Healthy Kansans living in safe and sustainable environments

Harmful Algae Blooms: A TOOL KIT For Health Departments

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Healthy Kansans living in safe and sustainable environments
Introduction
This toolkit has been developed for local Health Departments when responding to Harmful Algae Blooms (HABs) in your community.
Goals:
- Support local health department’s response to HAB
- Provide a guide for reporting of HAB cases
- Assist local health departments with information of where to go when HAB questions are presented.

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Who to Contact with HAB Questions 8
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Cover photo courtesy of Elaine Toland
What is a HAB?
Cyanobacteria, also known as blue-green algae, are prominent in Kansas waters and, under certain conditions, HAB will produce toxins that pose a health risk to people and animals. Blooms are an emerging public health issue in Kansas. In 2011, Kansas experienced a number of HAB involving 38 reported water bodies and in 2012, 24 water bodies were confirmed as having HAB.

Large accumulations of algae or HABs can release toxins and contribute to human and animal health problems, however, not all blooms produce toxins. Visible blooms may be harmless, and harmful blooms may not be obvious to the untrained observer. Cyanotoxins are a diverse group of chemical substances that are categorized by their specific toxic effects. Depending on the genera, water conditions, and other factors, specific toxic effects include: neurotoxins (affecting the nervous system), hepatotoxins (affecting the liver), dermatotoxins (affecting the skin) and lipopolysaccharides (chemicals that can affect the gastrointestinal system). These toxins are mostly released to the water as the bacteria die. Water samples from various Kansas lakes have detected the presence of microcystins. Both humans and animals can experience illness from exposure to these toxins during recreational activities and other water uses.

HABs and their toxins in freshwaters have been implicated in human and animal illness in at least 36 states in the United States. The greatest risk of adverse human health effects appears after exposure to activities such as swimming and skiing. Adverse health effects can vary and are dependent upon the type of toxin and route of exposure. Contact with high concentrations of HAB, independent of the level of toxins, may also cause adverse health effects. The most common complaints after recreational exposure include vomiting, diarrhea, skin rashes, eye irritation and respiratory symptoms.

There is no specific antidote available. Treatment is aimed at early detection, control of symptoms and supportive care. Diagnosis in humans is usually based on clinical signs and exposure to waters with confirmed HAB events.

HAB Season
Generally the HAB season begins in May and continues through October. It coincides with the longest periods of light and warmest water temperatures. Summer and Fall includes three holidays which include high numbers of visitors to public recreational water bodies:

- Memorial Day
- Independence Day
- Labor Day

There were one suspect, five probable and seven confirmed cases of human illness from HABs in 2011 and four probable, two confirmed cases in 2012. Several dog deaths were confirmed in 2011.
# Health Effects: Exposure and Clinical Presentation

<table>
<thead>
<tr>
<th>Route of Exposure</th>
<th>Signs and Symptoms</th>
<th>Time to symptom onset</th>
<th>Differential Diagnosis</th>
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</thead>
<tbody>
<tr>
<td>Hepatotoxins:</td>
<td>Elevated ALT</td>
<td>Minutes to hours</td>
<td>Other hepatotoxin poisoning, other microbial infections/toxins</td>
</tr>
<tr>
<td>Swallowing water contaminated with cyanobacteria or toxins</td>
<td>Gastroenteritis</td>
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<td>Acute hepatitis</td>
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<td>Kidney toxicity</td>
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<td>Malaise</td>
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<td>Headache</td>
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<tr>
<td>Neurotoxins:</td>
<td>Tremor</td>
<td>Minutes to hours</td>
<td>Pesticide poisoning, other toxic poisoning</td>
</tr>
<tr>
<td>Swallowing water contaminated with cyanobacteria or toxins</td>
<td>Diarrhea</td>
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<td></td>
<td>Motor weakness</td>
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<td>Respiratory paralysis</td>
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<td></td>
<td>Vomiting</td>
<td></td>
<td></td>
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<tr>
<td>Dermatotoxins:</td>
<td>Itchy Skin</td>
<td>Minutes to hours</td>
<td>Other dermal allergens. Non-allergic urticaria, photosensitivity reactions</td>
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<tr>
<td>Skin contact with water contaminated with cyanobacteria or toxins or contact with animals contaminated with cyanobacteria</td>
<td>Red Skin</td>
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<td></td>
<td>Hives</td>
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<td></td>
<td>Skin Blistering</td>
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<td></td>
<td>(including lips)</td>
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<tr>
<td></td>
<td>Allergic Reactions</td>
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</tr>
<tr>
<td>Inhaling aerosolized droplets contaminated with cyanobacteria or toxins</td>
<td>Sore Throat</td>
<td>Unknown, but likely an acute reaction</td>
<td>Other airborne allergens, upper respiratory infection, flu</td>
</tr>
<tr>
<td></td>
<td>Congestion</td>
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<tr>
<td></td>
<td>Cough</td>
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<td>Wheezing</td>
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<td>Upper respiratory irritation Rhinitis</td>
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<tr>
<td></td>
<td>Possible allergic reaction</td>
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source: [www.kdheks.gov/algae-illness/index.htm](http://www.kdheks.gov/algae-illness/index.htm)
Reporting HAB-Related Human Illness
Use the Kansas Department of Health and Environment Human Algae Illness Reporting form to report a human illness that may be related to blue-green algae. The form is found online by going to http://www.kdheks.gov/algae-illness/index.htm

