Ohio | Department of Health
Environmental Protection Agency
Department of Natural Resources

State of Ohio Harmful Algal Bloom Response Strategy For Recreational Waters

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Scott J. Nally, Director — Ohio Environmental Protection Agency
James Zehringer, Director — Ohio Department of Natural Resources
Dr. Theodore E. Wymyslo, Director — Ohio Department of Health

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1. INTRODUCTION

1.1 Purpose, Focus and Coordination

The purpose of the Ohio Harmful Algal Bloom Response Strategy is to provide a unified statewide approach to addressing HABS in Ohio recreational waters and to protect people from toxins produced by cyanobacteria. The Strategy is designed to identify levels of concern to be used in making advisory decisions. Sampling will target those toxins that may be present at levels of concern compared to threshold criteria established by the State of Ohio.

The focus of the Ohio Harmful Algal Bloom Response Strategy will be on publically owned, recreational lakes with public beaches and/or boat ramps, although these principles and practices can apply to any water body. The State will post advisories at state park lake beaches. Managers of other public lakes are encouraged to follow the State Strategy for posting advisories for consistency in communicating risk to the public.

HABs reported in non-public waters may be referred to the Ohio State University Extension Office or local health departments.

1.2 Agency Responsibilities

The following are the responsibilities of each of the three state agencies that developed this Strategy:

Ohio Department of Natural Resources

- Monitor state park lakes for HAB development
- Sample when blooms are sighted in contact recreational areas
- Post advisories at state park lakes
- Provide outreach to the public about HABs

Ohio Department of Health:

- Review illness reports and determine if they are related to cyanotoxins.
- Determine advisory thresholds in consultation with ODNR and Ohio EPA
- Advise the public about private lake HAB issues
- Provide information to the public about safety
- Provide outreach to the public about the health effects of HABS

Ohio Environmental Protection Agency

- Maintain a database of all state reported HAB data
- Maintain the interactive map of HAB advisories at public lakes
- Collect and review HAB reports, and determine who should be contacted for follow-up
- Maintain the ohioalgaeinfo.com website for the three agencies

- Advise the public about collecting HAB samples at private lakes and refer them to OSU Extension, local health departments or ODH for additional assistance
- Assist with sampling at public lakes as needed
- Assist in determining the presence of a cyanobacteria bloom by microscopic review to determine genera and cell counts
- Monitor satellite imagery provided by NOAA to track HAB development and to help focus state response at public lakes
- As part of the Inland Lakes Monitoring Program, sample for cyanotoxins when blooms are sighted in contact recreational areas
- Train others in sample collection
- Provide outreach to the public about HABs

1.3 Background

1.3.1 Cyanobacteria

Cyanobacteria can produce a variety of toxins which can cause illness and death in humans and animals. These toxins include liver toxins, nerve toxins, and skin toxins. Some of the more common cyanotoxins found in Ohio waters include microcystins, cylindrospermopsin, saxitoxin and anatoxin-a. Cyanobacteria toxins can be found within cells or in the water. Toxin production is strain specific, and many of these organisms can produce one or several different types of toxins. These toxins are colorless and persist in the water after a bloom is gone. Toxins may be degraded by bacterial action and sunlight over time.

In addition to toxin production, cyanobacteria can cause other problems in recreational waters. Large blooms can cause decreased dissolved oxygen concentrations resulting in fish kills. Many cyanobacteria also produce taste and odor compounds that affect the taste of fish. The foul smell produced by some cyanobacteria is a nuisance to those living around or recreating on the water.

1.3.2 Cyanobacterial Blooms

Cyanobacterial blooms vary in species composition and toxin production over time and within a water body. The distributions of cyanobacteria populations are affected by weather and lake conditions, hydrology and morphology. They may be distributed evenly throughout a lake, or may be irregularly distributed because of currents and/or prevailing winds. Hydrologic changes because of heavy rains, or the discharge from a stream resulting in “localized” currents, can significantly affect cyanobacteria population distributions. Areas like shallow bays, coves, sites directly affected by nutrient-rich inflows, or structures that affect flow (e.g., dikes, piers, or intake towers) can significantly affect population growth rates and cyanobacteria distribution.

Cyanobacteria may maintain a position at a particular depth, or may be found throughout the photic zone (e.g. *Planktothrix,Cylindospermopsis*). Cyanobacteria may migrate vertically to different locations in the photic zone throughout the day. Surface accumulations (scum) may develop when cyanobacteria float to the surface during calm, sunny weather and may dissipate within hours as conditions change. Entire cyanobacteria populations

may accumulate at 1 or 2 cm below the water surface. Surface accumulations of cyanobacteria may concentrate further when blown by wind to leeward areas like bays, inlets, or near-shore areas (with the direction of the wind). Dense accumulations may extend from the surface to depths more than 1 m.

1.3.3 Rationale for Strategy Development

Ohio government officials became aware of HAB development in Ohio's lakes in 2007 when the Ohio EPA participated in the Nation Lakes Survey. This survey included sampling for the algal cyanotoxin, microcystin.

In April 2009, the results of the 2007 National Lake Survey were released, showing that more than 36% of the randomly selected 19 Ohio lakes sampled had detectable levels of microcystin, which was higher than the national average. This revelation spurred the development of a HAB response program to ensure public awareness and safety.

For more information on the events that initiated and shaped Ohio's HAB Strategy from 2007 to the present, go to Appendix B.

2. CYANOTOXIN TOXICITY THRESHOLDS

2.1 Introduction

This section is intended to provide guidelines for any public lake manager responding to HABs and their potential to adversely impact human health. Included in this document are cyanotoxin thresholds protective of human health in recreational waters; a framework to be used in issuing algal bloom and toxin advisories, and language for signage to use when posting affected water bodies.

These guidelines were recommended by a committee that included representatives from Ohio EPA, ODH and ODNR and were adopted by the Directors of those state departments. The guidelines are intended to supersede previous advisory protocols, toxin thresholds, and sign advisory language pertaining to harmful algal blooms. The state of the science of HABs and their related toxins is evolving, and these guidelines may require updating, revising, and/or may become obsolete with the issuance of new toxicity information or national algal bloom guidance or policy.

2.1.1 Human health impacts from exposure to cyanobacteria toxins

Cyanobacteria are organisms that are found in all bodies of water. Under favorable conditions (nutrient availability, light, and heat) cyanobacteria can multiply and create a bloom becoming visible to the naked eye. These blooms generally occur in eutrophic or hypereutrophic water bodies. Eutrophication is most often the result of an elevated supply of nutrients, particularly nitrogen and phosphorus, to surface waters that results in enhanced production of primary producers, particularly phytoplankton and aquatic plants (Prepas and Charette 2003).

These organisms have the ability to produce some of the most potent toxins known to humankind. These toxins can affect liver and brain function. Many of the cyanobacteria produce toxins that can cause skin irritation. Due to the potency of these toxins and no known antidote, it is recommended that public health and other regulatory agencies take a conservative approach with human exposure to these toxins when setting recreational water thresholds.

Many of the health symptoms associated with exposure to cyanotoxins can mimic other illnesses and diseases and therefore may not be readily recognized by the medical community or the public. Some of these symptoms include nausea, skin rashes, gastro-intestinal distress, disorientation, numbness and fatigue. Increasing the level of awareness through education within the medical community, general public and government agencies is strongly recommended in order to determine the public health impact of these cyanotoxins.

More recently, during the summer of 2010 in Ohio there were a number of HABOCs identified. A number of illnesses were reported to the Ohio Department of Health and an epidemiological investigation was conducted. The questionnaire provided by the Centers for Disease Control and Prevention (CDC) was modified for the outbreak in consultation with the CDC. Case definitions were established as follows:

Suspect Case: Exposure to water or to seafood with a confirmed algal bloom AND onset of associated signs and symptoms within a reasonable time after exposure AND without identification of another cause of illness.

Probable Case: Meets criteria for *Suspect Case* AND there is laboratory documentation of a HAB toxin(s) in the water.

Confirmed Case: Meets criteria for a *Probable Case* combined with professional judgment based on medical review.

