

WEST VIRGINIA

**DEPARTMENT OF HEALTH AND
HUMAN RESOURCES**

**HARMFUL ALGAL BLOOM
RESPONSE PLAN
FOR RECREATIONAL WATERS**

April 2018

PROMULGATION LETTER

The West Virginia Department of Health and Human Resources (DHHR), Bureau for Public Health (BPH), Center for Threat Preparedness (CTP) is committed to protecting the well-being of West Virginia Citizens as well as property and facilities. The vision of the Bureau for Public Health is to have healthy West Virginians in healthy communities. The mission is to help shape the environments within West Virginia so communities can be safe and healthy. To help ensure that, we as a public health agency are as prepared as we can be to protect the state and the occupants in the event of a serious threat, hazard or emergency situation. The following Harmful Algal Bloom (HAB) Response Plan for Recreational Waters was developed for DHHR through a collaborative multi-agency effort including the BPH's Office of Environmental Health Services (OEHS) and the CTP; the West Virginia Department of Environmental Protection; the West Virginia Division of Natural Resources; the U.S. Army Corps of Engineers; and Local Health Departments. These are the agencies primarily responsible for responding to HABs in West Virginia. The principal objective of DHHR's HAB Response Plan is to provide a unified statewide approach to address HABs in West Virginia's recreational waters and to protect people and animals from toxins produced by cyanobacteria.

No plan can completely prevent the consequences of an incident, whether to property or to life. However, good plans executed by knowledgeable and well-trained personnel can and will minimize harm and losses. This plan establishes specific general policies and specific procedures that should be followed when a potential HAB is observed in public recreational waters and is designed to help DHHR employees and partners respond appropriately. While the development of a HAB is fairly unpredictable, this plan allows for an immediate response by DHHR and partners, thereby protecting public health.

This plan is considered a living document and will require regular evaluation for updates and revisions. The OEHS and CTP will be responsible for maintenance and updates. This plan will be considered a component of the West Virginia Public Health Threat Response Plan which supports Annex G of the West Virginia State Emergency Operations Plan. The authority and responsibility to implement this plan begins immediately upon notification of authorities.

Questions about this plan should be directed to the Director of OEHS, Walter Ivey, at 304-356-4272; the Interim Director of CTP, Donnie Haynes, at 304-558-6900.

Respectfully Submitted,

Donnie Haynes, Interim Director
Center for Threat Preparedness
West Virginia Bureau for Public Health

SIGNATURE PAGE

We the undersigned endorse this plan and agree to support DHHR by accomplishing, to the best of our abilities, the assigned responsibilities in advance of, during, and following a recognized public health threat. These activities are aimed at reducing injury, disease, disability and death among WV's citizens:

Director, Office of Environmental
Health Services

Interim Director, Center for Threat Preparedness

RECORD OF DISTRIBUTION

Change Number	Section	Date of Change	Individual Making Change	Description of Change

RECORD OF CHANGES

Change Number	Section	Date of Change	Individual Making Change	Description of Change

ACKNOWLEDGEMENTS

The development of this document could not have been possible without a close collaboration between the West Virginia Bureau for Public Health, West Virginia Department of Environmental Protection, West Virginia Division of Natural Resources, Wheeling-Ohio County Health Department, Kanawha-Charleston Health Department, U.S. Army Corps of Engineers and Ohio Environmental Protection Agency. The State of Ohio’s “Harmful Algal Bloom Response Strategy for Recreational Waters” served as the foundation for this document.

TABLE OF CONTENTS

PROMULGATION LETTER.....	1
SIGNATURE PAGE.....	2
RECORD OF DISTRIBUTION.....	3
RECORD OF CHANGES.....	3
ACKNOWLEDGEMENTS.....	4
TABLE OF CONTENTS.....	5
I. PURPOSE.....	7
II. SCOPE AND APPLICABILITY.....	7
III. SITUATION AND ASSUMPTIONS.....	8
A. Situation.....	8
1. Rationale for Harmful Algal Bloom (HAB) Response Plan	8
2. Cyanobacteria and Cyanotoxins.....	9
3. Cyanobacterial Blooms.....	9
4. Cyanotoxin Exposure and Health Impacts.....	10
5. Cyanotoxin Advisory Thresholds for Recreational Waters.....	11
B. Assumptions.....	12
IV. CONCEPT OF OPERATIONS—GENERAL.....	12
V. AGENCY ROLES AND RESPONSIBILITIES AND RESPONSE ACTIVITIES.....	12
A. Agency Roles and Responsibilities.....	12
1. Bureau for Public Health.....	12
2. Department of Environmental Protection.....	13
3. Division of Natural Resources.....	13
4. Local Health Departments.....	13
5. Joint Agency Collaboration.....	14
B. Response Activities.....	14
1. Observation and Reporting of Potential HABs.....	14
2. Reporting HAB-related Illness in Humans or Animals.....	15
3. Sampling, Screening and Cyanotoxin Analysis.....	15
4. Data Management and Information Sharing.....	16

5. HAB Advisory Postings.....	16
a. HAB General Information Sign.....	17
b. Recreational Public Health Watch Advisory.....	17
c. Recreational Public Health Warning Advisory.....	17
d. HAB Fish Consumption Advisory Sign.....	18
6. Public Awareness and Education.....	18
7. Media Outreach for HABs.....	19
GLOSSARY.....	20
ACRONYMS.....	21
APPENDICES.....	22
APPENDIX 1 – Table 1. Cyanobacteria and Their Associated Cyanotoxins	23
APPENDIX 2 – Table 2. Public Health Advisory Thresholds for Cyanotoxins in Recreational Waters.....	25
APPENDIX 3 – Table 3. Roles and Responsibilities of State Agencies.....	27
APPENDIX 4 – Regulated Beaches.....	29
APPENDIX 5 – Algal Bloom Report Form.....	32
APPENDIX 6 – HAB-Related Human Illness and Animal Illness Report Forms.....	34
APPENDIX 7 – Safety Precautions and Sampling Protocol.....	39
APPENDIX 8 – Suggested Materials for Grab Sample Collection.....	43
APPENDIX 9 – Laboratories Available for Cyanotoxin Analysis.....	45
APPENDIX 10 – HAB General Information Sign.....	48
APPENDIX 11 – Recreational Public Health Watch Advisory.....	50
APPENDIX 12 – Recreational Public Health Warning Advisory.....	52
APPENDIX 13 – Fish Consumption Advisory.....	54
APPENDIX 14 – 2018 HAB Contacts.....	56

I. PURPOSE

The purpose of West Virginia’s Harmful Algal Bloom Response Plan is to provide a unified statewide approach to address harmful algal blooms (HABs) in West Virginia’s recreational waters and to protect people and animals from toxins produced by cyanobacteria. The focus of this plan is on public recreational waters, although these principles and practices can apply to any body of water.

This HAB response plan is an annex to the West Virginia Department of Health and Human Resources (DHHR) Public Health All Hazards Threat Response Plan. See the DHHR Public Health All Hazards Threat Response Plan and the West Virginia State Emergency Operations Plan for more information.

A separate response plan for responding to HABs in sources of drinking water is available from the West Virginia Bureau for Public Health (BPH) at http://www.wvdhhr.org/oehs/public_health/blue_green_algae.asp. This plan follows the U.S. Environmental Protection Agency’s (EPA) “Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water” (2015) and includes guidance on testing private drinking water sources for the presence of cyanotoxins and treatment options.

