Ohio Environmental Protection Agency

Public Water System Harmful Algal Bloom Response Strategy

Division of Drinking and Ground Waters
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Mike DeWine, Governor State of Ohio
Laurie A. Stevenson, Director Ohio Environmental Protection Agency

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List of Definitions

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

Biovolume — The volume of cells in a unit volume of water. Biovolume is calculated to determine the relative abundance of co-occurring phytoplankton of varying shapes and sizes.

Blue-green algae — Common name for cyanobacteria, see definition below.

Cyanobacteria — Photosynthesizing bacteria, also called blue-green algae, which naturally occur in marine and fresh-water ecosystems and may produce cyanotoxins which at sufficiently high concentrations can pose a risk to public health.

Cyanotoxin — Toxin produced by cyanobacteria. These toxins include liver toxins, nerve toxins and skin toxins. Also sometimes referred to as algal toxin.

Cylindrospermopsin — A liver toxin produced by a number of cyanobacteria.

Detection —A result greater than the method reporting limit.

ELISA (Enzyme-Linked Immunosorbent Assay) — A rapid assessment method commonly used to detect microcystins, cylindrospermopsin, and saxitoxins.

Finished drinking water — Treated water ready for human consumption.

Extracellular — Located or occurring outside of a cell or cells.

HAB (harmful algal bloom) — A concentration of cyanobacteria that discolors the water, or a cell count greater than 4,000 cells/mL of cyanobacteria genera capable of cyanotoxin production (Shambaugh and Brines, 2003). Accumulations of cyanobacteria cells may be present at the water surface, at a defined depth, or throughout the water column.

Intracellular — Located or occurring within a cell or cells.

Microcystins — Liver toxins produced by a number of cyanobacteria. Total microcystins are the sum of all the variants/congeners (forms) of the cyanotoxin microcystin.

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.

Phytoplankton — free-floating photosynthesizing microscopic organisms that inhabit almost all bodies of water, and include cyanobacteria, diatoms, green algae and dinoflagellates.

qPCR — Quantitative polymerase chain reaction. Molecular technique for quantifying the presence of specific genetic material (DNA) in a sample.

Saxitoxins — Nerve toxins produced by a number of cyanobacteria.

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

Source water — Water used as a source for public drinking water.

Vicinity of intake — Area where there is a likelihood of contaminants being drawn into the intake (within 500 yards of the intake).

Executive Summary

The Public Water System (PWS) Harmful Algal Bloom Response Strategy provides guidelines on harmful algal bloom (HAB) monitoring and sampling protocols, identifies acceptable analytical methods, identifies cyanotoxin levels that will be used to make advisory decisions and recommends contingency planning for PWSs. The strategy has been updated annually since it was first created in 2011. As in years past, it includes several changes built upon the State's experience and knowledge in harmful algal blooms. Per Ohio Administrative Code (OAC) 3745-90-03(A)(3), the strategy sets forth reduced microcystins monitoring schedules and eligibility.

Numerical Cyanotoxin Thresholds for Drinking Water

The thresholds will be used to determine when a public health advisory will be issued for a detection of cyanotoxins in finished drinking water. In the 2020 PWS Response Strategy the 'Do Not Use' thresholds were removed, as these values are based on incidental ingestion during recreation and may not apply to other uses for drinking water. The numerical cyanotoxin thresholds for recreational waters are identified in the current Ohio HAB Response Strategy for Recreational Waters. The drinking water thresholds for anatoxin-a have been updated in the 2020 PWS Response Strategy based on a review of the reference dose values and to be consistent with tiered approach and ingestion assumptions used for other cyanotoxins. The child and adult drinking water thresholds for all other cyanotoxins remain unchanged and are as follows:

Drinking Water Thresholds*	Microcystins (µg/L)	Anatoxin-a (µg/L)	Cylindrospermopsin (µg/L)	Saxitoxins (µg/L)
Do Not Drink –children under 6, including bottle-fed infants	0.3	0.3	0.7	0.3
Do Not Drink –children 6 and older and adults	1.6	1.6	3.0	1.6

**Microcystins and saxitoxins thresholds are intended to be applied to total concentrations of all reported congeners/variants of those cyanotoxins.*

HAB Monitoring

Routine microcystins monitoring and cyanobacteria screening are required to be conducted by all surface water PWSs under OAC Rule 3745-90-03. The 2020 PWS response strategy continues the reduced monitoring provided in Schedules 2 and 3, and the options for reduced off-season monitoring provided in the 2019 PWS Response Strategy. Detection of saxitoxins or cylindrospermopsin production genes in the cyanobacteria screening sample will trigger follow-up cyanotoxin testing and additional sampling by Ohio EPA. In the 2020 PWS Response Strategy, Ohio EPA modified the response sampling for low-level detections of saxitoxins and cylindrospermopsin based a review of historical data. Ohio EPA will also provide assistance following detections under the U.S. EPA's Unregulated Contaminant Monitoring Rule (UCMR).

Analytical Methods

The analytical methods for cylindrospermopsin and saxitoxins were updated in 2020. Other analytical methods remain unchanged from the 2019 PWS Response Strategy. The analytical methods and reporting requirements for cyanobacteria screening and microcystins are described in OAC Rule 3745-90-04. Cyanobacteria screening will be conducted using a molecular quantitative polymerase chain reaction (qPCR) testing method (DES Method 705.0, Version 1.0, September 2018). Microcystins (DES Method 701.0, Version 2.3, July 2018), saxitoxins (DES Method 702.0, Version 2.1, April 2020) and

cylindrospermopsin (DES Method 703.0, Version 2.0, April 2020) are analyzed via ELISA-ADDA methods. Anatoxin-a will be analyzed using LC-MS/MS via U.S. EPA Method 545.

Response to Finished Water Threshold Exceedances

The response to finished water threshold exceedances remains unchanged from the 2019 PWS Response Strategy. The responses to microcystins threshold exceedances are detailed in OAC Rules 3745-90-03, 3745-90-05, and 3745-90-06.

Ohio EPA will conduct all response sampling for saxitoxins, cylindrospermopsin, or anatoxin-a threshold exceedances. If the water system chooses to conduct their own response sampling and follows the analytical methods outlined in the strategy, Ohio EPA may elect to not duplicate sampling. If a drinking water threshold for saxitoxins, cylindrospermopsin, or anatoxin-a is exceeded Ohio EPA will:

1) **Resample** the raw and finished water within 24 hours of being notified of the results. If the result of the resample is above the threshold in finished water, the PWS should notify all consecutive water systems as soon as practical and within three hours after receiving the resample result. Ohio EPA will analyze the raw water for both total and extracellular cyanotoxins and may also collect treatment train samples to help guide treatment optimization.
2) **Collect a repeat** set of raw and finished samples within 24 hours of collecting the resample.
3) **Coordinate** with the water system to collect distribution samples and samples at any satellite systems, if cyanotoxins are detected in the resample or repeat samples.

Ongoing sampling by Ohio EPA will depend on the results of the finished water samples.

Drinking Water Use Advisory

A drinking water use advisory will be issued based upon finished water detections of a cyanotoxin above the applicable threshold. Public notification for total microcystins threshold exceedances will be conducted in accordance with OAC Rule 3745-90-06. While the health advisories for microcystins and cylindrospermopsin are based on ten-day health advisory values, PWSs need to take actions to protect the public from exposures as soon as practicable. Ohio EPA will recommend the PWS issue a public notification, including health effects language and use restrictions, if thresholds for saxitoxins, cylindrospermopsin, or anatoxin-a are exceeded in resample and repeat sample results. Ohio EPA will evaluate a variety of site specific factors to determine if a public notice should be issued prior to a resample, after the resample results indicate a threshold exceedance, or until additional actions can be taken and additional sample results are available. If the PWS does not issue public notification as recommended, Ohio EPA may issue a drinking water use advisory in accordance with Ohio Revised Code (ORC) section 6109.06 or may require the PWS to issue public notification under the authority of OAC Rule 3745-81-32.

Proactive Measures

Ohio EPA encourages PWSs to be proactive and consider additional source water HAB monitoring, reservoir management practices, development of HAB treatment optimization protocols, and contingency planning. The PWS Response Strategy provides details on how these proactive measures can minimize the potential for finished water cyanotoxin threshold exceedances and help a water system respond effectively.

1 — Introduction

1.1 Purpose

The purpose of the PWS Harmful Algal Bloom (HAB) Response Strategy is to protect the public from cyanotoxins produced by cyanobacteria that may be in sources of drinking water at concentrations that can affect human health. Ohio's PWS Response Strategy identifies cyanotoxin levels that will be used to make use advisory decisions. It also provides monitoring guidelines and sampling protocols, identifies acceptable analytical methods, and recommends treatment optimization and contingency planning for PWSs. The PWS Response Strategy complements the HAB rules included in Chapter 3745-90 of the Ohio Administrative Code (OAC) and amended rules in Chapter 3745-89 of the OAC (laboratory certification).

A separate procedure for responding to harmful algal blooms on recreational waters, The State of Ohio Harmful Algal Bloom Response Strategy for Recreational Waters, is available online at ***ohioalgaeinfo.com***.

1.2 Cyanobacteria Causes of Concern

Cyanobacteria can produce a variety of cyanotoxins which can cause illness and death in humans and animals. These cyanotoxins include liver toxins, nerve toxins, and skin toxins. Some of the more common cyanotoxins detected in Ohio waters include microcystins and saxitoxins. Appendix A provides a summary of common cyanobacteria genera and associated cyanotoxins and taste and odor compounds. Cylindrospermopsin and anatoxin-a have also been detected, but much less frequently. The Ohio Departments of Health and Agriculture have received reports of probable human illness and dog deaths associated with exposure to cyanotoxins in Ohio. Symptoms of cyanotoxin exposure include nausea, skin rashes, gastro-intestinal distress, disorientation, numbness and fatigue. Many of these health symptoms can mimic other illnesses and diseases and therefore may not be readily recognized by the medical community or the public. Due to the potency of these cyanotoxins and no known antidotes, it is recommended that public health and other regulatory agencies take a conservative approach to limit human exposure to these cyanotoxins.

In addition to cyanotoxin production, cyanobacteria can cause other problems for PWSs. For example, excess organic load is a concern because chlorination of organic material can result in the production of disinfection byproducts (DBPs), including total trihalomethanes (TTHMs) and haloacetic acids (HAAs), which are carcinogens. Many cyanobacteria also produce the taste and odor compounds Geosmin and 2-Methylisoborneol (MIB) that affect drinking water palatability.

1.3 Cyanobacterial Blooms

Cyanobacteria are naturally occurring microorganisms that are found in most bodies of water. Under favorable conditions (nutrient availability, light, and sometimes warmer temperatures) cyanobacteria can multiply and create a bloom that may be visible to the naked eye. Cyanobacterial blooms generally occur in eutrophic or hypereutrophic water bodies. These are water bodies that receive excess nutrients, particularly nitrogen and phosphorus, that stimulate excessive plant growth.

Cyanobacterial blooms may vary in species composition and cyanotoxin production over time and within a water body. The distributions of cyanobacteria populations are affected by weather, 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 resulting from 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 (for example, dikes, piers, or intake towers) can affect population growth rates and cyanobacteria distribution.

Cyanobacteria can be found at the water surface (scums), at a particular depth (for example, *Planktothrix rubescens*), or can occur throughout the water column (for example, *Planktothrix spp*., *Cylindospermopsis spp*.). Strong winds, rainfall, currents, and lake turnover can all mix a surface algal bloom throughout the water column. Winds can also concentrate a surface algal bloom in calm leeward (downwind) areas such as a bay, cove, beach, or inlet. Some cyanobacteria are also capable of buoyancy regulation, and during calm non-mixed conditions can move vertically throughout the water column based on light and nutrient availability. These various factors, that can move a visible surface algal bloom below the surface or to a different portion of the lake or river, are important to understand because the absence of a surface algal bloom does not necessarily indicate an algal bloom is not present. If a surface algal bloom has dissipated, the bloom may not have senesced (died), but could have just moved to another area of the lake or mixed below the lake surface within the water column. In addition, some cyanobacteria do not form surface scums, so surface accumulations should not be relied on as the only indicator that an algal bloom is present.

It is important for PWSs to be familiar with their source waters and recognize changes that may be associated with a cyanobacterial bloom. Color is not necessarily a good way to distinguish cyanobacteria from green algae or suspended sediment. Cyanobacteria can appear in many colors that include brown, green, blue, and red. *Cylindrospermopsis spp*. blooms are generally brown and appear like suspended sediment. Other blooms are green and are mistaken for green algae. The best way to know for sure if cyanobacteria are present is through sampling.

Cyanotoxins can be found within cyanobacteria cells (intracellular) or free or dissolved (extracellular) in the water. Cyanotoxin production is cyanobacteria strain specific. Many cyanobacteria can produce one or several different types of cyanotoxins. Some cyanotoxins are comprised of multiple variants or congeners. Potential health effects are not known for all variants. Cyanotoxins are colorless and may persist in the water after a cyanobacterial bloom is gone. Cyanotoxins may degrade over time in the environment due to bacterial action and sunlight.

1.4 History of Strategy Development and Cyanotoxin Occurrence

Ohio became aware of HAB development in Ohio's lakes when the Ohio EPA participated in the U.S. EPA National Lakes Assessment. This survey included sampling for the cyanotoxin microcystins. In April 2009, the results of the 2007 National Lakes Assessment were released, showing that more than 36 percent of the 19 randomly selected Ohio lakes sampled had detectable levels of microcystins. This spurred development of a HAB response program to ensure public awareness and safety. The initial State of Ohio HAB Response Strategy was finalized in 2011. In 2012, the Ohio HAB Response Strategy was separated into a recreation response strategy and a PWS response strategy, to better distinguish the response at beaches and water supplies and clarify roles and expectations.

Since Ohio EPA began regularly sampling in 2010, microcystins have continued to be present in many of the water bodies used as sources of drinking water. Microcystins concentrations typically peak in August and September, although maximum microcystins concentrations at some PWSs have occurred as early as May and as late as December. In addition, some source waters experience microcystins year-round (see Figure 1).

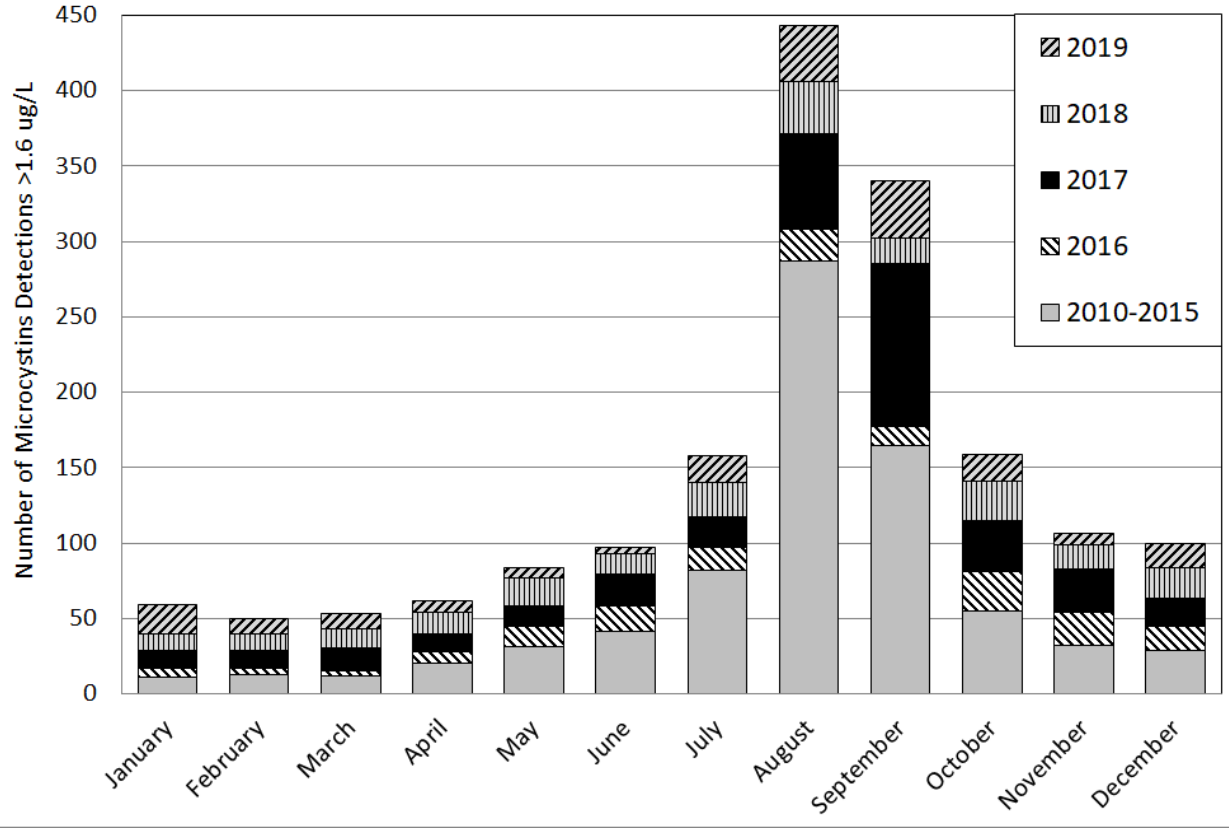
In 2015, the Ohio legislature passed Senate Bill 1, which directed Ohio EPA to protect against cyanobacteria in the western basin of Lake Erie and in public water supplies. This prompted the development of HAB monitoring, reporting, and treatment technique rules which became effective on June 1, 2016. Since those rules went into effect, microcystins have been detected in the raw water for 72 PWSs. Saxitoxin production genes have been detected in the raw water for 61 PWSs, and saxitoxins have been detected in the raw

water for 30 PWSs. Cylindrospermopsin production genes were detected in the raw water for five PWSs, and cylindrospermopsin was only detected at one PWS.

Ohio EPA reviewed the historical occurrence data for cylindrospermopsin and saxitoxins at PWS and revised the response sampling in 2020 PWS HAB Response Strategy based on this information. Cylindrospermopsin production genes were rarely detected in raw water at PWS. While saxitoxin production genes are more commonly detected in raw water at Ohio PWS, follow-up response sampling for saxitoxins were only detected at half the sites and typically only at low concentrations (below drinking water thresholds). The concentration of saxitoxins detected in finished water were all less than 0.15 µg/L, which is 50 percent of the drinking water threshold for children under six (0.3 µg/L), and 92 percent of saxitoxin detections in raw water had concentrations less than 0.15 µg/L. Based on this information, in 2020 Ohio EPA revised the response sampling for saxitoxins and cylindrospermopsin to reduce repeat sampling when concentrations are less than 50 percent of threshold in finished drinking water (see Section 3.2).