2.1.2 Fish Consumption and Cyanotoxins

Ohio EPA also did microcystin sampling in Grand Lake Saint Marys and Lake Erie during the 2011 season to determine if fish were affected by algal toxin. All samples taken in Lake Erie in October 2011, testing yellow perch and walleye, showed no detections. Grand Lake Saint Marys samples were also taken in November 2010, June 2011 and August 2011, and only the June sample set showed a detection level, only in black crappie. To round out the limited data available, Ohio EPA plans to continue sampling, and will evaluate and post updates as they become available.

2.2 Cyanotoxin Thresholds for Recreational Waters

Numerous risk assessment frameworks, exposure assumptions, and toxicity values from state, national, and primary literature sources were considered prior to developing the cyanotoxin thresholds. Thresholds were based on the best scientific information, guidance, and public policy available at the time.

The thresholds are protective of human exposures based on information available in 2011. The thresholds given here may or may not be protective of animals such as dogs or livestock.

For a toxicity review of various toxins, exposure assumptions and threshold calculations, see Appendix C.

2.2.4 Numeric Thresholds

Threshold (µg/L)	Microcystin*	Anatoxin-a	Cylindrospermopsin	Saxitoxin*
Recreational Public Health Advisory	6	80	5	0.8
Recreational No Contact Advisory	20	300	20	3

*Microcystin and saxitoxin thresholds are intended to be applied to total concentrations of all reported congeners of those toxins.

3. HARMFUL ALGAL BLOOM ADVISORIES

3.1 Advisory Postings

The numeric thresholds listed in the previous section are conservative and designed to protect the most vulnerable members of society, children, elderly and immune-compromised individuals. The thresholds may or may not be protective of animals such as dogs and livestock. Advisories are necessary to inform the public of the health risks associated with exposure to water that contain cyanotoxins. The State of Ohio will issue three types of advisories for contact recreational areas based upon the available evidence as described below and in Figure 1.

Upon identification of an algal bloom, samples will be taken for phytoplankton and algal toxin analysis. A report is made by notifying the Ohio EPA HAB coordinator by calling (614) 644-2001 or by e-mailing the HAB Report Form to the Ohio EPA HAB mailbox (***HABmailbox@epa.ohio.gov***). The HAB Report Form is located in Appendix E and on the Ohio EPA HAB website ***ohioalgaeinfo.com***.

Advisory postings will be the responsibility of the managing agency of the public lake. Advisory posting removal by the managing agency will be based upon two consecutive samples taken at least one week apart with cyanotoxin levels below threshold levels and the bloom is gone.

3.1.1 General Signage

To protect the public from potential HABs in areas of state park lakes that are not monitored, signs with the following language may be posted at lake access points such as boat launch ramps and docks:

Have fun on the water, but know that blue-green algae are in many Ohio lakes. Their toxins may be, too.

Be alert! Avoid water that:

- **looks like spilled paint**
- **has surface scums, mats or films**
- **is discolored or has colored streaks**
- **has green globs floating below the surface**

Avoid swallowing lake water.

For more information, log onto *www.ohioalgaeinfo.com*.

3.1.2 Recreational Public Health Advisory

A Recreational Public Health Advisory will be issued at a public beach when cyanotoxin levels are equal to or exceed a Recreational Public Health Advisory thresholds, whether or not a HAB is still present. A Recreational Public Health Advisory will be issued with an ORANGE sign (with black lettering) posted with the following language:

WARNING
High levels of algal toxins have been detected.
Swimming and wading are not recommended for the very old, the very young or those with compromised immune systems.

Once an Algal Bloom Advisory is issued, sampling for cyanotoxins will occur according to procedures in Section 5. The Advisory may be removed after two consecutive samples taken at least one week apart indicate cyanotoxin concentrations are below threshold levels and the bloom is gone.

3.1.3 No Contact Advisory

Reports of human illnesses and pet deaths believed to be related to harmful algal blooms will be investigated by the State of Ohio. A No Contact Advisory will be issued when cyanotoxin levels are equal to or exceed the Recreational No Contact Advisory thresholds AND there are one or more probable cases of human illness or pet deaths attributable to cyanotoxins. When both conditions are met, a No Contact Advisory will be issued with a RED sign (with white lettering) posted with the following language:

DANGER

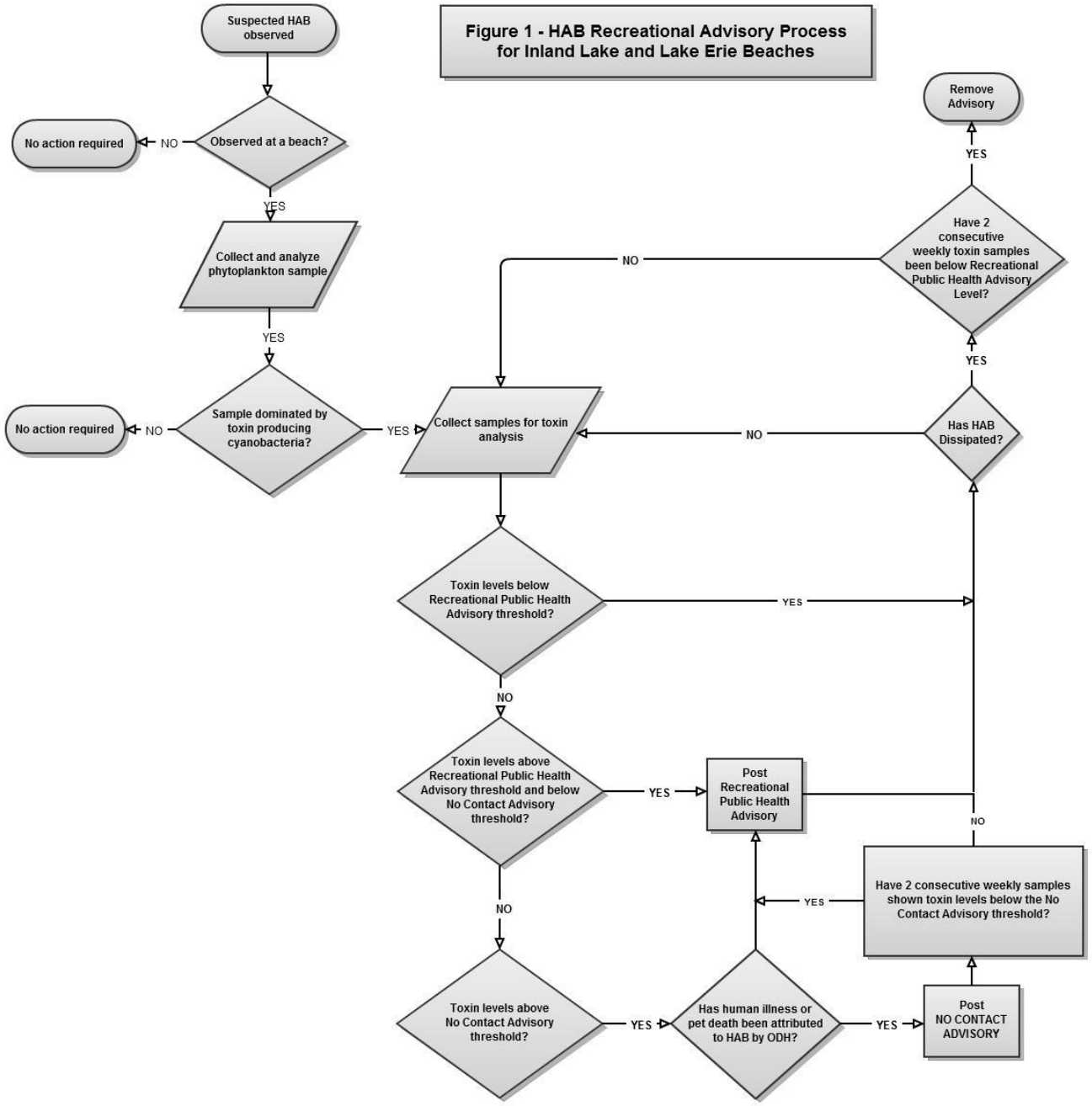
Avoid all contact with the water.

Algal toxins at UNSAFE levels have been detected.

A No Contact Advisory will remain until toxin levels have decreased to below Recreational Public Health Advisory thresholds and the bloom is gone.

When the Ohio Department of Health determines that an outbreak has occurred, then a No Contact Advisory may be posted when toxin levels are between the Recreational Public Health Advisory thresholds and the Recreational No Contact Advisory thresholds.