II. SCOPE AND APPLICABILITY

This annex facilitates coordination between agencies responsible for responding to HABs by defining agency roles and responsibilities and detailing response procedures. Specifically, this plan includes:

- Background information on cyanobacteria and cyanotoxins and health effects of exposure to cyanotoxins
- Information on environmental sampling for cyanobacteria and screening and analysis for cyanotoxins
- Information to educate the recreating public
- Procedures for reporting potential HABs observed in public recreational waters
- Procedures for reporting HAB-related illness in humans and animals
- Numeric cyanotoxin thresholds for making public health advisory decisions
- Guidance for issuing, posting, and lifting public health advisories
- Procedures for data management and information sharing
- Resources and websites for more detailed information
- Description of the State’s response/coordination process

III. SITUATION AND ASSUMPTIONS

A. Situation

1. Rationale for HAB Response Plan

Since cyanotoxins have been associated with numerous animal deaths and human illnesses, they are a growing environmental and public health concern. Harmful algal blooms and algal toxins have increased globally in geographic range, frequency, duration, and severity in recent years. In 2012, the Centers for Disease Control and Prevention (CDC), the EPA and the U.S. Geological Survey (USGS) established the Inland Harmful Algal Blooms Discussion Group to address HAB issues nationwide. The increasing importance of this issue was underscored in 2014 when a HAB impacted the drinking water of approximately 500,000 residents of Toledo, Ohio.

Health advisories provide states, drinking water utilities, and the public with information on health effects of cyanotoxins, analytical methods to test for cyanotoxins in water samples, and treatment technologies to remove cyanobacteria toxins from drinking water. Due to the potency of these toxins and no known antidote, it is recommended that public health and other regulatory agencies take a conservative approach when setting recreational water thresholds to avoid human exposure to these toxins. In 2015, the EPA released drinking water health advisories for the cyanobacterial toxins microcystin and cylindrospermopsin. In 2016, the draft of “Human Health Recreational Ambient Water Quality Criteria and/or Swimming Advisories for Microcystins and Cylindrospermopsin—2016” was published by the EPA. This draft includes recommended threshold concentrations of microcystins and cylindrospermopsin for issuing advisories in recreational water that are protective of human health. While these recommended criteria are not regulations, these values can be used in making decisions whether to close, open, or warn about concerns in recreational waters in a manner consistent or similar to their current recreational water advisory programs.

It is not clear how expansive the algal problem is in West Virginia. DEP’s lakes monitoring program collects observational and nutrient data but has not conducted algae identification or toxin analysis. Some algal blooms have been observed on small lakes with minimal or no contact recreation areas or drinking water intakes. In the summer of 2015, HABs occurred in the Ohio River and in R.D. Bailey Lake, a USACE lake in Wyoming County. These recent blooms have identified a need for a multi-agency, statewide HAB response plan in West Virginia.

2. Cyanobacteria and Cyanotoxins

Cyanobacteria, or blue-green algae, are photosynthetic microorganisms present in streams, lakes, wetlands, and oceans worldwide. Cyanobacteria can grow in the water column (planktonic), aggregated on the water surface (metaphytic), attached to other algae (epiphytic), or attached to substrates (benthic) depending on the species. Some cyanobacteria produce toxins called cyanotoxins that can cause illness and death in humans and animals. Toxin production is strain specific and many cyanobacteria can produce one or several different types of toxins including hepatotoxins (acting on the liver), neurotoxins (acting on the nervous system), and dermatotoxins (causing skin irritation) (see Appendix 1, Table 1). Cyanotoxins can be found within bacterial cells or can be released into the water column in great concentration following the sudden die-off of an algal bloom (e.g. when an algaecide is used) or gradually as some bacteria die during the lifecycle of a bloom. Cyanotoxins are colorless, odorless, and tasteless and can persist in the water column after a HAB is gone. Toxins are degraded by bacterial action and sunlight over time.

3. Cyanobacterial Blooms

Most cyanobacteria species occur in low concentrations, however, when environmental conditions are favorable, cells can multiply rapidly forming either planktonic or benthic blooms. Formation of algal blooms is regulated by three primary environmental conditions: water temperature, light exposure, and trophic status of the water. Algal blooms often arise when there are warm temperatures, sunny conditions, eutrophic conditions (excess organic matter and nutrients such as phosphorus and nitrogen), and low-flow or low-water conditions. Cyanobacterial blooms can vary in species composition and toxin production over time and within a water body. Not all cyanobacterial blooms result in cyanotoxin production. When blooms are dominated by potentially toxigenic genera of cyanobacteria, they are referred to as “harmful algal blooms” (HABs). The specific mechanism and conditions necessary for toxin production are not yet fully understood.

Cyanobacteria blooms can be distributed evenly throughout a body of water, or they may be irregularly distributed by weather and lake conditions, water movement, and topographic features. Cyanobacteria populations may accumulate at 1 or 2 cm below the water surface. These surface accumulations, or scum, can develop during calm, sunny weather and can extend to depths of more than 1 meter. Many species of planktonic cyanobacteria possess specialized intracellular gas vesicles which enable the organism to regulate its buoyancy. These species actively seek water depths with optimal growth conditions during calm, non-mixed conditions. However, regulation of buoyancy is slow and conditions such as strong winds,

rainfall, and currents can mix a surface algal bloom throughout the water column. Winds can concentrate a surface algal bloom in a leeward (downwind) area such as a bay, cove, beach, or inlet. Hydrologic changes caused by heavy rains or discharge from a stream can result in “localized” currents that significantly affect cyanobacteria distributions. Areas like shallow bays, coves, sites directly affected by nutrient-rich inflows, or structures that affect flow (e.g., locks, dams, dikes, piers, or intake towers) can significantly affect population growth rates and distribution. It is important to understand these various factors that affect the distribution of cyanobacteria because the absence of a surface algal bloom does not necessarily indicate an algal bloom is not present. Blooms can dissipate within hours as conditions change, however, the dissipation of a HAB does not necessarily mean the bloom has senesced, or died. The bloom may have moved to another area of the lake or mixed below the surface within the water column. In addition, some cyanobacteria cannot form surface scums, so surface accumulations should not be relied on as the only indicator that a HAB is present.

Color is not necessarily a good way to distinguish cyanobacteria from green algae or suspended sediment. The name “blue-green algae” doesn’t necessarily correspond to the color of all cyanobacteria as some cyanobacteria can appear brown, white, black, purple, or red and/or green. For example, *Cylindrospermopsis* spp. blooms are generally brown and appear like suspended sediment. Other blooms are green and are often mistaken for green algae. The best way to determine if toxigenic cyanobacteria are present is through microscopic examination and other cyanobacteria screening tools (e.g. molecular methods, cyanotoxin field test kits).

In addition to toxin production, HABs can have negative impacts on the environment and can raise serious concerns for drinking water sources, recreational water use, and animals. Large blooms can cause decreased dissolved oxygen concentrations resulting in fish kills. Many cyanobacteria also produce taste and odor compounds that affect the taste of fish. The foul smell produced by some cyanobacteria is a nuisance to those living around or recreating on the water.

4. Cyanotoxin Exposure and Health Impacts

The most common routes of human exposure to cyanotoxins include: accidental ingestion of water during recreational activities or ingestion of contaminated drinking water; inhalation or direct skin or mucous membrane contact during recreational activities such as swimming, canoeing or bathing; consumption of foods (such as fruits and vegetables) washed with contaminated water; and consumption of fish or shellfish from contaminated waters. Children may be more susceptible and sensitive to the effects of algal toxins and are more likely to engage

in activities that allow water to be swallowed or inhaled.

Some algal toxins can accumulate in fish tissues, particularly in internal organs such as the liver and kidneys. Fish tissue monitoring and research has shown that fish fillets from fish caught in areas affected by a HAB should be safe to eat as long as sport fish consumption advisories are followed. It is recommended that the fat, skin, and internal organs be removed from the fish and discarded before cooking. The fillets should be rinsed with clean water to remove any contaminants from the cleaning process before cooking or freezing. West Virginia Sport Fish Consumption Advisories are posted on the West Virginia Department of Health and Human Resources (WVDHHR's) website at <http://www.wvdhhr.org/fish>.