The State of Ohio continues to refine its PWS Response Strategy to provide a consistent and timely response to HABs in PWS source waters and ensure treatment technologies are effective at cyanotoxin removal. The state of the science of HABs and their related cyanotoxins is rapidly evolving and Ohio EPA will continue to update these guidelines as appropriate.

Figure 1. Frequency of Microcystins Detections > 1.6 ug/L in Public Water System Source Waters



1.5 Additional Information

Additional information about HABs can be found at ***ohioalgaeinfo.com.*** Information specific for PWS operators can be found at ***epa.ohio.gov/ddagw/HAB.aspx***.

2 — Cyanotoxin Toxicity Thresholds

2.1 Introduction

This section describes human health advisory levels for cyanotoxins in drinking water. In 2011, representatives from Ohio EPA, ODH and ODNR cooperatively developed cyanotoxin thresholds for microcystins, cylindrospermopsin, saxitoxins, and anatoxin-a that were adopted by the respective state agency directors. In May 2015, U.S. EPA released tiered health advisory levels for microcystins and cylindrospermopsin. These new levels were established after review of available toxicological information and were subjected to independent peer review. Ohio adopted the recommended U.S. EPA health advisory concentrations for microcystins and cylindrospermopsin and revised the saxitoxins threshold to be consistent with U.S. EPA's tiered approach and other state thresholds. In June 12016, the microcystins drinking water thresholds were formally adopted into OAC 3745-90-02 as action levels. In the 2020 PWS HAB Response Strategy, the drinking water thresholds for anatoxin-a were lowered based on a review of toxicity reference information and using the same tier structure and exposure assumptions consistent with all other cyanotoxins (see Section 2.3 and Appendix B). Additionally, the 'Do Not Use' values were removed from the drinking water thresholds, as these values are based on incidental ingestion while recreating and may not apply to other uses of drinking water (e.g., showering). When the 'Do Not Drink' values were first added to the Strategy in 2011, it was intended as a placeholder until studies could be completed on other routes of exposure that would allow Ohio to set a more appropriate value. In 2019, U.S. EPA published guidance for cyanotoxins in recreational waters with a review of direct (incidental ingestion) and indirect (such as inhalation, dermal) exposure routes for microcystins while recreating. U.S. EPA (2019) concluded that the indirect dose can be substantially lower than the incidental ingestion dose during recreational activities and further noted that more research is needed on indirect exposure to microcystins (no data for other cyanotoxins). At this time, there remains a lack of information on the non-drinking water exposures (e.g., inhalation or dermal) for the four cyanotoxins to set protective values and to warrant keeping the 'Do Not Use' thresholds.

2.2 Numerical Cyanotoxin Thresholds for Drinking Waters

Table 1. Ohio Numerical Cyanotoxin Thresholds for Drinking Water

Drinking Water Thresholds*	Microcystins (µg/L)	Anatoxin- a (µg/L)	Cylindrospermopsin (µg/L)	Saxitoxins (µg/L)
Do Not Drink – children under 6 and sensitive populations	0.3	0.3	0.7	0.3
Do Not Drink – children 6 and older and adults	1.6	1.6	3.0	1.6

**The microcystins and saxitoxins thresholds are intended to be applied to total concentrations of all reported congeners/variants. Ohio EPA will also consider established saxitoxin toxicity equivalency factors when determining if a threshold has been exceeded (see Appendix B).*

The U.S. EPA health advisories for microcystins and cylindrospermopsin indicate that pregnant women, nursing mothers, those receiving dialysis treatment, the elderly, and immuno-compromised individuals may be more susceptible than the general population, and recommends these individuals may want to consider following the recommendations for children under six years old. In order to be protective, Ohio has included pregnant women, nursing mothers, and those receiving dialysis treatment in the do not drink category for children for all cyanotoxins. Ohio has also added those with pre-existing liver conditions to the do not drink category for children for the microcystins and cylindrospermopsin advisories only. Ohio

concurs with the recommendation that elderly and immunocompromised individuals may want to consider following the recommendations for children.

In response to the high occurrence of microcystins in sources of drinking water, microcystins ability to break through treatment, and the establishment of national health advisories for microcystins, Ohio EPA adopted the thresholds for microcystins as action levels under OAC Rule 3745-90-02. Action levels for cylindrospermopsin were not established in rule due to the low historic occurrence of cylindrospermopsin in Ohio. Action levels were not established for saxitoxins or anatoxin-a due in part to a lack of an established national health advisory for those two cyanotoxins.

2.3 Basis for Cyanotoxin Thresholds

U.S. EPA's national health advisories for microcystins and cylindrospermopsin were established for a short-term (10-day) exposure. While based on a 10-day exposure, U.S. EPA guidance recommends that PWSs act as soon as possible if a threshold is exceeded. This means, based on specific circumstances, a PWS may have some limited time to adjust treatment or take other actions to prevent exposures prior to issuing an advisory. More information on the basis for the health advisories is available at ***epa.gov/sites/production/files/2017-06/documents/microcystins-report-2015.pdf***.

Ohio EPA established drinking water thresholds for anatoxin-a and saxitoxins based on a review of available toxicological studies and guidance documents, and in consultations with other states. The toxicity value for saxitoxins was based on documented acute intoxications in humans following ingestion of seafood containing saxitoxins (EFSA 2009). The toxicity value for anatoxin-a was based on a subchronic exposure study, and threshold values were updated in the 2020 PWS HAB Response Strategy to reflect current information. To be consistent with the tiered health advisories established by U.S. EPA for microcystins and cylindrospermopsin, tiered thresholds were established for both child and adult exposure for anatoxin-a and saxitoxins. The thresholds were calculated based on the same exposure assumptions used to calculate the microcystins and cylindrospermopsin health advisory concentrations.

More details on reference values, exposure assumptions, and calculations for cyanotoxin thresholds are provided in Appendix B.

3 — Monitoring Strategy

3.1 Microcystins Monitoring and Cyanobacteria Screening

Routine microcystins monitoring and cyanobacteria screening are required to be conducted by all surface water PWSs under OAC Rule 3745-90-03. The analytical methods and reporting requirements are described in OAC Rule 3745-90-04. Sample collection procedures are outlined in Section 6. The cyanobacteria screening required under OAC Rule 3745-90-03 utilizes a molecular quantitative polymerase chain reaction (qPCR) testing method to identify and quantify the presence of cyanobacteria in a water sample (16S gene) and the presence of toxin-production genes for microcystins (mcyE gene), cylindrospermopsin (cyrA gene), and saxitoxin (sxtA gene). Molecular screening methods can distinguish between strains of cyanobacteria that are capable of toxin-production from those that are not. This gives molecular methods an advantage over microscopic identification of cyanobacteria. However, the molecular screening method used by Ohio EPA cannot distinguish between live and dead cells, moreover, the presence of a cyanotoxin gene does not mean the cyanotoxin is present in water. Ohio EPA will use the results of the screening data to help target response sampling for cylindrospermopsin and saxitoxins.

In accordance with OAC 3745-90-03(A)(3), Ohio EPA has proposed reduced monitoring schedules. To be eligible for monitoring reductions, systems must have two consecutive weeks with no microcystins detection in raw or finished water. The schedules are consistent with reduced monitoring schedules established in the 2018 HAB Response Strategy for the May through end of October monitoring season. Additional reduced monitoring options for the November through end of April monitoring season are described in Table 2. Water systems are assigned to Schedules 1, 2, or 3 based on microcystins occurrence and an evaluation of treatment effectiveness for microcystins. Only PWSs with sources considered ground water under the direct influence of surface water (ground water well sources; GWUDI) with no historic microcystins or saxitoxins detections, no sxtA or mcyE detections, and low 16S results are eligible for Schedule 3 (biweekly qPCR screening only). Sampling triggers and HAB monitoring implementation notes are included on Table 3. Please note, there is an option for Schedule 2 and 3 PWSs that are transitioned to Schedule 1 during the May through October monitoring season to request a transition to Schedule 2 if microcystins cease to be detected for four consecutive weeks (see Table 3). Only consecutive water systems receiving water from an out-of-state surface water source are assigned to Schedule 4. The PWS microcystins schedule assignments are available on Ohio EPA's website at ***epa.ohio.gov/ddagw/HAB.aspx***. The website also contains links to a list of Ohio PWS lakes and Ohio PWS Station IDs to identify sample locations when reporting results to Ohio EPA.

A list of on-demand labs certified by Ohio EPA to conduct microcystins analysis and/or qPCR cyanobacteria screening is available at ***epa.ohio.gov/Portals/28/documents/habs/Lab_Information_final.pdf***

Table 2. Microcystins and Cyanobacteria Screening Monitoring Requirements

Schedule	PWS Criteria	HAB Season Monitoring Requirements[a] (start first FULL week of May)	Off-season HAB Monitoring Requirements[a,b,c] (start first FULL week of November)
1	Historic microcystins detections in finished drinking water; OR High source water susceptibility (more than two historic microcystins detections greater than 1.6 µg/L in raw water since 6/15/15) and either: Pre-oxidizes with chlorine or chlorine dioxide and has limited down-stream processes to address extracellular microcystins[d] **OR** Has no advanced treatment processes in place[e]	Biweekly qPCR screening **AND** Weekly raw/finished microcystins (paired with biweekly screening sample)	Biweekly raw water microcystins **OR** Biweekly qPCR screening
2	PWSs that do not meet the criteria for Schedule 1, 3, or 4	Biweekly qPCR screening **AND** Biweekly raw water microcystins (collected on alternate week of screening sample, not paired)	Biweekly raw water microcystins **OR** Biweekly qPCR screening
3	PWSs with ground water well source considered ground water under the influence of surface water with no historic microcystins or saxitoxins detections, no sxtA or mcyE detections, and low 16S	Monthly qPCR screening	Monthly qPCR screening **OR** Monthly microcystins monitoring
4	Consecutive water systems receiving water from an out-of-state surface water source.	Weekly finished water microcystins	Biweekly finished water microcystins

[a] *See monitoring requirement implementation (Table 3). Microcystins or gene detections may trigger additional sampling requirements. Systems must have two consecutive weeks with no microcystins detection in raw or finished water to be eligible for monitoring reductions. During transitions periods, eligibility will be based on microcystins results from the two weeks prior the start of HAB season (first full week of May) and off-season (first full week of November).*

[b] *During off-season (November through May), PWSs sampling for total microcystins may discontinue qPCR screening.*

[c] *Water systems must notify Ohio EPA of preference for microcystins or qPCR monitoring two weeks prior to start of off-season monitoring period and must maintain sampling for specified parameter throughout entire off-season.*

[d] *Some PWSs that met the criteria for Schedule 1 were moved to Schedule 2 if monitoring data demonstrated the PWS currently has the capacity to effectively remove/destroy microcystins. For example, PWSs with historic finished water microcystins detections that have since upgraded or optimized treatment and demonstrated they are capable of treating higher concentrations of microcystins (without repeat finished water detections) are on Schedule 2.*

[e] *Advanced treatment is treatment beyond conventional coagulation, sedimentation, filtration, and chlorine disinfection that has capacity to remove or destroy extracellular microcystins.*

Table 3. HAB Monitoring Sampling Triggers and Implementation Notes

Microcystins and Cyanobacteria Screening Monitoring Requirements **HAB Season (First FULL week of May through October)**		
Schedule	**Monitoring Requirements**	**Additional Sampling Triggers**
1	Biweekly qPCR screening; AND Weekly raw/finished microcystins (paired with biweekly screening sample)	Increased monitoring would be triggered by finished water microcystins detections or raw water detections greater than 5 µg/L (see "All Schedules," below).
2	Biweekly qPCR screening; AND Biweekly raw water microcystins collected on alternate week of qPCR screening (not paired)	**If microcystins are detected in the raw water:** • PWS must collect raw and finished water sample within 24 hours of receiving the result and complete analysis within five days. If PWS voluntarily collected a paired finished water sample with their initial raw water sample, an additional set of raw and finished samples is not required until the following week unless raw is greater than 5 µg/L or a finished water detection triggers more immediate sampling (see "All Schedules" below). • PWS will be changed to Schedule 1 requirements for the remainder of the season. If the PWS has at least four consecutive weeks of non-detect microcystins sampling results, and mcyE is less than 5 gene counts/µL during that same time period, the PWS can send an e-mail to their HAB coordinator requesting a transition back to schedule 2 monitoring. **If mcyE are detected in raw water greater than 5 gene copies/µL:**

		• PWS must collect raw/finished water microcystins sample within 24 hours of receiving the result and complete analysis within five days. • If microcystins are not detected, the PWS will remain on Schedule 2 monitoring requirements. • If microcystins are detected in either the raw or finished water, the PWS will be changed to Schedule 1 monitoring requirements for the remainder of the season. If the PWS has at least four consecutive weeks of non-detect microcystins sampling results, and mcyE is less than 5 gene counts/µL during that same time period, the PWS can send an e-mail to their HAB coordinator requesting a transition back to schedule 2 monitoring.
3	Monthly qPCR screening	**If mcyE genes are detected:** • PWS must collect raw and finished water microcystins sample within 24 hours and complete analysis within five days. • If microcystins are not detected (only mcyE genes are detected), PWS transitions to Schedule 2 monitoring. • If microcystins are detected in the raw or finished water, the PWS will switch to Schedule 1 monitoring for remainder of the season. If the PWS has at least four consecutive weeks of non-detect microcystins sampling results, and mcyE is less than 5 gene counts/µL during that same time period, the PWS can send an e-mail to their HAB coordinator requesting a transition to schedule 2 monitoring.
4	Weekly finished water microcystins	Increased monitoring would be triggered by finished water microcystins detections (see "All Schedules," below).
	If sxtA or cyrA genes are detected in the raw water: • PWS must notify Ohio EPA no later than the end of the next business day per OAC Rule 3745-89-08. Ohio EPA also recommends written or verbal results be communicated as soon as possible to ensure timely Ohio EPA follow up.	

All Schedules	**If microcystins are detected in raw water greater than 5 µg/L:** • PWS must begin sampling raw/finished water microcystins three days per week beginning no later than the week following the receipt of the results in exceedance. • PWS may resume routine monitoring (Schedule 1) if ALL the following occur: o Raw water microcystins concentrations are less than or equal to 5 µg/L in two consecutive samples collected at least one day apart. o Microcystins are not detected in finished water and not detected in distribution samples (if collected) during that same time period. **If microcystins are detected in finished water or distribution samples (reported value ≤0.3-0.34 µg/L):** • PWS must begin sampling raw/finished water microcystins daily and complete analysis within 24 hours of sample collection beginning the day after receiving results. • PWS may resume routine monitoring (Schedule 1) if microcystins are not detected in two consecutive finished water daily samples AND raw water microcystins are less than or equal to 5 µg/L during that same time period • PWS may transition to raw/finished water sampling three days per week as outlined above if microcystins are not detected in two consecutive finished water daily samples AND raw water microcystins are greater than 5 µg/L in either of the samples during that same time period. **If microcystins are detected in finished water greater than 0.3 µg/L (reported value ≥0.35 µg/L):** • All the conditions described above for finished water detections apply. • PWS must collect one resample of raw/finished water within 24 hours of action level exceedance and collect an additional repeat sample of raw/finished water within 24 hours of resample. Analysis must be completed within 24 hours in each case. Resamples and repeats satisfy daily sampling requirements outlined above. • If microcystins are greater than 0.3 µg/L in either resample or repeat, PWS must notify all consecutive systems within three hours of receiving results. PWS and consecutive systems must, within 24 hours of receiving results, collect samples from representative distribution points established in the contingency plan and complete analysis within 24 hours. Additional distribution sampling may be required.

Microcystins and Cyanobacteria Screening Monitoring Requirements **HAB Off-season (First FULL week of November through April)**		
Schedule	**Monitoring Requirements**	**Additional Sampling Triggers**
1 & 2	Biweekly qPCR screening; OR Biweekly raw water microcystins	**If microcystins are detected in the raw water:** • PWS must collect raw and finished water sample within 24 hours of receiving the result and complete analysis within five days. If PWS voluntarily collected a paired finished water sample with their initial raw water sample, an additional set of raw and finished samples is not required until the following week unless raw is greater than 5 µg/L or a finished water detection triggers more immediate sampling (see "All Schedules" below). • PWS will continue with weekly paired raw and finished water microcystins monitoring until non-detect for at least two consecutive weeks, then PWS is eligible to return to off-season monitoring Schedule 1/2. **If mcyE are detected in raw water:** • PWS must collect raw/finished water microcystins sample within 24 hours of receiving the result and complete analysis within five days. • If microcystins are not detected, the PWS will remain on reduced off-season monitoring Schedule 1/2. • If microcystins are detected in either the raw or finished water, the PWS continues with weekly raw/finished microcystins monitoring and biweekly qPCR screening until microcystins are non-detect for at least two consecutive weeks, and then PWS is eligible to return to off-season monitoring Schedule 1/2.