Figure 1 - HAB Recreational Advisory Process for Inland Lake and Lake Erie Beaches



Threshold (µg/L)	Microcystin	Anatoxin-a	Cylindrospermopsin	Saxitoxin*
Recreational Public Health Advisory	6	80	5	0.8
Recreational No Contact Advisory	20	300	20	3

4. A TIERED APPROACH TO ADDRESSING HABS IN RECREATIONAL WATERS

This section describes the tiered approach the State of Ohio will use in determining if a HABOC exists and when to conduct monitoring. Section 5 describes in more detail the specific monitoring protocols that will be used when sampling HABs.

4.1 Observation

The initial observation of a possible HAB involves identifying the presence of color and/or scum in surface water. Frequent, close monitoring of the bloom's location(s) should be continued, especially in contact recreational areas. Generally, the water will be discolored if the number of cells is 4,000 cells/ml or more. The color can vary from brown, green, blue green, white, black, purple or red. (See Photo Gallery of Ohio HABs at ***ohioalgaeinfo.com***). A report is made by notifying the Ohio EPA, DSW HAB coordinator by calling (614) 644-2001, or by emailing the HAB Report Form to the HAB Mailbox (***HABMailbox@epa.ohio.gov***). The HAB Report Form is located in Appendix E and on the Ohio EPA HAB website ***ohioalgaeinfo.com***.

Bloom observers can submit digital photographs with the HAB Report for HAB evaluation. Close-up (within 24 inches) and landscape photographs showing the extent and location of the bloom are needed to evaluate the bloom. If no photographs are available, or if a determination cannot be made, a qualified agency staff member may visit the site to corroborate the initial report.

4.1.1 Use of Satellite Imagery for HAB Tracking

The State may use satellite imagery to assist in identifying the location of HABs in Lake Erie and inland lakes. A processed satellite image can detect HABs below the surface when the human eye cannot. It can also detect blooms in turbid waters when the blooms can be difficult to visually identify. The MERIS satellite used by NOAA takes images at a frequency of up to two times per week that can capture developing HABs in lakes that are at least 1 km wide. Because of the temporal nature and spatial extent of HABs, satellite imagery will be a valuable tool to help the State focus limited resources on areas of probable HAB development in contact recreational areas at public lakes.

When a cyanobacterial bloom is identified by agency staff reviewing satellite imagery and the bloom appears to be in a potential contact recreational area, sampling for phytoplankton and cyanotoxins will be recommended to public lake managers.

4.2 Screening

Cyanobacterial screening may include: qualitative identification of genera and/or species present; cell quantification (cell counts); and rapid assessment field tests for cyanotoxins. The procedural requirements for collecting, preserving, transporting and analyzing phytoplankton and/or cyanotoxin samples (standard operating procedures or SOPs) are described in Section 5.

4.3 Toxin Analysis

Microcystin will be tested in many of the samples submitted for toxin analysis, as this is the most prevalent toxin. However, other toxins such as cylindrospermopsin, anatoxin-a, and saxitoxin may be analyzed if a majority (> 50%) of cyanobacterial cells are those that can produce toxins other than microcystin. Additional toxin testing will be determined on a case by case basis depending on the predominant genera and the toxins they can produce, as well as any reported health effects from ODH.

4.4 Data Management

Individuals reporting HABs will be encouraged to fill out a form on Ohio EPA's HAB website and e-mail the form with digital photos to Ohio EPA's HAB mailbox (***HABMailbox@epa.ohio.gov***). All HAB reports and HAB data (cyanotoxin and phytoplankton data, and photographs) will be entered into a database housed at the Ohio EPA. An interactive web-based map for locating advisories at state park lakes will be maintained by Ohio EPA and located on their website. Links will be provided to other listings of advisory postings at other public lakes when available.

5. HAB SAMPLING IN RECREATIONAL WATERS

This sampling protocol is designed to be responsive to HAB reports in recreational waters so that public health may be protected. It is applicable to collections by anyone who wishes to characterize phytoplankton and cyanotoxins in Ohio waters.

5.1 Safety Precautions

Safety must come first when sampling HAB toxins. Shoulder-length gloves should be worn when sampling HABs. Goggles should be worn to prevent spray from getting into the eyes. Chest waders should also be worn if collecting a cyanotoxin sample when wading off the shore to protect skin from contact with toxins. A personal floatation device should be worn. Avoid inhaling spray from boats, wind, or irrigation water from areas with harmful algal blooms. Wear a mask to prevent inhalation of spray.

Do not ingest or allow the water to come in contact with the skin. Always wash hands with clean, fresh water after sampling and do not touch hands to mouth or other exposed areas of the body before washing. All equipment, gloves, and waders should be rinsed with de-ionized water (not lake water) after collections.

5.2 Sampling Methodology Goal

The concept behind the sample collection procedures is to focus on collecting samples representative of areas being sampled. Higher cyanotoxin concentrations are expected near shore, especially on the downwind (away from where the wind is coming from) side of a lake. Highest cyanotoxin concentrations are usually expected with scums (below the dead material at the surface), and within dense cyanobacteria blooms. Most cyanobacteria that produce cyanotoxins hold them within their cells and release the toxins upon cell death. Higher cyanotoxin concentrations may be detected after a rapid bloom die-off, such as when algaecide is added to a dense bloom of cyanobacteria producing cyanotoxins.

5.3 Sample Location(s)

Observe areas of likely recreational use or contact. Consider wind direction and where the blooms may be blown such as the downwind side of a lake, or transported by currents. Review any satellite data, if available, to see where the heaviest concentration of cyanobacteria is located. Look for areas of bloom growth and decay throughout the photic zone.

5.4 Sample Frequency

Sampling will occur on a case-by-case basis depending on current water conditions. Sampling will focus on the peak recreational season between Memorial Day and Labor Day. If a HAB is identified and verified, a sample will be taken. Continued monitoring may occur beyond the peak recreational season based on environmental conditions and relative health risk, in consultation with Ohio EPA, ODH and ODNR.

5.5 Preparations

Plan weekly sampling early in the week and ship for overnight delivery. Cyanotoxin samples need to be analyzed within 36 hours of collection, and must be kept cold and in the dark. Phytoplankton samples should be kept on wet ice or ice packs, but not frozen.

IMPORTANT - On the Friday before sampling occurs, if shipping to the Ohio EPA DES Laboratory for analysis, contact the DES Sample Coordinator at (614) 644-4243 and indicate how many samples will be collected and when they will be delivered to DES. Be sure to contact the DES sample coordinator with any questions before shipping.

5.6 Label Information

Label the collection containers with a waterproof marker or attach a label to the outside of the container and mark with a waterproof marker. Include the following information:

Site Name
Date
Time
Preservative (if applicable)

5.7 Sample Collection

5.7.1 Beaches

5.7.1.1 Phytoplankton Sample Collection at Beaches

The purpose of collecting phytoplankton samples is to identify the organism to determine if the bloom consists of cyanobacteria or another organism. If it is not a cyanobacteria bloom, then no Algal Advisory sign would be posted. If the bloom is cyanobacteria, then the type of cyanobacteria will determine which cyanotoxins should be analyzed.

If the location of the bloom is evident (i.e. at the surface or just below the surface), collect a grab sample from the densest part of a bloom. The grab sample should be collected in a 1-quart Cubitainer™ or other Ohio EPA-approved container. If the bloom is not at a distinct location, but diffuse throughout the water column, use a composite sampler that includes a collection for a range of depth. If collecting a scum, collect a grab sample from the scum-water surface interface.

If you suspect the presence of benthic cyanobacteria, collect a sample near (at 1 foot above) the bottom where you believe the benthic cyanobacteria is located.

Ideally samples should be preserved at the time of collection with Lugol's iodine solution at a ratio of 1:100 although Lugol's can be added to a sample anytime within eight hours. To achieve a 1:100 ratio add about 1 ml of Lugol's solution per 100 ml of sample. (Final Lugol's solution in a sample should be 1%.) Final preserved sample color should be similar to that of weak tea. Ship

for delivery to the laboratory, such as Ohio EPA's DES. Samples should be kept on wet ice and in the dark during transport. **Do not freeze the phytoplankton sample - doing so will make identification difficult.**

5.7.1.2 Cyanotoxin Sample Collection at Beaches-Overview

The purpose of collecting cyanotoxin samples is to determine if a Public Health Advisory or No Contact Advisory (if there are probable human illnesses or pet deaths) should be posted.

