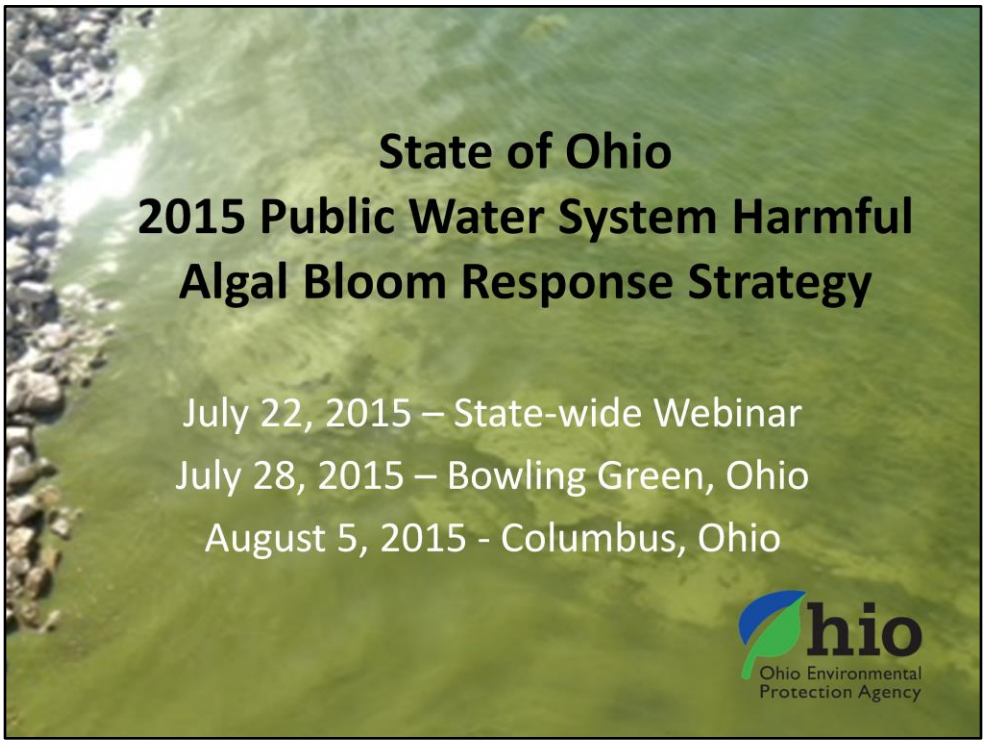
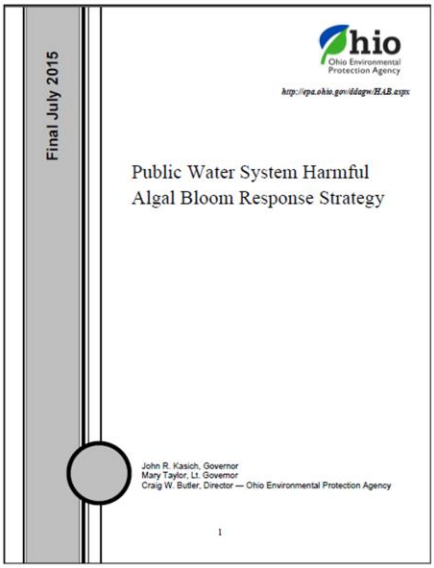


This presentation provides an overview of the 2015 update to the Public Water System (PWS) Harmful Algal Bloom (HAB) Response Strategy. The 2015 Strategy was formally released July 16 during a press conference held by the Director of Ohio EPA in Toledo.

2015 PWS HAB Response Strategy


Final July 2015

Ohio Environmental Protection Agency

http://epa.ohio.gov/ddagw/HAB.aspx

Public Water System Harmful Algal Bloom Response Strategy

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director — Ohio Environmental Protection Agency

1

This presentation summarizes the 2015 update of Ohio's Harmful Algal Bloom Response Strategy for public water systems

Now available online at: http://epa.ohio.gov/ddagw/HAB.aspx

Ohio Environmental Protection Agency

The Strategy is available on Ohio EPA's web site: http://epa.ohio.gov/ddagw/HAB.aspx.

