Microcystin-LR and water

Microcystin-LR is a toxin produced naturally by cyanobacteria, also known as blue-green algae. It may be present when a harmful algal bloom has formed on a lake, pond, or stream. Not all algal blooms contain the cyanobacteria that produce Microcystin-LR, and it is impossible to tell if an algal bloom contains Microcystin-LR just by looking at it. There are many types of microcystin; microcystin-LR is one of the more toxic and well-studied varieties.

The Minnesota Department of Health (MDH) Risk Assessment Unit evaluates health risks for contaminants in drinking water and develops health-based guidance values for groundwater. Microcystin-LR was last reviewed in October 2015, where a human health-based guidance value was developed. The toxicological summary for microcystin-LR can be found at the MDH Human Health-Based Water Guidance Table website.[1] MDH works in collaboration with the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Agriculture (MDA) to understand the occurrence and environmental effects of these contaminants.

Microcystin-LR in Minnesota waters

Microcystin, without specifying the LR variety, has been detected in raw (pre-treatment) Minnesota drinking water at eight of nine community water systems tested between 2024 and 2026, at concentrations ranging from 0.15 to 3.08 parts per billion (ppb). In finished drinking water, microcystin was detected in 10 community water systems at a maximum of 0.25 ppb. In surface water, microcystin (variety not specified) has been detected in 41 percent of 640 samples collected since 2006, at concentrations up to 11,600 ppb. Much higher concentrations of microcystin-LR have been detected by the MPCA in some lakes affected by large algal blooms.[2]

MDH guidance value

Based on available information, MDH developed a guidance value of 0.1 parts per billion (ppb) for microcystin-LR in drinking water. MDH does not use guidance values to regulate water quality, but they may be useful for situations where federal regulations do not exist.

MDH develops guidance values to protect people who are most highly exposed and people who are most sensitive to the potentially harmful effects of a contaminant, including pregnant people, fetuses, infants, and children. A person drinking water with concentrations at or below the guidance value would be at little or no risk for harmful health effects from that contaminant.

Potential health effects

Microcystin-LR is highly toxic, and even drinking a small amount could be harmful to the liver. There is evidence that Microcystin-LR stimulates the growth of cancerous tumors in the liver and colon.[3] Cancer is not likely a major concern for Minnesotans due to the seasonal nature of algal blooms. Immediate effects after exposure to Microcystin-LR include gastrointestinal upset and rash.

Potential exposure to Microcystin-LR

You may be exposed to low levels of microcystins through recreational activities such as swimming or boating in affected waterbodies, consuming fish that have been exposed to algal blooms, or taking dietary supplements containing algae. MDH and the MPCA have published advice on identifying potential harmful algal blooms and how to prevent algal bloom-related illness.[4,5]

Microcystin-LR in the environment

Algal blooms may be symptoms of an unhealthy lake. Microcystin concentrations in an impacted lake can vary greatly with location and time and may "flare up" quickly and then decline again. Most microcystins are bound inside the living cyanobacteria cell. When the cells die, the microcystins can be released into the water. Under most conditions, microcystins outside the cell will degrade in about one week.

References

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3. U.S. Environmental Protection Agency. (January 2026). Indicators: Cyanotoxins (microcystin). https://www.epa.gov/national-aquatic-resource-surveys/indicators-cyanotoxins-microcystin.
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