Samples will be collected from nine locations within the designated recreational area and composited. The nine locations will be determined by evenly dividing the recreational area into three transects that begin at the beach and extend into the water. Samples will be collected from three locations (ankle, knee and hip deep) along each transect. (Note: use a rod ahead of where you are walking to gauge depth. Do not stir up the sediment. If the depth drops off quickly past hip depth, then just collect the ankle-depth and knee depth samples. Do not go past hip depth.)

Wade slowly (as not to stir bottom substrate) to the sampling locations. Avoid collecting suspended sediment that may be kicked up while accessing the sampling point. Ankle-deep water samples will be collected approximately 15 cm below the surface. Knee- and hip-deep water samples will be collected approximately 30 cm below the surface. If dense cyanobacterial accumulations are present outside of the transect locations (which includes a scum or heavy biomass in the photic zone), an additional sample will be collected from the densest accumulation by filling a separate clean 1-quart Cubitainer™ or other Ohio EPA-approved container half way (500 ml). Submit this sample in addition to the composited samples with a separate Sample Submission Form and clearly marked as scum (adapted from USGS, 2008).

Cyanotoxin Sample Collection Instructions

1) Use a clean 1-quart Cubitainer™ or other Ohio EPA approved container to collect from each sampling point along all three transects at a beach location. Carry the clean bucket with you (or you can place a float around the bucket). Fill the 1-quart Cubitainer™ or other Ohio EPA-approved container from the ankle-depth location on the first transect and completely dispense the collection into the bucket. Carefully wade out to the knee-depth location with the bucket and collect another 1-quart sample using the same Cubitainer™ or other Ohio EPA-approved container. Completely dispense the sample into the bucket. Then wade out to hip depth and collect another 1-quart sample and completely dispense the collection into the bucket.

2) Go to the second transect. Using the same 1-quart Cubitainer™ or other Ohio EPA-approved container, collect the three samples along the second transect in the same way the samples were collected along the first transect and dispense them into the bucket with the first transect collections. Once the second transect collections are dispensed into the bucket, go to the third

transect and collect the three samples along the third transect in the same way collections were made on the first two transects and dispense into the bucket.

3) Use a clean stirring rod to mix the composite samples from all three transects in the bucket. Continue to stir the composite sample while you dispense a sub-sample of the composite sample into the same 1-quart Cubitainer™ or other Ohio EPA-approved container you used to collect all the samples at that beach. This is the sample you will submit to the laboratory.

4) In addition, if a scum is found at any area where the public is expected to recreate outside the transect lines, collect a surface grab sample which includes the scum at the scum-water interface and clearly noted on the container label. Note the percentage of recreational area covered by the scum on your Sample Submission Form. This sample is **not** mixed into the composite sample but submitted to the laboratory in addition to the composite sample.

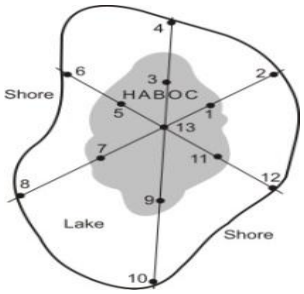
5) Immediately transfer each capped sample to a dark cooler on wet ice or ice packs when collected. The sample must be kept in the dark and cool to preserve any toxin that may be present.

If there are multiple beaches on a single lake with cyanobacteria blooms, all beaches should be sampled in the same manner as stated above, differentiating each sample location by an alternate location name. When you move to a new beach location to set up new transects, rinse the collection bucket and stirring rod three times with lake water at each location. Rinse away from the transect sampling points so as not to cross contaminate or mix the water where samples will be collected. Use a new, clean 1-quart Cubitainer™ or other Ohio EPA-approved container for each different beach sampled.

5.7.2 Open Water (Inland Lakes)

Open water sampling is not prescribed by this Strategy, but if it is deemed necessary, this section describes the methodology for collecting samples.

Establish a **central sampling point** in the approximate center of a HABOC on the open lake and record the latitude and longitude. Each time an open-water HAB sample is collected, there will probably be a different central sampling location and those coordinates should be recorded each time. Collect phytoplankton and toxin samples.



Choose one of the following methods that will best capture the extent of the HABOC.

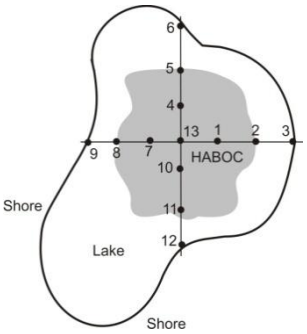
5.7.2.1 Radial Transect Method (for irregular-shaped, or elongated HABOCs)

Project three transects through the central sampling point ensuring there are six equal arcs radiating from the central sampling point. Extend each of the six radial arms to the shore. Along

each of the six radial arms, divide each into two equal length segments with two equally spaced sampling points (not counting the central sampling point.)

5.7.2.1.1 For Phytoplankton Samples

Using a vertical-composite sampler, collect a phytoplankton sample from the densest bloom area and dispense the sample into a Cubitainer™ or other Ohio EPA-approved container or a clean bucket. Take a 1-quart Cubitainer™ or other Ohio EPA-approved container or sub-sample for analysis. Collect additional separate samples of blooms that have a different appearance if applicable and note the latitude and longitude of each collection. Note if a scum is included in the collection. Preserve with Lugol's iodine (1 ml Lugol's solution to 100 ml sample).



5.7.2.1.2 For Cyanotoxin Samples

Collect a grab toxin sample in a rinsed 1-quart Cubitainer™ or other Ohio EPA-approved container at each collection point. Rinse by filling the 1-quart Cubitainer™ or other Ohio EPA-approved container with native water on the opposite side of the boat from where the collection will be made. Collect 1 quart sample from the photic zone where there is the highest concentration of cyanobacteria at each sampling location. If there is a surface scum, collect a surface sample (scum-water interface) at that location. If it is unclear where the highest concentration of phytoplankton is located in the water column, then collect a grab sample from approximately 15 cm below the surface. Combine a sample collected from the central sampling point to the 12 sample collections along each of the six radial arms in a clean churn splitter or clean bucket. Mix the composite sample in the churn splitter or in the bucket with a clean stirring rod and continue to mix while decanting a sub-sample into the 1-quart collection Cubitainer™ or other Ohio EPA-approved container.

If saxitoxin analysis is ordered, collect a sample form the churn splitter or clean bucket in a 40 ml glass vial pre-dosed with preservative from DES.

Important - The composite sample should be placed on wet ice or ice packs in a cooler as soon as possible.

5.7.2.2 Perpendicular Transect Method (For regular-shaped, or round HABOCs)

Establish two transects that cross at right angles through the central sampling point. Extend each transect end to the shore. Along each of the four radial arms, divide each into three equal length segments with three equally spaced sampling points (not counting the central sampling point.)

5.7.2.2.1 For Phytoplankton Samples

Using a vertical-composite sampler, collect a phytoplankton sample from the densest bloom area and dispense the sample in a clean bucket. Collect a subsample in a clean 1-quart Cubitainer™ or other Ohio EPA-approved container. Collect additional separate samples of blooms that have a different appearance if applicable and note the latitude and longitude of each collection. Note if a scum is included in the collection. Preserve with Lugol's iodine (1 ml Lugol's solution to 100 ml sample).

5.7.2.2.2 For Cyanotoxin Samples

Collect a cyanotoxin grab sample in a rinsed 1-quart Cubitainer™ or other Ohio EPA-approved container at each collection point. Rinse by filling the 1-quart Cubitainer™ or other Ohio EPA-approved container with native water on the opposite side of the boat from where the collection will be made. Collect a 1-quart sample from the photic zone where there is the highest concentration of cyanobacteria at each sampling location. If there is a surface scum, collect a surface sample (scum-water interface) at that location. If it is unclear where the highest concentration of phytoplankton is located in the water column, then collect a grab sample from approximately 15 cm below the surface. Combine a sample collected from the central sampling point to the 12 samples collected from the transect arms in a clean churn splitter or clean bucket. Mix the composite sample in the churn splitter or in the bucket with a clean stirring rod and continue to mix while decanting a sub-sample into the 1-quart collection Cubitainer™ or other Ohio EPA-approved container.

If saxitoxin analysis is ordered, collect a sample form the churn splitter or clean bucket in a 40 ml glass vial pre-dosed with preservative from DES.