Background

- **2010:** Ohio EPA began sampling for cyanotoxins at PWSs
- **2011:** OEPA/ODNR/ODH created Ohio HAB Strategy
- **2012:** Separate Strategy documents developed for recreational and drinking water use (updated annually)
- **2015:** PWS HAB Response Strategy released July 16, 2015, incorporating U.S. EPA's health advisory levels for microcystin and cylindrospermopsin

Ohio Environmental Protection Agency

The Strategy has been updated annually – the most recent being the Strategy released earlier this year and discussed in this presentation.

While there were other changes to the Strategy ,the most significant change for this year's document is incorporating U.S. EPA's health advisory levels for microcystins and cylindrospermopsin.

2015 PWS HAB Response Strategy

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- Cyanotoxin toxicity thresholds
- Monitoring strategy
- Response to finished water threshold exceedances
- Contingency planning

APPENDICES

A- Early messaging and public notice templates
B - Cyanobacteria and their associated cyanotoxins and T&O compounds
C – Basis for anatoxin-a and saxitoxin thresholds
D – Forms
E – HAB Contingency Plan Checklist
F- Station IDs
G- 2015 HAB Contacts
H- U.S. ACE Contacts

Ohio Environmental Protection Agency

From an organizational stand point, this year's Strategy looks very similar to previous editions. Ohio EPA has added an executive summary and a flow chart that summarize the Strategy and the actions Ohio EPA will take in cooperation with public water systems to monitor for and respond to HABs in drinking water sources. These sections can be pulled from the document and used as concise reference tools.

Other sections of the strategy have been modified, as necessary, to incorporate U.S. EPA's new thresholds. Ohio EPA has also done some general cleanup to make this document much easier to use than previous versions.

2015 PWS HAB Response Strategy

Ohio has thresholds for four cyanotoxins:

Drinking Water Threshold	Microcystins** (µg/L)	Cylindro-spermopsin (µg/L)	Saxitoxins** (µg/L)	Anatoxin-a (µg/L)
Do Not Drink – children under 6 and sensitive populations***	**0.3**	**0.7**	0.2	20
Do Not Drink – children 6 and older and adults	**1.6**	**3.0**	0.2	20
Do Not Use*	20	20	3	300

* Based on Recreational No Contact Advisory thresholds.

** Microcystins and saxitoxins thresholds are applied to total concentrations of all congeners/variants.

*** Includes nursing and pregnant women, individuals with liver disease and on dialysis

Ohio Environmental Protection Agency

This chart shows the new health advisory thresholds. In accordance with U.S. EPA's guidelines, Ohio EPA has established a two tiered approach to issuing advisories for microcystins and cylindrospermopsin. There is an initial, lower level for children less than 6 years old and sensitive populations; and a second, higher level for children 6 years of age and older and adults.

U.S. EPA guidance indicates that certain sensitive populations may want to consider following the guidelines for children less than 6. Ohio EPA's Strategy specifically includes sensitive populations in the use advisory for children less than 6. Sensitive populations include nursing and pregnant women, individuals with liver disease and those on dialysis.

For microscystins the advisory level for children less than 6 and sensitive populations is 0.3 ug/l and it is 1.6 ug/l for older children and adults. For cylindrospermopsin the thresholds are 0.7 ug/l for children less than 6 and sensitive populations and 3.0 ug/l for older children and adults. You may recall, in previous years Ohio EPA had an advisory threshold of 1 ug/l for both microcystins and cylindrospermopsin that applied to everyone. The new levels are lower for children but a bit higher for adults.

For saxitoxin and anatoxin-a the thresholds remain the same as in previous years and are the same for everyone.

2015 PWS HAB Response Strategy

Ohio has thresholds for four cyanotoxins:

Drinking Water Threshold	Microcystins** (µg/L)	Cylindro-spermopsin (µg/L)	Saxitoxins** (µg/L)	Anatoxin-a (µg/L)
Do Not Drink – children under 6 and sensitive populations***	**0.3**	**0.7**	0.2	20
Do Not Drink – children 6 and older and adults	**1.6**	**3.0**	0.2	20
Do Not Use*	20	20	3	300

* Based on Recreational No Contact Advisory thresholds.