In addition to skin irritation, cyanotoxins can affect liver and brain function. Many of the health symptoms associated with exposure to cyanotoxins are non-specific and can mimic other illnesses and diseases. Therefore, cyanotoxin exposure might not be readily recognized by the medical community or the public. These symptoms include nausea, skin rashes, gastrointestinal distress, disorientation, numbness and fatigue. A person who experiences any of these symptoms after recreational water activities should seek medical care immediately. Dogs can have more severe symptoms than humans, including collapse and sudden death after drinking contaminated water, swallowing contaminated water while swimming, or licking algae from their fur. There are no known antidotes to cyanotoxin poisoning and medical care is supportive.

Increasing the level of awareness within the medical community, general public and public health agencies through education is strongly recommended in order to determine the public health impact of exposure to cyanotoxins. Human and animal illness should be reported by healthcare providers and veterinarians to the LHD of residence (See Section V, Response Activities).

5. Cyanotoxin Advisory Thresholds for Recreational Waters

To maintain consistency and facilitate multi-state responses to HABs on shared waters such as the Ohio River, West Virginia adopted the State of Ohio's cyanotoxin public health advisory threshold guidelines in 2016 (see Appendix 2, Table 2). The State of Ohio developed these guidelines using risk assessment frameworks, exposure assumptions, and toxicity values from state, national, and primary literature sources. These guidelines were based on incidental ingestion only and while protective of human exposures based on current information, they might not be protective of animals such as dogs or livestock. When guidelines for threshold concentrations of microcystins and cylindrospermopsin in recreational water are finalized by the EPA, the State of West Virginia will consider adopting

these guidelines. Moreover, as scientific knowledge of HABs and their related toxins continues to evolve, this response plan may require updating, revising, and/or may become obsolete with the issuance of new toxicity information or national HAB guidance or policy.

B. Assumptions

In the event of a large-scale HAB, an incident command structure may be used within DHHR to respond. DHHR Health Command will work with incident command entities at federal, state, regional and local levels, as applicable. Incident command structures and operations will be consistent with the National Incident Management System model. DHHR staffing will be reallocated to meet the needs of the response. Further details regarding incident management for DHHR can be found in their Public Health Threat Response Plan. Other impacted State agencies may establish their own internal incident management process. If the incident expands in scope or complexity, the State Emergency Operations Center may be considered for activation.

IV. CONCEPT OF OPERATIONS—GENERAL

Please see the *West Virginia Public Health All Hazards Response Plan, Command and Control section* for information.

V. AGENCY ROLES AND RESPONSIBILITIES AND RESPONSE ACTIVITIES

A. Agency Roles and Responsibilities

A coordinated effort is crucial to successfully respond to HABs in West Virginia. Agencies primarily responsible for HAB response in West Virginia include West Virginia's BPH, Department of Environmental Protection (DEP), Division of Natural Resources (DNR) and Local Health Departments (LHDs). The following are the responsibilities of each of the state agencies that participated in the development of this response plan:

1. Bureau for Public Health

- Prepare awareness and educational messaging
- Assist with sampling as needed when blooms are sighted
- Report potential HAB to West Virginia's HAB mailbox at HAB@wv.gov
- Conduct laboratory analysis
- Provide information about safety regarding HAB issues
- Provide outreach to the public about the health effects of HABS

- Evaluate illness reports, support LHD investigations, and classify reports according to existing case definitions
- Provide outreach to LHDs
- Issue Health Alert Network (HAN) advisory/alert to LHDs, community health providers, hospital-based physicians, veterinarians and other applicable partners
- Establish and maintain departmental incident coordination process through activation of DHHR Health command as indicated

2. Department of Environmental Protection

- Conduct sampling when blooms are sighted
- Report potential HAB to West Virginia's HAB mailbox at HAB@wv.gov
- Train others in sampling protocols
- Conduct aerial surveillance to monitor HABs
- Maintain database of all reported HAB data
- Maintain website, reporting app and interactive map of HAB advisories
- Provide outreach to the public about HABs
- Coordinate with the U.S. Army Corps of Engineers (USACE) on all USACE lakes

3. Division of Natural Resources

- Monitor state park lakes and wildlife management areas for HAB development
- Report potential HAB to West Virginia's HAB mailbox at HAB@wv.gov
- Conduct sampling when blooms are sighted
- Post public health advisories at designated locations
- Provide outreach to the public about HABs
- Coordinate with USACE on jointly managed lakes

4. Local Health Departments

- Assist with sampling as needed when blooms are sighted
- Report potential HAB to West Virginia's HAB mailbox at HAB@wv.gov
- Post public health advisories at designated locations
- Provide information to the public about safety regarding HAB issues
- Provide outreach to the public about the health effects of HABs
- Distribute HAN advisory/alert locally
- Report human and animal illnesses to the BPH's Office of Environmental Health Services (OEHS)

5. Joint Agency Collaboration

- Determine sampling plan including areas to be sampled, frequency of sampling, and agency performing sampling
- Determine public health advisory thresholds
- Determine areas where public health advisories will be posted
- Collect, analyze and store HAB report data and determine who should be contacted for follow-up of HAB reports
- Identify and engage stakeholders and partners
- Provide outreach to the public about HABs
- Establish multi-agency coordination of ongoing incident response through activation of the state Emergency Operations Center as indicated and approved through the Director of the WV Division of Homeland Security and Emergency Management

Appendix 3, Table 3 outlines roles and responsibilities of state agencies for sampling and posting advisories at various recreational water bodies.

Federal agencies, including the U.S. Army Corps of Engineers (USACE), and community partners play an important role in West Virginia's HAB response activities including:

- Report potential HABs to West Virginia's HAB mailbox at HAB@wv.gov
- Coordinate with state agencies to respond to HABs including DNR on jointly managed lakes
- Assist with sampling as needed and allowable when blooms are sighted
- Post public health advisories at designated locations as needed and allowable
- Provide outreach to the public about HABs

B. Response Activities

1. Observation and Reporting of Potential HABs

The initial observation of a possible HAB involves identifying the presence of color and/or scum in surface water. Blooms can take many forms, from a slight cloudiness in the water column to large, globular scums that resemble spilled paint. The color can vary from brown (looks like suspended sediment), green, blue-green, white, black, purple or red. Blooms can occur on any part of a waterbody, at any time of the year, and at any time of the day. While many blooms consist of harmless green algae, it is best to err on the side of caution and report any bloom that is observed (See photo gallery of HABs at <http://ohioalgaefinfo.com>).

Individuals or agencies that observe a potential HAB in public recreational waters are encouraged to report the HAB using DEP's web application at

<http://tagis.dep.wv.gov/algae> or complete an Algal Bloom Report Form and e-mail the form to West Virginia's HAB mailbox at HAB@wv.gov. The form can be found at http://www.wvdhhr.org/oehs/public_health/blue_green_algae.asp and in Appendix 5 of this response plan. Algal bloom observers are encouraged to submit digital photographs via the HAB web application or with the Algal Bloom Report Form for algal bloom evaluation. Close-up (within 24 inches) and landscape photographs showing the extent and location of the algal bloom are helpful in HAB identification.

HABs reported in non-public (private) waters may be referred to LHDs for assistance. For sampling in private waters, guidance provided in Appendix 7 and Appendix 8 can be used to collect samples. Samples can be sent to the West Virginia Office of Laboratory Services (OLS). Additional labs that perform phytoplankton identification and cyanotoxin analysis are listed in Appendix 9.

2. Reporting HAB-Related Illness in Humans or Animals

West Virginia's Reportable Disease Rule (WV Code 16-3-1; 64 CSR 7) establishes procedures governing the reporting of certain diseases and conditions, unusual health events and clusters or outbreaks of diseases to the BPH. Suspected or confirmed cases of HAB exposure and illness fall under Category II as "any unusual condition or emerging infectious disease" and should be reported by healthcare facilities and providers to the LHD where the individual resides within 24 hours using the Human Illness Report Form (see Appendix 6). Veterinarians with knowledge of an animal case of HAB exposure and illness are encouraged to report this to the LHD where the animal resides using the Animal Illness Report Form (see Appendix 6). LHDs receiving HAB illness reports from physicians or veterinarians should fax completed forms to the BPH's Office of Epidemiology and Prevention Services at 304-558-8736. Alternatively, LHDs can collect case information using the report forms and fax completed forms to the BPH. LHDs will work with the BPH's OEHS on reviewing these reports and determining next steps. If it is determined that an outbreak of HAB-associated illness has occurred, a Recreational Public Health Warning Advisory, as described in Section V, Response Activities, may be posted even when toxin levels are below advisory thresholds.

