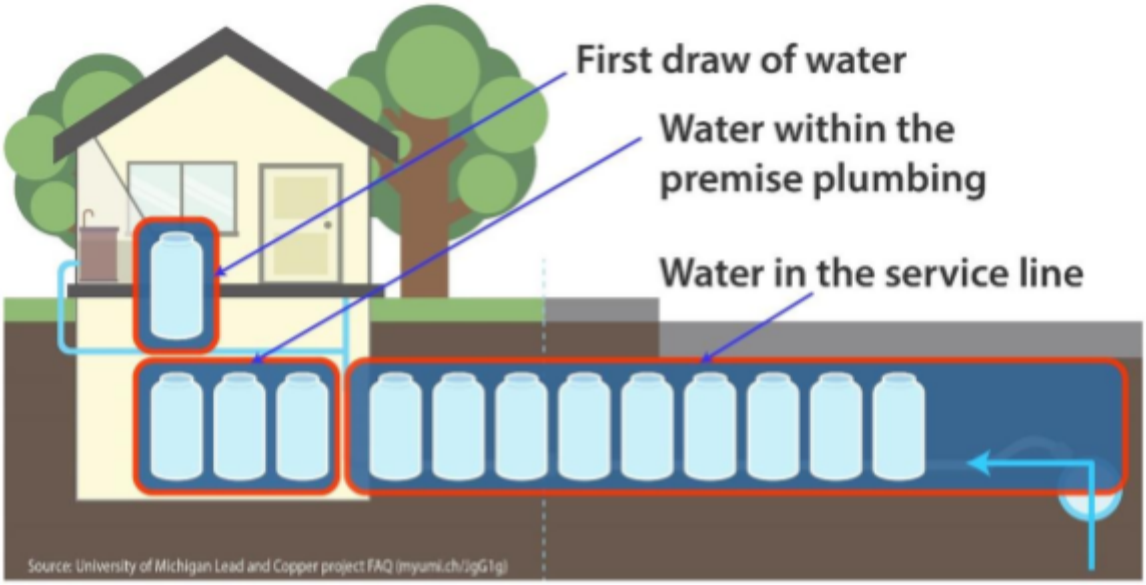
This report explains the differences between the most common methods of water sampling and clarifies some of the questions clean water advocates may have about implementation of the new fifth liter sampling method. The information presented was gathered from water scientists, environmental protection officials, and utility workers, as well as a review of recent research.

How are different water samples collected?

- *First draw:* Under this approach, the sample is collected after a stagnation period of at least six hours, long enough for lead to gradually leach from a existing LSL or indoor lead plumbing into the drinking water so that the worst-case scenario may be measured.[1]
- *Sequential sampling:* Often used as an investigatory tool, samples are consecutively collected to locate the source of the lead. (This technique is most effective if the plumbing dimensions inside and outside of the home are known in order to predict the expected volume at which lead is expected from contact with the LSL.[1,2])
- *Fifth liter:* This technique represents a balance between first draw and sequential sampling. Both first and fifth liters are collected after a stagnation period (i.e., typically, six hours). This approach is required by EPA's LCRR because it is generally thought to test water that was in contact with the LSL.[3]
- *Random daytime:* Samples are collected from various residences without stagnation or pre-flushing at random times throughout the day. This approach is

thought to be most reflective of a community's exposure to lead from daily water use.[1]

- *Flushed:* Samples are collected after a given period (usually 5 minutes) of flushing.[1,4]



Graphic showing how water gets from the water main to the home through the lead service line.

What water sampling method is best?

The answer to this question depends on what is of interest. Sequential sampling in combination with lead profiling is the most accurate method to determine where the LSL starts and to obtain the worst-case scenario of lead exposure in a single household. First draw samples are useful for compliance with EPA's LCRR regulations. Fifth liter samples add accuracy by measuring the water in contact with the LSL and comply with the updated LCRR regulations. Random daytime and flushed samples are useful for measuring exposure to lead from realistic daily water usage and are good for screening large numbers of households because they are least intrusive. Some evidence suggests that these may be useful for detecting LSLs as well.[4]

Why fifth liter? Is it better?

According to recent data from Michigan, adding fifth liter data to the first draw samples increases the amount of homes that are detected with LSLs. In Michigan, a study led by Safe Water Engineering LLC examined over 10,000 water samples from 629 water utilities across the state. The highest of ***either*** the first ***or*** fifth liter samples resulted in exceedances (i.e., 90th percentile exceeding 15 ppb Pb) in 13% of the water utilities measured, which is a ***threefold increase*** compared to the sole use of a first draw sample, where only 4% of utilities would have had exceedances.[5,6] Furthermore, the 90th

percentile value for fifth liter samples was 10 ppb, which reflects ***five times as much*** lead as first liter only samples (2 ppb). Since these studies examined the aggregate dataset and did not investigate subpopulations, it remains to be seen if there are any geospatial or demographic patterns to the additional exceedances. Nevertheless, it appears that fifth liter sampling tends to detect more exceedances than first draw sampling. It will be interesting to see how this trend holds up when more nationwide data is collected.

What issues are associated with fifth liter sampling?

Fifth liter sampling is *not guaranteed* to test water that was in contact with the LSL because that determination depends on the volume (length and width) of the house plumbing.[5,6] However, it is far more likely that the fifth liter of water was in contact with the LSL than that from first draw sample. As outlined below, there are a few other issues of concern that typically accompany the decentralization of sampling among water customers.

How does the fifth liter testing work with the public?

The primary issue with most compliance water sampling that is taken after stagnation periods is the reliance on homeowners to take samples. Because the stagnation period requires that no one can use any water in the home for at least six hours, sample collection tends to occur early in the morning, when homeowners may accidentally flush pipes or use an unsanctioned tap (i.e., only bathroom and kitchen sink taps should be used).

However, these issues also occur with first draw sampling, and early indications suggest that fifth liter sampling does not add any additional complications. To simplify the process, Michigan's Department of Environment, Great Lakes, and Energy (EGLE) suggested that water provide homeowners with kits containing five color-coded, one liter bottles with distinct labels or caps. This process is not more intrusive than a regular first draw sample and requires only slightly more time to collect samples.

How does the public feel about fifth liter sampling?

Based on Michigan's experience, homeowners and residents seem to welcome the change in testing since it provides more information about the quality of the drinking water.[7] However, if quick action (in the form of LSL replacement and a decrease in lead levels from subsequent testing) is not taken to address the elevated test levels, public frustration will grow.[8] Water utilities should be prepared to quickly implement next steps.

What about false negatives?

The LCR change was instituted to try to limit the amount of false negatives that occur by selecting the higher lead level of either the first or fifth liter. This approach could detect over three times the number of exceedances than by using only the first draw.[5]

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About the Report

Jersey Water Works - Lead in Drinking Water Task Force

This publication was developed by Jersey Water Works' Lead in Drinking Water Task Force, and specifically its Lead Service Line Implementation Workgroup, whose mission is to identify best practices. The Workgroup, which is composed of water utility officials, consultants, and public policy advocates, is chaired by Rich Calbi, Executive Director of Ridgewood Water, and Mike Furrey, owner of Agra

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About Jersey Water Works

Jersey Water Works is working to transform New Jersey's inadequate water infrastructure through sustainable, cost-effective solutions that provide communities with clean water and waterways; healthier, safer neighborhoods; local jobs; flood and climate resilience; and economic growth.

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