

Anatoxin-a and water

Anatoxin-a occurs naturally and may be present when a harmful algal bloom (blue-green algae) has formed on a lake, pond, or stream. Not all algal blooms contain the cyanobacteria that produce anatoxin-a. However, there is no clear way to know if an algal bloom contains harmful toxins just by looking at it.

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. Anatoxin-a was last reviewed in August 2016, where a human health-based guidance value was developed. The toxicological summary for anatoxin-a 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.

Anatoxin-a in Minnesota waters

Anatoxin-a was found in raw (pre-treatment) Minnesota drinking water at six out of nine community water supplies sampled in 2025. Concentrations ranged from 0.15 to 0.5 parts per billion (ppb). In finished drinking water, anatoxin was detected in eight community water systems at a maximum of 0.28 ppb. Anatoxin-a has also been found in Minnesota surface water at concentrations up to 137 ppb. A 2010 study looked for anatoxin-a in six Minnesota lakes that tended to have algal blooms. The study detected anatoxin-a in three of the six lakes. The highest level of anatoxin-a detected was 1.1 ppb.²

MDH guidance value

Based on available information, MDH developed a guidance value of 0.1 parts per billion (ppb) for anatoxin-a 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

There is limited information about how anatoxin-a affects humans. It is clear, however, that drinking water with high levels of anatoxin-a can harm the nervous system. Symptoms can

include muscle twitching, loss of coordination, and seizures. Tests done on laboratory animals show that swallowing high levels of anatoxin-a can cause death from respiratory paralysis.

Potential exposure to anatoxin-a

Activities such as swimming, boating, and fishing may result in exposure if you swallow water or inhale water spray from a lake with an algal bloom. It may be possible to be exposed to anatoxin-a by eating fish caught during or after a lake has experienced an algal bloom, but there is limited information on anatoxin-a in fish. MDH and the MPCA have published advice on identifying potential harmful algal blooms and how to prevent algal bloom-related illness.^{3,4}

Anatoxin-a in the environment

Anatoxin-a naturally occurs in lakes, rivers, and ponds when harmful algal blooms are present. Algal blooms may be a symptom of an unhealthy lake. Fertilizer run-off and wastewater feed algal blooms and can increase anatoxin-a in surface water. In sunlight, anatoxin-a rapidly degrades, with a half-life as short as 1 to 2 hours under some conditions. In the absence of sunlight, it may take several days to months for anatoxin-a to break down.⁵

References

1. Minnesota Department of Health (MDH). (August 2016). Human Health-Based Water Guidance Table. "Toxicological Summary for: Anatoxin-a."
<https://www.health.state.mn.us/communities/environment/risk/docs/guidance/gw/anatoxinsumm.pdf>.
2. Graham J.L., Loftin K.A., Meyer M.T., Ziegler A.C. (2010.) Cyanotoxin mixtures and taste-and-odor compounds in cyanobacterial blooms from the Midwestern United States. Environ. Sci. Technol; 44:7361–7368. <https://pubs.acs.org/doi/abs/10.1021/es1008938>.
3. Minnesota Department of Health (2024). Preventing Harmful Algal Bloom-Related Illness. <https://www.health.state.mn.us/diseases/hab/prevention.html>.
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5. 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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