In order to improve the health of all Kansas residents and visitors, we encourage local public health providers with knowledge of a case or suspected case of HAB exposure and illness to report this information to KDHE using the online reporting form. If you have questions about the reporting form, please call KDHE Epi Hotline at 877-427-7317 or by email at Epihotline@kdheks.gov.

Reporting HAB-related Animal Illness
Reports of suspected domestic animal illness associated with exposure to HAB are reported to KDHE using the online reporting form. Animals often serve as sentinels for human illness therefore the Kansas Department of Health and Environment requests a report of any suspected case of blue-green algae poisoning to the Epi Hotline or the online reporting form. The online form is located on our website at http://www.kdheks.gov/algae-illness/index.htm. Local health departments receiving reports from veterinarians can also contact the KDHE Epi Hotline at 877-427-7317 or by email at epihotline@kdheks.gov.

Role of Kansas Department of Health and Environment
The KDHE does not routinely monitor all water bodies in the state for HABs but responds to complaint forms submitted online. Based on test results of public water body samples, KDHE determines whether a lake should be under an Advisory or a Warning status. In rare cases where HAB represent an extreme threat to the health of the public, KDHE may recommend the closure of a lake.
KDHE Response to HAB Reports

- Suspected HAB in a public recreational lake is reported to KDHE
- KDHE contacts lake management and coordinates sample collection
- Samples collected at predetermined locations identified as “most frequently used points of public access”
- Samples are transported to KDHE lab for analysis
- Public health threat assessed
- Proper response issued

KDHE coordinates a HAB response involving four bureaus that include: Epidemiology (BEPHI), Environmental Field Services (BEFS), Water (BOW), Environmental Health (BEH) and the Office of Public Information. The collection, analysis, and reporting of just a single sample requires the efforts of more than 10 staff.

KDHE performs sampling of recreational bodies of water for cyanobacteria in response to submission of the on-line complaint form and validation of the claim. Most of the toxins require specialized testing. KDHE has the capability to test for microcystin toxin and to quantify and identify the type of cyanobacteria present. When a HAB has been properly identified in a Kansas public lake, KDHE will issue either a Public Health Advisory or Public Health Warning, dependent on the level of risk associated with the HAB as determined through water sampling and testing. The issuing of a Public Health Advisory or Public Health Warning is based on the concentration of microcystin toxin or cyanobacteria cell counts.

KDHE coordinates sampling, analysis and identification of concentrations of cyanobacteria and microcystin toxins in reported “Public Waters” and when necessary issues appropriate public health messages. Lakes sampled for HAB based on the online complaint form include reservoirs, community lakes, state fishing lakes and/or are waters managed or owned by federal, state, county or municipal authorities.
How to Avoid HAB Exposure

- Do not swim, water ski, or boat in areas where the water is discolored or where visible foam or scum from algae is on the water.
- If you do swim in water that might have a HAB, rinse off with clean water as soon as possible.
- Do not let pets or livestock swim in or drink from areas where the water is discolored or where visible foam or scum from algae is in the water.
- Do not let dogs or pets walk along beaches with dried algae.
- If pets (especially dogs) swim in scummy water, rinse them off immediately—do not let them lick the algae and toxins off their fur.
- Do not irrigate lawns or golf courses with pond water that looks scummy or smells bad.
- Respect any water-body closures announced by the Kansas Department of Health and Environment.