** Microcystins and saxitoxins thresholds are applied to total concentrations of all congeners/variants.

*** Includes nursing and pregnant women, individuals with liver disease and on dialysis

Ohio Environmental Protection Agency

For microcystin and cylindrospermopsin, the advisories U.S. EPA has established are based on a 10-day exposure. In other words, no adverse health effects will occur if consuming water containing microcystins or cylindrospermopsin at this concentration for up to 10 days. U.S. EPA's guidelines do not speak to exposures at higher concentrations. They describe the advisory levels as "not to exceed" numbers with a cushion. In other words water systems may have some limited opportunity to take actions to limit exposures to the public. How that impacts our response to a detection in finished drinking water is discussed later in this presentation.

Another item to note is that the thresholds for microcystins and saxitoxins are based on the total concentration of all congeners or variants of those toxins. There are over 100 known congeners, or variants, of microcystin. Microcystin LR is the most studied and served as the basis of the thresholds established by U.S. EPA. However U.S. EPA indicates in their guidance that there are uncertainties about whether all the other congeners are more or less toxic than microcystin LR and microcystin LR serves as a surrogate for all congeners. Therefore, the threshold is based on the total of all congeners or variants of microcystin. That is significant because it means you have to use an analytical method that looks for all of the congeners.

2015 PWS HAB Response Strategy

Analytical Methods

	Microcystins (µg/L)	Cylindro-spermopsin (µg/L)	Saxitoxins (µg/L)	Anatoxin-a (µg/L)
Surveillance sampling	ELISA (MC-ADDA)	ELISA	ELISA	LC-MS/MS
Repeat sampling in response to a finished water detection	ELISA (MC-ADDA)	LC-MS/MS	LC-MS/MS	LC-MS/MS

ELISA: Enzyme-Linked Immunosorbent Assay

LC-MS/MS: Liquid Chromatography followed by tandem Mass Spectrometry

Ohio Environmental Protection Agency

Acceptable analytical methods are detailed in the Strategy. For microscystins, Ohio EPA will be using the ELISA ADDA methodology for both surveillance testing and repeat sampling in response to a finished water detection. The ELISA method is a proven method for analyzing for total microcystins. Ohio EPA has worked with a number of public water systems, U.S. EPA, researchers and commercial laboratories to develop a detailed Standard Operating Procedure (SOP) for this methodology. The SOP is also available on our web page.

As listed in the table the ELISA method is used for surveillance monitoring; however, for cylindrospermopsin and saxitoxin there are LC-MS/MS methods available for repeat sampling after a detection in finished water. For anatoxin-a, LC-MS/MS is used for both surveillance and repeat sampling.

2015 PWS HAB Response Strategy

Analytical Methods

	Microcystins (µg/L)	Cylindro-spermopsin (µg/L)	Saxitoxins (µg/L)	Anatoxin-a (µg/L)
Surveillance sampling	ELISA (MC-ADDA)	ELISA	ELISA	LC-MS/MS
Repeat sampling in response to a finished water detection	ELISA (MC-ADDA)	LC-MS/MS	LC-MS/MS	LC-MS/MS

ELISA: Enzyme-Linked Immunosorbent Assay

LC-MS/MS: Liquid Chromatography followed by tandem Mass Spectrometry

Ohio Environmental Protection Agency

The PWS HAB Response Strategy is written assuming all sampling and analysis will be done by Ohio EPA. Systems are encouraged to establish their own analytical capabilities. Ohio EPA will provide a grant to purchase the equipment needed to conduct the ELISA ADDA method for microcystin.

If a water system has its own analytical capability, Ohio EPA will conduct an audit and determine if they are following our written SOP. If Ohio EPA determines that the analytical capabilities are acceptable and the system reports their data in a timely manner there will be no need to duplicate that sampling.

