

## **Diseases Fact Sheet – Algae Toxins Cyanobacterium**

### **South Dakota Department of Health**

**Office of Disease Prevention Services - 605-773-3737 -(1-800-592-1861 in South Dakota only)**

This material is provided for informational purposes only and is not a substitute for medical care. We are not able to answer personal medical questions. Please see your health care provider concerning appropriate care, treatment or other medical advice.

#### **What is it?**

Algal toxins are chemicals that are produced by algae during its life cycle. The algal toxins are released from the cell into the surrounding water. Algal toxins may have an increased potential of concern when an algae bloom is in effect. Some algae blooms are harmful to animal life, and those algae blooms are called harmful algae blooms (HAB). When a large number of algae are present (e.g., during an algae bloom) the concentration of algal toxins may increase. High concentrations of algal toxins in an algae bloom may begin to affect wildlife and humans using the water. ([1](#), [2](#))

Some algal toxins may not be produced by algae and may be produced by bacterium that look and act like algae. When first discovered Cyanobacterium was called “blue-green algae;” although not an alga, cyanobacteria does produce cyanotoxin which is a type of algal toxin that is harmful to animal life. Cyanobacterium is commonly found in freshwater lakes and cannot easily be visually distinguished from non-harmful green algae. ([3](#)) Another harmful alga is *Karenia brevis* which produces a phenomenon called “red tides” in marine water ecosystems (seas and oceans that are mostly comprised of salt water) and their blooms may be found in coastal Florida or Texas in the Gulf of Mexico.

Although algal toxins are harmful to humans and other animal life, algae, harmful and non-harmful, fills a very important role in the world’s ecosystem. Algae produce 40-85% of the world’s oxygen through photosynthesis. ([4](#), [5](#)) Algae are also a major food group for many primary consumers.

#### **How are you poisoned by algal toxins?**

There are many types of algae as well as types of poisoning from the algae, some types of algae are not harmful to humans but others are, and not all algae or their toxins are visible. Sometimes after an algal bloom dies off, the concentration of algal toxins may rise in the affected area due to the increase in ruptured (lysed) algae cells that release their toxins into the water. ([1](#)) Algal toxins may have very different effects on humans based on their type. Some common types and effects of algal toxins include hepatoxins which damage your liver,

neurotoxins which damage your nerve cells, and dermatotoxins which affect your skin. Although not technically an algae, one of the more heavily researched and common blooming harmful “alga” is blue-green algae, also known as cyanobacteria. A cyanobacterium is a photosynthetic bacterium, which means that the bacterium creates its food from light. Cyanobacterium is commonly found in fresh water systems and produces a byproduct of cyanotoxin which may affect humans and other animals. The cyanobacterium when in bloom may be termed as a cyano-HAB. (5)

### How do you develop algal toxin poisoning?

Algal toxins are more often most toxic when ingested (drinking the water or consuming poisoned wildlife), but poisonings may occur when the algal toxin is inhaled (from ocean sprays) or contacted through exposure to the skin, such as when swimming. The algal toxin may then migrate through your blood stream to your brain, liver, or nervous system.

Algal toxin poisoning may also occur when shellfish or other marine life that was exposed to an algal toxin is consumed. A common poisoning from contaminated shellfish, specifically bivalve mollusks, is paralytic shellfish poisoning (PSP). PSP comes from the toxin family of Saxitoxins. (1) Bivalve mollusks (e.g., clams, oysters, muscles, scallops, etc.) are consumers (primary) of algae. If the algae are contaminated with algal toxins and enough are consumed over time the bivalve mollusk may become contaminated. When humans consume contaminated bivalve mollusks they may develop PSP.

### What are the symptoms of algal toxin poisoning?

- Rashes
- Headaches
- Fever
- Nausea
- Abdominal pain
- Muscle aches
- Blistering of the lips
- Stomach cramps
- Mouth ulcers
- Vomiting
- Diarrhea
- Eye irritation
- Allergic reactions
- Liver problems
- Nervous system problems

### How do algal toxins affect you?

When algal toxins are consumed (oral intake), the algal toxin may affect the liver (hepatotoxins) or nerve cells of the body (neurotoxins). Oral intake of algal toxins may occur when you drink contaminated water, inhale contaminated spray, or consume a primary algae consumer contaminated by a harmful algae bloom.