<table>
<tr><td>3</td><td>Monthly qPCR screening

OR

Monthly raw water microcystins</td><td>If mcyE genes are detected:
PWS must collect raw/finished water microcystins sample within 24 hours and complete analysis within five days. If PWS collected a paired finished water sample with their initial raw water sample, an additional raw and finished water sample is not required until the following week.
If microcystins are detected in the raw or finished water, the PWS will continue with weekly paired raw and finished water microcystins monitoring until non-detect for at least two consecutive weeks, then transition to off-season Schedule 1/2 monitoring.
If only mcyE genes are detected (microcystins are not detected), PWS transitions to off-season Schedule 1/2 monitoring.
If sxtA or cyrA genes are detected in the raw water;
TPWS transitions to off-season Schedule 1/2 biweekly qPCR monitoring.</td></tr>
<tr><td>4</td><td>Biweekly finished water microcystins</td><td>Increased monitoring would be triggered by finished water microcystins detections (see “All Schedules,” below).</td></tr>
<tr><td>All Schedules</td><td colspan="2">If sxtA or cyrA genes are detected in the raw water:
PWS must notify Ohio EPA no later than the end of the next business day per OAC Rule 3745-89-08. Ohio EPA also recommends written or verbal results be communicated as soon as possible to ensure timely Ohio EPA follow up.
If microcystins are detected in raw water greater than 5 µg/L:
PWS must begin sampling raw/finished water microcystins three days per week beginning no later than the week following the receipt of the results in exceedance of 5 µg/L.</td></tr>
</table>

	• PWS may resume routine monitoring (Schedule 1) if ALL the following occur: o Raw water microcystins concentrations are less than or equal to 5 µg/L in two consecutive samples collected at least one day apart. o Microcystins are not detected in finished water and not detected in distribution samples (if collected) during that same time period. **If microcystins are detected in finished water or distribution samples (reported value ≤0.3-0.34 µg/L):** • PWS must begin sampling raw/finished water microcystins daily and complete analysis within 24 hours of sample collection beginning the day after receiving results. • PWS may resume routine monitoring (Schedule 1) if microcystins are not detected in two consecutive finished water daily samples AND raw water microcystins are less than or equal to 5 µg/L during that same time period • PWS may transition to raw/finished water sampling three days per week as outlined above if microcystins are not detected in two consecutive finished water daily samples AND raw water microcystins are greater than 5 µg/L in either of the samples during that same time period. **If microcystins are detected in finished water greater than 0.3 µg/L (reported value ≥0.35 µg/L):** • All the conditions described above for finished water detections apply. • PWS must collect one resample of raw/finished water within 24 hours of action level exceedance and collect an additional repeat sample of raw/finished water within 24 hours of resample. Analysis must be completed within 24 hours in each case. Resamples and repeats satisfy daily sampling requirements outlined above. • If microcystins are greater than 0.3 µg/L in either resample or repeat, PWS must notify all consecutive systems within three hours of receiving results. PWS and consecutive systems must, within 24 hours of receiving results, collect samples from representative distribution points established in the contingency plan and complete analysis within 24 hours. Additional distribution sampling may be required.

3.2 Cylindrospermopsin and Saxitoxins Sampling

Ohio EPA will review all cyanobacteria screening data and conduct follow-up sampling for cylindrospermopsin or saxitoxins when the cylindrospermopsin or saxitoxin production genes are detected. Ohio EPA can provide additional sampling and technical assistance at the request of a PWS in response to cyanotoxin gene and cyanotoxin detections. For example, a PWS may use an avoidance strategy after cyanotoxin gene and/or cyanotoxins are initially detected, and additional raw water samples of the off-line source water may help inform when the source can return to service. In the 2020 PWS HAB Response Strategy, Ohio EPA reviewed historical occurrence data for cylindrospermopsin and saxitoxins and revised the response sampling based on occurrence data. The response sampling for detections in raw and finished water at concentrations below drinking water thresholds are tiered based on concentration and percentage of drinking water threshold (Table 4).

Table 4. Select Concentrations for Cylindrospermopsin and Saxitoxins Response Sampling.

	Cylindrospermopsin (µg/L)	Saxitoxins* (µg/L)
Method Reporting Limit	0.05	0.02
15 Percent of Threshold	0.11	0.05
50 Percent of Threshold	0.35	0.15
Do Not Drink Threshold, Children under 6 and sensitive populations	0.7	0.3

**Saxitoxins thresholds are intended to be applied to total concentrations of all reported congeners/variants. Ohio EPA will also consider established saxitoxin toxicity equivalency factors when determining if a threshold has been exceeded (see Appendix B)*

For cyanotoxin gene detections the response is as follows:

If cylindrospermopsin or saxitoxin genes are detected in raw water and Ohio EPA does not have access to the cyanobacteria screening sample for cyanotoxin analysis, Ohio EPA will conduct follow-up raw and finished water monitoring as soon as is practical and no later than five business days following notification of the gene detection. Details on sample handling, including safety considerations, containers, preservatives, labeling, and paperwork are included in Section 6. Ohio EPA will conduct the sampling and analysis unless the water system is conducting sampling and analysis in accordance with this strategy.

If cyanotoxins are not detected in the initial sampling described above, Ohio EPA will review the screening results from the next sampling event and use that information to decide if ongoing cyanotoxin sampling is necessary. As a preliminary guide, if cyanotoxin production gene copies remains less than 0.5 gene copies/µL since the prior sampling event, additional response sampling may not be necessary. If the number of cyanotoxin production gene copies in the next routine cyanobacteria screening sample is greater than or equal to 0.5 gene copies/µL or shows a substantial increase, Ohio EPA will analyze the screening sample for cyanotoxins or collect another raw and finished water sample set, if necessary.

For cyanotoxin results in raw water only (not detected in finished water) the response is as follows:

If cylindrospermopsin or saxitoxins are detected at concentrations less than the threshold in raw water (non-detect in finished water), cyanotoxin sampling in the raw and finished water will continue weekly until cyanotoxins are less than 50 percent of the cyanotoxin thresholds in two consecutive weekly sampling events in raw water and cyanotoxins are not detected in the finished water. If treatment has been proven to be consistently effective at cyanotoxin removal, Ohio EPA may consider decreasing sampling and/or analysis frequency.

For cyanotoxins detected in finished water (below drinking water threshold) the response is as follows:

If cylindrospermopsin or saxitoxins are detected in the finished water at less than 15 percent of threshold, weekly sampling for raw and finished water will continue until cyanotoxins are less than 50 percent of the threshold in raw water in two consecutive weekly sampling events and are not detected in the finished water.

If cylindrospermopsin or saxitoxins are detected in the finished water at concentrations between 15 percent and 50 percent of the thresholds, collect a raw and finished water sample for cyanotoxin analysis within 24 hours of receiving the results. If the follow-up sample remains less than 50 percent of the threshold in finished water, cyanotoxin sampling and analysis will continue in the raw and finished water weekly until cyanotoxins are less than 50 percent of the threshold in raw water in two consecutive weekly sampling events and are not detected in the finished water. Ohio EPA may conduct additional cyanotoxin sampling including weekly sampling when finished water concentrations are between 15 percent and 50 percent of threshold based on additional information.

If saxitoxins or cylindrospermopsin are detected in the finished water at greater than 50 percent of the thresholds (but less than the threshold), sampling frequency will increase to daily. In addition, an extra set of raw and finished water samples will be collected and submitted to an independent lab for LC-MS/MS analysis (See 3.2.1). Daily sampling will continue until concentrations decrease to less than 50 percent of the threshold in two consecutive days of sampling or conditions stabilize below the threshold. At that point, sampling can decrease according to the tiered response outlined above.

The response protocol for responding to finished water detections at concentrations above thresholds is presented in Section 4.

3.2.1 Analytical Methods for Cylindrospermopsin and Saxitoxins

This section describes the analytical methods Ohio EPA will utilize. Ohio EPA will continue to evaluate new analytical methods and refine this strategy based on the best information available.

PWSs conducting their own monitoring are requested to submit the results of analyses to Ohio EPA. If the PWS uses an accepted quantitative analysis method listed below, follows recommended sample handling and preservation procedures, and submits the results to Ohio EPA in a timely manner, then Ohio EPA may elect not to duplicate sampling.

Cylindrospermopsin

Ohio EPA utilizes the ELISA method for the detection of cylindrospermopsin. Ohio EPA DES developed an SOP that outlines sample collection and handling procedures and quality assurance measures for the ELISA cylindrospermopsin method (DES Method 703.0, Version 2.0 April 2020). Ohio EPA will conduct additional analysis using a LC- MS/MS method following any ELISA finished water cylindrospermopsin detections that are greater than 50 percent of the cylindrospermopsin threshold.

Saxitoxins

Ohio EPA utilizes the ELISA method for the detection of saxitoxins. The Ohio EPA DES developed an SOP that outlines sample collection and handling procedures and quality assurance measures for the ELISA saxitoxins method (DES Method 702.0, Version 2.1 April 2020). Saxitoxin is comprised of multiple variants, but unlike microcystins, the ELISA method used to detect it is not capable of detecting total saxitoxins. The saxitoxins ELISA method is not based on detection of a structure common to all saxitoxin variants, and may underreport total saxitoxins. Therefore, Ohio EPA will conduct additional analysis using an alternate LC-MS/MS method for detection of saxitoxin variants following an initial ELISA finished water saxitoxins detection that is greater than 50 percent of the saxitoxins threshold.

3.3 Anatoxin-a Sampling and Analytical Method

A commercial molecular screening tool for anatoxin-a is currently not available. Ohio EPA will limit sampling to the following circumstances:

1) At the request of a PWS in response to a HAB on a source water that is capable of producing anatoxin-a (based on phytoplankton identification and enumeration) and
2) At the request of the Ohio Department of Health or a local health district in response to a potential animal death or human illness that could be linked to anatoxin-a or
3) Following a UCMR 4 anatoxin-a detection (see Section 3.5 below).

Ohio EPA is utilizing LC-MS/MS method for detection of anatoxin-a. U.S. EPA Method 545 has been developed for the quantitation of anatoxin-a in finished water. Additional LC-MS/MS methods can detect anatoxin-a and at least six of the anatoxin-a variants in both finished and source water samples.

3.4 Posting Data to Ohio EPA Website

The data from raw and finished water cyanotoxin samples collected by Ohio EPA or collected by PWSs in accordance with OAC Rule 3745-90-03 will be posted at ***epa.ohio.gov/ddagw/HAB.aspx***. Data from additional voluntary raw and finished water sampling reported to Ohio EPA by the PWS will also be posted on Ohio EPA's website.

3.5 Unregulated Contaminant Monitoring Rule 4 Cyanotoxin Monitoring

All surface water designated PWSs with a population greater than 10,000 and a select number of surface water systems with a population less than 10,000 are required to collect finished water samples for cylindrospermopsin, microcystins, and anatoxin-a analysis under U.S. EPA's UCMR 4. PWSs are encouraged to notify Ohio EPA of any finished water cyanotoxin detections as soon as possible to coordinate follow up sampling, if necessary. Although Ohio EPA has access to the UCMR 4 results database, there is often a delay from when a PWS is notified of results by the lab that conducted the analysis and when results are available to Ohio EPA in the database. Federal rules require PWSs to include all UCMR4 finished water cyanotoxin detections in the PWS's Consumer Confidence Report. If requested, Ohio EPA HAB staff may provide assistance to PWS to properly describe UCMR cyanotoxin detections in the CCR.

If cylindrospermopsin or anatoxin-a are detected at concentrations greater than Ohio thresholds, Ohio EPA will conduct follow-up sampling as outlined in Section 4. Ohio EPA may also conduct anatoxin-a and/or cylindrospermopsin sampling if concentrations of these cyanotoxins are elevated and there is concern they could be increasing.

If microcystins are detected above the Ohio EPA child microcystins threshold (0.3 µg/L) in a UCMR 4 sample and the system has been collecting routine finished water microcystins compliance samples (not on reduced monitoring), additional response sampling may not be necessary. If compliance finished water microcystins samples were not collected following the UCMR 4 finished water microcystins detection, Ohio EPA will require the water system to collect repeat paired raw and finished water samples immediately and return to routine microcystins monitoring, as specified under OAC Chapter 3745-90.

In 2018 and 2019, 86 PWSs collected samples for cyanotoxins as part of UCMR 4. Total microcystins and cylindrospermopsin were not detected in any samples. Anatoxin-a was detected at 3 PWS entry points, all follow-up samples were non-detect.

Questions on UCMR 4 monitoring can be directed to U.S. EPA's UCMR 4 sampling coordinator at ***UCMR_sampling_coordinator@epa.gov***. More information about UCMR 4 monitoring is available at ***epa.gov/dwucmr/fourth-unregulated-contaminant-monitoring-rule***.

3.6 Ohio EPA Coordination with PWSs

Ohio EPA DDAGW district office staff will be the primary points of contact for communication with PWSs to provide technical assistance, obtain status updates, screening or sampling results and to collect samples. They will also provide results of Ohio EPA sampling to the PWS. Staff in the Central Office Emerging Contaminants Section will provide additional assistance, as needed.

4 — Response to Finished Water Threshold Exceedances

This section outlines the steps that will be taken in response to a finished water saxitoxins, cylindrospermopsin or anatoxin-a detection above an Ohio threshold. The responses to microcystins threshold exceedances are detailed in OAC Rules 3745-90-03, 3745-90-05, and 3745-90-06. This response protocol is written assuming Ohio EPA will conduct all cyanotoxin analyses, with the exception of microcystins analysis, which is covered under rule. If a water system conducts their own analysis using an accepted method outlined in Sections 3.2.1 and 3.3, they may choose to conduct their own resample and repeat sample analysis (steps 1 and 2) as outlined below. Ohio EPA should still be notified immediately of any finished water detections above thresholds. If information is shared in a timely manner, Ohio EPA may not duplicate analysis.

4.1 Sampling

If cylindrospermopsin, saxitoxins, or anatoxin-a are detected in the finished water above the thresholds (Section 2.2), the following steps will be taken:

1) **Resample.** Two sets of samples (two finished and two raw) will be collected by Ohio EPA within 24 hours of being informed of the initial sample results. One set will be transported to Ohio EPA DES (or an Ohio EPA designated laboratory) for analysis and the other set will be shipped to a commercial lab for LC-MS/MS analysis. If the result of the resample sample is above the threshold in finished water, the PWS should notify all consecutive water systems as soon as practical and within three hours after receiving the resample sample result.
    a) Treatment Train Sampling - Treatment train samples may also be collected to provide additional information on how to best optimize for cyanotoxin destruction/removal.
    b) Raw Water Analysis - The raw water resample will be analyzed for both intracellular and extracellular cyanotoxins, to help guide treatment optimization.
2) **Repeat.** Two additional sets of samples (two finished and two raw) will be collected within 24 hours of collecting the resample. One set will be delivered to Ohio EPA DES (or an Ohio EPA designated laboratory) for analysis and the second set will be shipped to a commercial lab for LC-MS/MS analysis (the second set will be collected and shipped to a commercial lab for LC-MS/MS analysis only if the finished water detection in the resample was greater than 50 percent of the threshold.)
3) **Distribution Sampling.** If cyanotoxins are detected above the threshold in either the Resample or Repeat finished water sample, the PWS should immediately coordinate with Ohio EPA concerning collection and analysis of samples within the distribution system and at any satellite systems. If cyanotoxins are not detected above Ohio EPA thresholds within all the portions of the distribution system or at satellite system locations, the water system may be able to isolate impacted areas of the distribution and limit the extent of a drinking water advisory. Water systems are requested to

address distribution modeling and sampling in their contingency plans and identify appropriate sampling locations in advance, as outlined in Section 7.

Ongoing sampling by Ohio EPA depends on the results of the finished water samples, as follows:

- If cylindrospermopsin or saxitoxins are detected in the finished water at concentrations less than 50 percent of the thresholds, sampling frequency will decrease to weekly.
- If cylindrospermopsin or saxitoxins are detected in the finished water at greater than 50 percent of the thresholds, daily sampling will continue until concentrations decrease to less than 50 percent of the threshold in two consecutive days of sampling. At that point, sampling can decrease to weekly.
- If cyanotoxins are detected in the finished water samples at concentrations above Ohio EPA thresholds, daily sampling and analysis will continue until cyanotoxins are no longer detected at concentrations greater than 50 percent of the threshold in the finished water in two consecutive sampling events. Distribution sampling will also be conducted as outlined under Step 2. Sampling frequency can then decrease, depending on results of distribution samples, cyanotoxin concentrations in the raw water, status of treatment, and other factors.

4.2 Applicable Regulations and Guidelines

- ORC § 6109.12: PWS Analysis
- ORC § 6109.06: Water Use Advisory
- OAC Rule 3745-81-32: Public Notification

4.3 Drinking Water Use Advisories and Public Notification

The decision to issue a drinking water use advisory will be based upon detections of a cyanotoxin above thresholds in finished water. While the thresholds for microcystins and cylindrospermopsin are based on the ten-day health advisories established by U.S. EPA, PWSs need to take actions to protect the public from exposures as soon as practicable.

Ohio EPA will recommend the PWS issue a public notification, including health effects language and use restrictions, if thresholds continue to be exceeded in the repeat sample results. Public notice templates are included in Appendix C.

Ohio EPA will evaluate a variety of site specific factors to determine if a public notice should be issued earlier, after the resample results indicate a threshold exceedance, or if conditions are such that the issuance can be delayed until additional actions can be taken and additional repeat sample results are available. The following factors will be considered by Ohio EPA when deciding the timing of public notification:

- What type of cyanotoxin is present?
- When was the last finished water sample collected that was non-detect for cyanotoxins?
- How high are the cyanotoxin concentrations detected? Higher concentration may warrant at least an advisory for sensitive populations.
- Does the PWS have enhanced cyanotoxin treatment capability or an alternative source of water?
- What are the current raw water cyanotoxin concentrations? Are there indications raw water conditions are improving?

In limited circumstances, based on the factors described above, the recommendation to issue an advisory may be delayed until additional daily sampling results are available. The delay would provide additional time for the water system to optimize treatment, yet still be protective of public health given the 10-day

health advisory for cylindrospermopsin and subchronic exposure assumptions for anatoxin-a. Informing the public of current conditions and efforts underway would still be conducted.

4.3.1 Public Notice Procedure

Public notification for total microcystins will be conducted in accordance with the provisions contained in OAC Rule 3745-90-06. Public notification for all other toxins should be conducted in accordance with the provisions contained in OAC Rule 3745-81-32. Any public notification that needs to be modified from the guidelines and templates presented in Appendix C will be coordinated with ODH.

If public notification is recommended, Ohio EPA will call the PWS to discuss issuing an immediate Tier 1 public notice informing all customers of the situation. A public notice template will be provided containing the appropriate health effects language and use restrictions.

If the PWS does not issue public notification as recommended, Ohio EPA may issue a drinking water use advisory in accordance with ORC section 6109.06, or may require the PWS to issue public notification under the authority of OAC Rule 3745-81-32.

The use drinking water restrictions may be modified, based on sampling results and other factors, after consultation with the director. For example, a decrease in finished water cyanotoxin concentrations could warrant transitioning from an advisory for the entire population to a more limited advisory for children pre-school age and younger. This change will require additional public notification.