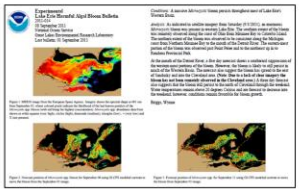
Even if deemed acceptable, some systems may still want Ohio EPA to conduct repeat analysis if there is a detection in finished water. If this is the case DDAGW staff will work with the system to ensure the analyses are conducted.

Establishing analytical capabilities will allow systems to collect timely source water quality information and better ensure they are optimizing treatment.

2015 PWS HAB Response Strategy

Observation

- Public Water System (PWS) reports bloom
  - weekly phytoplankton monitoring encouraged
- Remote sensing data (NOAA, NASA)



- Third party bloom reports

- Ohio EPA water quality surveys
- Other data sources
  - USGS, USEPA,
    Army Corps of Engineers, universities
    Ohio Lake Management Society

Ohio Environmental Protection Agency

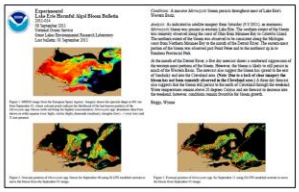
The next several sections in the Strategy describe the actions Ohio EPA will take in cooperation with Ohio's PWSs, as well as other state, federal and local agencies to detect, screen and monitor for cyanotoxins in source waters so that public water systems can take appropriate actions to avoid detections in finished drinking water.

As part of our early warning system, Ohio EPA uses a number of sources of information to determine when there may be a bloom present that could impact a PWS. This includes reports from PWSs, remote sensing data provided by the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) and various research institutions; third party reports of blooms such as the charter captains on Lake Erie; water quality sampling conducted by Ohio EPA, the Ohio Department of Natural Resources and other agencies and organizations listed here.

2015 PWS HAB Response Strategy

Observation

- Public Water System (PWS) reports bloom
  - weekly phytoplankton monitoring encouraged
- Remote sensing data (NOAA, NASA)



- Third party bloom reports

- Ohio EPA water quality surveys
- Other data sources
  - USGS, USEPA,
    Army Corps of Engineers, universities
    Ohio Lake Management Society

Ohio Environmental Protection Agency

Ohio EPA has also been providing grants to PWSs for equipment to help them identify water quality changes that could indicate a HAB that could affect their water supply is present. This includes microscopes for phytoplankton identification and various sensor, probes or data sondes that can be used to monitor raw water conditions on a real time basis.

The data sondes measure phycocyanin, which is a direct measurement of the presence of cyanobacteria capable of producing cyanotoxins. Several water systems across Ohio have taken advantage of this funding, allowing Ohio EPA to develop a much better information network for tracking raw water conditions across Ohio.

2015 PWS HAB Response Strategy

Screening

- Ohio EPA reviews all available screening information:
  - Phytoplankton identification and cell counts
  - Phycocyanin and chlorophyll-a data
  - Raw water quality (pH, taste and odor compounds)
  - Operation parameters (reduced filter run times and filter clogging, increased chlorine demand)
  - Remote sensing data
- Advance to monitoring if screening suggests a HAB of concern.