Important - The composite sample should be placed on wet ice or ice packs in a cooler as soon as possible.

5.8 Cyanotoxin Preservation Instructions

Upon collection, samples should be immediately put in a cooler in the dark and on wet ice. If a sample will not arrive for processing at the laboratory within 24 - 36 hours, the sample must be frozen in a standard freezer until it is processed. Samples received at DES frozen will take four hours for quart containers or smaller to thaw.

5.9 Phytoplankton Preservation Instructions

Ideally samples should be preserved at the time of collection with Lugol's iodine solution at a ratio of 1:100, although Lugol's iodine can be added to a sample anytime within eight hours. Addition of Lugol's iodine will allow for extended preservation.

5.10 Equipment Decontamination Between Sampling Locations

When sampling for phytoplankton or algal toxins at different contact recreational areas, use clean cubitainers and rinse the collection bucket and stirring rod three times with lake water at each location. Rinse away from the transect sampling points so as not to cross contaminate or mix the water where samples will be collected.

5.11 Toxin Processing Instructions

Total toxin (free toxins and endotoxins) shall be determined for recreational water sample analysis. Samples will be processed to ensure all algal cells are lysed, which should be verified through microscopic observation. Utilizing an ultrasonicator is a good way to lyse algal cells, however care must be employed to prevent any loss of the toxin while sonicating. This will mean careful selection of the processing parameters for the type of sonicator used, and possibly sonicating the sample in a cold water bath.

5.12 QA/QC

Ohio EPA will use quality assurance/quality control procedures that meet quality objectives for HAB sampling.

5.13 Paperwork

Fill out a Chain of Custody Report and Sample Submission Forms (one for each sample) (see attached templates in Appendix E). Put the paperwork in double ziplock-type bags and seal each bag well. Place the paperwork on the samples in the cooler.

5.14 Shipping

Contact the appropriate laboratory prior to collecting samples (see Appendix D). Include any paperwork required by the receiving laboratory. This will usually include a Chain of Custody Report and a Sample Submission Form (see Appendix E.) Make sure that the data are reported back to the sample submitter and to the HAB Coordinator so that data can be entered into the HAB database.

Enclose each sample container in a separate sealed plastic bag. Place on ice in a sealed plastic bag and place in the shipping container. Note that ice packs should be used if shipping Fed-Ex and wet ice sealed in plastic bags or ice packs for UPS shipments. Prepare the package for shipment.

6. OUTREACH PROTOCOL FOR HABS

The goal of the media outreach is to inform Ohioans about harmful algal blooms and ensure that they understand potential risks associated with contacting blooms. The media outreach protocol will support the agencies' technical decisions and relay them to the public.

Ohio EPA, ODNR and ODH will work together to educate the public and media in the following way:

- Inform reporters that media advisories will not be issued every time a public health advisory is issued. This information will be promptly posted on the ***ohioalgaeinfo.com*** website, which is available 24 hours a day. Remind reporters throughout the sampling season to check the ***ohioalgaeinfo.com*** website for sampling results.
- If an advisory elevates to a "No Contact" advisory then a media advisory or press release will be issued.
- Initiate a series of joint Ohio EPA, ODNR and ODH educational materials to focus on algae blooms and their potential impacts. We will also promote the ***ohioalgaeinfo.com*** website that will house sampling data and advisory levels and encourage the public to check these sites before they visit a park.
- Point reporters and the public to ***ohioalgaeinfo.com***, a website that lists all levels of toxin advisories as well as sampling data and other algae information.

7. GLOSSARY

Algal toxin: A toxin produced by cyanobacteria. Also called cyanotoxin.

Anatoxin-a: A nerve toxin produced by a number of cyanobacteria.

Beach: Area along the shore that is a designated swimming area and is managed for public use.

Biovolume: Biovolume can be estimated by associating the phytoplankton with similar geometric forms and determining the volume of these by measuring the linear dimensions required for its calculation under the microscope (Vadrucci et al. 2007).

Blue-green algae: Photosynthesizing bacteria, also called cyanobacteria (see definition below).

Contact recreational area: Water area where swimming, wading, diving, jet skiing, water skiing, tubing, wakeboarding, windsurfing, kite boarding or any other in-water activity may occur that is likely to result in immersion or ingestion of water.

Cyanobacteria: Also called blue-green algae. These photosynthesizing bacteria may produce toxins that can cause sickness and possibly death in exposed populations of humans and animals. Cyanobacteria can be present as unicellular, colonial, or filamentous organisms. Some have the ability to fix nitrogen and/or regulate their buoyancy.

Cyanotoxin (algal toxin): Toxin produced by cyanobacteria. These toxins include liver toxins, nerve toxins and skin toxins.

Cylindrospermopsin: A nerve toxin produced by a number of cyanobacteria.

ELISA (Enzyme Linked Immunoassay): A rapid assessment method commonly used to detect microcystins, cylindrospermopsin and saxitoxin.

HAB (Harmful Algal Bloom): A visually identified concentration of cyanobacteria that discolors the water, or a cell count greater than 4,000 cells/ml of cyanobacteria genera (Shambaugh and Brines, 2003) Accumulations of cyanobacteria cells may be present at the water surface, at a defined depth, or throughout the water column.

HABOC (Harmful Algal Bloom of Concern): A HAB in a contact recreational area.

DES (Division of Environmental Services): Ohio EPA Laboratory

Microcystin: A common type of cyanotoxin that is toxic to the liver. There are more than 80 congeners (forms) of this toxin. Microcystin-LR is the most toxic congener.

Ohio EPA: Ohio Environmental Protection Agency

ODH: Ohio Department of Health

ODNR: Ohio Department of Natural Resources

Photic zone: The uppermost layer in a body of water into which light penetrates in sufficient amounts to influence living organisms, especially by permitting photosynthesis.

Public Lake: A lake managed by a political subdivision of the State of Ohio.

Saxitoxin: A nerve toxin produced by a number of cyanobacteria.

Scum: A cyanobacteria bloom that has a dense surface accumulation of cyanobacteria cells.

APPENDIX A –
SAMPLING AND SAFETY MATERIALS

Materials for basic grab sample phytoplankton and toxin collections at beaches:

- Plastic shoulder-length gloves (to protect skin from toxin irritation)
- Goggles, and mask for over nose and mouth
- Chest waders – if collecting samples by wading off the shore
- Personal flotation device (PFD)
- For phytoplankton collections: Two 1-quart Cubitainers™ or other Ohio EPA-approved containers/beach to sample (one for phytoplankton and one for additional scum sample if needed)
  For toxin collections: Two 1-quart Cubitainers™ or other Ohio EPA-approved containers/beach to sample (one for transect collection which is used for the final composite collection and one for a scum sample (if any) outside the transects)
- 40 ml vials from DES pre-dosed with preservative for saxitoxin collection (if ordered by HAB Coordinator)
- Secchi disk (if available)
- Lugol's iodine
- Clean bucket (at least 12 quart capacity) and clean non-porous stirring rod (metal or plastic, not wood)
- Centimeter measure for selecting sampling depth at sampling locations
- Walking stick to check depth ahead of sampling when wading
- Yardstick or weighted measuring tape
- Digital camera to record appearance of bloom (submit to HAB Coordinator)
- GPS or a map to mark the location of collection (email scanned map to HAB coordinator)
- Cooler with wet ice or ice packs
- Waterproof permanent marker
- Large trash bags and twist ties (to contain ice in cooler)
- Chain of Custody Report and Sample Submission Forms (See Appendix D)
- FedEx or UPS shipping labels
- Multi-probe sampler (if available)

*** Collection containers and preservative will be determined by Ohio EPA DES.**

For composite phytoplankton collections, add the following:

- Vertical whole water composite sampler (2 m integrated tube sampler)
    - Build the units as a two-piece for easier transport, although they may be built as a one-piece as well. The sampler is constructed from 1 1/4 inch Schedule 40 PVC pipe and fittings. The graduations on the sampler are in tenth meter increments which can be marked with colored tape. The material list is:
        1. one 1 1/4 inch neoprene stopper
        2. one PVC coupler (slip to slip type)
        3. 2 meters of 1 1/4 inch PVC pipe
        4. one 1 1/4 inch slip to thread adapter (male)
        5. one 1 1/4 inch slip to thread adapter (female)
        6. one 1 1/4 inch valve (optional; can also be accomplished with a stopper if necessary)

        (Modeled after Minnesota DNR. Not commercially available)

- Churn splitter OR clean bucket (at least 16 quart capacity) and clean non-porous stirring rod (metal or plastic, not wood)
- Multi-probe sonde/water quality instrument (if available)
- At least two-1-quart Cubitainers™ or other Ohio EPA-approved container for phytoplankton collection(s)
- At least two 1-quart Cubitainers™ or other Ohio EPA-approved container for toxin collections
- Lake map or chart to measure off transects
- Boat

APPENDIX B -
EVENTS SHAPING OHIO'S HAB STRATEGY

Events Shaping Ohio's HAB Strategy

Formal lake monitoring in Ohio ceased in the mid-1990s when federal funding for the Clean Lakes Program ended. In 2007, Ohio EPA participated in the National Lakes Survey which included sampling for the algal toxin, microcystin. This initiated the new Ohio EPA Inland Lakes Sampling Program which formally commenced in 2008.