4.3.2 Limiting Extent of Public Notice

The geographic area under public notification may be limited based on distribution sample results and provisions described in the system's written contingency plan (in accordance with OAC Rule 3745-85), after consultation with the director. Distribution sampling results may also be a consideration when modifying use restrictions or lifting the advisory.

4.3.3 Public Notice Templates

Eight public notice templates are included in Appendix C:

- **drinking water advisories** for exceeding the microcystins, saxitoxins and cylindrospermopsin preschool age children and younger exposure thresholds;
- **do not drink** advisories for exceeding the microcystins, saxitoxins and cylindrospermopsin school age children and adult thresholds; and

4.3.4 Alternative Water Supply

In the event a public notification is required with use restrictions for any population, the PWS is requested to provide a supply of alternate emergency water for their consumers.

4.3.5 Lifting the Advisory

The PWS may end issuance of public notification when the cyanotoxin levels are below the drinking water thresholds in two consecutive sampling events collected a minimum of 24 hours apart and after consultation with the director on distribution monitoring, raw water quality, treatment optimization, and other extenuating factors.

4.3.6 Consumer Confidence Report (CCR)

If microcystins action levels are exceeded in daily, resample, repeat sample, or distribution samples, the range of levels detected and highest single microcystins concentration measured must be included in the community's consumer confidence report (OAC) Rule 3745-90-06. The CCR must also include the microcystins action level, information regarding the major source of the contaminant, and standard health

effects language. Community water systems are also encouraged to include finished water saxitoxins, cylindrospermopsin, and anatoxin-a threshold detections and exceedances in their CCR. Drinking water use advisory language (Appendix C) can be used for CCR health advisory language.

5 — Source Water Surveillance and Reservoir Management

Waters used as a source of public drinking water will be under increased observation for HABs through direct surveillance by PWS personnel, HAB reports submitted via Ohio EPA's website, NOAA satellite imagery and analysis, and water quality surveys conducted by Ohio EPA and other state or local organizations. Water systems are encouraged to conduct routine phytoplankton identification on their source waters and collect other raw water screening information to help manage their source water for HABs, provide an early warning for HAB impacts, and know when to optimize treatment for cyanotoxin removal. Ohio EPA is available to provide guidance on reservoir management and treatment optimization in response to a new or expanding HAB.

5.1 PWS Surveillance

PWSs should be aware that some raw water quality and operational changes can indicate a potential HAB impact. Potential indicators include pH increases, phycocyanin or chlorophyll a increases, elevated turbidity not associated with a rain event, shortened filter run times, increased chlorine demand, taste and odor (Geosmin or MIB) events, a shift in phytoplankton community (increase in cyanobacteria or cyanobacteria dominance), presence of cyanotoxin production genes, or cyanotoxin detections.

It is beyond the scope of this document to provide guidance on the collection of screening data or establishing a source water monitoring program. More information is available in the ***USGS Lake Monitoring Field Manual***, Lakes and Reservoirs: Guidelines for Study Design and Sampling at: ***https://pubs.er.usgs.gov/publication/tm9A10***.

5.2 HAB Report via Ohio EPA Website

PWSs are requested to notify the district or central office HAB coordinator of a bloom occurring on a drinking water source water. Contact information is included in Appendix D. Ohio EPA can provide assistance on bloom response and reservoir management.

Individuals reporting HABs are requested to fill out a Bloom Report Form on Ohio EPA's HAB website ***ohioalgaeinfo.com***. The report can either be entered electronically on the website, emailed to Ohio EPA's HAB Mailbox (***HABMailbox@epa.ohio.gov***), or printed and mailed to Ohio EPA. All HAB reports and HAB data (cyanotoxin and phytoplankton data, and photographs) will be entered into a data repository housed at Ohio EPA.

Ohio EPA will share all third-party reports of blooms on public water supply source waters with the affected PWS.

5.3 HAB Remote Sensing Surveillance

Ohio EPA will review NOAA HAB reports, MODIS/OCLI satellite, and NASA hyperspectral overflight data. Ohio EPA will share reports of moderate to severe blooms with the affected public water supply.

5.4 Ohio EPA Water Quality Surveys

Ohio EPA collects water quality data as part of its inland lakes program and other monitoring programs. This data may be useful to water systems interested in starting a reservoir monitoring program or developing reservoir management strategies. Ohio EPA will provide results of cyanotoxin detections on PWS source waters directly to the PWS.

5.5 Other Data Sources

Ohio EPA has reached out to other organizations, such as the Ohio Lakes Management Society, U.S. Army Corps of Engineers, USGS, U.S. EPA, and various state universities to request they share HAB information with Ohio EPA in a timely manner. All pertinent data will be assessed and shared with affected PWSs.

5.6 Assessing Bloom Severity

PWSs can use the available screening data to help characterize a bloom as severe, moderate or minor. It may be necessary to make an initial assessment based on visual evidence, which can then be refined as additional information is collected. Guidance on the visual appearance of cyanobacterial blooms versus other green algae blooms, including a picture gallery of blooms, is available on Ohio EPA's ***epa.ohio.gov/ddagw/HAB***. Since a severe cyanobacterial bloom may not form a surface scum, in the absence of any additional data, a visible bloom should be regarded as severe until additional data is collected. The following guidelines will help water systems characterize the severity of a bloom:

- Severe bloom (meets any of the following):
  - cyanobacteria cell count (or phycocyanin equivalents*) > 100,000 cells/mL
  - qPCR 16S results > 100,000 gene copies/mL
  - biovolume > 10 mm3/L
  - chlorophyll a** > 50 µg/L
  - scum or surface accumulation is present and/or significant concentration of cells are visible throughout the water column
  - presence of cyanotoxins, as indicated by test kit or laboratory analyses
  - presence of cyanotoxin production genes
- Moderate bloom (meets any of the following):
  - cyanobacteria cell count (or phycocyanin equivalents*) 10,000-100,000 cells/mL
  - qPCR 16S results 10,000-100,000 gene copies/ml
  - biovolume 1-10 mm3/L
  - chlorophyll a** 5-50 µg/L
  - bloom is visible throughout the water column
- Minor bloom (meets any of the following):
  - cyanobacteria cell count (or phycocyanin equivalents*) 4,000-10,000 cells/mL
  - biovolume 0.4-1 mm3/L
  - chlorophyll a** 2-5 µg/L
  - some visual evidence of a bloom (note: blooms may not be visually apparent at the lake surface)

**Phycocyanin is a pigment unique to cyanobacteria. Sensors are available which measure the presence of this pigment and report in either relative fluorescence units (RFUs) or cyanobacteria concentrations in cells/mL. The cell concentration data, however, should be used with caution because sensors are typically calibrated to a pure Microcystis culture, and Microcystis may not be the dominant cyanobacteria in the water source. Also, other factors such as turbidity and overall light availability can impact the amount of phycocyanin that is produced per cyanobacterial cell. It is often best for a water system to review the general changes in RFUs over time as an indication of an increase in bloom severity instead of a particular cell/mL reading.*

***Chlorophyll a values are based on quantitative in vitro analysis. Semi-quantitative in vivo chlorophyll a readings can be used if they have been corrected for turbidity effects. Real-time in vivo chlorophyll a analysis is also helpful if a water system is primarily interested in relative changes in chlorophyll concentrations over time, but not as concerned with the precise chlorophyll a concentration.*

In some situations, a severe bloom may be present but not visually evident. This can be the case with cyanotoxin-producing *Planktothrix rubescens* blooms that can occur at significant depth in the water column and not be visible at the water surface and with *Cylindrospermopsis* blooms that can resemble

turbid brownish-green water. These blooms do not appear like the more typical blue or green colored scum-forming cyanobacterial blooms and can pose a monitoring challenge.

Ohio EPA recommends that PWSs conduct routine phytoplankton/algae analysis (community composition and dominance) of their source waters. This information can help water systems to better assess the potential threat of cyanotoxins and provide the information needed to help optimize their treatment to address cyanotoxins and other potential algae-related issues (taste and odor concerns, disinfection byproduct formation, filter clogging, etc.). The information can also be used to guide source water management practices, including algaecide application. Phycocyanin and other sensors positioned in the source water (intake structure, wet well, etc.) can also provide extremely valuable real-time information that can be used to trigger treatment optimization for HABs.

5.7 Reservoir Management

Source water monitoring is an essential component of reservoir management and can help assess the water body for problems such as excessive nutrient loading and HABs. Monitoring data is needed to establish baseline conditions and triggers for source water control strategies, as well as to determine the effectiveness of control strategies (for example, algaecide treatment). Control and treatment strategies to minimize HABs focus on controlling nutrients (primarily phosphorus) and algae. An example of direct control on algae is use of algaecides, whereas watershed management actions only address nutrients. Some actions, such as phosphorus precipitation, aim to control both nutrients and algal populations.

U.S. EPA developed a list of control and treatment strategies and provided benefits and limitations associated with each strategy. The guidance is available at ***epa.gov/cyanohabs/control-measures-cyanobacterial-habs-surface-water***.

The reservoir management techniques commonly used in Ohio inland reservoirs to control HABs are summarized in Table 5 with information on recommendations from Osgood and Gibbons (2017).

Table 5. Common HAB reservoir management techniques.

Technique	Control Type	Recommendation	Benefits	Limitations
Algaecides	Algae	Recommended, but does not address ongoing nutrient loading	High applicability and reliability	Short duration; Frequent or repeat applications needed throughout year
Artificial Circulation	Algae; Internal phosphorus	Recommended only with critical implementation*	Critically implemented examples have shown success	Typically requires continuous operation with ongoing operation and maintenance expenses; Uncritical examples show poor reliability and even unintended negative effects
Phosphorus stripping (primarily alum, lower doses)	Algae; Phosphorus in water column	Recommended, but does not address ongoing nutrient loading	High applicability and reliability	Limited duration; may require repeat (yearly) applications
Phosphorus inactivation (primarily alum, higher doses)	Algae; Phosphorus in water column and internal phosphorus in sediments	Recommended, addresses internal -but not external- nutrient loads	High applicability and reliability (especially if internal phosphorus loads are driver for HABs)	May require repeat (yearly) applications if external phosphorus loads are not addressed

**Critical implementation means reservoir management strategy is only employed after careful source water evaluation, including collecting site specific data to help ensure strategy is adequately designed and implemented.*

It is beyond the scope of this guidance to discuss all relevant reservoir management strategies, but algaecides are so commonly used they warrant additional discussion. Algaecides (including copper sulfate

and peroxide formulations), when applied to a drinking water source under controlled conditions, may control the growth of algae and cyanobacteria. Water systems are required to submit a Notice of Intent (NOI) to Ohio EPA Division of Surface Water and obtain coverage under the pesticide general permit prior to applying algaecide to a source of drinking water. Information and forms associated with the pesticide application discharge general permit are available at ***epa.ohio.gov/dsw/permits/GP_Pesticide***.

Before applying an algaecide, it is important to closely read the pesticide label and be fully aware of both the environmental impact and practical problems with its use. Water systems must also follow the conditions outlined in the pesticide general permit. Treatment should be applied at the early stages of a bloom prior to raw water cyanotoxin detections when cyanobacteria abundance is low (<10,000 cells/mL, or cyanotoxin production genes are not detected) because:

1) this is when the potential for cyanotoxin release is not probable or low;
2) if the treatment is applied at the early stages of a bloom, then low concentrations of cyanotoxins released into the water can be removed effectively during the treatment processes; and
3) to eliminate or reduce the future severity of the bloom. To keep the algae under control for extended periods of time, the algaecide applications should be performed at specific intervals based upon the pesticide label.

The pesticide general permit prohibits algaecide application to drinking water source waters if cyanotoxin concentrations at the water supply intake exceed Ohio EPA drinking water thresholds or if there is a severe bloom (>100,000 cells/mL) or any scums that are within 500 yards of the intake or cover greater than 20 percent of the reservoir. In some instances, algaecide application is permissible if information is provided to Ohio EPA prior to application that confirms: the bloom is not currently producing cyanotoxins, or the surface water will not be used as a source of drinking water until monitoring can confirm cyanotoxins are below levels of concern, or the water system has demonstrated that treatment is capable of removing high concentrations of cyanotoxins. Please contact your district or central office HAB coordinator prior to applying algaecide to a source water currently in use that has a severe bloom or a visible bloom of unknown severity or if raw water cyanotoxins concentrations exceed Ohio EPA thresholds. More information is available in the Ohio EPA algaecide application fact sheet, available at ***epa.ohio.gov/Portals/28/documents/HABs/Publications/AlgaecideApplicationFactSheet.pdf.***

6 — HAB Sampling Protocol

This sampling protocol outlines how to collect HAB samples at PWS source waters, finished waters, and at treatment train sampling locations.

Generally, cyanobacteria screening, phytoplankton, and cyanotoxin samples will be collected by PWSs or Ohio EPA. Other sample collectors, such as lake managers, ODNR, ODH, Local Health Districts, Army Corps of Engineers, universities, and volunteers, are requested to also use this guidance so that collection methodology is consistent.

6.1 Safety Precautions

Safety must come first when sampling for cyanotoxins. Gloves should be worn when sampling HABs (shoulder length if collecting source water samples at depth). Chest waders should also be worn if collecting a cyanotoxin sample when wading off the shore. A personal floatation device (PFD) should be worn if sampling from a boat or wading into swift water. Avoid inhaling spray or getting spray in eyes from boats, wind, or irrigation water from areas with harmful algal blooms. Consider wearing eye protection and a mask if conditions exist that promote aerosolization of cyanotoxins.

Do not ingest or allow the water to come in contact with the skin. Always wash hands with clean, fresh water after sampling. Do not touch hands to mouth, eyes, open cuts or other exposed areas of the body before washing. All equipment, gloves, and waders should be rinsed with clean (tap or bottled) water (not lake water) after a sampling event.

Ohio EPA staff should follow the guidelines in the agency's Safety Standard Operating Procedure SP 16-5 (Safety and Health Requirements for Sampling Waters Where Known Harmful Algal Blooms (HABs) are Present and/or When Sampling Waters for HABs).

For molecular screening, phytoplankton sampling and cyanotoxin sampling at PWSs, the recommended supplies include:

- Plastic disposable gloves
- For microcystins or cylindrospermopsin sampling: 125 mL PETG or 100 mL glass containers
- For cyanobacteria screening: 250 mL PETG container
- For phytoplankton sampling: lab-approved containers and Lugol's iodine or preservative specified by the laboratory processing samples
- For saxitoxins sampling: 60 mL glass vials from Ohio EPA DES, pre-dosed with preservative for saxitoxins collection
- Cooler with wet ice
- Waterproof permanent marker (for writing on sample containers, pre-printed labels are also acceptable)
- Large trash bags and twist ties (to contain ice in cooler)
- Chain of Custody Report and Sample Submission Forms (See Appendix E)
- FedEx, UPS, or U.S. Cargo shipping labels (if shipping)
- Digital camera to record appearance of bloom, if available
- If collecting raw water or scum samples directly from water source these additional supplies may be necessary:
    - Elbow- or shoulder-length gloves (to protect skin from dermal toxin irritation if sampling at depth)
    - Goggles (if wind is aerosolizing water droplets)
    - Respirator (if wind is aerosolizing water droplets)
    - Plastic knee boots, hip waders, or chest waders (if collecting samples requires wading off-shore)
- Personal flotation device (PFD) (if collecting samples requires wading off-shore) If appropriate protective sampling gear is not available, the sampler should avoid contact with the source water and only collect samples from the raw and finished water plant taps.

6.2 Sample Collection

6.2.1 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
  (please use military time)
- Preservative (if applicable)

If using Ohio EPA pre-printed labels, you must still write the date and time sample was collected on the label using a waterproof marker. If using glass containers with paper labels, fill out the label and then cover it with clear plastic tape. This will prevent the label from coming off once the container is placed on ice.

6.2.2 Cyanotoxin Samples

For microcystins compliance sampling, collect one sample from the raw water tap or designated raw water sampling point and one sample from finished water at the entry point to the distribution system. Raw water samples must be collected prior to chemical addition. PWSs should work with their Ohio EPA district office HAB coordinator if they would like to request an alternate sampling location, post chemical addition. Additional special purposes samples may be collected at alternate raw water sampling points (individual reservoir intake structures, etc.), within the treatment train, and within the distribution system.

Microcystins and cylindrospermopsin samples must be collected in clean 125 mL PETG or 100 mL glass containers. Saxitoxins samples must be collected in 60 mL pre-preserved glass vials provided by Ohio EPA. Finished water samples and any treatment train samples that have already been subjected to an oxidant MUST be quenched with sodium thiosulfate immediately upon collection (sodium thiosulfate tablets may also be placed in vial prior to collecting samples). The 60 mL, 100 mL and 125 mL containers should be preserved with one 10 mg sodium thiosulfate tablet. Immediately put all cyanotoxin samples in a dark cooler on wet ice or ice packs.

If a sample will not arrive for processing at the laboratory within 5 days, the sample must be frozen in a standard freezer until it is processed. If freezing saxitoxins samples, the sample should first be mixed by repeatedly inverting the sample vial and then half the sample volume should be decanted and disposed of prior to freezing (to avoid breaking glass vial). Saxitoxins vials should be placed longwise in the freezer (not upright).

If collecting samples for LC-MS/MS analysis, verify with the receiving lab the sample volume necessary and required container type. For samples submitted to Greenwater Laboratory, collect duplicate samples in a one-liter amber glass jar and a 250 mL PETG container. Triple rinse both containers using the water you are sampling, prior to collecting sample that will be submitted to lab (fill and discard water, fill and discard water, fill and discard water, fill and cap container). Include a chain of custody with any samples shipped to Greenwater Laboratory (available at ***greenwaterlab.com/servicerequestform.pdf***).

If conducting follow-up UCMR 4 finished water sampling and plan on analyzing samples for anatoxin-a or cylindrospermopsin using U.S. EPA Method 545, follow these sample handling and preservation procedures:

1) Collect samples in amber glass bottles with PTFE-lined screw caps. Recommend using minimum 500 mL sample bottle (method only requires 10 mL for analysis, but additional volume needed to fulfill QC requirements).

2) Add the following sample preservatives:

Preservative	Amount	Purpose
Sodium bisulfate	1.0 g/L	Acidic microbial inhibitor
Ascorbic acid	0.10 g/L	Quenching agent for chlorine

3) After collecting sample, invert container several times to thoroughly mix sample with preservatives. Use caution when filling container to avoid flushing out preservatives added to pre-preserved containers. It is acceptable to leave head-space in the container (do not need to completely fill container with sample).

