UNDER-SINK ACTIVATED CARBON WATER FILTERS EFFECTIVELY REMOVE LEAD FROM PRIVATE WELL WATER

This policy brief summarizes a recent study that found that point-of-use (POU) water filters were very effective at lead removal in households using private well water.

*Lead Faculty Researchers: Riley Mulhern, University of North Carolina at Chapel Hill, and Jacqueline MacDonald Gibson, Indiana University Bloomington*

**BACKGROUND**

In recent years, research has shown that private well users in the United States may be at an elevated risk of exposure to lead in drinking water. Lead is a dangerous metal that can cause long-term health problems and is known to interfere with neurological development in children. There is no “safe” level of lead exposure; however, as exposure increases so does the range and severity of poisoning symptoms.

In areas with corrosive groundwater, lead can leach into drinking water from household plumbing components, such as pipes and taps. Because private wells are largely unregulated, high lead levels as well as other drinking water contaminants often go unnoticed. Additionally, there has been a lack of research into potential methods of lead reduction, such as POU (point-of-use) filter treatments, that could be essential in combating this issue.

The Mulhern and MacDonald Gibson study was designed to fill the critical knowledge gap in current literature and research about how private well users can best protect themselves against lead in their water. This study is the first ever evaluation of POU water filter effectiveness over time and includes analysis of other key variables relating to filter effectiveness such as water volume and usage patterns. These findings are especially crucial for improving environmental health in rural, low-income, and minority communities.
Researchers recruited households served by private wells in three geographic clusters (A, B, and C) in Orange and Robeson Counties, North Carolina. The clusters were meant to represent diverse water quality and demographic characteristics and are all located in areas with suspected groundwater contamination.

RESEARCH FINDINGS
The under-sink activated carbon block filter examined in this study removed lead to very low levels – below 1ug/L – during the entire 6-month lifetime stated by the manufacturer.

The researchers took water samples in pairs—before and after the water traveled through the filter. Both of these samples were collected without utilizing a process known as “flushing,” which is when a household runs the tap for several minutes before collecting water in an attempt to reduce lead levels.

Virginia Tech researchers collect tap water in Flint, Michigan for lead testing in March 2016. The manner of water collection shown is similar to that used in this study.1

The mean lead removal among all samples and households in this study was 98% (with 10% of samples being excluded from this calculation due to sampling error). This finding was consistent across all geographic clusters, and therefore across income and demographic levels, indicating that the filter’s effectiveness was independent of two factors:

1) the quality of the groundwater before it traveled through the filter; and
2) variations in water-usage patterns (i.e. volume of water used, amount of time between water usage, etc.).

Several of the households took additional samples directly from the main faucet before and after filter installation. These samples were collected upon the initial faucet use after six hours of disuse, and then several more times over a 5-minute period of flushing. This data showed that the filter significantly improved the effectiveness of flushing in lead reduction. Overall, POU filters are successful in removing lead in private well water for their entire lifetime, and they achieve comparable lead removal as municipal tap water.
The graph above displays results of lead profile sampling in five households before and after filter installation.

OPTIONS FOR THE FUTURE
Low-income, rural, and minority communities are disproportionately dependent on private wells as a result of both historical and ongoing processes of exclusion from municipal services and infrastructure throughout the United States. Although POU water treatment is not a one-size-fits-all approach to systemic injustices that prevent equitable water access, this study provides data that can be used to both improve the decision-making of individual well users and to inform evidence-based policies and investments around under-sink POU devices.

Periodic testing events and treatment system subsidies would help prevent lead exposure among private well users, and future research should extend this work to test similar filter designs under more diverse groundwater conditions. Additionally, faucet-mounted devices should be evaluated as an additional or alternative option.

Finally, activated carbon devices such as the one used in this study are not appropriate in all scenarios, as they are not effective at removing other dangerous chemicals such as nitrate and arsenic. Studies of a similar longitudinal nature should be undertaken for other technologies and contaminants to develop a toolkit of validated solutions for private wells.

More information about this study can be found at: https://www.mdpi.com/2073-4441/12/12/3584