MAY 2017

CYANOBACTERIA IN FRESHWATER

What are cyanobacteria?

Cyanobacteria, or 'blue-green algae,' are naturally occurring microscopic organisms found in fresh, brackish, or marine water. Under conditions such as warmer water temperatures, high nutrient loads, and other anthropogenic influences, cyanobacteria can multiply quickly and create blooms, sometimes called harmful algae blooms (HABs), cyanoHABs, or cyanoblooms. Cyanoblooms can occur in Canada at any time of year, but are more common in summer or early fall.[1]

What is the problem?

Cyanobacteria can produce cyanotoxins, high concentrations of which are harmful to animal and human health, in both drinking and recreational water e.g., during a cyanobloom. In rare cases, cyanotoxin exposure has been fatal to humans.[2] Not all cyanobacteria species produce toxins, but every bloom should be treated as toxic until known otherwise.

There are four main types of cyanotoxin – microcystin, nodularin, saxitoxin, and cylindrospermopsin. Different cyanotoxins target different organs e.g., liver, nervous system, skin.[2] Over the last decade, microcystins, the most common cyanotoxin, were detected in lakes in every Canadian province.[3] Climate change is likely to promote cyanoblooms,[4] thus increasing the risk to Canadians from cyanotoxins.

Are cyanoblooms visible?

Visible cyanoblooms are not always toxic, but lack of a visible bloom could still pose harm. Cyanoblooms can appear as a blue sheen, scum, mats, or foam on the water's surface, and may be red, brown, green, or blue. They can also cause an "off" odour or taste in drinking water. As a cyanobloom dies, the water can smell like rotting plants.

Cyanobloom on Lake St. Clair, July 2015.
(Photo credit: earthobservatory.nasa.gov)

Are cyanoblooms preventable?

Ideal conditions for cyanoblooms occur through interactions between the natural state of the water body (nutrient-rich or nutrient-poor), season and associated temperature fluctuations, water flow and mixing, and the influence of climate change e.g. increases in water temperature[4]. Additionally, anthropogenic influences such as development, certain farming practices, sewage and industry effluent, or urban and stormwater runoff, may contribute excess nutrients to freshwater bodies. Risk of cyanobloom occurrence can be reduced by minimizing fertilizer use on agricultural land, avoiding fertilizer use on private lawns, treatment of waste water and sewage, and/or choosing to use phosphorus-free detergents and household products.[4]

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Who is at risk and how does exposure occur?

Humans, pets, and farm animals e.g., cattle, can be affected by cyanotoxins. Children tend to become sick more easily and frequently than adults because of their lower body weight, and the potential developmental effects of cyanotoxins.[5] Infants fed formula reconstituted from contaminated drinking water are also at greater risk.[6]

Cyanotoxin exposure can occur by drinking contaminated water; inhalation and skin contact during swimming, bathing, or showering; consumption of produce irrigated with tainted water;[2] and ingesting fish or other foods collected from affected freshwater bodies. Acute (short-term) exposure can cause vomiting, diarrhoea, skin irritation, rash, fever, headache, muscle/joint pain, weakness, pale skin, cold hands/feet, numbness of lips/mouth, incoordination, respiratory, and muscular paralysis. Chronic (long-term) exposure can lead to tumor formation, with microcystin-LR possibly a human carcinogen (Group 2B).[7] Climate change is expected to affect bloom timing and cyanobacterial dominance.[8]

CANADIAN GUIDELINES FOR TOTAL MICROCYSTINS

DRINKING WATER	1.5 µg/L
RECREATIONAL WATER	20 µg/L

Is there testing for cyanotoxins?

In Canada, field test kits for determining presence or absence, and laboratory analyses for identifying cyanobacterial species are available.[9] However, testing for microcystins is more complicated and few Canadian laboratories have this ability. Even if microcystins are absent, water sampling should be repeated at regular intervals until the bloom has collapsed[6]. When drinking water is affected, various water treatment options are available. Best treatment depends on genus/toxin present; some treatments increase toxin concentration[10].

Risk communication

Any indication of a bloom/microcystin presence warrants an advisory for alternative suitable drinking water to reconstitute formula for bottle-fed infants. **Toxins are not removed by boiling water**, thus advisories such as “do not consume” or ”do not use” are warranted for communities lacking necessary treatment capabilities (e.g., coagulation, flocculation) and alternate drinking and bathing water sought.[6] Beaches are often closed during blooms. The public are encouraged to avoid entering water where blooms are present, and should rinse thoroughly afterwards using uncontaminated water.

Summary

The risk to Canadians from cyanotoxins is predicted to increase[9]. If you become ill and suspect cyanotoxin exposure, contact your local health care provider, health unit, or poison control centre: http://www.capcc.ca/en

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