4) Samples should be shipped on wet ice and must be at or below ten degrees Celsius when they are received at the laboratory. Samples must be held at or below six degrees Celsius and protected from light at the laboratory. Samples cannot be frozen. Samples must be analyzed within 28 days of collection.

6.2.3 Cyanobacteria Screening Samples

Use a clean 250 mL PETG container to collect one sample from the raw water tap. Rinse the sample container three times with the raw water prior to collecting the compliance sample (Fill and discard water, fill and discard water, fill and discard water, fill and cap container). Raw water samples should be collected prior to chemical addition. Water systems should work with their Ohio EPA district office HAB coordinator if they would like to request an alternate sampling location, post chemical addition. Instructions for collecting cyanobacteria screening samples are available at ***epa.ohio.gov/Portals/28/documents/habs/qPCR Sample Collection Procedure_Final.pdf***.

6.2.4 Phytoplankton Samples

PWSs are encouraged to collect routine phytoplankton samples within their source waters. If a bloom is observed, the water system should consider collecting samples from the scum or biomass in the areas where the bloom is concentrated using a clean lab-approved container. The densest bloom may be near the surface or at a different depth. If the bloom is not at a distinct location, but diffuse throughout the water column, consider using a composite sampler that includes collection from a range of depths. If collecting a scum, collect a sample from the scum-water surface interface. The goal is to collect live cells that have not been lysed (the top of scum –often colored blue or white- is usually dead cells that may be difficult to identify).

Phytoplankton samples should be collected in a clean glass, plastic, or other laboratory approved container. The sampler should contact the lab that will be analyzing the samples for further instruction on containers, sample volume, and preservation guidance. Ideally, samples should be preserved at the time of collection with Lugol's iodine solution at a ratio of 1:100. To achieve a 1:100 ratio, add approximately 1 mL of Lugol's solution per 100 mL of sample. Final preserved sample color should be similar to that of weak tea. Samples should be kept on wet ice and in the dark during transport. Ship for overnight delivery to the laboratory. If samples are shipped immediately after collection on wet ice, sample preservation with Lugol's iodine may not be necessary (consult lab conducting analysis). Do not freeze the phytoplankton sample - doing so will make identification difficult.

6.2.5 QA/QC

Ohio EPA will use quality assurance/quality control procedures that meet quality objectives for HAB sampling. As part of these procedures, Ohio EPA recommends collecting and analyzing one field duplicate sample for every 20 samples collected.

6.3 Cyanotoxin Processing (Lysing) Instructions

At the laboratory, total cyanotoxins (free extracellular cyanotoxins and intracellular cyanotoxins stored within cyanobacteria cells) shall be determined for PWS sample analysis. Samples should be processed to ensure all algal cells are lysed. The Ohio EPA DES total cyanotoxin analysis methods (Method 701, 702, and 703) all require samples be subjected to at least three freeze/thaw cycles prior to analysis.

6.4 Paperwork

6.4.1 Samples Submitted to Ohio EPA for Analysis

PWSs should use the combined chain of custody and sample submission form provided to them by Ohio EPA. Instructions for completing the form are included in Appendix E. Place the paperwork in zip top bags and seal each bag. Place the paperwork on top of the samples and ice in the cooler.

Other entities submitting samples to Ohio EPA must first contact the DES Sample Coordinator to arrange delivery. Samples submitted to Ohio EPA must include a Chain of Custody Report and one Sample Submission Form for each sample location (see attached templates in Appendix E). Place the paperwork in zip top bags and seal each bag. Place the paperwork on top of the samples and ice in the cooler.

6.4.2 Samples Submitted to Alternate Labs

Please follow the instructions provided by the lab conducting the analysis. At a minimum, Ohio EPA recommends that a chain of custody be included with all samples shipped to a lab for analysis. A list of laboratories currently accepted for Total Microcystin Testing by the Ohio EPA is available at ***https://epa.ohio.gov/Portals/28/documents/habs/Lab_Information_final.pdf*** .

6.5 Shipping

Wet ice sealed in plastic bags should be used to ensure samples arrive at the lab at the proper temperature. Ice packs are often not sufficient to maintain temperature, especially during warmer months. The sample container should be sealed with three continuous circles of tape to help avoid melting ice leaking out of the container during shipment.

6.5.1 Shipping Samples to Ohio EPA DES Routine Cyanobacteria Screening Samples

PWSs must ship cyanobacteria screening samples overnight on ice to Ohio EPA's lab (DES). Samples must be received by noon on the day following sample collection and can only be received on Monday through Thursday. Samples may also be hand delivered to the lab on the same day as collection Monday through Thursday.

6.5.2 Cyanotoxin and Other Samples Collected by Ohio EPA

Ohio EPA staff should plan weekly sampling early in the week and ship overnight for next day delivery by 14:00 hrs. so samples can be properly processed, and results will be ready by the weekend. Samples can be received by DES Monday through Thursday. If Friday delivery is required, DES may not be able to analyze the sample until the following week. 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 prior to sampling.

If samples will not arrive at DES within that timeframe, samples may need to be frozen to preserve the cyanotoxin until they are shipped to DES the following week (depending on holding time). The exception is for resample or repeat sampling following cyanotoxin detections in finished water or source water conditions that warrant rush sampling. The Central Office staff will coordinate with DES following any finished water cyanotoxin detections to ensure the laboratory has capacity to analyze samples over the weekend or holiday, if necessary.

6.5.3 Shipping to Alternate Labs

Contact the appropriate laboratory prior to shipping samples. Include any paperwork required by the receiving laboratory. Make sure that all compliance sampling data is submitted to Ohio EPA via eDWR. Voluntary PWSs sampling data can also be reported to eDWR using the special purpose code.

7 — Treatment Considerations

There are a variety of resources available to help PWSs understand which treatment processes are effective at cyanotoxin destruction or removal and how to optimize a treatment plant to deal with cyanotoxins. Ohio EPA partnered with the Ohio Section of AWWA to develop a white paper on cyanotoxin treatment. The white paper covers microcystins, saxitoxins, cylindrospermopsin, and anatoxin-a treatment. It is available at ***epa.ohio.gov/portals/28/documents/HAB/AlgalToxinTreatmentWhitePaper.pdf***

Ohio EPA developed guidance documents on how to develop a cyanotoxin treatment optimization protocol and HAB general plan. Guidance is available at ***epa.ohio.gov/ddagw/HAB.aspx***.

8 — Contingency Planning

Ohio EPA requests PWSs work with Ohio EPA, their local emergency management agency, and local health departments to develop a coordinated response to cyanotoxin detections in finished water at concentrations above Ohio's drinking water thresholds. A detailed response protocol must be included in the contingency plans of those PWSs which Ohio EPA has deemed susceptible to a harmful algal bloom. On May 5, 2015, susceptible systems were notified by letter of the need to update their contingency plans to include a coordinated response to cyanotoxin detections in finished water above Ohio's drinking water thresholds. All other PWSs with a surface water source are requested to include a detailed response protocol in their contingency plan. For more information regarding contingency plan requirements and public notification please refer to OAC Rules 3745-85-01 and 3745-81-32, respectively. Items the water system must address in their contingency plan include a communication strategy, including 24-hour emergency contacts, identification of critical users/possible susceptible populations, and considerations for water restrictions at satellite systems. A complete list of the items a PWS should address are contained in the checklist in Appendix F.

PWSs will be expected to address the need for distribution sampling for cyanotoxins in their contingency plan. The goal of distribution sampling is to potentially isolate portions of the distribution system and limit the extent of an advisory. The sampling points for cyanotoxin sampling may coincide with existing sampling points for total coliform. PWSs need to ensure the sampling points are accessible at any hour and day of the week. Sampling must also be performed at interconnections with other PWSs, input and output from finished water storage and areas of the distribution systems served by different sources. PWSs will also need to contact the local emergency management agency to make sure each party's preparations do not conflict. Items to review include alternate sources of water; distribution of water; and communications with the public and other agencies. The contingency plan must be reviewed and updated at least annually, or more frequently as needed, for current information on critical water users, consecutive water systems, alternate sources of water and contacts for state and local agencies.

APPENDIX A
CYANOBACTERIA AND THEIR ASSOCIATED CYANOTOXINS AND TASTE AND ODOR COMPOUNDS

Cyanobacterial Genera	Hepatotoxins		Neurotoxins		Tastes and Odors	
	CYLINDRO-SPERMOPSIN	MICROCYSTINS	ANATOXIN	SAXITOXINS	GEOSMIN	MIB
Anabaena (Dolichospermum)	x	x	x	x	x	
Anabaenopsis		x				
Aphanizomenon (Cuspidothrix)	x	x	x	x	x	
Aphanocapsa		x				
Arthrospira		x	x			
Chrysosporum	x					
Cylindrospermum	x		x	x		
Fischerella		x			x	
Gloeotrichia		x				
Hapalosiphon		x				
Hyella					x	x
Leptolyngbya (Plectonema)		x			x	x
Limnothirix		x				
Lyngbya (Microseira)	x	x		x	x	x
Merismopedia		x				
Microcystis		x				
Nostoc		x		x	x	x
Oscillatoria (Planktothrix)	x	x	x	x	x	x
Phormidium (Anagnostidinema, Geitlerinema, Microcoleus)		x	x	x	x	x
Pseudanabaena		x				x
Raphidiopsis (Cylindrospermop-sis)	x	x	x	x		
Scytonema		x				
Snowella		x				
Synechococcus		x			x	x
Synechocystis		x				
Umezakia	x	x				
Woronichinia		x	x			

Information adapted from Jennifer Graham (USGS) with cyanotoxin production documented by Bernard et al., 2017; Chapman and Foss, 2019; Huang and Zimba, 2019.

APPENDIX B
BASIS FOR CYANOTOXIN THRESHOLDS

Toxicity Review and Calculations

Toxicity values for microcystins and cylindrospermopsin are consistent with U.S. EPA national health advisories for these cyanotoxins. Toxicity values for anatoxin-a and saxitoxins are detailed below. The toxicity values for the specific cyanotoxins are referred to as reference doses (RfDs), which are intended to represent a "safe" dose for humans, below which no toxic effect is to be expected. The values are expressed in micrograms per kilogram body weight per day (µg/kg-day). Uncertainty factors are included between 10 and 1000, depending on the number, variety, and quality of the available studies. The child and adult advisory values use the same toxicity data (RfD) and represent differences in drinking water intake and body weight for different human life stages. The child advisory value is based on the summation of the time-weighted drinking water intake/body weight ratios for birth to less than 12 months of age (U.S. EPA 2011). The adult advisory value is based on the mean body weight and the 90th percentile drinking water consumption rate for adults age 21 and over (U.S. EPA 2011), which is similar to that of school-aged children.

The basic calculation and other exposure factors used to calculate cyanotoxin thresholds in drinking water are consistent with U.E. EPA's national health advisories for microcystins and cylindrospermopsin:

$$\text{Threshold} = \frac{\text{NOAEL or LOAEL}}{\text{UF} \times \text{DWI/BW}}$$

Where:

NOAEL or **LOAEL** = No- or Lowest-Observed-Adverse-Effect Level (µg/kg BW-day) from a study of an appropriate duration.

UF = Uncertainty factors account for: intraspecies variability (variation in susceptibility across individuals); interspecies variability (uncertainty in extrapolating animal data to humans); uncertainty in extrapolating from a LOAEL to a NOAEL; and uncertainty associated with extrapolation when the database is incomplete.

DWI/BWI = Normalized ratio of drinking water ingestions to body weight (L/kg-day). For children under the age of six, this value is 0.15 L/kg-day and based on the 90th percentile of drinking water consumption and meant body weight. For adults and children age six and older, the value is 0.03 L/kg-day based on adult default values of 2.5 L/day and 80 kg.

Threshold unit is µg/L.

The toxicity review with supporting references are described for each cyanotoxin, and the values used in the threshold calculation are provided in the table below.

Table B1. Toxicity values used to calculate cyanotoxin thresholds in drinking water.

	Microcystins	Cylindrospermopsin	Anatoxin-a	Saxitoxins
RfD (µg/kg-day)	0.05	0.1	0.05	0.05
NOAEL (µg/kg-day)	NA	30	50	0.5
LOAEL (µg/kg-day)	50	NA	NA	NA
UF	1000	300	1000	10
DWI/BW, children under 6 (L/kg-day)	0.15	0.15	0.15	0.15
DWI/BW, children 6 and older and adults (L/kg-day)	0.03	0.03	0.03	0.03

Microcystins

U.S. EPA identified a study by Heinze (1999) conducted on rats as the critical study used in the derivation of the RfD for microcystins. The critical effects identified in the study are increased liver weight, slight to moderate liver lesions with hemorrhages, and increased enzyme levels as a result of exposure to microcystin-LR. The LOAEL was determined to be 50 µg/kg-day, based on these effects. The drinking water route of exposure matches potential drinking water exposure scenarios in humans. The total UF applied to the LOAEL was 1000. This was based on a UF of 10 for intraspecies variability, a UF of 10 for interspecies variability, a UF of 3 ($10^{0.5}$) for extrapolation from a LOAEL to NOAEL, and a UF of 3 ($10^{0.5}$) to account for deficiencies in the database. U.S. EPA is using microcystin-LR as a surrogate for other microcystin congeners. Therefore, the threshold value applies to total microcystins. U.S. EPA issued a ten-day health advisory for microcystins based on the duration of the supporting health effects study and human exposure scenario for microcystins in drinking water.

Cylindrospermopsin

U.S. EPA identified a study by Humpage and Falconer (2002, 2003) conducted on mice as the critical study used in the derivation of the RfD for cylindrospermopsin. The critical effects identified in the study are increased kidney weight and decreased urinary protein. The NOAEL was determined to be 30 µg/kg-day, based on kidney toxicity. The total UF applied to the NOAEL was 300. This was based on a UF of 10 for intraspecies variability, a UF of 10 for interspecies variability, and a UF of 3 ($10^{0.5}$) to account for deficiencies in the database. U.S. EPA issued a ten-day health advisory for cylindrospermopsin based on the duration of the supporting health effects study and human exposure scenario for cylindrospermopsin in drinking water.

Anatoxin-a

U.S. EPA's *Health Effects Support Document for the Cyanobacteria Toxin Anatoxin-A* from 2015 was used as the basis for the anatoxin-a thresholds presented here. U.S. EPA determined that data were inadequate to develop acute, short term, or chronic RfDs for anatoxin-a. Additionally, this document noted a change from U.S. EPA's 2006 draft toxicological review of anatoxin-a in the interpretation of the NOAEL and LOAEL values from the a seven-week drinking water study in rats that supports the subchronic oral toxicity of anatoxin-a (Astrachan and Archer 1981, Astrachan et al. 1980). The same study served as the basis for the subchronic RfD and threshold calculations for anatoxin-a in the 2019 PWS HAB Response Strategy. The threshold values for anatoxin-a are recalculated herein with the NOAEL of 50 µg/kg**-**day to determine subchronic RfD and to incorporate the exposure assumptions (i.e., body weight and ingestion rates) used for other cyanotoxins. The total UF applied to the NOAEL was 1000. The UF 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. To be consistent with the tiered health advisories established by U.S. EPA for microcystins and cylindrospermopsin, tiered thresholds were established for both child and adult exposure. The thresholds were calculated based on the same assumptions used to calculate the microcystins and cylindrospermopsin health advisory concentrations.

Saxitoxins

Neither U.S. EPA nor World Health Organization (WHO) have issued an RfD for saxitoxins; though WHO recently posted a draft document for public review, *Cyanobacterial Toxins: Saxitoxins DRAFT Background Document for Development of WHO Guidelines for Drinking-Water Quality and Guidelines for Safe Recreational Water Environments* (2019). To develop a saxitoxins guideline, the committee reviewed information in the Report of the Joint FAO/IOC/WHO ad hoc Expert Consultation on Biotoxins in Bivalve Molluscs from 2004, as well as a peer- reviewed paper by Galváo et al. (2009). The joint FAO/IOC/WHO

report recommends an acute reference dose for saxitoxins of 0.7 µg/kg-day, but does not establish an RfD. The report does not describe the toxicological basis for the recommended value.

Galváo (2009) states:

From available reports on exposure in humans, a lowest-observed-adverse-effect-level (LOAEL) in the region of 1.5 µg STXs/kg body weight (b.w.) could be set, and an estimated no-observed-adverse-effect-level (NOAEL) of 0.5 µg STXs/kg b.w. was established. Thus, the CONTAM panel has defined an acute reference dose (ARfD) of 0.5 µg STXs/kg b.w.

The Galváo paper refers to a report in the European Food Safety Authority (EFSA), 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, a total UF of 100 was applied to the NOAEL-based ARfD. The UF includes a factor of 10 for human variability and 10 for a lack of chronic, developmental, and reproductive studies. In 2016 Ohio EPA consulted with the State of Oregon and reviewed the EFSA data and determined that the application of an uncertainty factor of 10 for human variability was not appropriate. This is because "No additional factor for variation among humans was deemed necessary because the data covered a large number of affected consumers, including sensitive individuals" (EFSA 2009). The factor of 10 for human variability was removed, and the total UF of 10 is used in the current threshold calculations. To be consistent with the tiered health advisories established by U.S. EPA for microcystins and cylindrospermopsin and the saxitoxin thresholds established by the State of Oregon, tiered thresholds were established for both child and adult exposure. The thresholds were calculated based on the same assumptions used to calculate the microcystins and cylindrospermopsin health advisory concentrations.

Toxicity Equivalency Factors (TEFs) for Saxitoxins

The Food and Drug Administration (FDA), U.S. EPA, and the European Food Safety Authority utilize TEFs when calculating saxitoxins exposure in seafood. The TEFs are based on research on the acute toxicity of saxitoxin analogues following intraperitoneal administration in mice. The established TEFs are in the Table B2.

Table B2. List of saxitoxin analogues and corresponding TEF.