3. Sampling, Screening and Cyanotoxin Analysis

Following initial observation of a HAB, frequent, close monitoring of the bloom's location(s) and sampling should be conducted, especially in contact recreational areas. A standard sampling protocol and list of suggested materials for grab sample collection can be found in appendices 8 and 9, respectively. Cyanobacterial screening may include: phytoplankton identification (qualitative identification of

genera and/or species present); cell quantification (cell counts); biochemical assessment of the presence of toxins using enzyme-linked immunosorbent assay (ELISA); molecular (qPCR) assessment of cyanobacteria genes or cyanotoxin-production genes; and rapid assessment field tests for cyanotoxins.

If screening is not conducted prior to cyanotoxin analysis, sampling for microcystin is recommended since microcystin has been the commonly occurring cyanotoxin in states bordering West Virginia. If phytoplankton identification or molecular screening shows an abundance of cyanobacteria capable of producing other cyanotoxins (such as cylindrospermopsin, anatoxin-a, and saxitoxin) additional analysis for those cyanotoxins is recommended.

4. Data Management and Information Sharing

All HAB reports and HAB data (cyanotoxin and phytoplankton data, and photographs) will be entered into a database housed at the DEP and cyanotoxin data will be posted on <http://go.wv.gov/algae>. This website has been developed as the State's primary site for HAB information and includes data on reported HABs in recreational waters, public health advisory notifications, the ability to report algal blooms, fact sheets and general HAB information, and an interactive web-based map for locating public health advisories on recreational waters.

When a HAB is confirmed and a "Recreational Public Health Warning Advisory" (described in Section V, Response Activities) is issued, a public health alert may be issued and distributed via the WV Health Alert Network (HAN) to LHDs, community health providers, hospital-based physicians, veterinarians and other applicable partners, especially healthcare providers in general practice, urgent care and emergency departments who might treat patients with HAB exposure and illness.

5. HAB Advisory Posting

Public advisories are necessary to inform the public of the health risks associated with exposure to water that contains cyanotoxins. The State of West Virginia will issue two levels of advisories for recreational waters based upon the available evidence as described below. It is recommended that all coordinating agencies post (and remove) advisories according to this plan to ensure consistency in messaging. Electronic versions of the sign templates are available at http://www.wvdhhr.org/oehs/public_health/blue_green_algae.asp for use by LHDs and coordinating agencies to help ensure timely and consistent messaging across the state.

a. HAB General Information Sign

Harmful algal bloom general information signs with the following language may be posted for recreational waters with a history of HAB occurrence or upon confirmation of a potential HAB: “Have fun on the water, but know that blue-green algae are present in many of West Virginia’s recreational waters. Their toxins may be, too. Be alert! Avoid water that: looks like spilled paint; has surface scums, mats or films; is discolored or has colored streaks; has green globs floating below the surface Avoid swallowing water. For more information go to: <http://www.wvdhhr.org/oehs> or <http://go.wv.gov/algae> (see Appendix 10 for general informational sign template).

b. Recreational Public Health Watch Advisory

When a potential HAB is confirmed and cyanotoxin levels are equal to or exceed the Recreational Public Health Watch Advisory threshold level (6 µg/L for microcystin)(see Appendix 2, Table 2), a Recreational Public Health Watch Advisory will be issued whether or not a HAB is still present. An ORANGE sign (with black lettering) with the following language will be posted: “A harmful algal bloom (HAB) is present and/or algal toxins have been detected in this area. Swimming and wading are not recommended for children, pregnant or nursing women, those with certain medical conditions and pets. For more information go to: <http://go.wv.gov/algae> or <http://www.wvdhhr.org/oehs> or contact your local health department at [Insert LHD info]” (see Appendix 11 for public health watch advisory sign template).

Once a HAB advisory is posted, sampling for cyanotoxin will occur according to standard sampling procedures for cyanotoxin found in Appendix 7. The Public Health Watch Advisory may be lifted after two consecutive samples taken at least one week apart indicate cyanotoxin concentrations are below the watch advisory threshold level and the algal bloom has dissipated.

c. Recreational Public Health Warning Advisory

A Recreational Public Health Warning Advisory will be issued when cyanotoxin levels are equal to or exceed the Recreational Public Health Warning Advisory threshold level (20 µg/L for microcystin)(see Appendix 2, Table 2). A RED sign (with white lettering) with the following language will be posted (see Appendix 12 for public health warning advisory sign template): “Algal toxins at UNSAFE levels have been detected in this area. Swimming, wading and water activities that create spray are not

recommended. For more information go to: <http://go.wv.gov/algae> or <http://www.wvdhhr.org/oehs> or contact your local health department at [Insert LHD info]”

A Public Health Warning Advisory may be lifted after two consecutive samples taken at least one week apart indicate cyanotoxin concentrations are below the warning advisory threshold level and the algal bloom has dissipated. If cyanotoxin levels remain above public health watch advisory levels, the warning advisory will be changed to a watch advisory.

d. Fish Consumption Advisory Sign

Harmful algal bloom fish consumption advisory signs with the following language may be posted if the HAB is located in a waterbody frequented for fishing (see Appendix 13 for HAB fish consumption advisory sign template): “Eating Fish Caught from Waters with a Harmful Algal Bloom: Some algal toxins can accumulate in fish tissues, particularly in internal organs such as the liver and kidneys. If you decide to eat fish caught from waters affected by a harmful algal bloom, it is recommended that the fat, skin, and internal organs be removed and discarded before cooking. Before cooking or freezing the fish, rinse the fillets with clean water to remove any contaminants from the cleaning process. Fish tissue monitoring and research has shown that fish fillets from fish caught in areas affected by harmful algal blooms (HABs) should be safe to eat as long as sport fish consumption advisories are followed. West Virginia Sport Fish Consumption Advisories are posted on the West Virginia Department of Health and Human Resources (WVDHHR’s) website at: <http://wvdhhr.org/fish>.

6. Public Awareness and Education

West Virginia’s BPH, DEP, DNR, LHDs, and other collaborating agencies will work together to educate the general public about HABs in West Virginia’s public recreational waters. This education includes posting where HABs have been detected, their type and water sample testing levels, potential health risks, and any public health advisories that have been issued for contaminated recreational waters.

Here are the primary ways the agencies educate the general public about HABs:

- All agencies will offer extensive HAB information and resources on the HAB website, which can be accessed at <http://go.wv.gov/algae>.

- Signage will be posted at regulated beaches and public access points (see Section 4 “Harmful Algal Bloom Advisories”).
- When a “Recreational Public Health Watch Advisory” is issued, signage will be posted and the information listed on the website’s HAB Advisory Map at <https://dep.wv.gov/WWE/watershed/Algae/Pages/Harmful-Algal-Blooms.aspx#maps>.
- When a “Recreational Public Health Warning Advisory” is issued, signage will be posted and the information listed on the website’s HAB Advisory Map at <https://dep.wv.gov/WWE/watershed/Algae/Pages/Harmful-Algal-Blooms.aspx#maps> and a press release may be issued to alert area residents.
- For recreational bodies of water under a public health advisory, updated water sample test results will be posted periodically on the HAB website, which can be accessed at <https://dep.wv.gov/WWE/watershed/Algae/Pages/Harmful-Algal-Blooms.aspx#maps>.