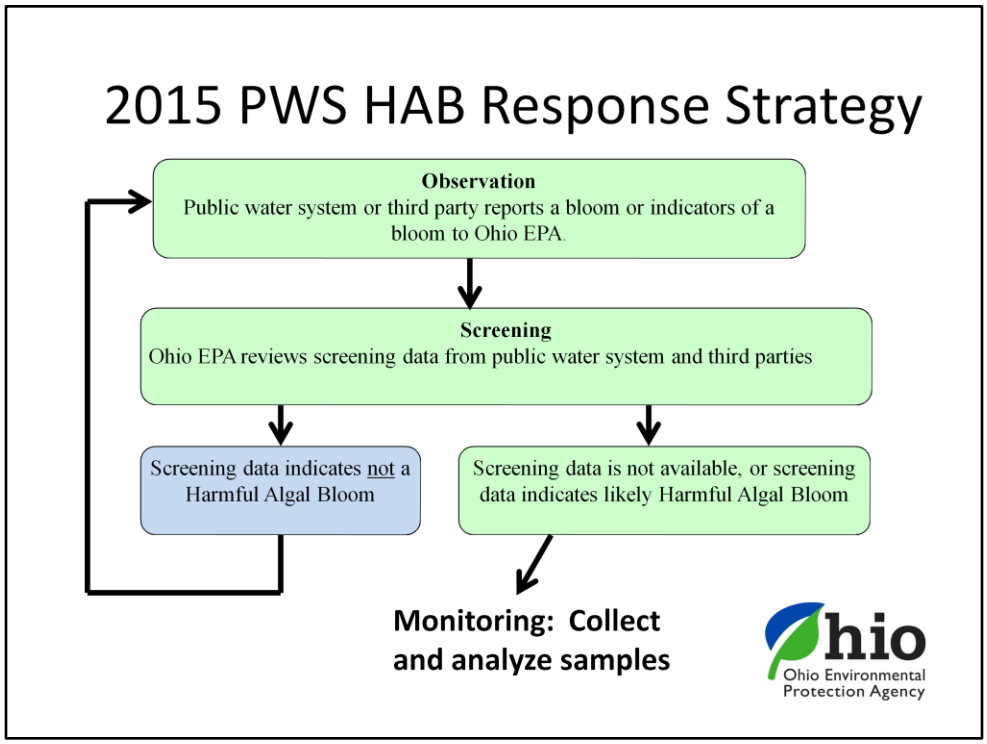
Ohio Environmental Protection Agency

Public water systems also collect a lot of operational data that can serve as early warning indicators that there is a bloom present or developing. These data include:

- Raw water quality indicators such as pH or the presence of taste and odor compounds

- Operational parameters such as reduced filter run times, filter clogging or increased chlorine demand

If there is an indication through observation and screening that a bloom is present and it could impact the public water system, Oho EPA and the PWS move to collect and analyze additional samples.



To recap:

Observation and screening sampling is shown on this portion of the flow chart included in the Strategy.

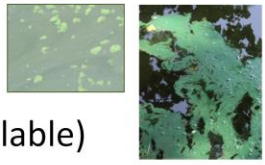
As part of our early warning system, Ohio EPA uses a number of sources of information to determine when there may be a bloom present that could impact a PWS. This includes reports from PWSs, remote sensing data provided by NOAA and NASA and various research institutions; third party reports of blooms such as the charter captains on Lake Erie; water quality sampling conducted by Ohio EPA, the Ohio Department of Natural Resources and other agencies.

Public water systems also collect a lot of operational data that can serve as early warning indicators that there is a bloom present or developing.

If there is an indication through observation and screening that a bloom is present and it could impact the public water system, Oho EPA and the PWS move to collect and analyze additional samples.

2015 PWS HAB Response Strategy

Monitoring



- Sample raw water for phytoplankton identification (if data not already available)
- Sample raw and finished water for microcystins and any other cyanotoxins associated with the types of cyanobacteria dominating the bloom.
- If algaecide has been applied and phytoplankton ID is not possible, sample for all four cyanotoxins

Ohio Environmental Protection Agency

If observation and screening indicate a bloom that has the potential to affect a PWS, Ohio EPA or the PWS will collect and analyze water samples. If the PWS hasn't already done so, Ohio EPA will collect a raw water sample for phytoplankton. This allows Ohio EPA and the PWS to better determine what cyanotoxin to test for.

Both raw (untreated) and finished (treated) water samples will be collected.

If no determination of what form of cyanobacteria is present samples will be analyzed for all four cyanotoxins listed in Slide 6.