Saxitoxin Analogue	Toxicity Equivalency Factor
STX	1
NeoSTX	1
GTX1	1
GTX2	0.4
GTX3	0.6
GTX4	0.7
GTX5	0.1
GTX6	0.1
C2	0.1
C4	0.1
dc-STX	1
dc-NeoSTX	0.4
dc-GTX2	0.2
dc-GTX3	0.4
11-hydroxy-STX	0.3

Ohio EPA may utilize the established TEFs to help determine if a saxitoxins threshold has been exceeded. If a saxitoxin variant is detected that does not have an established TEF, it will be assigned a TEF of 1. ELISA analysis for total saxitoxins may be utilized for ongoing sampling after an initial finished water threshold exceedance.

APPENDIX C
EARLY MESSAGING AND PUBLIC NOTICE TEMPLATES

DRINKING WATER ADVISORY

Microcystins are present in [name] water system

ESTE INFORME CONTIENE INFORMACION IMPORTANTE ACERCA DE SU AGUA POTABLE. HAGA QUE ALGUIEN LO TRADUZCA PARA USTED, O HABLE CON ALQUIEN QUE LO ENTIENDA.

Microcystins, compounds produced by blue-green algae, have been detected in the finished drinking water from [name] water system. A sample[s] collected on [date] shows microcystins at [level] micrograms/liter (µg/L). U.S. EPA has established a national health advisory level for bottle-fed infants and children younger than school age based on drinking water for 10 days. The Ohio Environmental Protection Agency recommends that bottle-fed infants and children younger than school age do not drink the water at microcystins levels above 0.3 µg/L.

Consuming water containing concentrations of microcystins over the action level may result in abnormal liver function, diarrhea, vomiting, nausea, numbness or dizziness. Children younger than school age, pregnant women, nursing mothers, the elderly, immune-compromised individuals, those with pre-existing liver conditions and those receiving dialysis treatment may be more susceptible than the general population to the health effects of microcystins. Seek medical attention if your child is experiencing any of these symptoms.

What should I do?

- **THE FOLLOWING INDIVIDUALS SHOULD NOT DRINK THE WATER: Bottle-fed infants and children younger than school age, pregnant women, nursing mothers, those with pre-existing liver conditions and those receiving dialysis treatment. These individuals may be more susceptible than the general population to the health effects of microcystins. Alternative water should be used for drinking, making infant formula, making ice, brushing teeth, and preparing food.**
- **As a precautionary measure, the elderly and immune-compromised individuals may want to consider using an alternate water source for drinking, making ice, brushing teeth and preparing food.**
- **School-age children and adults not in the categories listed above may drink the water.** Healthy school age children and adults may use the water for all uses including bathing, washing hands, washing dishes and doing laundry. The water may be used for flushing toilets.
- Infants and children younger than school age must be supervised while bathing to prevent accidental ingestion of water. Providing a final rinse of skin with uncontaminated water is recommended for people with open wounds or skin conditions such as eczema. Recommend rinsing with uncontaminated water items that go into the mouths of infants and children under the age of six years (i.e., teething rings, nipples, bottles, toys, silverware).
- **DO NOT BOIL THE WATER.** Boiling the water will not destroy microcystins and it may become more concentrated as a result of boiling.
- Contact a veterinarian immediately if pets or livestock show signs of illness.

What happened? What is being done?

[Lake/name of water source], which is a source of drinking water for the [drinking water system] is experiencing a harmful algal bloom (HAB). XXX water system is making adjustments to its treatment processes (this may need to be modified based on water system capability) to help reduce microcystins levels. We are working closely with local and state public health and emergency response agencies to address and resolve the situation. We will keep you informed as the situation is resolved.

For more information, please contact _____at_____. More information about harmful algal blooms can be found at ***ohioalgaeinfo.com***.

Please share this information anyone who drinks this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

PWSID#:		STUID#:		Date distributed:	

DRINKING WATER ADVISORY

Microcystins are present in [name] water system

ESTE INFORME CONTIENE INFORMACION IMPORTANTE ACERCA DE SU AGUA POTABLE. HAGA QUE ALGUIEN LO TRADUZCA PARA USTED, O HABLE CON ALQUIEN QUE LO ENTIENDA.

DO NOT DRINK THE WATER NO BEBA EL AQUA

Microcystins, compounds produced by blue-green algae, have been detected in the finished drinking water from [name] water system. A sample[s] collected on [date] shows microcystins at [level] micrograms/liter (µg/L). U.S. EPA has established a national health advisory level based on drinking water for 10 days. The Ohio Environmental Protection Agency recommends that you do not drink the water at microcystins levels above 1.6 µg/L.

Consuming water containing concentrations of microcystins over the action level may result in abnormal liver function, diarrhea, vomiting, nausea, numbness or dizziness. Children younger than school age, pregnant women, nursing mothers, the elderly, immune-compromised individuals, those with pre-existing liver conditions and those receiving dialysis treatment may be more susceptible than the general population to the health effects of microcystins. Seek medical attention if your child is experiencing any of these symptoms.

What should I do?

- **DO NOT DRINK THE WATER. Alternative water should be used for drinking, making infant formula, making ice, brushing teeth, and preparing food.**
- Healthy adults may use the water for bathing, washing hands, washing dishes and doing laundry. The water may be used for flushing toilets.
- Infants and children must be supervised while bathing to prevent accidental ingestion of water. Providing a final rinse of skin with uncontaminated water is recommended for people with open wounds or skin conditions such as eczema. Recommend rinsing with uncontaminated water items that go into the mouths of infants and children (i.e., teething rings, nipples, bottles, toys, silverware).
- **DO NOT BOIL THE WATER.** Boiling the water will not destroy microcystins and it may become more concentrated as a result of boiling.
- Pets should not drink the water. Contact a veterinarian immediately if pets or livestock show signs of illness.

What happened? What is being done?

[Lake/name of water source], which is a source of drinking water for the [drinking water system] is experiencing a harmful algal bloom (HAB).

XXX water system is making adjustments to its treatment processes (this may need to be modified based on water system capability) to help reduce microcystins levels. We are working closely with local and state public health and emergency response agencies to address and resolve the situation. We will keep you informed as the situation is resolved.

For more information, please contact _____at_____. More information about harmful algal blooms can be found at ***ohioalgaeinfo.com***.

Please share this information anyone who drinks this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

PWSID#:		STUID#:		Date distributed:	

DRINKING WATER ADVISORY

Saxitoxin is present in [name] water system

ESTE INFORME CONTIENE INFORMACION IMPORTANTE ACERCA DE SU AGUA POTABLE. HAGA QUE ALGUIEN LO TRADUZCA PARA USTED, O HABLE CON ALQUIEN QUE LO ENTIENDA.

Saxitoxin, a compound produced by blue-green algae, has been detected in the finished drinking water from [name] water system. A sample[s] collected on [date] shows saxitoxins at [level] micrograms/liter (µg/L). The Ohio Environmental Protection Agency recommends that children under six, including bottle fed infants, and sensitive populations do not drink the water at saxitoxin levels above 0.3 µg/L.

Consuming water containing saxitoxins may result in numbness or tingling around the mouth, numbness spreading to arms and hands, headache, dizziness, a floating sensation, muscle soreness, muscle weakness, difficulty breathing, paralysis, nausea or vomiting. Seek medical attention if your child is experiencing any of these symptoms.

What should I do?

- **THE FOLLOWING INDIVIDUALS SHOULD NOT DRINK THE WATER: Bottle-fed infants and children younger than school age, pregnant women, nursing mothers and those receiving dialysis treatments. These individuals may be more susceptible than the general population to the health effects of saxitoxins. Alternative water should be used for drinking, making infant formula, making ice, brushing teeth, and preparing food.**
- **As a precautionary measure, the elderly and immune-compromised individuals may want to consider using an alternate water source for drinking, making ice, brushing teeth and preparing food.**
- **School-age children and adults not in the categories listed above may drink the water.** Healthy school age children and adults may use the water for all uses including bathing, washing hands, washing dishes and doing laundry. The water may be used for flushing toilets.
- Infants and children younger than school age must be supervised while bathing to prevent accidental ingestion of water. Providing a final rinse of skin with uncontaminated water is recommended for people with open wounds or skin conditions such as eczema. Recommend rinsing with uncontaminated water items that go into the mouths of infants and children under the age of six years (i.e., teething rings, nipples, bottles, toys, silverware).
- **DO NOT BOIL THE WATER.** Boiling the water will not destroy microcystin and it may become more concentrated as a result of boiling.
- Contact a veterinarian immediately if pets or livestock show signs of illness.

What happened? What is being done?

[Lake/name of water source], which is a source of drinking water for the [drinking water system] is experiencing a harmful algal bloom (HAB). XXX water system is making adjustments to its treatment processes (this may need to be modified based on water system capability) to help reduce saxitoxin levels. We are working closely with local and state public health and emergency response agencies to address and resolve the situation. We will keep you informed as the situation is resolved.

For more information, please contact _____at_____. More information about harmful algal blooms can be found at ***ohioalgaeinfo.com***.

Please share this information anyone who drinks this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

PWSID#:		STUID#:		Date distributed:	

DRINKING WATER ADVISORY

Saxitoxin is present in [name] water system

ESTE INFORME CONTIENE INFORMACION IMPORTANTE ACERCA DE SU AGUA POTABLE. HAGA QUE ALGUIEN LO TRADUZCA PARA USTED, O HABLE CON ALQUIEN QUE LO ENTIENDA.

DO NOT DRINK THE WATER NO BEBA EL AGUA

Saxitoxin, a compound produced by blue-green algae, has been detected in the finished drinking water from [name] water system. A sample[s] collected on [date] shows saxitoxin at [level] micrograms/liter (µg/L). The Ohio Environmental Protection Agency recommends that you do not drink the water at saxitoxin levels above 1.6 µg/L.

Consuming water containing saxitoxin may result in numbness or tingling around the mouth, numbness spreading to arms and hands, headache, dizziness, a floating sensation, muscle soreness, muscle weakness, difficulty breathing, paralysis, nausea or vomiting. Seek medical attention if you are experiencing any of these symptoms.

What should I do?

- **DO NOT DRINK THE WATER. Alternative water should be used for drinking, making infant formula, making ice, brushing teeth, and preparing food.**
- Healthy adults may use the water for bathing, washing hands, washing dishes and doing laundry. The water may be used for flushing toilets.
- Infants and children must be supervised while bathing to prevent accidental ingestion of water. Providing a final rinse of skin with uncontaminated water is recommended for people with open wounds or skin conditions such as eczema. Recommend rinsing with uncontaminated water items that go into the mouths of infants and children (i.e., teething rings, nipples, bottles, toys, silverware).
- **DO NOT BOIL THE WATER.** Boiling the water will not destroy saxitoxins.
- Pets should not drink the water. Contact a veterinarian immediately if pets or livestock show signs of illness.

What happened? What is being done?

[Lake/name of water source], which is a source of drinking water for the [drinking water system] is experiencing a harmful algal bloom (HAB). XXX water system is making adjustments to its treatment processes (this may need to be modified based on water system capability) to help reduce saxitoxin levels. We are working closely with local and state public health and emergency response agencies to address and resolve the situation. We will keep you informed as the situation is resolved.

For more information, please contact _____at_____. More information about harmful algal blooms can be found at ***ohioalgaeinfo.com***.

Please share this information anyone who drinks this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

PWSID#:		STUID#:		Date distributed:	

DRINKING WATER ADVISORY

Cylindrospermopsin is present in [name] water system

ESTE INFORME CONTIENE INFORMACION IMPORTANTE ACERCA DE SU AGUA POTABLE. HAGA QUE ALGUIEN LO TRADUZCA PARA USTED, O HABLE CON ALQUIEN QUE LO ENTIENDA.

Cylindrospermopsin, a compound produced by blue-green algae, has been detected in the finished drinking water from [name] water system. A sample[s] collected on [date] shows cylindrospermopsin at [level] micrograms/liter (µg/L). U.S. EPA has established a national health advisory level for bottle-fed infants and children younger than school age based on drinking water for 10 days. The Ohio Environmental Protection Agency recommends that bottle-fed infants and children younger than school age do not drink the water at cylindrospermopsin levels above 0.7 µg/L.

Consuming water containing cylindrospermopsin at the detected level may result in abdominal pain, fever, vomiting, diarrhea or impaired liver or kidney function in this population. Seek medical attention if your child is experiencing any of these symptoms.

What should I do?

- **THE FOLLOWING INDIVIDUALS SHOULD NOT DRINK THE WATER: Bottle-fed infants and children younger than school age, pregnant women, nursing mothers, those with pre-existing liver or kidney conditions and those receiving dialysis treatment. These individuals may be more susceptible than the general population to the health effects of cylindrospermopsin. Alternative water should be used for drinking, making infant formula, making ice, brushing teeth, and preparing food.**
- **As a precautionary measure, the elderly and immune-compromised individuals may want to consider using an alternate water source for drinking, making ice, brushing teeth and preparing food.**
- **School-age children and adults not in the categories listed above may drink the water.** Healthy school age children and adults may use the water for all uses including bathing, washing hands, washing dishes and doing laundry. The water may be used for flushing toilets.
- Infants and children younger than school age must be supervised while bathing to prevent accidental ingestion of water. Providing a final rinse of skin with uncontaminated water is recommended for people with open wounds or skin conditions such as eczema. Recommend rinsing with uncontaminated water items that go into the mouths of infants and children under the age of six years (i.e., teething rings, nipples, bottles, toys, silverware).
- **DO NOT BOIL THE WATER.** Boiling the water will not remove cylindrospermopsin.
- Contact a veterinarian immediately if pets or livestock show signs of illness.

What happened? What is being done?

[Lake/name of water source], which is a source of drinking water for the [drinking water system] is experiencing a harmful algal bloom (HAB). XXX water system is making adjustments to its treatment processes (this may need to be modified based on water system capability) to help reduce cylindrospermopsin levels. We are working closely with local and state public health and emergency response agencies to address and resolve the situation. We will keep you informed as the situation is resolved.

For more information, please contact _____at_____. More information about harmful algal blooms can be found at ***ohioalgaeinfo.com***.

Please share this information anyone who drinks this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

PWSID#:		STUID#:		Date distributed:	

DRINKING WATER ADVISORY

Cylindrospermopsin is present in [name] water system

ESTE INFORME CONTIENE INFORMACION IMPORTANTE ACERCA DE SU AGUA POTABLE. HAGA QUE ALGUIEN LO TRADUZCA PARA USTED, O HABLE CON ALQUIEN QUE LO ENTIENDA.

DO NOT DRINK THE WATER NO BEBA EL AGUA

Cylindrospermopsin, a compound produced by blue-green algae, has been detected in the finished drinking water from [name] water system. A sample[s] collected on [date] shows cylindrospermopsin at [level] micrograms/liter (µg/L). U.S. EPA has established a national health advisory level based on drinking water for 10 days. The Ohio Environmental Protection Agency recommends that you do not drink the water at cylindrospermopsin levels above 3.0 µg/L.

What should I do?

- **DO NOT DRINK THE WATER. Alternative water should be used for drinking, making infant formula, making ice, brushing teeth, and preparing food.**
- Healthy adults may use the water for bathing, washing hands, washing dishes and doing laundry. The water may be used for flushing toilets.
- Infants and children must be supervised while bathing to prevent accidental ingestion of water. Providing a final rinse of skin with uncontaminated water is recommended for people with open wounds or skin conditions such as eczema. Recommend rinsing with uncontaminated water items that go into the mouths of infants and children (i.e., teething rings, nipples, bottles, toys, silverware).
- **DO NOT BOIL THE WATER.** Boiling the water will not remove cylindrospermopsin.
- Consuming water containing cylindrospermopsin at the detected level may result in abdominal pain, fever, vomiting, diarrhea, or impaired liver or kidney function. Seek medical attention if your child is experiencing any of these symptoms.
- Pets should not drink the water. Contact a veterinarian immediately if pets or livestock show signs of illness.

What happened? What is being done?

[Lake/name of water source], which is a source of drinking water for the [drinking water system] is experiencing a harmful algal bloom (HAB).

XXX water system is making adjustments to its treatment processes (this may need to be modified based on water system capability) to help reduce cylindrospermopsin levels. We are working closely with local and state public health and emergency response agencies to address and resolve the situation. We will keep you informed as the situation is resolved.

For more information, please contact _____at_____. More information about harmful algal blooms can be found at ***ohioalgaeinfo.com***.

Please share this information anyone who drinks this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

PWSID#:		STUID#:		Date distributed:	

DRINKING WATER ADVISORY

Anatoxin-a is present in [name] water system

ESTE INFORME CONTIENE INFORMACION IMPORTANTE ACERCA DE SU AGUA POTABLE. HAGA QUE ALGUIEN LO TRADUZCA PARA USTED, O HABLE CON ALQUIEN QUE LO ENTIENDA.

Anatoxin-a, a compound produced by blue-green algae, has been detected in the finished drinking water from [name] water system. A sample[s] collected on [date] shows saxitoxin at [level] micrograms/liter (µg/L). The Ohio Environmental Protection Agency recommends that children under six, including bottle fed infants, and sensitive populations do not drink the water at anatoxin-a levels above 0.3 µg/L.

Consuming water containing anatoxin-a may result in loss of coordination, muscular twitching, convulsions, difficulty breathing, and potentially other neurotoxicity symptoms: headache, dizziness, a floating sensation, muscle soreness, muscle weakness, nausea or vomiting, and paralysis. Seek medical attention if you are experiencing any of these symptoms.

What should I do?

- **THE FOLLOWING INDIVIDUALS SHOULD NOT DRINK THE WATER: Bottle-fed infants and children younger than school age, pregnant women, nursing mothers and those receiving dialysis treatments. These individuals may be more susceptible than the general population to the health effects of anatoxin-a. Alternative water should be used for drinking, making infant formula, making ice, brushing teeth, and preparing food.**
- **As a precautionary measure, the elderly and immune-compromised individuals may want to consider using an alternate water source for drinking, making ice, brushing teeth and preparing food.**
- **School-age children and adults not in the categories listed above may drink the water.** Healthy school age children and adults may use the water for all uses including bathing, washing hands, washing dishes and doing laundry. The water may be used for flushing toilets.
- Infants and children younger than school age must be supervised while bathing to prevent accidental ingestion of water. Providing a final rinse of skin with uncontaminated water is recommended for people with open wounds or skin conditions such as eczema. Recommend rinsing with uncontaminated water items that go into the mouths of infants and children under the age of six years (i.e., teething rings, nipples, bottles, toys, silverware).
- **DO NOT BOIL THE WATER.** Boiling the water will not destroy microcystin and it may become more concentrated as a result of boiling.
- Contact a veterinarian immediately if pets or livestock show signs of illness.