7. Media Outreach for HABs

The goal of media outreach is to inform West Virginians about HABs and to ensure that they understand potential risks associated with coming into contact with HABs and/or algal toxins. Media outreach will support the agencies’ technical decisions and relay them to the public.

West Virginia’s BPH, DEP, DNR, and LHDs will work together to educate the public and media in the following way:

- Inform reporters that media advisories will not be issued every time a public health advisory is issued. This information will be promptly posted on the website, which is available 24 hours a day and reporters should be reminded throughout the sampling season to check the website for sampling results.
- If an advisory elevates to a “Public Health Warning Advisory” a press release may be issued.
- Initiate a series of joint educational materials to focus on HABs and their potential impacts. We will also promote the HAB website <http://go.wv.gov/algae>, that will house sampling data and advisory levels and encourage the public to check these sites before they visit recreational waters.
- Direct reporters and the public to the HAB website, which can be accessed at <http://go.wv.gov/algae>. The website will list all levels of toxin advisories as well as sampling data and other algae information.

GLOSSARY

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

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

Benthic: Living in or on the bottom of a body of water.

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

Congeners: Variants or configurations of a toxin.

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

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

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

Enzyme Linked Immunosorbent Assay (ELISA): A rapid assessment method commonly used to detect microcystin, cylindrospermopsin and saxitoxin.

Eutrophic: Water enriched with organic matter and dissolved nutrients, such as nitrates and phosphates that promote a proliferation of algae and aquatic plants.

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

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

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.

Planktonic: Living in the water column or floating.

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

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

Water Column: Column of water from the surface of a river or lake to the bottom sediments

ACRONYMS

BPH: Bureau for Public Health

DEP: Department of Environmental Protection

DHHR: Department of Health and Human Resources

DNR: Division of Natural Resources

HABs: Harmful Algal Blooms

LHDs: Local Health Departments

OEHS: Office of Environmental Health Services

OLS: Office of Laboratory Services

ORSANCO: Ohio River Sanitation Commission

USACE: United States Army Corps of Engineers

EPA: Environmental Protection Agency

APPENDICES

**APPENDIX 1 – TABLE 1. CYANOBACTERIA AND THEIR ASSOCIATED
CYANOTOXINS**

TABLE 1. CYANOBACTERIA AND THEIR ASSOCIATED CYANOTOXINS

Cyanobacterial Genera	Hepatotoxins		Neurotoxins	
	CYLINDRO-SPERMOPSIN	MICROCYSTIN	ANATOXIN	SAXITOXIN
<i>Anabaena/Dolichospermum</i>	X	X	X	X
<i>Anabaenopsis</i>		X		
<i>Aphanizomenon</i>	X		X	X
<i>Aphanocapsa</i>		X		
<i>Cylindrospermopsis</i>	X			X
<i>Haplosiphon</i>		X		
<i>Lyngbya (Plectonema)</i>	X			X
<i>Microcystis</i>		X		
<i>Nostoc</i>		X		
<i>Oscillatoria (Planktothrix)</i>		X	X	X
<i>Phormidium</i>			X	
<i>Pseudanabaena</i>		X		
<i>Raphidiopsis</i>	X		X	
<i>Umezakia</i>	X			
<i>Synechococcus</i>		X		
<i>Synechocystis</i>		X		

**APPENDIX 2 – TABLE 2. PUBLIC HEALTH ADVISORY THRESHOLD
LEVELS FOR CYANOTOXINS IN RECREATIONAL WATERS**

Table 2. Public Health Advisory Threshold Levels for Cyanotoxins in Recreational Waters

Threshold Level (µg/L)	Microcystin*	Anatoxin-a	Cylindrospermopsin	Saxitoxin*
General Informational Signage	<6	<80	<5	<0.8
Recreational Public Health Watch Advisory	6	80	5	0.8
Recreational Public Health Warning Advisory	20	300	20	3

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

APPENDIX 3 – TABLE 3. ROLES AND RESPONSIBILITIES OF STATE AGENCIES

Table 3. Roles and Responsibilities of State Agencies

Type of Waterbody	Sampling or Observations of Blooms	Post Advisory Signage
State Park Lakes	DNR, LHD	DNR, LHD
Regulated Beaches	DEP, LHD	LHD
Ohio River	DNR, DEP	LHD
Rivers – public access points	DNR, DEP	LHD

APPENDIX 4 – REGULATED BEACHES

NAME	LOCATION	COUNTY	PERMIT HOLDER	TELEPHONE
Bee Run Beach	1734 Bee Run Road, Sutton, WV 26601	Braxton	USACE	304-765-2816
Bulltown Beach	1 Burnsville Lake Road, Burnsville, WV 26335	Braxton	USACE	304-452-8006
Sutton Dam Beach	1734 Bee Run Road, Sutton, WV 26601	Braxton	USACE	304-765-2816
Fox Fire KOA Bathing Beach	290 Fox Fire Road, Milton, WV 25441	Cabell	Brent Andrews	304-743-5622
Crystal Lake Beach	80 Crystal Lake Road, West Union, WV 26456	Doddridge	Crystal Lake Club	
Summit Betchel Boy Scout Reserve	2550 Jack Furst Dr, Glen Jean, WV 25846	Fayette	Boy Scouts of America	304-465-2800 Fax: 304-465-2819
Ace Adventures	1 Concho Road, Minden, WV 25879	Fayette	Ace Adventures	Fax: 304-469-3053
Blue Bend Recreation Area*	W State Route 16, White Sulphur Springs, WV 24986	Greenbrier	U.S. Forest Service	
Camp Alleghany for Girls	Stonehouse Road, Lewisburg, WV 24901	Greenbrier	Camp Alleghany	540-760-1026
Camp Greenbrier	100 Camp Greenbrier Drive, Alderson, WV 24910	Greenbrier	Camp Greenbrier	304-445-7168
Greenbrier River Campground	Route 63, Alderson, WV 24910	Greenbrier	Robert Bociek & Beverly Wolfe	304-956-4086
Lake Sherwood *	Lake Sherwood Road, White Sulphur Springs, WV 24986	Greenbrier	U.S. Forest Service	304-536-2144
Ritter's Hidden Valley Estates	PO Box 146 Capon Bridge, WV 26711	Hampshire	RHV Maintenance, Inc.	304- 856-1159
Lake Floyd Club, Inc.	581 Lake Floyd Circle, Salem, WV 26426	Harrison	Lake Floyd Club, Inc.	304-627-7868
Maple Lake Club, Inc.	Maple Lake Road, Bridgeport, WV 26330	Harrison	Maple Lake Club, Inc.	304-842-2598; 304-641-9703
Oral Lake Fishing Club, Inc.	284 Oral Lake Road, Bridgeport, WV 26330	Harrison	Oral Lake Fishing Club, Inc.	304-622-0944; 304-669-3385
Mountain Lake Club, LLC	1329 Lakeside Drive (Shannondale) Harpers Ferry, WV 25425	Jefferson	Mountain Lake Club, LLC	240-731-1349
Upper Mud River Bathing Beach	4956 Upper Mud River Road, Branchland, WV 25506	Lincoln	DNR	304-524-2020
Green Lakes Sportsman Club	McCurdysville Pike, Rivesville, WV 26588	Marion	Joe Urse	304-366-9688