In 2008, because of developing awareness of algal toxins reported in other states, Ohio EPA Division of Surface Water formed a Harmful Algal Bloom Focus Group consisting of representatives from state and federal agencies and universities. The purpose of this group was to develop a network to benchmark on HAB issues and to develop an initiative to address HABs in Ohio.

In April 2009, the results of the 2007 National Lake Survey were released, showing that more than 36% of the randomly selected 19 Ohio lakes sampled had detectable levels of microcystin. Tis percentage was higher than the national average. The highest concentration of microcystin detected in Ohio was at Grand Lake St. Marys. Ohio EPA sampled the water at Grand Lake St. Marys during May 2009 and determined that the microcystin level was four times higher than the World Health Organization's criterion established for recreational exposure. A water quality advisory was posted. That advisory remained in place for the entire 2009 recreational season due to persistent, high concentrations of microcystin.

In 2010, Ohio EPA, ODNR and ODH developed a three-tiered advisory system. The highest level of advisory was posted at Grand Lake St. Marys and at Cutler Lake in Blue Rock State Park where swimming, boating and fishing were discouraged. The City of Celina has continued to test their finished water. There has not been a single detection of microcystin in their finished waters since testing began in May 2009.

Also in 2010, Ohio EPA conducted limited testing of finished water supplies along the Lake Erie Western Basin and in several inland lakes. Akron had low levels of microcystin detected in their finished water. Ohio EPA followed up with additional testing to ensure that the water supply was safe. Western Basin Lake Erie beaches were also tested; the Maumee Bay State Park Beach had microcystin levels over 25 times higher than the World Health Organization's benchmark criterion for recreational waters.

Multiple meetings were held in 2010 between Ohio EPA, ODNR and ODH and with numerous groups around Grand Lake St. Marys. A consultant hired by U.S. EPA developed recommendations for addressing nutrient cycling in the lake and nutrient input from the watershed, which was recognized as causing the HABs. Two in-lake pilot projects were conducted in the fall of 2010 to collect data and address HAB issues. The State initiated in-lake treatment in the summer of 2011 to immediately address HAB growth. In addition, ODNR designated the watershed as "distressed," and adopted rules to mitigate nutrient loading in that watershed.

Based on the State's experiences in 2009-2010, a formal Strategy was developed in June 2011 that:

- Established commonly accepted terminology;
- Developed consistent sampling methodology;
- Reviewed algal toxin thresholds; and
- Revised the advisory protocol.

The 2012 revisions to the Strategy include:

- Addition of a beach managers guide which is intended to be a pull-out quick reference that outlines the sample collection and advisory posting process;
- Removal of the public water supply guidance so this document can focus only on recreational waters;
- Discussion of the use of satellite imagery for tracking HABs;
- Clarification of agency roles; and
- Streamlining of the Strategy document by placing some of the details in the appendices.

APPENDIX C –

Toxicity Review, Exposure Assumptions, and Threshold Calculations

Toxicity Review

Toxicity values for microcystin, anatoxin-a, cylindrospermopsin, and saxitoxin were selected by an interagency committee for the establishment of recreational thresholds. The toxicity values are referred to as either "reference doses (RfDs)" or "tolerable daily intakes (TDIs)". Either one is intended to represent a "safe" dose for humans, below which no toxic effect is to be expected. The values are expressed in milligrams per kilogram body weight per day (mg/kg-day). Both RfDs and TDIs include safety factors of between 3 and 3000, depending on the number, variety, and quality of the available studies. The values are derived to account for varying lengths of exposure to the toxins, including an acute exposure, which can be as short as one day, a short-term exposure, a subchronic exposure, and a chronic (or lifetime) exposure. Not all toxins have all four exposure lengths assessed, depending on the toxin-specific data available specific to the toxin.

Anatoxin-a

U.S. EPA's draft toxicological review of anatoxin-a from 2006 was used as the basis for the toxin thresholds presented here. Although the document was draft at the time of the threshold development, it contained the most recent, relevant, and well-reviewed studies available for anatoxin-a. Short-term and subchronic reference doses (RfDs) are given in the review. U.S. EPA determined that data were inadequate to develop acute or chronic RfDs. After considering both the short-term and subchronic RfDs, the committee decided to use the subchronic RfD to develop toxin thresholds. The committee's rationale for this decision was that the thresholds developed using the subchronic RfD were closest to the thresholds for anatoxin-a in use by other states and organizations (e.g., California, Washington). The subchronic RfD is from a 7 week rat drinking water study, and is 0.0005 mg/kg-day based on systemic toxicity, which includes an uncertainty factor of 1000. The uncertainty factor includes a factor of 10 for rat to human variability, 10 for variability among humans, and 10 for database deficiencies, including limitations within the study used as the basis for the RfD, lack of reproductive studies, and lack of toxicity testing in a second species.

Cylindrospermopsin

U.S. EPA's draft toxicological review of cylindrospermopsin from 2006 was used as the basis for the toxin thresholds presented here. Although the document was draft at the time of the threshold development, it contained the most recent, relevant, and well-reviewed studies available for cylindrospermopsin. The only RfD developed for cylindro-spermopsin is for subchronic exposures, based on an 11 week mouse study. The RfD is 0.00003 mg/kg-day based on increased kidney weight, which includes an uncertainty factor of 1000. The uncertainty factor includes a factor of 10 for mouse to human variability, 10 for variability among humans, and 10 for database deficiencies, including the lack of a chronic study, lack of a study in a second species, and the lack of reproductive or developmental studies.

Microcystins

The committee reviewed both U.S. EPA's 2006 draft toxicological review of microcystin LR, RR, YR, and LA, as well as the World Health Organization's (WHO) 2003 microcystin-LR in drinking water background document. The committee generally found the U.S. EPA toxicological review to be more recent and inclusive of available studies evaluating microcystin toxicity. However, the committee decided to use the WHO tolerable daily intake (TDI, similar to an RfD) instead of U.S. EPA's RfD for microcystin, owing to the widespread use and acceptance of the TDI by a variety of other governments and organizations evaluating algal toxin risks. The committee agreed that should U.S. EPA finalize its microcystin toxicological review, revisiting the microcystin threshold values would be appropriate.

The WHO TDI is 0.00004 mg/kg-day, derived from a 13-week mouse study. The basis for the TDI is liver pathology, and includes an uncertainty factor of 1000. The uncertainty factor includes a factor of 10 for mouse to human variability, 10 for variability among humans, and 10 for database deficiencies, including the lack of chronic data and carcinogenic studies.

Saxitoxin

Neither U.S. EPA nor WHO have, at the time of this report, issued an RfD or TDI for saxitoxin. To develop a saxitoxin guideline, the committee reviewed information in the Report of the Joint FAO/IOC/WHO ad hoc Expert Consultation on Biotoxins in Bivalve Mollusks from 2004, as well as a peer-reviewed paper by Galváo et al. 2009 in the journal Toxicon, Saxitoxins Accumulation in Freshwater Tilapia (Oreochromis niloticus) for Human Consumption. The joint FAO/IOC/WHO report recommends an acute reference dose for saxitoxins of 0.0007 mg/kg-day, but does not establish a TDI. The report does not describe the toxicological basis for the recommended value.

