Blue-Green Algae

What are they?

Blue-green algae are a diverse group of primitive aquatic organisms that are common in lakes, reservoirs, and ponds throughout the world. More correctly, scientists refer to them as **cyanobacteria**. They have many of the characteristics of other bacteria, but use the same photosynthetic pigment (chlorophyll-a) all advanced plant species have.

Why are they in our waters?

Blue-green algae are a natural component of all aquatic ecosystems. Even in a very pristine setting, it may be common for blue-green algae to be the dominant algal type during the summer months, although they will be present in fairly small numbers.

What is not "natural" are the very large or frequent **blooms** of blue-green algae that impair recreational uses or water supply. An algae "bloom" is the name given to the result of rapid population growth, which many species of algae can undergo if conditions are right. Most blue-green algae blooms appear as surface scums, clumps (colonies) floating in the water (which can look like grass clippings or curds of green cottage cheese), or simply a strong green color in the water. Very often, they are also accompanied by foul odors (septic, fishy, or petroleum-like odors are the most common).

Blue-green algae are adapted to a given environment, just as other organisms are. The conditions that most blue-green algae seem to flourish in include standing water (such as a pond or lake), warm water temperatures (as seen in the summer), and nutrient rich conditions (which increase when urban lands and agricultural activities are present within the watershed). The nutrient of most concern in fueling blue-green algae blooms is **phosphorus**, but nitrogen can be a secondary concern.

Blue-green algae, when these basic growth conditions are met, can be very effective in out-competing other types of algae. Many species can control their buoyancy, which allows them to "shade out" other types of algae, preventing them from getting enough sunlight for photosynthesis. This adaptation is what allows blue-green algae to readily form surface covering blooms, which can then concentrate along the windward shores of lakes.

Overall, blue-green algae are true survivors in the environment. They have been around for roughly 3.5 billion years and have adapted themselves to almost every habitat on the planet in that time. Given that many lakes, reservoirs, and ponds in the world are nutrient enriched, often due to pollution, it is no wonder blue-green algae related problems are becoming more frequent.

Why should I be aware of blue-green algae?

Many of the common blue-green algae have the ability to produce toxins. These biochemical poisons come in two main forms, hepatotoxins (that primarily target the liver) and neurotoxins (that target the nervous system). Well over 100 different algal toxins have been identified to date, but the group referred to as **microcystins** are the most frequently observed as well as some of the more toxic metabolic compounds known. A large percentage of the public will report "allergic" type reactions after exposure to blue-green algae, such as intestinal problems, respiratory problems, or skin irritations. A number of the microcystins have also been implicated as tumor promoting compounds, which makes chronic exposures (low exposure over time) a growing concern.

Toxic blue-green algae have been documented from countries throughout the world. Published reports date back to the 1870s, although there are suggestive references back to antiquity. Livestock deaths are commonly reported in the literature, as well as cases of pets or wildlife dying after contact with lakes and ponds suffering a blue-green algae bloom. While no human deaths have been linked to blue-green algae blooms in the United States to date, many countries have reported outbreaks of gastroenteritis, liver problems, and some deaths as a result of contact with blue-green algae infested water.

The exact "triggers" in the environment that cause these algae to produce toxins have not been identified, although toxin production does seem to be correlated with increasing amounts of phosphorus in the water column (i.e., the overall level of nutrient enrichment). Another confounding factor is that some species, or strains within species, seem to adjust their toxin production to unknown environmental cues. Until the ability to test for the common algal toxins becomes widely available, it is best to assume a large blue-green algae bloom is toxic (especially when composed of species with a known history of toxin production) and take reasonable precautions.

What precautions and actions should I take?

If your water supply lake has an overtly visible blue-green algae bloom in progress, you will almost certainly have started getting taste and odor complaints from customers. The best course requires prior planning in the form of 1) having an alternate raw water source you can switch to, or 2) having an activated carbon filtration system in place for such occasions. Granulated activated carbon (GAC), when used after the standard sequence of water treatment steps, but pre-final chlorination, can provide almost 100% removal of taste and odor compounds including, presumably, any algal toxins. Particulate activated carbon (PAC) can be almost as effective if used later in the process stream, but before the final chlorination step.

Adding chemicals to the raw water, to kill the algae, is almost certain to release more of the undesirable compounds into the water and is, therefore, not recommended. Neither is treating the lake and bloom with herbicides, such as copper sulphate. When applied to a bloom in progress, herbicides release a great deal of the offending chemical substances into the water and make treatment even more difficult. Additionally, treatment could cause rapid oxygen depletion in the lake due to the sudden die off and decomposition of the algae. Lake aeration is often touted as a "cure" for algae blooms, but works best in small lakes and needs to be tailored to a lake's specific ecology.

There are as many lakes that degraded after aerators were installed as have shown improvement.

In lakes with recreational use, a bloom will cause many people to think twice about swimming and boating. Most blooms look very unattractive and smell bad besides. However, areas where bloom material is collecting represent a greater risk of exposure to toxins. It is advisable that such areas be posted to warn the public to avoid any activities, that expose them to contact with the algae or water, until the bloom goes away. Be aware this may take a couple weeks to months if the lake is very enriched with nutrients. The areas where algal material collects may also change over time due to the prevailing winds and weather. Blooms often can appear to have gone away after a rain, only to visibly reappear in a couple days.

To correct the problem of excessive algae growth and blue-green algae blooms requires treating the cause and not the symptoms, although you will likely need to resort to symptomatic treatment for the problem as well (advanced water treatment, alternate sources, recreation postings). Reductions of nutrients reaching the lake from the watershed represent the ultimate means to prevent these problems. These reductions can be achieved through advanced wastewater treatment, management practices on farmland and pasture, and storm water controls. Effective nutrient management and reduction in most watersheds will require plenty of community involvement and education of the public.

How can I find out what algae is in my lake?

Although blooms of blue-green algae species often have some distinctive macroscopic features, identification of which species are present requires a microscopic examination by someone with experience in algal taxonomy. Few commercial laboratories presently have algal taxonomists on staff, so universities and state agencies are the most promising resource. The Kansas Department of Health and Environment (KDHE) does possess staff trained to identify common blue-green algae and have offered this expertise to communities and water suppliers for over 20 years now. Contact your nearest KDHE District Office, or the KDHE central office (numbers below).

Sample collection can take place in several locations, depending on the situation. Samples can be taken from the bloom material collecting along shore to characterize an area of maximum risk. Samples related to water supply should be taken near water intake structures, or from multiple depths if the intake has multiple ports. Samples from the open water or from swimming beaches characterize the lake “as a whole” or the risk associated with specific recreation activities. All samples should be collected, if possible, from just beneath the surface (1 to 2 inches), although samples from a surface scum may require skimming the water at the surface layer. If you are collecting samples for identification, discuss specific needs with whoever will be doing the identification for you.

Contact Numbers

KDHE Central Office (Topeka) 785-296-5565/296-6603

District Offices

North Central (Salina)	785-827-9639	Northeast (Lawrence)	785-842-4600
Northwest (Hays)	785-625-5663	South Central (Wichita)	316-337-6020
Southeast (Chanute)	620-431-2390	Southwest (Dodge City)	620-225-0596

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