Rock Lake Club	191 Rock Lake Road, Fairmont, WV 26554	Marion	Rock Lake Club	
Jennings Randolph Lake Beach *	WV Rte. 46 E., Elk Garden, WV 26717	Mineral	USACE	304-355-2346
Camp Mountaineer (Park Pond)	187 Camp Mountaineer Road, Morgantown, WV 26508	Monongalia	Mountaineer Area Council/BSA	304-366-3940; 304-366-3944
Chestnut Ridge Regional Park (park pond)	346 Chestnut Ridge Camp Road, Bruceton Mills, WV 26525	Monongalia	Monongalia County Commission	304-594-1773; 304-594-1711
Emma Kaufmann Camp (Cheat Lake)	297 Emma Kaufmann Camp Road, Morgantown, WV 26508	Monongalia	Jewish Community Center of Greater Pittsburgh	304-599-4435; 304-599-5064
Millstone Point Beach (Cheat Lake)	Cheat Lake Park & Trail, Morgantown, WV 26508	Monongalia	Lake Lynn Generation	724-725-6209
Cacapon State Park Beach	818 Cacapon Lodge Drive, Berkeley Springs, WV 25411	Morgan	Cacapon State Park	304-258-1022, ext.5185; Fax:304-258-8867
Summersville Lake Beach*	2981 Summersville Lake Road, Summersville, WV 26651	Nicholas	USACE	304-872-3459
Alpine Lake HOA	700 W. Alpine Drive, Terra Alta, WV26764	Preston	Alpine Lake HOA	304-789-2481
Big Bear Lake	450 Big Bear Lake Road, Bruceton Mills, WV 26525	Preston	Big Bear Lake	304-379-4382
Lake Stephens Bathing Beach	Lake Stephens, Surveyor, WV 25932	Raleigh	Raleigh Co. Recreation Authority	304-934-5323
Tygart Lake State Park Beach	1240 Paul E. Malone Road, Grafton, WV 26354	Taylor	Tygart Lake State Park	304-518-1759
Beech Fork Lake Stowers Branch Bathing Beach	3784 Beech Fork Road, Lavalette, WV 25535	Wayne	USACE	304-525-0359
East Lynn Lake	683 Overlook Trail Road, East Lynn, WV 25512	Wayne	USACE	304-849-5000

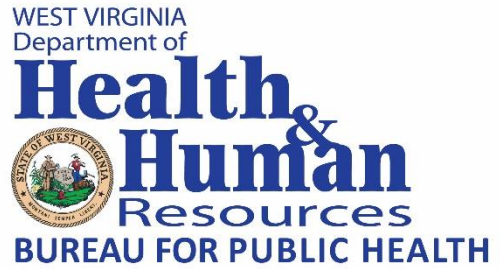
*Operations not under LHD permits

APPENDIX 5 – ALGAL BLOOM REPORT FORM

**APPENDIX 6 – HAB-RELATED HUMAN ILLNESS AND ANIMAL ILLNESS
REPORT FORMS**

**HARMFUL ALGAL BLOOM (HAB)
HUMAN ILLNESS REPORT**

West Virginia Bureau for Public Health
350 Capitol Street, Room 125
Charleston, WV 25301
Phone: 304-558-5358 Fax: 304-558-8736



Reporting entity:

- General public Veterinarian Poison Control Center Biologist
 Local Health Department State agency Other _____

Contact name _____ Phone number _____

Identifying information for case:

Name _____ Phone number _____

Address _____ County _____

Demographic information for case:

Date of birth ____/____/____ Height: ____' ____" Weight: _____ lbs

Sex: Male Female Ethnicity: Hispanic Non-Hispanic

Race: American Indian Asian Black White Other _____

Suspected source of exposure:

Public water body (name and location) _____

Home/private water body (name and location) _____

Food (type) _____

Drinking water (source/location) _____

Other (please describe) _____

If exposure source was a water body:

Visible algae present: Yes No Unknown Odor: Yes No Unknown

Describe water body color and appearance _____

Sick or dead animals present: Yes No Unknown

If yes, (type, number): _____

Activities during exposure to water body:

Swimming Wading Boating Fishing Tubing/skiing

Other (please describe) _____

(See next page)

Exposure details:

Suspected routes(s) of exposure:

Inhalation Drinking/Swallowing Skin contact Other _____

Date(s) of exposure ____/____/____ ____/____/____ ____/____/____

Total duration of exposure _____ minutes hours days

Symptoms:

Did case seek medical attention? Yes No

Onset date of symptoms ____/____/____ Duration of symptoms _____ days

General:

Fever Headache Nasal congestion Fatigue Eye redness/irritation Sore throat

Respiratory:

Cough Wheezing Shortness of breath

Gastrointestinal:

Nausea Vomiting Diarrhea

Muscular/skeletal:

Muscle pain Joint pain Difficulty walking

Neurologic:

Numbness Blurred vision Tingling/burning Confusion Paralysis Seizures Coma

Dermal:

Rash Blisters Itching

Other symptoms (please describe) _____

Are you aware of other people that were exposed and became ill? Yes No

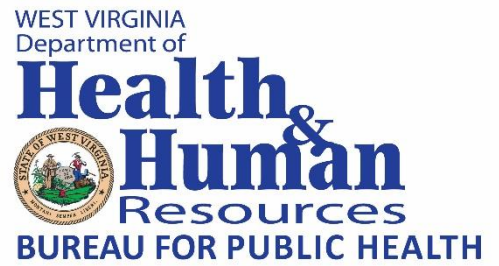
If yes, name and contact information of exposed person(s) _____

Exposure/illness (please describe) _____

Please fax completed form to the West Virginia Bureau for Public Health's Office of Epidemiology and Prevention Services. Fax: 304-558-8736 ATTN: Erica Thomasson, OEHS

**HARMFUL ALGAL BLOOM (HAB)
ANIMAL ILLNESS REPORT**

West Virginia Bureau for Public Health
350 Capitol Street, Room 125
Charleston, WV 25301
Phone: 304-558-5358 Fax: 304-558-8736



Reporting entity:

- General public Veterinarian Poison Control Center Biologist
 Local Health Department State agency Other _____

Contact name _____ Phone number _____

Address _____ County _____

Animal owner name (if not reporting entity) _____

<p>If reporting a single animal or small group of animals (please fill out a form for each animal):</p> <p>Animal type: <input type="checkbox"/> Domestic <input type="checkbox"/> Stray <input type="checkbox"/> Unknown</p> <p>Species: Dog (breed/description) _____ Cat (breed/description) _____ Livestock (type) _____ Other (describe) _____</p> <p>Animal characteristics: Sex: <input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Unknown Age _____ years Weight _____ lbs</p> <p>Did the animal receive veterinary care? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown If yes, veterinary clinic name and address _____ _____ _____</p> <p>Did the animal die? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p>	<p>If reporting a large group of animals (e.g. flock, herd, or school of fish)</p> <p>Species: Livestock (type) _____ Birds (type) _____ Fish (type) _____ Other (describe) _____</p> <p>Number of animals affected _____</p> <p>Did animals receive veterinary care? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown If yes, veterinary clinic name and address _____ _____ _____</p> <p>Did any animals die? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p> <p>If yes: What condition were animals found in? (check all that apply) <input type="checkbox"/> Fresh <input type="checkbox"/> Scavenged <input type="checkbox"/> Decomposed <input type="checkbox"/> Unknown</p> <p>How many dead animals were counted? _____</p> <p>Necropsy performed? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p>
--	--

(See next page)

Suspected source of exposure:

- Public water body (name and location) _____
- Home/private water body (name and location) _____
- Drinking water (source/location) _____
- Other (describe) _____

If exposure source was a water body:

- Visible algae present: Yes No Unknown
- Odor present: Yes No Unknown
- Describe water body color and appearance _____

Exposure details:

Routes(s) of exposure:

- Inhalation Swallowing/Drinking Skin contact Unknown Other _____

Date(s) of exposure ____/____/____ ____/____/____ ____/____/____

Total duration of exposure _____ minutes hours days

Symptoms:

Onset Date of Symptoms ____/____/____ Duration of Symptoms _____ days

General:

- Fever Lethargy Loss of appetite Difficulty walking

Respiratory:

- Cough Wheezing Rapid breathing

Gastrointestinal:

- Vomiting Diarrhea Excessive drooling Lip licking/gagging

Neurologic:

- Weakness Stumbling Behavior change Paralysis Seizure Coma

Dermal:

- Rash Itching Redness/Swelling

Other symptoms (please describe) _____

Are you aware of other animals that were exposed and became ill? Yes No

If yes, please describe and provide contact info _____

Please fax completed form to the West Virginia Bureau for Public Health’s Office of Epidemiology and Prevention Services. Fax: 304-558-8736 ATTN: Erica Thomasson, OEHS

APPENDIX 7 – SAFETY PRECAUTIONS AND SAMPLING PROTOCOL

SAFETY PRECAUTIONS AND SAMPLING PROTOCOL

The purpose of collecting phytoplankton samples is to determine whether a bloom consists of potentially toxigenic genera of cyanobacteria. This sampling protocol is designed to be responsive to HAB reports in recreational waters in order to protect public health. It is applicable by anyone who wishes to collect and characterize phytoplankton and cyanotoxin in West Virginia's waters. These guidelines shall provide sampling consistency between coordinating agencies involved in HAB response.