The Galváo et al. paper states that "From available reports on exposure in humans, a lowest- observed-adverse-effect-level (LOAEL) in the region of 1.5 ug STXs/kg b.w. could be set, and an estimated no-observed-adverse-effect-level (NOAEL) of 0.5 ug STXs/kg b.w. was established. Thus the CONTAM panel has defined an acute reference dose (ARfD) of 0.5 ug STXs/kg b.w." The citation given in the Galváo paper is the European Food Safety Authority, 2009, Marine Biotoxins in Shellfish – Saxitoxin Group Scientific Opinion of the Panel on Contaminants in the Food Chain.

Using the WHO and U.S. EPA method of applying an uncertainty factor to the NOAEL to derive an RfD or TDI, the committee agreed to apply an uncertainty factor of 100 to the NOAEL-based ARfD, 10 for human variability and 10 for a lack of chronic, developmental, and reproductive studies. The resulting value for use in calculating a saxitoxin threshold is 0.000005 mg/kg-day.

Exposure Assumptions

Children were assumed to have a body weight of 15 kg, and adults were assumed to have a body weight of 60 kg, based on exposure assumptions from WHO Guidelines for Safe Recreational Water

Environments, Volume 1, 2003. Incidental ingestion of water during water-based recreational activity was assumed to be 0.1 liters per event for both children and adults. Children were assumed to drink 1 liter of water per day, and adults were assumed to drink 2 liters of water per day. Ingestion rates were taken from U.S. EPA's Exposure Factors Handbook, except for the 1 liter per day for children, which was taken from U.S. EPA's 2009 Edition of the Drinking Water Standards and Health Advisories.

Calculations

The basic calculation used in developing all thresholds is:

$$\text{Threshold} = \frac{\text{BW x TDI or RfD}}{\text{IR}} * \text{CF}$$

Where:

BW = Body weight in kg
TDI = Tolerable Daily Intake in mg/kg-day
RfD = Reference Dose in mg/kg-day
IR = Ingestion Rate in L/day
CF = Conversion Factor, 1000 µg/mg
Threshold given in µg/L

APPENDIX D -
LABORATORIES USED
BY THE STATE OF OHIO

This list of laboratories is not exhaustive, and does not indicate an endorsement by the State of Ohio.

There are other laboratories that may perform algal toxin and phytoplankton analysis.
Any laboratory selected must use the protocol outlined in the Strategy or other method approved by Ohio EPA.

Algal Toxin Analysis Options

This list represents facilities that the agency has worked with or consulted with recently. This list is not exhaustive, and the State of Ohio EPA does not endorse or recommend any commercial laboratories or products.

For microcystin, cylindrospermopsin, and saxitoxin

Ohio EPA-Division of Environmental Services (DES)
Attention: DES Sample Coordinator
8955 E. Main St.
Reynoldsburg, OH 43068
(614) 644-4243

For anatoxin-a

GreenWater Laboratories/Cyano Lab
205 Zeagler Dr., Suite 302
Palatka, FL 32177
(386) 328-0882

For microcystin

T. Mike Sudman Jr.
Supt. of Water & Distr.
Celina Utilities - Water Dept.
714 S. Sugar Street
Celina, Ohio 45822
Phone (419)586-2270
Cell (419) 733-4112
cwtpsupt@bright.net
Fax (419) 586-3598

For phytoplankton (genus and species identification and quantification), microcystin and cylindrospermopsin analysis (for non-State and some State of Ohio collections):

BSA Environmental Services, Inc.
23400 Mercantile Road
Suite 8
Beachwood, OH 44122
Email: ***j.beaver@bsaenv.com***
Telephone: (216) 765-0582
Fax: (216) 765-0583

APPENDIX E -
FORMS

Note:
If you are reporting a HABOC to the HAB coordinator and/or submitting phytoplankton and/or algal toxin samples to a laboratory for analysis, the HAB Report Form should be e-mailed to: ***HABMailbox@epa.ohio.gov***

The HAB Report Form may be accessed at: ***ohioalgaeinfo.com***

The Inorganic Sample Submission Form and the Laboratory Chain of Custody Report must both be completed and submitted with samples sent to DES for processing. You can copy each form from this appendix and submit them with your samples. Be sure to keep a copy for yourself.

Bloom Report Form

Please provide information about the potential blue-green algae bloom observed. Information can be entered into this electronic form and saved on your computer using Word or Adobe Reader (version 9+).
Please save and email a completed copy of this form to *HABmailbox@epa.state.oh.us*.
You are encouraged to include digital photographs as additional email attachments (close-up, and landscape showing extent and location of bloom).
If possible, consider including an image from an online mapping application such as Google, Bing or Yahoo Maps, with a marker at the bloom location. For more information go to the *ohioalgaeinfo.com* website.

Bloom Location:

Water body:	Date bloom observed: / /
County (optional):	Drinking water source? Yes ☐ No ☐ Unknown ☐
Publicly Owned Lake? Yes ☐ No ☐ Unknown ☐	Attached map with bloom location noted (e.g. Google Map image)? Yes ☐ No ☐ Digital photos attached? Yes ☐ No ☐

Report Completed By:

Name:	Organization:	
Title:	Phone: ( ) - ext.	Email:

Bloom Description and Sampling Information:

Please describe the location of the bloom in the water body (e.g. center of lake, at the boat dock, at the beach):

Do you notice any colors in the water column? Yes ☐ No ☐

Please check any colors you see, or describe the color(s) below: Green ☐ Blue ☐ Red ☐ Rust ☐ Brown ☐ Milky White ☐ Purple ☐ Black ☐

Please estimate the size (sq. feet) or the extent of bloom:

Can you see a surface scum (an accumulation at the surface) or algae floating near the water surface?
Algae floating at the surface can look like grass clippings, green cottage cheese curds, or spilled paint. Yes ☐ No ☐ Uncertain ☐

Is the bloom near a public beach? If yes, please specify the beach name or location below. Yes ☐ No ☐ Unknown ☐

Is the bloom near a drinking water intake? (Specify water system name if known) Yes ☐ No ☐ Unknown ☐

Were samples taken? Yes ☐ No ☐

If yes, what type of samples; when and where were they collected; and where were they sent for analysis?

Do you know if other water quality information is available? (Specify what data is available and where) Yes ☐ No ☐

APPENDIX F -
OHIO STATE PARK BEACHES

OHIO STATE PARK BEACHES

LAKE ERIE BEACHES					
County	**State Park**	**Beach**	**Latitude**	**Longitude**	**Acres of Water**
Ashtabula	Geneva State Park		41°51'25.58"N	80°58'39.85"W	
Lake	Headlands State Pk. (East)		41°45'24.38"N	81°17'24.35"W	
	Headlands State Pk. (West)				
Cuyahoga	Cleveland Lakefront St. Pk.	Edgewater	41°29'18.95"N	81°44'24.64"W	
		Euclid	41°35'2.27"N	81°34'8.28"W	
		Villa Angela	41°35'8.69"N	81°34'0.99"W	
Erie	Kelleys Island St. Pk.		41°36'55.32"N	82°42'17.15"W	
Ottawa	Catawba Island St. Pk.		41°34'25.45"N	82°51'27.09"W	
	East Harbor State Park		41°33'32.35"N	82°48'15.52"W	
	South Bass Island St. Pk.		41°38'31.97"N	82°50'14.05"W	
Toledo/Lucas	Maumee Bay St. Pk.	Erie	41°41'8.73"N	83°22'37.05"W	
		Inland	41°41'0.40"N	83°22'38.03"W	