2015 PWS HAB Response Strategy

Sampling Frequency

Provided finished water sample remains nondetect, sampling frequency for both raw and finished water is:

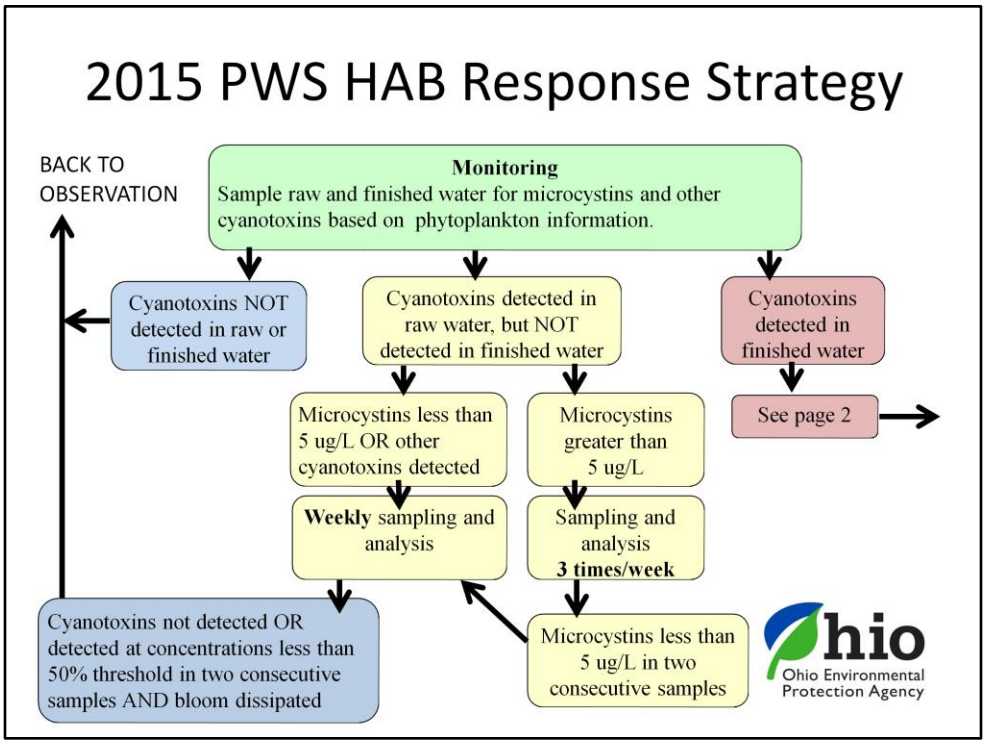
WEEKLY, while any cyanotoxins are detected in raw water, but

THREE TIMES A WEEK if microcystins are detected in raw water at greater than 5 ug/L. Once microcystins are less than 5 ug/L in two consecutive samples, sampling may return to weekly.

Once raw water is nondetect, or less than 50% of the threshold for any cyanotoxin in two consecutive samples—and bloom has dissipated– may return to observation.

Ohio Environmental Protection Agency

The Strategy identifies specific triggers that will be used to increase or decrease the frequency of sampling and analysis.



This is summarized in this portion of the flow chart in the Strategy.

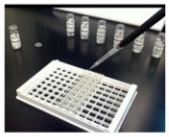
2015 PWS HAB Response Strategy

Sampling Frequency

If cyanotoxins are detected in finished water, sampling frequency for both raw and finished water samples is:

DAILY, if detected below the threshold for that cyanotoxin.

If above the threshold, the three R's (Reanalyze, Resample, Repeat) are initiated.



Ohio Environmental Protection Agency

Section four in the strategy outlines what actions will be taken if cyanotoxins are detected in finished water.

2015 PWS HAB Response Strategy

- **Reanalyze**. Immediately reanalyze sample with finished water detection.
  - Refer to Contingency Plan; optimize treatment
- **Resample**. Immediately collect and analyze another finished water sample.
  - Raw water extracellular and intracellular toxin analysis
  - Consider treatment train sampling
  - If cyanotoxins detected in Resample, collect distribution samples
- **Repeat**. Collect and analyze Repeat Sample within 24 hours.
- Ongoing sampling will be based on Repeat Sample results and may include distribution sampling.

Ohio Environmental Protection Agency

If there is a detection above the threshold in finished water the initial sample will be reanalyzed immediately, or as soon as practicable. Either Ohio EPA or the PWS, or both, will also immediately collect and analyze additional raw and finished water samples.