Safety Precautions

Safety must come first when collecting samples from algal blooms that are potentially harmful. A personal flotation device should always be worn while in or around lakes, rivers, or streams. It is crucial to avoid ingesting water or allowing water to come in contact with skin, eyes, or mucous membranes while collecting samples. Appropriate personal protective equipment including shoulder-length gloves and goggles should be worn to protect the skin and eyes. Chest waders should be worn if collecting a sample when wading off the shore to protect skin from contact with cyan toxin. Avoid inhaling spray from boats, wind, or irrigation water from areas with HABS. Consider wearing a mask to prevent inhalation of spray. Always wash hands with clean, fresh water after sampling and 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 after collecting samples.

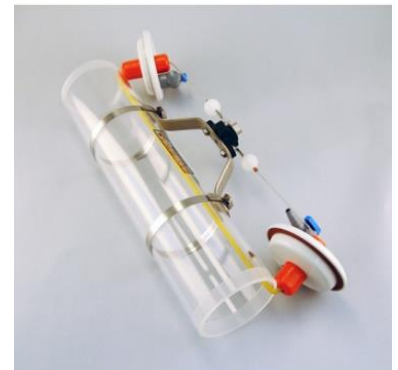
Sample Frequency, Location(s) and Times

Sampling will be conducted on a case-by-case basis depending on current water conditions as algae starts to appear, especially during the peak recreational season. Samples should be collected and if the laboratory determines the algal bloom is dominated by potentially toxigenic genera of cyanobacteria, the algal bloom will be classified as a HAB and cyanotoxin analysis should be conducted. The HAB location should be monitored closely and if cyanotoxin concentrations are above the Public Health Watch Advisory threshold listed in Table 2, the area should be sampled at least weekly. Sampling should continue until two consecutive results collected one week apart indicate that cyanotoxin concentrations are below the watch advisory threshold listed in Table 2. However, monitoring may continue based on environmental conditions and relative health risk.

Factors to consider when sampling includes; toxin concentration and bloom dynamics. The highest cyanotoxin concentrations are expected within dense cyanobacteria blooms and below dead surface scum. To select sample locations, observe locations where water contact is most likely to occur, i.e. swimming areas, boat ramps, water-skiing areas. Look for areas of bloom growth and decay throughout the photic zone. Higher cyanotoxin concentrations are expected near the shore, therefore, consider wind direction and where blooms may be blown, such as the downwind side of a lake (away from where the wind is coming from).

Grab Sample Collection for Recreational Waters

When the location of the bloom is evident (i.e. at the surface or just below the surface), collect a grab sample from the densest part of a bloom. If collecting scum, collect a grab sample from the scum-



water surface interface. Do not collect the portion of the scum that is above the water surface, as these are often dead cells that may no longer be readily identified.

If the bloom is not in a distinct location but diffuse throughout the water column, use a composite sampler that includes a collection for a range of depths. Samplers such as a Van Dorn sampler (pictured at right) allow users to collect water from multiple depths and fill sample containers from the same device. If you suspect the presence of benthic cyanobacteria, collect a sample near (at 6-12 inches above) the lake bottom.

Phytoplankton Sample Collection

Phytoplankton samples should be collected to determine the cause of the bloom. If cyanobacteria are present, Table 1 of Appendix 1 can be used to determine if the bloom is capable of producing cyanotoxins, and which cyanotoxins should be analyzed. If shipping to OLS, phytoplankton samples should be collected in a 125 ml polyethylene terephthalate glycol-modified (PETG) bottle. The bottle should be filled to about the neck leaving a 1 inch space at the top. The volume of water collected is around 100 ml. This air space is needed to provide sufficient space for mixing if preservation is required. If shipping to an alternate lab, the sampler should contact the lab that will be analyzing the samples for further instructions on containers, sample volume, and preservation guidance. Samples must be protected from sunlight at the time of collection and chilled on ice until the sample is processed at the laboratory. Care should be taken to avoid freezing as this can make cyanobacteria identification difficult. If samples are being shipped via courier using ice packs, samples should be wrapped in bubble wrap to avoid freezing. If samples are shipped immediately after collection on wet ice, sample preservation may not be necessary (consult lab conducting analysis). If preservation is necessary, samples should be preserved with Lugol's iodine within 8 hours of collection at a ratio of 1:100. To achieve a 1:100 ratio, add 1 ml of the Lugol's solution per 100 ml of sample. The preserved sample color should be similar to that of weak tea. Species identification is generally easier with unpreserved samples than with preserved samples. If possible, collect one preserved and one unpreserved sample.

Cyanotoxin Sample Collection

West Virginia's OLS conducts toxin analysis using the Ohio EPA Microcystins-ADDA ELISA Method for total microcystins. This method is used for the determination of total (extracellular and intracellular) microcystins, all congeners based on ADDA in water. The unique β -amino acid, ADDA (4E, 6E-3-amino-9-methoxy-2,6,8, trimethyl-10-phenyldeca-4,6-dienoic acid), is present in most (>80%) of the known variants of microcystins. If sending samples to OLS, collect at least 100 ml of sample in a glass or PETG plastic container. Cyanotoxins can attach to the HDPE plastic and are, therefore, not recommended for cyanotoxin analysis. No sample preservative is required with this method. If sending samples to an alternate laboratory, contact the laboratory prior to sample collection as the required sample volume, container type, and preservation may be different if an alternative method is used.

Immediately after sample collection, transfer the sample to a dark cooler on wet ice or ice packs. The sample must be kept in the dark and cool to preserve any cyanotoxins that may be present. If a sample will not arrive for processing at the laboratory within 24–36 hours, the sample must be frozen in a standard freezer until it is processed. Ensure enough head space in the container to allow for expansion of the water when frozen to avoid breaking the bottle.

Total cyanotoxins should be determined for recreational water sample analysis. Total cyanotoxins include both extracellular cyanotoxins, which are located outside the cyanobacteria cell wall, and intracellular cyanotoxins,

which are located inside the cell wall. Samples should be processed in the lab to ensure all algal cells are lysed, which should be verified through microscopic observation. Freeze/thaw three times is a preferred method for lysing algal cells providing total lysis is confirmed through microscopy.

APPENDIX 8 – SUGGESTED MATERIALS FOR GRAB SAMPLE COLLECTION

SUGGESTED MATERIALS FOR GRAB SAMPLE COLLECTION

- Plastic shoulder-length gloves (to protect skin from toxin irritation)
- Goggles and mask
- Chest waders if collecting samples by wading off the shore
- Personal flotation device (PFD)
- For phytoplankton collections: one 125 ml graduated glass bottle or other laboratory-approved container
- For toxin collections: one 125 ml PETG bottles or other laboratory-approved container
- 40 ml vials from DES pre-dosed with preservative if conducting saxitoxin collection
- Lugol's iodine and eye dropper if sample preservation is necessary
- GPS or cell phone with HAB application (insert link) to mark the location of collection
- Cooler with wet ice or ice packs
- Waterproof permanent marker or pencil to label samples
- Large trash bags and twist ties to contain ice in cooler
- FedEx or UPS shipping labels

*Sampler should contact the lab that will be analyzing the samples for further instructions on containers, sample volume, and preservation guidance.