INLAND BEACHES					
County	**State Park**	**Beach**	**Latitude**	**Longitude**	**Acres of Water**
Delaware	Alum Creek	Main	40°11'25.21"N	82°58'14.43"W	3387
		Camp	40°14'8.59"N	82°58'39.94"W	
Belmont	Barkcamp		40° 2'14.78"N	81° 0'37.98"W	117
Muskingum	Blue Rock		82°58'39.94"W	81°50'56.87"W	15
Clark	Buck Creek	Main	39°56'57.79"N	83°44'7.61"W	2120
		Camp	39°58'1.20"N	83°43'47.55"W	
Fairfield	Buckeye Lake	Crystal Beach	39°55'56.71"N	82°28'37.68"W	3173
		Fairfield	39°55'19.34"N	82°28'14.67"W	
		Lake Brooks	39°54'5.31"N	82°30'59.82"W	
Morgan	Burr Oak	Main	39°32'7.30"N	82° 2'11.11"W	664
		Lodge	39°31'49.79"N	82° 2'10.59"W	
Warren	Caesar Creek	North	39°32'13.27"N	83°59'8.52"W	2830
		South	39°29'16.67"N	84° 3'25.91"W	
Clinton	Cowan Lake	Main (S)	39°22'54.20"N	83°53'58.69"W	700
		Camp (N)	39°23'23.90"N	83°53'59.40"W	
Fayette	Deer Creek		39°37'9.62"N	83°13'42.78"W	1277
Delaware	Delaware		40°22'17.88"N	83° 3'29.47"W	1330
Muskingum	Dillon	Boaters	40° 0'54.60"N	82° 7'8.84"W	1560
		Swimmers	40° 0'59.25"N	82° 7'9.91"W	
Clermont	East Fork	Main	39° 1'10.38"N	84° 8'3.23"W	2610
		Camp	39° 1'20.58"N	84° 5'39.47"W	
Lorraine	Findlay		41° 8'6.45"N	82°12'51.82"W	93
Meigs	Forked Run		39° 5'39.05"N	81°46'29.84"W	102

INLAND BEACHES					
County	**State Park**	**Beach**	**Latitude**	**Longitude**	**Acres of Water**
Auglaize	Grn Lk St. Marys	Main East	40°32'30.02"N	84°25'19.02"W	13500
		Main West	40°32'33.62"N	84°25'34.44"W	
		Camp	40°32'42.00"N	84°26'25.53"W	
Columbiana	Guilford Lake	Main	40°48'10.70"N	80°52'58.49"W	396
		Camp	40°48'20.45"N	80°52'37.65"W	
Fulton	Harrison Lake		41°38'23.31"N	84°21'41.83"W	105
Preble	Hueston Woods		39°34'30.51"N	84°45'20.13"W	625
Logan	Indian Lake	Fox Island	40°28'34.79"N	83°52'54.61"W	5800
		Camp	40°30'34.95"N	83°53'46.68"W	
		Oldfield	40°30'0.97"N	83°54'41.77"W	
Jackson	Jackson Lake		38°54'6.59"N	82°35'39.13"W	242
Jefferson	Jefferson Lake		40°27'48.54"N	80°48'0.31"W	17
Champaign	Kiser Lake		40°11'4.78"N	83°57'5.05"W	396
Vinton	Lake Alma	#1-West	39° 8'54.01"N	82°30'52.50"W	60
		#2-East	39° 8'54.46"N	82°30'45.62"W	
Vinton	Lake Hope		39°19'13.88"N	82°21'21.99"W	120
Athens	Lake Logan		39°32'30.25"N	82°28'15.66"W	400
Shelby	Lake Loramie		40°21'39.87"N	84°21'25.85"W	1655
Trumbull	Lake Milton		41° 7'20.62"N	80°58'45.10"W	1685
Pike	Lake White		39° 5'58.49"N	83° 1'9.89"W	337
Madison	Madison Lake	(Deer Creek)	39°52'10.39"N	83°22'27.45"W	106
Trumbull	Mosquito		41°18'10.67"N	80°45'44.16"W	7850
Ross	Paint Creek		39°14'20.80"N	83°22'15.98"W	1190
Pike	Pike Lake		39° 9'42.15"N	83°13'11.36"W	13
Summit	Portage Lakes	Main	40°58'9.32"N	81°32'45.53"W	2034
		Camp	40°56'19.89"N	81°31'17.44"W	
Geauga	Punderson		41°27'18.14"N	81°12'33.80"W	150
Ashtabula	Pymatuning	Main	41°36'19.16"N	80°32'10.09"W	14000
		Camp	41°32'50.72"N	80°31'35.98"W	
		Cabins	41°34'41.98"N	80°31'57.07"W	
Highland	Rocky Fork	North	39°11'32.19"N	83°28'35.12"W	2080
		South	39°10'57.47"N	83°28'33.99"W	
Guernsey	Salt Fork	Main	40° 5'9.25"N	81°29'36.65"W	2952
		Camp	40° 4'27.22"N	81°29'55.52"W	
		Cabins	40° 6'30.32"N	81°32'12.79"W	
Ross	Scioto Trail		39°13'48.59"N	82°57'13.29"W	30
Scioto	Shawnee	Turkey Crk-Lodge	38°44'17.62"N	83°11'52.24"W	68
		Roosevelt-Camp	38°43'37.62"N	83°10'39.45"W	
Clermont	Stonelick		39°13'16.51"N	84° 4'39.47"W	200
Athens	Strouds Run		39°20'58.37"N	82° 2'15.31"W	161
Vinton	Tar Hollow	Main	39°23'4.35"N	82°45'5.23"W	15
		Camp	39°23'18.34"N	82°45'0.88"W	
Portage	West Branch		41° 8'16.57"N	81° 6'13.70"W	2650
Noble	Wolf Run		39°48'2.22"N	81°31'18.16"W	220

Appendix G -
2012 HAB Contacts

*= Primary Contacts

Report HABs - All Ohio Public Lakes

Linda Merchant-Masonbrink*
DSW HAB Coordinator (Recreational Waters)
Ohio EPA - Division of Surface Water
50 W. Town St., Suite 700
P.O. Box 1049
Columbus, OH 43215
Office (614) 644-2135
Cell (614) 560-5086
Fax (614) 644-2745
linda.merchant-masonbrink@epa.ohio.gov
ohioalgaeinfo.com

Report HABs - Public Water System Reservoirs and Finished Water

Heather Raymond*
PWS HAB Coordinator (Drinking Waters)
Ohio EPA - Division of Drinking and Ground Waters
50 W. Town St., Suite 700
P.O. Box 1049
Columbus, OH 43215
Office (614) 644-2911
Fax (614) 644-2909
heather.raymond@epa.ohio.gov
www.epa.ohio.gov/ddagw/HAB.aspx

Other Ohio EPA Contacts

Ohio EPA DSW Management – Central Office
General phone number: (614) 644-2001
George Elmaraghy (Chief) (614) 644-2041
Brian Hall (Assistant Chief) (614) 644-2033
Trinka Mount (Supervisor) (614) 644-2146

Other Ohio EPA DSW Contacts – Central Office
Amy Jo Klei (Lake Erie Coordinator) (614) 644-2871
Mylynda Shaskus (Risk Assessment and Toxicology) (614) 466-6308

Ohio EPA DES
Kirk Leifheit, Acting Chief
DES Sample Coordinator*
8955 East Main Street
Reynoldsburg, OH 43068
Office (614) 644-4243

Other Ohio EPA Contacts

Public Interest Center (Media Calls) (614) 644-2160
Legislative Liaisons (Legislative Inquiries) (614) 644-2782

Report HABs - State Park Lakes

Jean Backs, CPM*
Public Information Manager
Ohio State Parks
2045 Morse Road C-3
Columbus OH 43229
Office (614) 265-7077
Fax (614) 261-8407
jean.backs@dnr.state.oh.us

Report HABs – Ohio River

Greg Youngstrom
ORSANCO
5735 Kellogg Ave.
Cincinnati, OH 45228
Office (513) 231-7719
Fax (513) 231-7761
Gregy@orsanco.org

Report HABs - Private Lakes

Local Health Department
See Managing Harmful Algal Blooms in Private Ponds Fact Sheet
ohioalgaeinfo.com
Also see sampling methodology and laboratory information in this document.

Report Animal Illnesses

Local Veterinarian and

Kathleen A Smith DVM MPH
State Public Health Veterinarian
Ohio Department of Health
PO Box 1430
Reynoldsburg, OH 43068-6430
Office (614) 466-0283
Fax (614) 644-1057
kathy.smith@odh.ohio.gov

Report Animal Deaths

Dr. Tony Forshey
State Veterinarian
TForshey@agri.ohio.gov
Office (614) 728-6220
(800) 282-1955 Ask for ODA Division of Animal Industry

Report Human Illnesses

ODH
Bureau of Environmental Health
Mary Clifton*
Office (614) 466-1390 or (614) 466-6736
Mary.Clifton@odh.ohio.gov

Gene Phillips
Chief, Bureau of Environmental Health
Office (614) 466-1390
Gene.Phillips@odh.ohio.gov

Appendix G -
BEACH MANAGERS GUIDE

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Note:

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