After any finished water detection a PWS should immediately start optimizing their treatment (that is, adjusting the treatment processes to maximize removal of any cyanobacteria and cyanotoxins). They should also pull their contingency plan off the shelf and begin thinking about what actions they may have to take if detections above the threshold continue. At this point the PWS staff may want to take some proactive avoidance strategies such as using an alternative source of water, limiting production and/or isolating storage.

When conducting the resample, analyses will also be run to determine intracellular and extracellular concentrations of cyanotoxins as that could help guide treatment adjustments. Ohio EPA, or the water system, may also want to collect samples at various stages of treatment to determine where toxins are being removed and identify opportunities to improve treatment.

A PWS may also want to start collecting distribution samples. Distribution samples may provide information enabling the PWS to limit the geographic area of an advisory or possibly not issue one at all. For example, you could have a detection above the threshold at the entry point tap, but not have any detection in the distribution system because toxins have degraded due to the additional chlorine contact time. Or there may be only limited portions of the distribution system where water samples contain cyanotoxins above the threshold.

2015 PWS HAB Response Strategy

Early Public Messaging / Water Use Advisory

- If **reanalysis and resamples** are above the threshold consider early public messaging.
- May include drinking water use advisory based on:
  - Date of last non-detect finished water sample
  - Cyanotoxin concentration- higher concentrations may warrant at least an advisory for sensitive populations
  - Advanced treatment capability and alternate water sources
  - Raw water cyanotoxin trends
  - Type of cyanotoxin present
- If **repeat** results are above the threshold, Ohio EPA will recommend the water system issue a public notice.
  - based on factors listed above, the recommendation may be delayed until additional repeat results are available.

Ohio Environmental Protection Agency

If the resample analysis also comes back over the threshold Ohio EPA will, in most circumstances, work with the PWS to provide some type of early public messaging. This message would inform the public:

- That there has been a detection,
- That while it is above the threshold, the threshold is based on a 10 day exposure, so a water use advisory has not yet been issued,
- That actions are being taken by the public water systems to remove the toxin,
- That the public will be informed if any conditions warrant any type of use restrictions.

There may be some concern that this will cause unnecessary alarm; however, Ohio EPA believes that it is in the best interest of the PWS to be completely transparent with the public about what is happening. Ohio EPA also believes it is better to inform the public early in an event rather than having to address why they weren't informed earlier.

2015 PWS HAB Response Strategy

Early Public Messaging / Water Use Advisory

- If **repeat** results are above the threshold, Ohio EPA will recommend the water system issue a public notice.
- Based on same factors the recommendation to issue a drinking water advisory may be delayed until additional repeat results are available.
  - Date of last non-detect finished water sample
  - Cyanotoxin concentration- higher concentrations may warrant at least an advisory for sensitive populations
  - Advanced treatment capability and alternate water sources
  - Raw water cyanotoxin trends