HAB and Health Impacts

The first signs of microcystin poisoning in animals usually occurs within 30 minutes of exposure and include vomiting and diarrhea. This is followed by progressively worsening signs of liver failure such as anorexia, lethargy and depression. Blood values of liver enzymes are typically high. Jaundice, abdominal swelling and tenderness in the abdominal area may also be observed. Dogs should not be allowed near the shore where decaying algae may be visible as the algae may stick to their feet. Should dogs lick their paws, they could ingest enough toxin to cause death. Horses, cattle and donkeys are also susceptible to toxins and should not drink water from ponds or lakes with cyanobacteria.
**KDHE Contacts**

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Bureau of Environmental Health  
Policy Questions  
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Environmental Health Officer  
HAB Related Human Illness Questions  
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Epi Hotline  
PH: 877/427-7317  
Epi email  
epihotline@kdheks.gov  
Human Illness Reporting Form Questions

Dr. Ingrid Garrison  
State Public Health Veterinarian  
Animal Illness Questions  
PH: 785/296-2501  
Email: igarrison@kdheks.gov

Epi Hotline  
PH: 877/427-7317  
Epi email  
Email: epihotline@kdheks.gov  
HABs Animal Illness Reporting Form Questions

After Hours Lake Status Hotline  
PH: 855/422-5253

Technical or sampling questions  
PH: 785/296-7757
KDHE HAB Guidance Document

The Kansas Department of Health and Environment Secretary developed the HAB Guidance Document and supports communication efforts to prevent or reduce the incidence of HAB-related illnesses and to communicate the symptomology of algal toxin exposure.

PURPOSE

Protecting the environment as well as public health, safety and welfare is the mission of KDHE. Harmful Algal Blooms (HAB) present unique difficulties in health risk assessment determination. This guidance document considers health and environmental risks as well as the economic impact on resources within KDHE. The basis for this policy is the epidemiologic study of HAB data collected by KDHE in Kansas and the analysis of established scientific and medical research including studies conducted by the World Health Organization (WHO).

DISCUSSION

Cyanobacteria, also known as blue-green algae, can produce toxins in Kansas lakes and have been implicated in human and animal illness. The threat to health is related to the prevalence of cyanotoxins and cyanobacteria cell concentrations in recreational waters and corresponding contact with, or accidental ingestion of, the cyanobacterial cells or cyanotoxins. Small children are most susceptible to the toxins. Actual acute exposures have demonstrated that there is a higher incidence of illness among children that suggest risk calculations based on data from adults or animal studies may not be sufficient to protect children. The most common complaints after recreational exposure to cyanobacteria and associated toxins include vomiting, diarrhea, skin rashes, eye irritation and respiratory symptoms. As the concentration of cyanobacterial cells increases the probability of adverse health effects also increases.

PROCEDURES

KDHE samples recreational bodies of water for cyanobacteria once alerted to a potential bloom. KDHE has the capability to test for microcystin toxin and to quantify and identify the type of cyanobacteria present. When HAB has been properly identified in a Kansas public lake, KDHE may issue a Public Health Advisory or Public Health Warning, dependent on the level of risk associated with HAB as determined through water sampling and testing. The issuing of a Public Health Advisory or Public Health Warning is based on the concentration of microcystin toxin or cyanobacteria cell counts.

ACTION

The primary distinctions between a Public Health Advisory and A Public Health Warning are:

a. the level of risk that needs to be communicated to the public; and
b. recommended actions to the governing authority of the affected body of water to discourage exposure.