Hepatotoxins may cause your liver to fail. Acute liver failure may occur when the concentration of hepatotoxins overcomes the functionality of your liver causing your liver to under-function, function irregularly, or cause liver disease.

Neurotoxins may cause issues with your central nervous system and may cause neural damage to your brain. For example, when you consume contaminated shellfish you may develop PSP. Symptoms of PSP usually appear 30 to 60 minutes after eating toxic shellfish and include numbness and tingling of the face, lips, tongue, arms, and legs. There may be headache, nausea, vomiting, and diarrhea. Severe cases are associated with ingestion of large doses of toxin and result in clinical features such as ataxia, dysphagia, mental status changes, flaccid paralysis, and respiratory failure. (6)

Dermatotoxins may cause itching and rashes on your skin. When algal toxins come in contact with your skin, the algal toxin may affect the outer layer and the middle layers of your skin, the epidermis and the dermis. You can be poisoned with dermatotoxins when you swim or recreate in bodies of water that are currently or were previously contaminated with an algae bloom.

### What is an algal bloom?

Algal blooms are an event of algae in excess of typical proportions usually called a “rampant growth of microalgae.” (7) Algal blooms are typically due to an excess of nutrients (nutrient pollution) mostly of phosphorous and nitrogen in the water. Algal blooms may be visible, such as with cyanobacteria where a greenish bluish film will layer the top of the water, or they may be invisible when the algae sinks below the surface. Freshwater algal blooms may be due to an excess of fertilizers that are applied to farmland for agricultural purposes. These algal blooms may be found near livestock and may harm the livestock if the algal bloom is a Harmful Algal Bloom (HAB). (2)

### How do algal toxins get into the water?

The algal toxins are a natural product of the lifecycle of the algae (or bacteria) cell. Using cyanobacteria as an example, at the end of the life of the cyanobacterium cell, it may die and the outer wall of the cell may lyse (rupture), releasing the cyanotoxin into the surrounding water system. However, in some species the cyanobacterium cells are able to “release” the toxins without rupturing. (3)

### What is done to protect you from algal toxins?

Algal toxins are monitored by the Safe Drinking Water Act (SDWA). The SDWA protects drinking water and its sources including lake, rivers, reservoirs, springs, and underground wells. (1) Also advisories may be issued based on contaminated water sources instructing people not to consume or recreate in bodies of water based on the levels of algal toxins.

### What is the treatment for algal toxin poisoning?

Algal toxins are still being studied and currently, there are no treatments or cures for poisonings from algal toxins. A doctor may be able to provide you with some tips or medicines that may reduce the symptoms or suffering from the algal toxin poisoning but there is currently no cure for the toxins. The best mode for algal toxin poisoning is preventative measures. (8)

### How do I protect myself from algal toxins?

You can protect yourself from algal toxins by following these tips:

- Follow any advisories provided by your local government or local health authorities including closures of public swimming areas and lake closures.
- Do not swim or boat in lakes or areas of lakes that are contaminated with visible algae blooms.
- Never drink water from lakes, ponds, or wetlands unless the water has been treated either with chemicals or properly filtered. Boiling the water does not remove algae or any toxins from the water.
- Do not cook with, or use water contaminated with algae for doing dishes or washing clothes.
- Provide a clean source of water for pets or livestock to drink from if available natural sources of water are contaminated with algae. (2, 8)

### What happens when an algae bloom occurs?

An algae bloom typically occurs when an excess of nutrients are available to the algae within water. Algae require nutrients to photosynthesize. Nutrients are chemicals that the algae use to create food (glucose) which fuels the cell. The most important nutrients for photosynthesis are carbon, oxygen, nitrogen, and phosphorus. Because carbon and oxygen are readily available in the environment the limiting nutrients can be nitrogen and phosphorus. When excess nitrogen and phosphorus are available, the algae are able to have excess glucose for reproduction. The algae are then able to reproduce more than normal, resulting in an algae bloom. The algae bloom will continue to increase in size until the nutrients run out and the bloom may die off and return to its original state.