What happened? What is being done?

[Lake/name of water source], which is a source of drinking water for the [drinking water system] is experiencing a harmful algal bloom (HAB). XXX water system is making adjustments to its treatment processes (this may need to be modified based on water system capability) to help reduce anatoxin-a levels. We are working closely with local and state public health and emergency response agencies to address and resolve the situation. We will keep you informed as the situation is resolved.

For more information, please contact _____at_____. More information about harmful algal blooms can be found at ***ohioalgaeinfo.com***.

Please share this information anyone who drinks this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

PWSID#:		STUID#:		Date distributed:	

DRINKING WATER ADVISORY

Anatoxin-a is present in [name] water system

ESTE INFORME CONTIENE INFORMACION IMPORTANTE ACERCA DE SU AGUA POTABLE. HAGA QUE ALGUIEN LO TRADUZCA PARA USTED, O HABLE CON ALQUIEN QUE LO ENTIENDA.

DO NOT DRINK THE WATER NO BEBA EL AGUA

Anatoxin-a, a compound produced by blue-green algae, has been detected in the finished drinking water from [name] water system. A sample[s] collected on [date] shows anatoxin-a at [level] micrograms/liter (µg/L). The Ohio Environmental Protection Agency recommends that you do not drink the water at anatoxin-a levels above 1.6 µg/L.

Consuming water containing anatoxin-a may result in loss of coordination, muscular twitching, convulsions, difficulty breathing, and potentially other neurotoxicity symptoms: headache, dizziness, a floating sensation, muscle soreness, muscle weakness, nausea or vomiting, and paralysis. Seek medical attention if you are experiencing any of these symptoms.

What should I do?

- **DO NOT DRINK THE WATER. Alternative water should be used for drinking, making infant formula, making ice, brushing teeth, and preparing food.**
- Healthy adults may use the water for bathing, washing hands, washing dishes and doing laundry. The water may be used for flushing toilets.
- Infants and children must be supervised while bathing to prevent accidental ingestion of water. Providing a final rinse of skin with uncontaminated water is recommended for people with open wounds or skin conditions such as eczema. Recommend rinsing with uncontaminated water items that go into the mouths of infants and children (i.e., teething rings, nipples, bottles, toys, silverware).
- **DO NOT BOIL THE WATER.** Boiling the water will not destroy anatoxin-a.
- Pets should not drink the water. Contact a veterinarian immediately if pets or livestock show signs of illness.

What happened? What is being done?

[Lake/name of water source], which is a source of drinking water for the [drinking water system] is experiencing a harmful algal bloom (HAB). XXX water system is making adjustments to its treatment processes (this may need to be modified based on water system capability) to help reduce anatoxin-a levels. We are working closely with local and state public health and emergency response agencies to address and resolve the situation. We will keep you informed as the situation is resolved.

For more information, please contact _____at_____. More information about harmful algal blooms can be found at ***ohioalgaeinfo.com***.

Please share this information anyone who drinks this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

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APPENDIX D
2020 HAB CONTACTS

Ohio EPA Division of Drinking and Ground Waters

If it is after normal business hours and an Ohio EPA staff person cannot be reached (*primary contact), call: **1-800-282-9378**

PWS HAB Webpage

epa.ohio.gov/ddagw/HAB.aspx

Central Office

(614) 644-2752
Ohio EPA - Division of Drinking and Ground Waters
50 W. Town St., Suite 700
P.O. Box 1049
Columbus, OH 43215

Colin White
Section Manager
(614) 644-2759
(614) 955-8802
colin.white@epa.ohio.gov

Emilie Eskridge
Section Supervisor
(614) 644-2765
emilie.eskridge@epa.ohio.gov

Ruth Briland
(614) 369-4045
ruth.briland@epa.ohio.gov

Marissa Ganzfried
(614) 644-3140
marissa.ganzfried@epa.ohio.gov

Tanushree Courlas (treatment)
Section Supervisor-Engineering
(614) 705-1142
tanushree.courlas@epa.ohio.gov

Northwest District Office

(419) 352-8461
347 North Dunbridge Road
Bowling Green, OH 43402

Ben Sloan (District HAB Coordinator)
(419) 373-3160
benjamin.sloan@epa.ohio.gov

Paul Brock (treatment)
(419) 373-3152
paul.brock@epa.ohio.gov

Northeast District Office

(330) 963-1200
2110 East Aurora Road
Twinsburg, OH 44087

Chris Maslo (District HAB Coordinator and treatment)
(330) 963-1164
christopher.maslo@epa.ohio.gov

Aaron Mueller
(330) 963-1227
aaron.mueller@epa.ohio.gov

Southwest District Office

(937) 285-6357
401 East Fifth Street
Dayton, OH 45402

Brian Chitti (District HAB Coordinator)
(937) 204-1199
brian.chitti@epa.ohio.gov

Jenna Houdashelt
(937) 285-6443
jenna.houdashelt@epa.ohio.gov

Southeast District Office

(740) 385-8501
2195 Front Street
Logan, OH 43138

Jessica Dingman (District HAB Coordinator)
(740) 380-5236
jessica.dingman@epa.ohio.gov

Guna Alagappan
(740) 380-5232
gunaseelan.alagappan@epa.ohio.gov

Central District Office

(614) 728-3778
Ohio EPA - CDO
P.O. Box 1049
Columbus, OH 43216-1049

Bridgette Marchio (District HAB Coordinator)
(614) 728-3870
bridgette.marchio@epa.ohio.gov

Allan Hurtt
(614) 728-3863
allan.hurt@epa.ohio.gov

Additional Ohio EPA Contacts:

Ohio EPA DES (Lab)

8955 East Main Street
Reynoldsburg, OH 43068
Phone: (614) 644-4247; Fax: (614) 644-4272

Kristin Sowards, DES Sample Coordinator
(614) 644-4243
kristin.sowards@epa.ohio.gov

Nik Dzamov, Chief
(614) 644-4068
nikola.dzamov@epa.ohio.gov

Public Interest Center (Media Calls)

(614) 644-2160

Legislative Liaisons (Legislative Inquiries)

(614) 644-3037

Ohio River

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

Ohio Beachguard Webpage (all recreation HAB Advisories):

http://publicapps.odh.ohio.gov/BeachGuardPublic/Default.aspx

GreenWater Laboratories (For LC-MS/MS Response Sampling):

Amanda Foss
(386) 328-0882
GreenWater Laboratories/CyanoLab
205 Zeagler Drive, Suite 302
Palatka, FL 32177

APPENDIX E
FORMS

Note: If you are reporting a potential harmful algal bloom to the HAB coordinator and/or submitting phytoplankton and/or cyanotoxin samples to a laboratory for analysis, the Bloom Report Form should be emailed to: ***HABMailbox@epa.ohio.gov***

The Bloom Report Form may be accessed at: ***https://arcg.is/qLSHO***

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

Ohio Environmental Protection Agency

Single Sample Submission Form

Separate COC form is required when using this form

DES Use Only

Sample # _____

Date Received MM / DD / YY

Sample Information

★ **Client (Bill to)** _____

Project _____

★ **Division (check one)**

DAPC ○ DDAGW ○ DERR ○ DMWM ○ DSW ○ Other _____

★ **OEPA District (check one)**

CO ○ CDO ○ NEDO ○ NWDO ○ SEDO ○ SWDO ○ Other _____

★ **Collection Date** MM / DD / YY HH / MM

Grab ○ (or) Composite ○ Use military time

Begin _____

End _____

Collector _____

★ **Station ID** See site list on website: epa.ohio.gov/ddagw/HAB

Location

★ Site name must match container

★ **Sample Type (check one)**

Raw ○ Plant ○ Distribution ○ } DW only

Field QC (check one)

Field Duplicate ○ Field/Equip/Acid Blank ○ MS/MSD ○ Trip Blank ○

★ **Matrix (check one)**

Air Filter ○ Quartz ○

Air Filter Composite ○ Quartz ○

Drinking water ○ Ground water ○ Solids ○ Surface water ○ Waste water ○ Reagent Water ○ Other

Number of containers submitted: _____

Special Instructions

*Rush** TAT requests, reporting instructions, safety concerns, etc.*

★ Information as needed

Parameters

Test Group: _____

Demand

○ % Solids
○ BOD-20 day
○ BOD-5 day
○ CBOD-20 day
○ CBOD-5 day
○ Oil&Grease
○ Particle Size
○ pH
○ Solids, Diss
○ Solids, Suspd
○ Solids, Total
○ Solids, Total Volatile
○ Solids, Volatile Suspended
○ TOC
○ DOC
○ Turbidity

Microbiology

QuantiTray
○ E. coli/Total Coliform (MPN)
○ Fecal Coliform (MPN)
○ Enterococci (MPN)

○ MMO-MUG (P/A)
○ Chlorophyll a
★ ○ Microcystins ○ EC*
★ ○ CYN ○ EC*
★ ○ STX ○ EC*
★ ○ qPCR *Extracellular toxins

Nutrients

○ Acidity, Total $CaCO_3$
○ Alkalinity, Total $CaCO_3$
○ Ammonia
○ Bicarbonate/Carbonate
○ Chloride
○ COD
○ Conductivity
○ Cyanide, Free
○ Bromide
○ Cyanide, WAD
○ Cyanide, Total
○ Fluoride
○ Nitrite
○ Nitrate+nitrite
○ Orthophosphate, Dissolved
○ LL Orthophosphate, Dissolved
○ Phenolics, Total w/man dist.
○ Phosphorus, Dissolved (Filt)
○ Phosphorous, Total
○ Sulfate
○ TKN

Metals

○ Total
○ Dissolved

○ **ICP 1**, *Water only*(Al,Ba,Ca,Fe,Mg,Mn,Na,K,Sr,Zn,Hardness)
○ **ICP 2**, *Water only*(Ca,Mg,Hardness)
○ **ICP 3**, *Sediment only*(Al,Ba,Ca,Fe,Mg,Mn,Na,K,Sr,Zn)
○ **ICP All**, *Water & solids* (Al,Ba,Ca,Fe,Mg,Mn,Na,K,Sr,Zn,V,Ti,Hardness*)
*not included for Solids matrix
○ **ICPMS 1**, *Water only*(As,Cd,Cr,Cu,Ni,Pb,Se)
○ **ICPMS 2**, *Sediment only*(As,Cd,Cr,Cu,Ni,Pb,Se)
○ **Mercury**
○ **Additional elements (please choose below)**

○ Antimony ○ Beryllium ○ Boron ○ Cobalt ○ Thallium ○ Titanium ○ Silver

○ **Custom list (please list elements below):**

Organics

○ PFAS, 537.1
○ Pesticides, 608/8081
○ PCBs, 608/8082
○ Chlordane, 608/8081
○ Toxaphene, 608/8081
○ Atrazine, ELISA
○ Cyanazine, 525.2
○ Herbicides, 525.2
○ SVOC, 625/8270
○ TO-15 (Air canister only)
○ Canister Cleaning, Only
○ VOC (524.2/624/8260)

Field Comments

Lab Comments

Chlorine, mg/L	Cond, umho/cm	DO, mg/L	ORP	Flow, cfs	Gage Ht, ft	pH, su	% Sat	Temp,° C	TDS	Corr.Cond, umho/cm
P50060	P94	P299		P61	P65	P400		P10		P94

Revised (9/19) ****All Rush Samples require prior approval**

Division of Environmental Services
Chain of Custody Report

Ohio Environmental Protection Agency

Date Received (Lab use only) Year Month Day

★ Collected by * _____

★ Ohio EPA Districts ☐ NEDO ☐ SWDO ☐ CO ☐ Other ☐ SEDO ☐ NWDO ☐ CDO

★ Division ☐ DSW ☐ DERR ☐ DDAGW ☐ DSIWM ☐ DAPC ☐ Other

★ Date of Grab Sample Y Y M M D D

Beginning and End Date of Composite Sample

Laboratory Number(s) (Lab use only) _____

★ Location(s) _____

★ Q.C. - Field Samples #☐ Trip Blank (organics only) #☐ Field Bank #☐ Duplicate

If needed

★ Sample Type(s) ☐ Compliance ☐ Ambient ☐ Survey ☐ Complaint ☐ Possible Legal Action ☐ With Bioassay ☐ Organic(s)

★ Additional Information/Comments If needed

★ Condition of Container of Transfer: (Seal all containers) ★ _____ Locked or Tamper Proof _____ Unlocked or Not Tamper Proof _____ Initial

★ Number of Samples (Containers/Sites) _____

★ Relinquished by Must match "collected by"

(must be collector*)

★ Received by As needed

★ Relinquished by As needed

Received by _____

Relinquished by _____

Received by _____

Relinquished by _____

Received by _____

MILITARY TIME

	Year	Month	Day	Hour	Minute
★					

Copy will be sent after sig.

Ohio Environmental Protection Agency

qPCR/HAB

Chain of Custody (COC) / Sample Submission Form (SSF)

for use by Surface Water PWSs

Division of Environmental Services

8955 E Main Street - Building 22

Reynoldsburg, Ohio 43068

To schedule samples, call (614) 644-4243

*Toxin samples will be analyzed ONLY with prior approval from Ohio EPA

Client (Bill To): DDAGW	Division/District: NWDO
PWS Name: BOWLING GREEN CITY	PWS ID: OH8700311
Collector (Print Name): 1	Phone #: 2

LAB USE ONLY

Date Received: MM/DD/YY ___/___/___

Cooler Sealed? Y N

DES Lab #

Site Name Location	Station ID	Collection Date	Collection Time	# of Containers	Sample Type (Check one only per sample line): Raw	Plant	Distribution	SMP (EP00X, LT200X, DS00…X, etc.)	…ate? (Y/N)	…? (Y/N)	Sodium thiosulfate? (Y/N)	qPCR (screening)	Saxitoxin*	Microcystin*	Cylindrospermopsin*
1 *8759903-LT2001* 8759903-LT2001 BOWLING GREEN CITY-TP-LT2001-Raw		3	4	5	----6	-----		7			9	------10	------		
2 11	12														
3															
4															

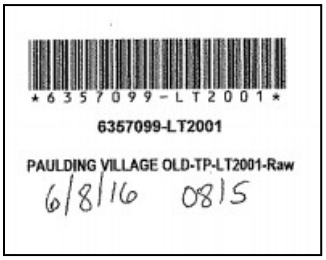
a. Relinquished by (Signature): 13	Date 14	Time 15	c. Relinquished by (Signature):	Date	Time	Lab Comments:
Received by (Signature): 16	Date	Time	Received by (Signature):	Date	Time	
b. Relinquished by (Signature): 17	Date	Time	d. Relinquished by (Signature):	Date	Time	Field Comments: 18
Received by (Signature):	Date	Time	Received by (Signature):	Date	Time	

Sample Only - Do Not Use

Numbered instructions, below, refer to boxes indicated by red numbers on sample form:

1. Name of person collecting the sample.
2. Phone number of person who should be notified if sample must be re-submitted, e.g., due to breakage.

All information about all raw samples collected from the LT2 Sample Monitoring Point (SMP) will be captured in sample line #1. Information concerning finished water, plant process, or distribution samples will be captured in sample line 2, 3, or 4, as applicable.



3. Date sample was collected. Must match date written on bottle label.
4. Time sample was collected. Use military time. Must match time written on bottle label.
5. The number of containers collected/shipped from the LT2 raw location. For routine bi-weekly screening samples, fill in "1." If you are asked to collect additional samples (for saxitoxin analysis, for example), you may have additional raw containers.
6. For routine screening monitoring, place a check in the "Raw" box. If you are asked to collect finished water or distribution samples, place a check in the "Plant" or "Distribution" box, respectively (on sample line 2, 3, or 4, as applicable).
7. The Sample Monitoring Point (SMP) where the sample was collected. See your monitoring schedule to obtain the correct SMP. For routine bi-weekly screening samples, fill in "LT200X." If you are asked to collect finished water or distribution samples, fill in "EP00X" or "DS000," respectively (on sample line 2, 3, or 4, as applicable).
8. Fill in "Y" or "N" to indicate if the sample contains permanganate, chlorine, or other oxidant. **REMINDER:** screening samples must be "true raw" samples. If you do not have a "true raw" monitoring location, contact your District Office HAB staff to discuss alternate sampling points.
9. Fill in "Y" or "N" to indicate if the sample contains sodium thiosulfate. **NOTE:** Sodium thiosulfate cannot be added to screening samples, even if the sample contains an oxidant, as it interferes with the analysis. All microcystins samples that contain an oxidant, e.g., finished water, distribution samples, and process locations after an oxidant feed point, must contain 10 mg sodium thiosulfate per 100 mL sample, added at the time the sample is collected.
10. Check the box(es) to indicate what analyses are requested. Check "qPCR (screening)" for screening samples. **NOTE:** analysis of saxitoxins, microcystins, and cylindrospermopsin by Ohio EPA's lab must be pre-approved by Ohio EPA HAB staff.

If samples from location(s) other than the LT2 SMP are approved by Ohio EPA HAB staff, provide information about these samples in sample lines 2, 3, or 4, as applicable.

11. Fill in the name of the sampling location. See the Station ID list for your PWS, provided by Ohio EPA.
12. Write in the Station ID for the sampling location. See the Station ID list for your PWS, provided by Ohio EPA.

If handing off your samples to Ohio EPA staff, complete boxes 13 –15. Ohio EPA staff should sign box 16 and fill in the date and time in your presence. If shipping samples independently, complete boxes 13 – 15 as you place samples in the cooler. Lab personnel will complete box 16 when the samples are unpacked at the lab. Box 17 and subsequent chain of custody boxes b, c, and d will be completed as needed for samples that pass through multiple handlers.

APPENDIX F
CONTINGENCY PLAN CHECKLIST

Division of Drinking and Ground Waters

2020

HARMFUL ALGAL BLOOMS: ACTIONS FOR PUBLIC WATER SUPPLIES

Public water supplies with source water identified as susceptible to Harmful Algal Blooms (HABs)--mainly systems utilizing surface water sources--must have a contingency plan for limiting the negative impact of a bloom on consumers.