Implementation of appropriate measures to restrict exposure will be the responsibility of the governing authority of the affected body of water. If the governing authority chooses to close the body of water, KDHE can provide example alert, warning or closure signs. A Public Health Advisory will be issued when the microcystin toxin concentration is detectable at a concentration of 4 µg/L to less than 20 µg/L or cyanobacteria cell counts are 20,000 to less than 100,000 cells/mL. A Public Health Advisory includes posting of signs at beaches, marinas, boat ramps, and other points of entry into the body of water. The Public Health Advisory indicates that harmful algae are present and that the body of water may be unsafe for people and animals, the symptoms of cyanobacterial poisoning, what to do in case of contact with the water and who to call in case of illness potentially associated with exposure.
Public Health Advisory

The Public Health Advisory discourages people from having full body contact with water (e.g., swimming, skiing, etc.) or allowing pets to drink or swim in the water, however boating and fishing are permitted. If fish are caught during a Public Health Advisory, the fish should be properly cleaned and have internal organs removed before eating. If water from the lake is used for irrigation, people should avoid the spray, thoroughly wash fruits or vegetables in clean water and not allow livestock to drink irrigation water. In addition, the Health Alert Network will send a message to local health departments, physicians, veterinarians and hospitals providing them an advance copy of a media release. Releases containing all lakes under a Public Health Advisory or Public Health Warning are distributed and request the public report adverse health affects associated with cyanobacterial toxin poisoning. Public water suppliers with intakes in the water body affected are also notified. The Public Health Advisory will remain in effect until cyanobacteria concentrations are less than 20,000 cells/mL at all sampling sites and microcystin toxin concentrations are less than 4 µg/L detectable at all sampling sites.

Public Health Warning

A Public Health Warning is issued when microcystin toxin concentrations are greater than or equal to 20 µg/L or cyanobacterial counts are greater than or equal to 100,000 cells/mL. A Public Warning may also be issued if there is documentation of visible cyanobacterial scum present. A Warning indicates that harmful algae are present and that the body of water is unsafe for people and pets. A Warning includes all of the actions of a Public Health Advisory and in addition, all contact with water should be restricted including prohibitions on swimming, water skiing, and other activities that involve direct contact with the affected water. Public water suppliers with intakes in the water body affected are notified in the event of a Warning. Bodies of water placed under a Public Health Advisory are tested by KDHE on a specific schedule. Bodies of water placed under a Public Health Warning will also be tested by KDHE on a predetermined schedule. The Public Health Warning will remain in effect until the cyanobacterial concentrations are less than 100,000 cells/mL at all sampling sites for at least one week and concentrations of microcystin toxins are less than 20 µg/L for two consecutive weeks at all sampling sites.

Lake Closure

In rare instances, KDHE may recommend closure of a lake due to extreme circumstances; the decision to close any public use lake is made by the lake manager.
<table>
<thead>
<tr>
<th>Condition</th>
<th>Alert Level</th>
<th>Recommended Action(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microcystin toxin concentration &lt;4µg/L and Cyanobacterial concentration &lt;20,000 cells/mL</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Microcystin toxin concentration &gt;4 to &lt;20 µg/L or Cyanobacterial concentration &gt;20,000 to &lt;100,000 cells/mL</td>
<td>Public Health Advisory</td>
<td>Post Public Health Advisory signage Discourage direct contact with the affected body of water Notify appropriate local health departments, healthcare providers, and veterinarians Notify public water suppliers with intakes in the water body affected Issue media release</td>
</tr>
<tr>
<td>Microcystin toxin concentration ≥ 20µg/L or Cyanobacterial concentration ≥ 100,000 cells/mL</td>
<td>Public Health Warning</td>
<td>Post Public Health Warning signage Prohibit direct contact with the affected body of water Notify appropriate local health departments, healthcare providers, and veterinarians Notify public water suppliers with intakes in the water body affected Issue media release</td>
</tr>
</tbody>
</table>
The Jar and Stick Tests

Options for testing a pond:
There are two simple tests a pond owner can do at no cost to determine if a green pond even has a blue-green algae community, or if any algal material visible at the water surface is a blue-green surface scum.