Ohio Environmental Protection Agency

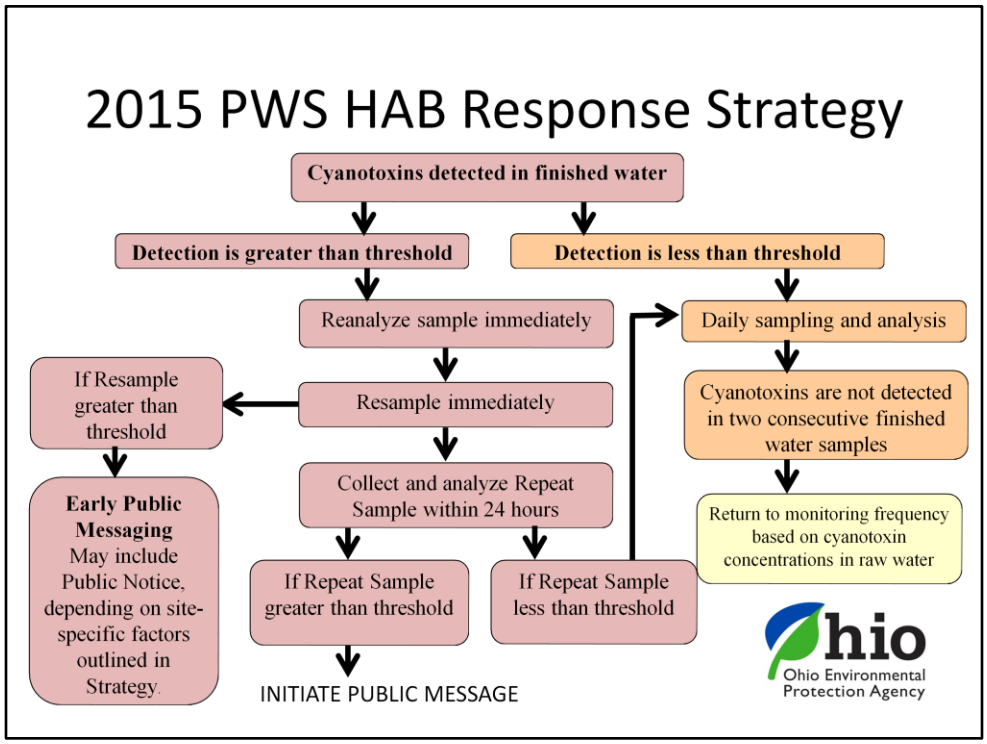
In some circumstances Oho EPA may also recommend issuing a drinking water use advisory after analysis of the resample. Factors in making this decision include:

- The date of last non-detect finished water sample
- The cyanotoxin concentration. Higher concentrations may warrant at least an advisory for sensitive populations
- Advanced treatment capability and alternate water sources
- Raw water cyanotoxin trends
- The type of cyanotoxin present

In most circumstances Ohio EPA will recommend issuing a drinking water use advisory if the repeat sample was collected within 24 hours after the resample and is also above the threshold.

Considering all of the factors listed above, there may also be circumstances where Ohio EPA will recommend delaying issuing an advisory even if the initial 24 hour repeat samples come back above the threshold using the same considerations listed above.

The earlier public messaging may provide greater flexibility with regard to issuing an advisory.



This portion of the flow chart in the Strategy summarizes these the response to finished water detections.

2015 PWS HAB Response Strategy

Contingency Planning

- On May 5, 2015, Ohio EPA sent a letter to PWSs most susceptible to a HAB, instructing them to insert a HABs response protocol in their contingency plans, including:
  - Communication strategies, internal and with public
  - Identification of critical users/susceptible populations
  - Water restrictions at satellite systems
  - Alternate sources and methods for activating them
  - Treatment adjustments to optimize destruction of toxins
  - Training staff /conducting drills
  - Where to collect distribution samples
- Appendix E of 2015 Strategy provides full checklist

Ohio Environmental Protection Agency

A critical component of a system's ability to respond to a detection of cyanotoxins in finished water is contingency planning at both the state and the local level.

Ohio EPA, in conjunction with the Ohio Emergency Management Agency, the Department of Public Safety and other state and local agencies, has been engaged in planning to ensure our staff are prepared to respond and provide assistance. PWSs need to do the same thing.

In May Ohio EPA sent a letter to the PWSs most susceptible to a HAB, instructing them to insert a HABs response protocol in their contingency plans. This protocol includes:

- Communication strategies, internal and with the public
- Identification of critical users/susceptible populations
- Water restrictions at satellite systems
- Alternate water sources and methods for activating them
- Treatment adjustments to optimize destruction of toxins
- Training staff /conducting drills
- Where to collect distribution samples

Appendix E of the Strategy provides a full list of the documentation needed for HAB event contingency planning.

Cyanotoxin Rules

- **Timeline and Opportunities for Comment**
  - Early Stakeholder Outreach completed June 1 to 30, 2015
  - Interested party review fall 2015
  - Propose rules to JCARR winter 2015/2016
  - Adopt final rules prior to 2016 HAB season

Ohio Environmental Protection Agency

Looking beyond the strategy, Ohio EPA is initiating rule development to address HABs at public water systems.

Questions?

Ohio Environmental Protection Agency

Questions from the webinar and presentations can be found in a separate document.