Required Action

The Ohio Administrative Code 3745-85-01 requires each community water system to develop contingency plans for supplying water to the public in the event of an emergency. The rule requires identification of likely emergencies, response and recovery plans, and mitigation efforts to protect the community health and safety in the event of disruption to the water supply. If you operate a water system which utilizes a water source susceptible to HABs, you must include a HAB response and recovery procedure in your contingency plan.

Assistance Provided

The Ohio EPA provides guidance to water systems in developing their general contingency plans. The agency provides a contingency planning template on the web http://epa.ohio.gov/ddagw/security.aspx and facilitates roundtable discussions, which include the local emergency management and health district officials.

The agency developed this checklist for public water systems to provide recommended response and recovery actions specific to HABs. More detailed information is available in the multi-agency HAB Strategy published by the Ohio EPA. If you require further assistance, please contact your Ohio EPA district office representative.

NOTE: Rule-required items are listed in **BOLD** in the checklist below. Additional items, although not required by rule, are included for guidance.

1.1 Plan for the impact of a HAB event on your water system:

Complete	In Progress	Not Started	Page or Section	Planning Element
❑	❑	❑		Identify a HAB coordinator (e.g. the operator of record) or team with defined roles and responsibilities in planning and response activities.
❑	❑	❑		Identify essential employees and contractors necessary to maintain the water system.
❑	❑	❑		Review the State of Ohio's current HAB Response Strategy for public water supplies.
❑	❑	❑		Prepare a model to estimate contaminant transport through the distribution system and establish a sampling plan to help you monitor its actual path through the system. Prepare sampling kits with labeled bottles, sampling instructions, and laboratory identification.
❑	❑	❑		Identify operational measures, such as isolation zones, that may limit the number of affected customers.

1.2 Plan for the impact of a HAB event on your customers

Complete	In Progress	Not Started	Page or Section	Planning Element
❑	❑	❑		**Prepare a list of water users having critical needs for a continuous supply of water** (e.g. home dialysis patients, dialysis clinics, hospitals, nursing homes) and key consumers (e.g. manufacturers, food processors). Incorporate their requirements into your plan. Include critical users of any satellite systems, if applicable.
❑	❑	❑		**Identify methods of notification of users when an emergency occurs**, such as preparing ready-to-use messages and procedures for distributing these notifications to consumers and satellite systems (i.e. purchasers of your water supply).
❑	❑	❑		Develop a plan for implementing water restrictions for satellite systems.
❑	❑	❑		Define and document the protocol for issuing a Tier 1 Drinking Water Advisory.

1.3 Establish policies and procedures to be implemented during an event:

Complete	In Progress	Not Started	Page or Section	Planning Element
❑	❑	❑		Establish policies for flexible work hours (e.g. staggered shifts) for 24 hour monitoring of the water system.
❑	❑	❑		**Describe the method that will be used to obtain and transport water from an alternate source should such procedure become necessary (including connecting to another water system), and describe at least three possible alternate sources of water and the method of disinfection that will be used for each source.**
❑	❑	❑		Set up authorities, triggers, and procedures for activating and terminating the contingency plan, altering operations, and transferring knowledge to other employees, contractors, or responders (such as Ohio WARN).
❑	❑	❑		Develop and document procedures for flushing contaminants from the water lines. Identify the most advantageous access points for effective flushing.
❑	❑	❑		Develop and document procedures for adjusting treatment processes to optimize the removal or destruction of cyanotoxins.
❑	❑	❑		Establish a plan for communications between the water supply and outside organizations, including volunteers, the news media, and the general public.

1.4 Allocate resources to protect the water system and your employees during an event:

Complete	In Progress	Not Started	Page or Section	Planning Element
❑	❑	❑		Provide sufficient personal protective equipment (PPE) and supplies to maintain employee safety and health.
❑	❑	❑		Ensure access to information technology infrastructure (e.g. SCADA systems) remains protected and is available to authorized persons active in the response efforts.
❑	❑	❑		Prepare security procedures (e.g. check-in stations, identification badges, registration lists) for volunteers and contractors to ensure continued protection of the water system facilities and its employees.

1.5 Communicate with and train your employees:

Complete	In Progress	Not Started	Page or Section	Planning Element
❑	❑	❑		Train and prepare employees or contractors who normally hold other functions but would likely be utilized for additional labor/relief team duties (e.g. billing clerks, administrative staff).
❑	❑	❑		Disseminate information to employees about your preparations and the response plan.
❑	❑	❑		Define the mode and frequency for communicating event status, work schedules, and task assignments.
❑	❑	❑		Implement an exercise/drill to test the response plan.

1.6 Coordinate with external organizations:

Complete	In Progress	Not Started	Page or Section	Planning Element
❑	❑	❑		Establish an emergency communications plan with **24 hour phone numbers for the Ohio EPA – Division of Drinking and Ground Waters, police, fire, the county emergency management director, water supply personnel, municipal administrative personnel, contractors for line breaks, electric power supplier, electricians, well drilling and pump service contractors, plant mechanical contractors, suppliers, hospital and emergency squad/medical assistance, critical water users** and health district personnel. Include the identification of key contacts (with back-ups), chain of communications, and processes for tracking and relaying event status information.
❑	❑	❑		Collaborate with local and state agencies and emergency responders to participate in their planning processes, share your plan, and understand their capabilities (e.g. funding).

Where possible, provide additional details in the space below for any items marked "In Progress" or "Not Started" so that Ohio EPA staff may better assist you in finalizing your plan. Attach additional sheets if needed.

After you complete the evaluation of your contingency planning efforts, submit a copy of the appropriate portions of the plan and this checklist to your Ohio EPA district office representative.

Contact

For more information about harmful algal blooms or to report suspected blooms or results of testing, contact Ruth Briland at ***ruth.briland@epa.ohio.gov*** or (614) 369-4045.

For more information regarding contingency planning contact Kevin Swiadek at ***kevin.swiadek@epa.ohio.gov*** or (614) 644-3497.

APPENDIX G
U.S. ARMY CORPS OF ENGINEERS
OHIO RESERVOIR
HAB CONTACT INFORMATION

Louisville District:

District POC
ED-EE Water Quality Team Louisville District
U.S. Army Corps of Engineers
600 Dr. M. L. King Jr. Place
Louisville, KY 40202
Jade Young, (502) 315-7439
jade.l.young@usace.army.mil
Jennifer Thomason, (502) 315-2085
jennifer.c.thomason@usace.army.mil

Louisville District Reservoir Park Managers
Area Operations Manager (Miami River Region)
4020 N. Clarksville Road
Waynesville, OH 45068-9408
Chris Rapenchuk, (513) 897-1050
christopher.t.rapenchuk@usace.army.mil

Caesar Creek Lake
4020 N. Clarksville Road
Waynesville, OH 45068-9408
Jim O'Boyle, (513) 897-1050
james.f.o'boyle@usace.army.mil

C.J. Brown Reservoir (Buck Creek State Park)
2630 Croft Rd.
Springfield, OH 45503-2515
Matthew Palmer, (937) 325-2411
matthew.h.palmer@usace.army.mil

William H. Harsha Lake
(East Fork Lake State Park)
2185 Slade Road
Batavia, OH 45103-9707
Dave Johnstone, (513) 797-6081
david.l.johnstone@usace.army.mil

West Fork Lake
10558 McKelvey Road
Cincinnati, OH 45240-3930
Dave Johnstone, (513) 851-0611

Huntington District:

District POC
EC-WM/Water Quality Team
Huntington District
U.S. Army Corps of Engineers
502 8th Street
Huntington, WV 25701
Thad Tuggle, (304) 812-3887
thaddaeus.s.tuggle@usace.army.mil

Muskingum Basin
Upper Tuscarawas Projects Office
(located at Atwood Lake)
Michael Woeste, (330) 343-5611
Facility Manager for all Upper Tuscarawas

Atwood Lake
3434 State Route 212 NE
Mineral City, OH 44656-9645
(330) 343-5611

Beech City Lake/Beach City Dam
5449 State Route 250 NE
Beach City, OH 44608-9801
(330) 878-7391

Bolivar Dam Lake
11614 Glenpark Road NE
Bolivar, OH 44612-9521
(330) 874-2121

Dillon Lake
4969 Dillon Dam Rd
Zanesville, OH 43701-9652
Will Rutter, (740) 454-2225

Dover Lake
5153 State Route 800, NE
Dover, OH 44612-6910
(330) 343-5725

Leesville Lake
5037 Deer Road SW
Bowerston, OH 44695-9621
(740) 269-2131

Lower Tuscarawas Projects Office (located at Piedmont Lake):
Brian Edgar, (740) 968-4440
Facility Manager for all Lower Tuscarawas

Clendening Lake
P.O. Box 116
Tippecanoe, OH 44699-0116
(740) 658-3743

Piedmont Lake
32665 Belmont Ridge Road
Piedmont, OH 43983-9721
(740) 968-4440

Senecaville Lake
Rfd #1
Senecaville, OH 43780-9801
(740) 685-5585

Tappan Lake
86801 Eslick Road
Urichsville, OH 44683-9802
(740) 269-2681

Walhonding Projects Office (located at Mohawk Dam):
Jerry Michael, (740) 824-4343
Facility Manager for all Walhonding Projects

Charles Mill Lake
2203 State Route 603
Lucas, OH 44843-9606
(419) 368-4334

Mohawk Dam
36007 State Route 715
Warsaw, OH 43844-9534
(740) 824-4343

North Branch Kokosing River Lake
36007 State Route 15
Warsaw, OH 43844-9534
(740) 824-4343

Pleasant Hill Lake
1041 County Road 3006
Perrysville, OH 44864-9782
(419) 938-5785

Wills Creek Lake
49320 County Road 497
Coshocton, OH 43812-9496
(740) 829-2425

Scioto Basin - Individual Lake Project Contact
Alum Creek Lake
5905 Lewis Center Rd.
Lewis Center, OH 43035-9215
Sylvia Chelf, (740) 548-6151

Deer Creek Lake
21897 Deer Creek Road
Mt. Sterling, OH 43143-9505
Bonnie Maki, (740) 869-2243

Delaware Lake
3920 US 23 North
Delaware, OH 43015-9708
Greg Feustel, (740) 363-4011

Paint Creek Lake
504 Reservoir Road
Bainbridge, OH 45612-9450
T.J. Milnes, (937) 365-1470

Hocking Basin - Individual Lake Project Contact
Tom Jenkins Dam (Burr Oak Lake)
23560 Jenkins Dam Road
Glouster, OH 45732-9727
Martin Dyer, (740) 767-3527

Pittsburgh District:

District POC
U.S. Army Corps of Engineers, Pittsburgh District
1000 Liberty Avenue
Pittsburgh, PA 15222
Rose Reilly, Biologist, Water Management
rosemary.j.reilly@usace.army.mil
(412) 395-7357

Berlin Reservoir/Berlin Lake
7400 Bidell Rd.
Berlin Center, OH 44401-9714
Rene Berberich, (304) 547-3801
rene.k.berberich@usace.army.mil

Mosquito Creek Lake
2961 Warren-Meadville Rd
Cortland, OH 44410-9321
Bill Spring, (330) 637-1961

Michael J Kirwan Lake (West Branch State Park)
Michael J Kirwan Reservoir
8657 Kestrel Way
Wayland, OH 44285-0058
Doug Krider, (330) 358-2622
douglas.a.krider@usace.army.mil

References

Astrachan, N. B., B. G. Archer, and D. R. Hilbelink. 1980. Evaluation of the subacute toxicity and teratogenicity of anatoxin-a. Toxicon, 18(5-6): 684-688.

Astrachan, N. B., and B. G. Archer. 1981. Simplified monitoring of anatoxin-a by reverse-phase high performance liquid chromatography and the sub-acute effects of anatoxin-a in rats. In: W. W. Carmichael, (Ed). The Water Environment: Algal Toxins and Health. Plenum Press, New York, NY: 437-446.

Bernard, C., P. Baker, B. Robinson, and P. Monis. 2007. *Application of an Image Analysis System to Enumerate and Measure Cyanobacteria.* Australian Water Quality Center. Research Report No 31. pp. 68.

Bernard, C., A. Ballot, S. Thomazeau, S. Maloufi, A. Furey, J. Mankiewicz-Boczek, B. Pawlik-Skowronsa, C. Capelli, and N. Salmaso. 2017. Appendix 2: Cyanobacteria Associated with Production of Cyanotoxins In J. Meriluoto, L. Spoof, and G. A. Codd (Eds.), *Handbook of Cyanobacterial Monitoring and Cyanotoxin Analysis*. West Sussex, U.K.: John Wiley & Sons, Ltd. pp 502-513.

Carson, B. 2000. *Cylindrospermopsin Review of Toxicological Literature.* Final Report. Prepared for the National Institute of Environmental Health Sciences. p 37.

Chapman, A., and A. Foss. 2019. GreenWater Laboratories Potentially Toxigenic (PTOX) Cyanobacteria List. 10.13140/RG.2.2.32214.50243.

Donohue, J., J. Orme-Zavaleta, M. Burch, D. Dietrich, B. Hawkins, T. Lloyd, W. Munns, J. Stevens, D. Steffensen, D. Stone and P. Tango. 2008. *Cyanobacterial Harmful Algal Blooms: Chapter 35: Assessment Workshop Report.* U.S. EPA Agency Papers. University of Nebraska – Lincoln. pp. 53.

European Food Safety Authority (EFSA). 2009. *Marine Biotoxins in Shellfish – Saxitoxin Group Scientific Opinion of the Panel on Contaminants in the Food Chain.* The EFSA Journal (2009) 1019, 1-76

Galvão, J.A., Oetterer, M., Bittencourt-Oliveira, M.D.C., Gouvêa-Barros, S., Hiller, S., Erler, K., Luckas, B., Pinto, E., and Kujbida, P. 2009. *Saxitoxins Accumulation by Freshwater Tilapia (Oreochromis niloticus) for Human Consumption.* Toxicon, Volume 54, pp. 891-894.

Graham, J. L., K. A. Loftin, A. C. Ziegler, and M. T. Meyer. 2008. *Cyanobacteria in Lakes and Reservoirs: Toxin and Taste Odor Sampling Guidelines.* Biological Indicators. Chapter A7. Cyanobacteria, Version 1.0.

Heinze, R. 1999. *Toxicity of the cyanobacterial toxin microcystin-LR to rats after 28 days intake with the drinking water*. Environmental Toxicology, 14(1): 57-60.

Huang, I-Shuo, and P. V. Zimba. 2019. *Cyanobacterial bioactive metabolites — A review of their chemistry and biology*. Harmful Algae. 86:139-209.

Kennedy, J. O. S. 1997. *The Economics of Algal Bloom Control.* 41st Annual Conference. Australian Agricultural and Resource Economics Society. January 1997. pp.6.

Barros, L. S. S., F. C. de Souza, L. H. S. Tavares, and L. A. do Amaral. 2009. *Cyanobacteria and Absence of Cyanotoxins in a Public Water Supply Source.* Journal of Public Health and Epidemiology. Vol. 1. (1). pp. 007-013.

North Carolina Department of Environmental and Natural Resources. January 2003. *Standard Operating Procedures for Algae and Aquatic Plant Sampling Analysis.* JAN-03 Version. pp. 76.

Prepas, E.E., and T. Charette. 2003. *Worldwide Eutrophication of Water Bodies: Causes, Concerns, Controls.* ***http://adsabs.harvard.edu/abs/2003TrGeo...9..311P***, retrieved April 2, 2011.

Shambaugh, M. A., and E. Brines. 2003. *Monitoring and Evaluation of Cyanobacteria in Lake Champlain (Summer 2002).* Ecosystem Science Laboratory and G. Boyer, SUNY Syracuse Department of Chemistry. For Lake Champlain Basin Program.

Tango, P., W. Butler, and B. Michael. 2008. *Cyanotoxins in the Tidewaters of Maryland's Chesapeake Bay: The Maryland Experience.* pp. 5.

UNESCO. 2005. *Report of the Joint FAO/IOC/WHO ad hoc Expert Consultation on Biotoxins in Bivalve Molluscs.* IOC/INF-1215. 2005.

U.S. EPA. 2019. *Recommended Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcystins and Cylindrospermopsin*. EPA-822R19001.

U.S. EPA. 2015. *Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water.* EPA-815R15010.

U.S. EPA. 2015. *Drinking Water Health Advisory for the Cyanobacterial Microcystin Toxins.* EPA-820R15100.

U.S. EPA. 2015. *Drinking Water Health Advisory for the Cyanobacterial Toxin Anatoxin-a.* EPA-820R15104.

U.S. EPA. 2015. *Drinking Water Health Advisory for the Cyanobacterial Toxin Cylindrospermopsin.* EPA-820R15101.

U.S. EPA. 2011. *Exposure Factors Handbook 2011 Edition*, EPA-600R09052F.

U.S. EPA, 2009. *2009 Edition of the Drinking Water Standards and Health Advisories.* EPA 822-R-09-001.

U.S. EPA. 2006. *Toxicological Reviews of Cyanobacterial Toxins: Anatoxin-A. Draft.* NCEA-C-1743.

U.S. EPA. 2006. *Toxicological Reviews of Cyanobacterial Toxins: Cylindrospermopsins. Draft.* NCEA-C- 1763.

U.S. EPA. 2006. *Toxicological Reviews of Cyanobacterial Toxins: Microcystins LR, RR, YR and LA. Draft.* NCEA-C-1765. November 2006.

U.S. EPA. 1997. *Exposure Factors Handbook (1997, Final Report).* NCEA.

USGS. 2008. *Guidelines for Design and Sampling for Cyanobacterial Toxin and Taste-and-Odor Studies in Lakes and Reservoirs.* Scientific Investigations Report 2008-5038.

Watzin, M., A. Shambaugh, and G. Boyer. 2003. *Monitoring and Evaluation of Cyanobacteria in Lake Champlain Summer 2002.*Technical Report No 41. Lake Champlain Basin Program. pp. 36.

World Health Organization. 1998. *Cyanobacterial Toxins: Microcystin LR in Drinking Water*. WHO/SDE/WSH/03.04/57.

Note: Some published literature that identifies cyanobacterial bloom threshold definitions include: Carson, Bonnie; Anonymous 2010; Bernard. Catherine et al.; Donohue. Joyce et al. 2008; Kennedy. John O.S. 1997; Tango. P. et al.; Watzin. M. et al. 2003; Ludmilla. Santana Soares e Barros. et al.; and North Carolina Department of Environmental and Natural Resources. January 2003.