APPENDIX 9 – LABORATORIES AVAILABLE FOR CYANOTOXIN ANALYSIS

**(THIS LIST OF LABORATORIES IS NOT EXHAUSTIVE, AND DOES NOT
INDICATE AN ENDORSEMENT BY THE STATE OF WEST VIRGINIA)**

LABORATORIES AVAILABLE FOR CYANOTOXIN ANALYSIS

This list is not exhaustive, and the State of West Virginia does not endorse or recommend any commercial laboratories or products.

For microcystin, cylindrospermopsin, and saxitoxin:

Gregory W. Young, HHR Program Manager
Chief Laboratory Certification Officer – Chemistry/Radiochemistry
DHHR – Office of Laboratory Services
Environmental Chemistry Section
4710 Chimney Drive Suite G
Charleston WV 25302
Phone: (304) 965-2694, x2222
Email: Gregory.W.Young@wv.gov
<http://www.wvdhhr.org/labservices/>

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

Jennifer Vydra, Manager of Laboratory Services
EnviroScience
5070 Stow Road
Stow, Ohio 44224
Phone: (330) 688-0111 or Toll-Free: (800) 940-4025
24h Emergency: (888) 866-8540
<http://www.EnviroScienceInc.com>

For anatoxin-a:

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

Jennifer Vydra, Manager of Laboratory Services
EnviroScience
5070 Stow Road
Stow, Ohio 44224
Phone: (330) 688-0111 or Toll-Free: (800) 940-4025
24h Emergency: (888) 866-8540
<http://www.EnviroScienceInc.com>

For microcystin:

T. Mike Sudman Jr., Superintendent of Water & Distribution
Celina Water Department
714 S. Sugar Street
Celina, Ohio 45822
Phone: (419) 586-2270, Cell: (419) 733-4112, Fax (419) 586-3598
Email: cwtpsupt@bright.net

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

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

APPENDIX 10 – HARMFUL ALGAL BLOOM GENERAL INFORMATION SIGN

Have fun on the water, but know that blue-green algae are present in many of West Virginia's recreational waters. Their toxins may be, too.

Be alert! Avoid water that:

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



Avoid swallowing water.

For more information, go to:

<http://www.wvdhhr.org/oehs>

or

<http://go.wv.gov/algae>

APPENDIX 11 – RECREATIONAL PUBLIC HEALTH WATCH ADVISORY

PUBLIC HEALTH WATCH ADVISORY

A harmful algal bloom (HAB) is present and/or algal toxins have been detected in this area.

Swimming and wading are not recommended for children, pregnant or nursing women, those with certain medical conditions, and pets.



For more information, go to:

<http://go.wv.gov/algae>

or

<http://www.wvdhhr.org/oehs>

or

Contact your local health department at:

APPENDIX 12 – RECREATIONAL PUBLIC HEALTH WARNING ADVISORY

PUBLIC HEALTH WARNING ADVISORY

**Algal toxins at UNSAFE levels have been detected
in this area.**

**Swimming, wading and water activities that create
spray are not recommended.**



For more information, go to:

<http://go.wv.gov/algae>

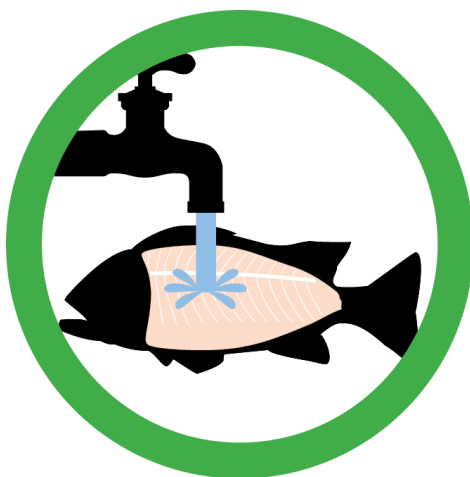
or

<http://www.wvdhhr.org/oehs>

or

Contact your local health department at:

APPENDIX 13 – FISH CONSUMPTION ADVISORY



Eating Fish Caught from Waters Affected By a Harmful Algal Bloom

A harmful algal bloom (HAB) is present and/or algal toxins have been detected in these waters. Some algal toxins can accumulate in fish tissues, particularly in organs such as the liver and kidneys.

Fish tissue monitoring and research have shown that fish fillets from fish caught in waters affected by a HAB should be safe to eat.

As a precaution, the following ACTIONS are RECOMMENDED:

- **Remove and discard fat, skin, and internal organs** before cooking.
- **Rinse fillets with clean water** before cooking or freezing to remove any contaminants from the cleaning process.
- **Follow fish consumption advisories** for West Virginia available at <http://www.wvdhhr.org/fish>.

For more information on harmful algal blooms, go to:

<http://go.wv.gov/algae> or <http://www.wvdhhr.org/oehs>

or contact your local health department at:

APPENDIX 13 – 2018 HAB CONTACTS

2018 WV HAB CONTACTS

BPH:

Walt Ivey

Office Director
Office of Environmental Health Services
West Virginia Bureau for Public Health
350 Capitol Street, Room 313
Charleston, WV 25301
Office: (304) 356-4272
Walter.M.Ivey@wv.gov

Erica Thomasson

Career Epidemiology Field Officer
Office of Environmental Health Services
West Virginia Bureau for Public Health
350 Capitol Street, Room 313
Charleston, WV 25301
Office: (304) 356-4983
Erica.R.Thomasson@wv.gov

Gregory Young

HHR Program Manager, Chief Laboratory Certification Officer – Chemistry/Radiochemistry
Office of Laboratory Services, Environmental Chemistry Section
West Virginia Bureau for Public Health
4710 Chimney Drive Suite G
Charleston, WV 25302
Office: (304) 965-2694 x2222
Gregory.W.Young@wv.gov

DEP:

John Wirts

Assistant Director Watershed Assessment Branch
Division of Water and Waste Management
West Virginia Department of Environmental Protection
601 57th St SE
Charleston, WV 25304
Office: (304) 926-0499 x1060
john.c.wirts@wv.gov

Danielle E. Nathanson

Environmental Resource Specialist III
Lakes Assessment and Harmful Algal Bloom Response
Watershed Assessment Branch
West Virginia Department of Environmental Protection
601 57th Street S.E.
Charleston, WV 25304
(304) 926-0499 x1083
Danielle.E.Nathanson@wv.gov

USACE:

Steve Foster

U.S. Army Corps of Engineers
Water Quality Operations Center
1744 RC Byrd Drive
Gallipolis Ferry, WV 25515
Work: (304) 857-3152
Cell: (304) 928-8835
Steven.w.foster@usace.army.mil

Thad Tuggle

Fisheries Biologist
U.S. Army Corps of Engineers
Water Quality Operations Center
1744 RC Byrd Drive
Gallipolis Ferry, WV 25515
Work: (304) 857-3151
Cell: (304) 812-3887
Thaddaeus.S.Tuggle@usace.army.mil

DNR:

Katherine Zipfel

Large River Fisheries Biologist
WVDNR Wildlife Resources
2311 Ohio Ave.
Parkersburg, WV 26101
Office: (304) 420-4550
Katherine.J.Zipfel@wv.gov

Dustin M. Smith

District 1 Fisheries Biologist
WVDNR Wildlife Resources Section
PO Box 99
1110 Railroad Street
Farmington, WV 26571
Office: (304) 825-6787
Dustin.M.Smith@wv.gov

Brandon Keplinger

District 2 Fisheries Biologist
WVDNR Wildlife Resources
1 Depot St
Romney, WV 26757
Office: (304) 822-3551
Brandon.J.Keplinger@wv.gov

LHDs:

A listing of local health departments can be found at: <http://www.dhhr.wv.gov/localhealth/pages/map.aspx>