### What other animals are affected by algal toxins?

Algal toxins can affect any animal that eats or drinks from a water source that is contaminated. Animals can be affected by algal toxins if they drink directly from the water source, eat other animals from the water source, or reside within the water source.

When observed on a food chain alga is considered a primary producer. Algae is a main food source for a variety of fish, reptiles, mollusks (e.g., snails), crustaceans (e.g., crabs), and many other animals which are considered primary consumers. Sometimes harmful algae can be inadvertently consumed by these primary consumers poisoning the animal. Sometimes when the poisoned primary consumer is eaten (or when enough of the poisoned primary consumers are eaten) a secondary consumer may become poisoned as well.

Pets should be prevented from drinking or playing in water that is contaminated with algae. If they do swim in contaminated water, rinse and wash the animal with clean water to prevent them from cleaning themselves and eating the algae.

Livestock should be provided clean water in a clean container whenever algae are visible or suspected within water sources and should be kept away from any sources of water that are contaminated. (2)

### What can be done to prevent Harmful Algae Blooms?

The best way to prevent HABs is to prevent excess nutrients from being available to the algae for photosynthesis and reproduction.

- Use only the amount of fertilizer you need. Avoiding over fertilizing can help prevent nutrient runoff from your grass or farm from entering the water and contributing to algae blooms.
- When boating wash your boat before entering a different lake or river to prevent from transferring an algae from one water system to a second water system.

### Additional Information

Morbidity and Mortality Weekly Report (MMWR): Community Needs Assessment After Microcystin Toxin Contamination of a Municipal Water Supply -

[http://www.cdc.gov/mmwr/volumes/65/wr/mm6535a1.htm?s\\_cid=mm6535a1\\_w](http://www.cdc.gov/mmwr/volumes/65/wr/mm6535a1.htm?s_cid=mm6535a1_w)

### References:

1. Cyanobacteria and Cyanotoxins: Information for Drinking Water Systems. Sept., 2014. Environmental Protection Agency; [Accessed November 07,

- 2016]. [https://www.epa.gov/sites/production/files/2014-08/documents/cyanobacteria\\_factsheet.pdf](https://www.epa.gov/sites/production/files/2014-08/documents/cyanobacteria_factsheet.pdf)
2. Harmful Algal Bloom (HAB) Associated Illness. May 27, 2016. Centers for Disease Control and Prevention; [Accessed November 07, 2016]. <http://www.cdc.gov/habs/general.html>
  3. Learn about Cyanobacteria and Cyanotoxins. Aug. 1, 2022. Environmental Protection Agency; [Accessed July 07, 2023]. <https://www.epa.gov/cyano-habs/learn-about-cyanobacteria-and-cyanotoxins>
  4. Algae, Phytoplankton, and Chlorophyll. 2016. Fondriest Environmental; [Accessed November 07, 2016]. <http://www.fondriest.com/environmental-measurements/parameters/water-quality/algae-phytoplankton-chlorophyll/>
  5. How much do oceans add to world's oxygen? June 18, 2015. Earth Sky; [Accessed November 07, 2016]. <http://earthsky.org/earth/how-much-do-oceans-add-to-worlds-oxygen>
  6. Ansdell, V. E. (July 10, 2015). Food Poisoning from Marine Toxins. *CDC Health Information for International Travel*. [Accessed November 07, 2016]. Retrieved from <http://wwwnc.cdc.gov/travel/yellowbook/2016/the-pre-travel-consultation/food-poisoning-from-marine-toxins>
  7. What are Algae? June 4, 2016. Live Science; [Accessed November 07, 2016]. <http://www.livescience.com/54979-what-are-algae.html>
  8. Harmful Algae Blooms. June 01, 2022. Centers for Disease Control and Prevention; [Accessed July 07, 2023]. <https://www.cdc.gov/habs/index.html>