LITHIUM: THE DRINKING WATER CONTAMINANT THAT COULD ALSO BE HEALTHY

By Steven Winkley

Introduction

On December 27, 2021 the USEPA published the fifth Unregulated Contaminant Monitoring Rule (UCMR 5). This rule requires many public water systems to sample for 30 chemical contaminants between 2023 and 2025 in order to determine the national occurrence of these contaminants in drinking water. UCMR 5 will provide data on 29 per- and polyfluoroalkyl substances (PFAS) and lithium in drinking water. All public water systems serving more than 10,000 people will have to monitor for these 30 substances. All public water systems serving 3,300 to 10,000 people and 800 representative public water systems serving fewer than 3,300 will monitor for the UCMR 5 substances. However, USEPA will pay for UCMR 5 analytical costs for public water systems serving 10,000 or fewer.

PFOA and PFOS (which are regulated here in New York State) are two of the 29 PFAS in the UCMR 5 list of contaminants. However, to my knowledge, lithium has not been sampled for by public water suppliers in New York State. In this article, I wanted to share some information on this substance and its potential public health significance. It is a contaminant that can have both negative and positive health implications for individuals.

Source and Occurrence of Lithium

Lithium is what is called an alkali metal, similar to more common metals such as sodium and potassium. Lithium compounds are used in a variety of industries including metallurgy, ceramics, air conditioning, chemicals and pharmaceuticals, and for lubrication grease. Lithium-ion batteries are used in everything from electric cars to cell phones. Lithium contamination can occur from mining, industrial manufacturing, and improper disposal.

For decades lithium has been used to treat and prevent manic/depressive episodes, stabilize mood, and reduce the risk of suicide. Lithium is also in all of our bodies naturally. The plants, animals, foods, beverages, and drinking water we consume contain lithium. It is estimated that drinking water only contributes about one fourth of our exposure to lithium. The average lithium intake from our food is only 2 mg/day compared to the therapeutic daily dose for treating bipolar disorder of 600 mg/day to 1200 mg/day.

Lithium in Drinking Water

Lithium is associated with groundwater where it interacts with lithium-containing minerals, brine (saline), or geothermal water. In addition, granite and other igneous rocks can have higher levels of lithium. A recently published United States Geological Survey (USGS) study that looked at results from previous sampling of 3,140 private and public water system wells found that the highest levels of lithium from groundwater was in arid regions and in "old" groundwater that recharged aquifers before 1953. Manmade sources of lithium can sometimes impact drinking water if contamination occurs from mining, industrial manufacturing, and improper disposal. The rapid increase of lithium battery use has increased this concern. The citation for this USGS study is: Lindsey, B.D., Belitz, K., Cravotta, C.A. III, Toccalino, P.L., and Dubrovsky, N.M., 2021, Science of the Total Environment, v. 767. Results of the USGS study showing the distribution of lithium in groundwater is presented as Figure 1 below.

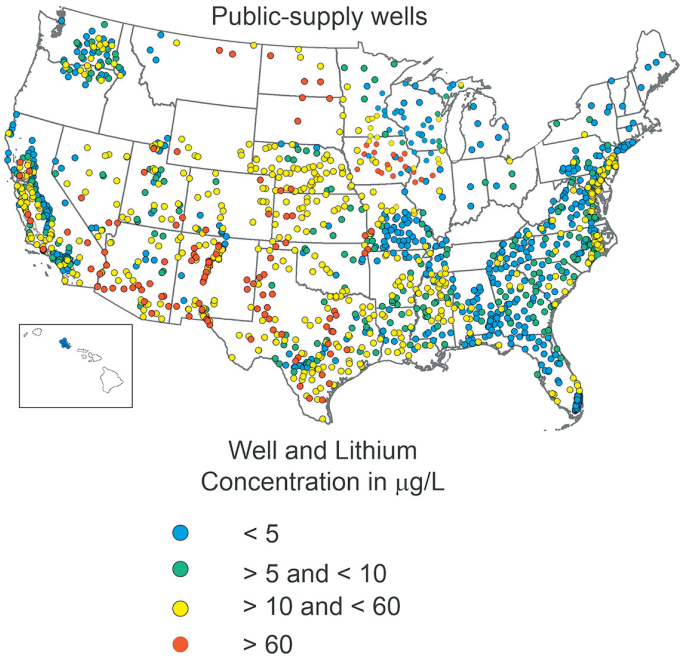

Figure 1. Lithium Concentrations in Public Water Supply Wells.

As you can see, the very limited data shows the levels of lithium in groundwater here in New York to be largely less than 5 parts per billion (ppb). Two of the seven wells in upstate New York had levels of lithium between 5 and 10 ppb. One well had a level of lithium between 10 and 60 ppb. So what is the safe level of lithium in drinking water?

Safe Levels of Lithium in Drinking Water

There is no drinking water standard for lithium in drinking water. The USGS, in collaboration with the EPA, calculated a Health-Based Screening Level (HBSL) for drinking water of 10 ppb. A second drinking-water-only value of 60 ppb was determined if the only source of lithium is from drinking water. However, safe values of lithium in drinking water have not been firmly established. I have also seen reference to an EPA recommended limit of lithium in drinking water as high as 700 ppb. At high levels lithium can cause skin disorders, heart disease, thyroid issues, and kidney disease.

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However, what is very intriguing about lithium in drinking water is that many studies have shown that there is a reduction in violent crimes and suicide based upon lithium levels in drinking water. The majority of the data support a link between lithium levels of greater than 30 ppb in drinking water and a reduction in suicides. It is theorized by some that low levels of lithium in drinking water over long periods of time promotes brain health. Some medical experts have even proposed the addition of lithium to drinking water analogous to fluoridation!

Conclusions

Much is unknown about the occurrence of lithium in drinking water and its impacts on health. UCMR 5 will provide more information on this substance which is becoming increasingly important in today's technological society.

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