NOTE: No test is 100% perfect, and that includes the jar test for blue-greens. The test relies on the buoyancy adaptation of most planktonic blue-green algae. In Kansas, bloom complaints are overwhelmingly the result of the forms that are buoyant. However, there is a small possibility (~1 to 2%) that the algae in your particular test happen to be non-buoyant species of blue-greens, resulting in a false negative test. Likewise, some swimming forms of non-blue-green algae (like Euglenoids) may form a surface layer during a jar test, resulting in a false positive. Fortunately, most Euglena blooms will be reddish in color rather than green, allowing for their identification. Although the jar test does provide a quick and inexpensive way to confirm whether you have a blue-green community in your lake, it does not tell you what species are present, nor does it tell you whether they are actually producing toxins. Be aware, however, that just having blue-green algae present does not mean your pond is automatically hazardous. Many lakes and ponds in Kansas typically have blue-green algae in them. Hazardous conditions occur when the amount of blue-green algae is large, and composed of species capable of generating toxins. For that information, a microscopic examination of the water, combined with a chemical test for toxins, would be required for a more complete picture.

The Jar Test:
Look out over the pond and see if the water looks very green. To decide whether the “green” is blue-green algae in the pond, or just an overabundance of some of the more beneficial types of planktonic algae, a simple test can be conducted called the “jar test.” Find a clear glass jar with a screw top lid (maybe pint-to-quart size, like a Mason jar), fill it three-quarters full with lake water (not directly from the surface, but collected just under the surface), and set it in a refrigerator where it can be left without being disturbed overnight.

The next day, carefully (don’t agitate and mix the water) take the jar out and look to see where the algae have accumulated. If the algae are all settled out near the bottom of the jar, then that is a likely indication that the lake does not have a lot of blue-green algae growing in it. If, instead, the algae have formed a green ring around the top of the water in the jar, or just seem to be collected at the air/water divide, there is a strong possibility that the pond does have a blue-green algae community present.

The Stick Test:
Look out over the pond and see if a mat of green material is floating on the surface. Is it blue-green algae forming a surface scum, or is it a mat of floating filamentous green algae (often called “fisherman’s moss”)? A simple test to determine what the material might be is called the “stick test.” Find a sturdy stick, long enough to thrust into the surface mat without your falling in, and see what comes back out on it. If the stick comes out looking like it has been thrust into a can of paint, the mat on the pond is likely to be a blue-green algae scum. If the stick pulls out strands that look like green hair or threads, the mat on the pond is likely filamentous green
algae. Although filamentous green algae can be a nuisance, when over-abundant, they do not pose a danger to health. The stick test can fail when a particular type of blue-green algae is present. A type called *Lyngbya wollei*. This species of blue-green algae can form tough filamentous mats that float to the surface, similar to the mats formed by harmless filamentous green algae. However, *Lyngbya wollei* typically will have a very putrid sewage-like odor which filamentous green algae do not. *Lyngbya wollei* mats also will often release a purple pigment in the water around them, which is something filamentous green algae do not do.

<table>
<thead>
<tr>
<th>Initial Sample</th>
<th>Likely Blue-Greens</th>
<th>Not Likely Blue-Greens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyngbya wollei</td>
<td>Filamentous Green Algae</td>
<td>A non blue-green algae bloom</td>
</tr>
</tbody>
</table>

Lyngbya wollei
A blue-green algae bloom

Filamentous Green Algae
A non blue-green algae bloom
More Information

Kansas Department of Health and Environment (KDHE) Bureau of Environmental Health (BEH)
Harmful Algal Bloom website www.kdheks.gov/algae-illness/index.htm

Centers for Disease Control and Prevention: http://www.cdc.gov/hab/cyanobacteria/pdfs/facts.pdf
Facts about Cyanobacteria and Cyanobacterial Harmful Algal Blooms. A factsheet developed by
the following: Department of Health and Human Services, Centers for Disease Control and Preven-
tion, National Center for Environmental Health and Division of Environmental Hazards and Health
Effects.

U.S. Environmental Protection Agency (EPA) International Symposium on Cyanobacterial Harmful
Algal Blooms (ISOC-HAB) www.epa.gov/cyano_habs_symposium/monograph.html

World Health Organization, Toxic cyanobacteria in water: A guide to their public health conse-
quencies, monitoring and management

Ohio Department of Health, visit the ODH HAS program Web site:
www.odh.ohio.gov/odhPrograms/eh/hlth_as/Hlth_As2.aspx