Region 8 DW Harmful Algal Bloom Response Actions 2016

Indicators of an Algal Bloom

Visual Observation : Third party or operator observes a bloom in the lake or river near the drinking water intake, or in the pre sedimentation basin used by a drinking water treatment facility. Bottle Test is positive (see guidance).

OR

PWS Treatment Indicators: Algaecide addition[1], taste and odors, impacts to sedimentation, shortened filter runs, increase in chlorine demand, diurnal pH swings of 1 to 2 pH units or where pH >8.5.

OR

Additional Indicators that the PWS may be Measuring: phytoplankton identification of toxin producers, cell counts, phycocyanin presence, chlorophyll-a (see Table 2).

Screening and indicators no longer indicates bloom.

Any visual, treatment, or other information indicates the presence of a potentially toxic bloom. **Call EPA Region 8[2].** (Do not add algaecide without consultation[1].)

Test Strip Toxin Monitoring

Monitor for microcystin (and/or other toxins as needed/desired) at the raw water intake using toxin screening methods like the Abraxis Test Strips. Take picture of results (they fade quickly) For test strips, contact EPA Region 8[2].

Below detection?

Above detection?

Toxin Monitoring (ELISA and/or LC-MS/MS)

Sample raw and finished water for microcystin (and possibly cylindrospermopsin, saxitoxin and anatoxin-a)[3]. For sample bottles and analytical support (no cost), contact EPA Region 8[2].

Cyanotoxins NOT detected in the raw and finished water

Cyanotoxins detected in the raw water but NOT detected in the finished water

Cyanotoxins detected in the finished water.

See page 2

Optimize treatment[4]. Sample raw and finished water for toxins of concern weekly. If microcystins in raw water are greater than 5 ppb, sample more often in consultation with EPA Region 8[2]. Test for other toxins[3], if you have not already done so.

Sampling can be discontinued if the bloom has dissipated AND if raw water sample results in two consecutive samples are:

- Not detected using ELISA, or
- Detected at less than 50% of the Do Not Drink threshold for children using LC-MS/MS (see Table 1)

Page 2: Cyanotoxins Detected in Finished Water

Detection is greater than the threshold for ELISA and/or above detect for LC-MS/MS[5]. Perform confirmation sample if possible. (see Table 1).

Issue public advisory dependent upon the levels found in the finished water (see Table 1). Site specific circumstances may apply on a case-by-case basis. See templates for public advisory.

Collect and analyze a repeat sample within 24 hours or as soon as possible. Consider sampling after each major treatment process and in the distribution system.

Repeat sample is greater than threshold

Issue public advisory dependent upon the levels found in the finished water (see table 1). See templates for public advisory.

Continue sampling daily or as frequently as possible. Consider sampling after each major treatment process and in the distribution system. **Continue public notice.**

Repeat sample is less than the threshold

Detection is less than the threshold (see table 1).

Daily sampling or as frequently as possible.

Cyanotoxins are not detected in two consecutive finished water samples.

Lift Public Notice, if issued. Return to monitoring frequency based on cyanotoxins concentrations in the raw water (Page 1).

1. Test for toxins prior to adding an algaecide because algaecides damage the cells releasing any toxins that may be within the cells. Whole cells are more easily removed than the much smaller toxins.
2. For HABs affecting drinking water contact Bob Clement 303-312-6653. For HABs affecting recreation contact Tina Laidlaw 406-457-5016.
3. Especially if microcystins are greater than 5 ppb in the raw water. PWSs may want to test for other toxins or review phytoplankton types to see if other toxins are present. When resources are limited testing for total microcystins using EISA should be the priority.
4. EPA Guidance on treatment "Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water" is available at: https://www.epa.gov/nutrient-policy-data/cyanohabs
5. ELISA-ADDA tests for all variants of microcystins but currently only has a detection level around 0.3 ppb. LC-MS/MS tests for a subset of the variants but has a very low detection level. Higher levels are typically found with ELISA as it is a measure of total microcystins. ELISA is the preferred method since the health advisory value is for total microcystins.

Table 1 Cyanotoxins thresholds and analytical methods

Cyanotoxin thresholds and analytical methods				
Type of notice	Total Microcystins[2]	Cylindrospermopsin	Anatoxin–a[1]	Total Saxitoxins[1,2]
Do not Drink: children under 6 and sensitive populations[3]	0.3 ppb (EPA Health Advisory value)	0.7 ppb (EPA Health Advisory value)	20 ppb (Ohio Health Advisory value)	0.2 ppb (Ohio Health Advisory value)
Do not Drink: Children 6 and older & adults	1.6 ppb (EPA Health Advisory value)	3.0 ppb (EPA Health Advisory value)	20 ppb (Ohio Health Advisory value)	0.2 ppb (Ohio Health Advisory value)
Do not use[4]	20 ppb	20 ppb	300 ppb	3 ppb
Test Strip Monitoring	Abraxis dip strips[5]	Abraxis dip strips[5]	Abraxis dip strips[5]	When available
Toxin Monitoring and Repeat Sampling	ELISA-ADDA and/or LC-MS/MS[6]	ELISA and/or LC-MS/MS	ELISA and/or LC-MS/MS	ELISA[7] and/or LC-MS/MS

1. Documentation of the calculations of the threshold levels for anatoxin–a and saxitoxin are found in Appendix C of Ohio EPA's Public Water System Harmful Algae Bloom Response Strategy, July 2015. The link to this document: http://epa.ohio.gov/Portals/28/documents/HABs/PWS_HAB_Response_Strategy.pdf

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

3. The USEPA health advisories identify potentially sensitive populations to include pregnant women, nursing mothers, those receiving dialysis treatment, those with pre-existing liver conditions, the elderly and immune-compromised as individuals who may want to consider following the recommendations for children.

4. The drinking water "do not use" thresholds are based on the recreational no contact advisory thresholds. These values are from Ohio EPA's Public Water System Harmful Algae Bloom Response Strategy, July 2015.

5. Use for raw water only.

6. ELISA-ADDA tests for all variants of microcystins but currently only has a detection level around 0.3 ppb. LC-MS/MS tests for a subset of the variants but has a very low detection level. Higher levels are typically found with ELISA as it is a measure of total microcystins. ELISA is the preferred method since the health advisory value is for total microcystins.

7. Unlike the ELISA method for microcystins, ELISA for saxitoxins tests for many of the variants but not all.

Table 2 Screening parameters for assessing bloom severity[1]

If a PWS is already routinely analyzing for the parameters below, then the severity of the bloom can be classified as:

Minor bloom (meets any of the following)

- **Cyanobacteria cell count (or phycocyanin equivalents[2]) 4,000 to 10,000 cells/ml**
- **Biovolume 0.4 to 1 mm^3/L**
- **Chlorophyll a 2 to 5 ppb**
- **Some visual evidence of a bloom (blooms may not be visually apparent at the surface)**

Moderate bloom (meets any of the following)

- **Cyanobacteria cell count (or phycocyanin equivalents[2]) 10,000 to 100,000 cells/ml**
- **Biovolume 1 to 10 mm^3/L**
- **Chlorophyll a 5 to 50 ppb**
- **Bloom is visible throughout the water column**

Severe bloom (meets any of the following)

- **Cyanobacteria cell count (or phycocyanin equivalents[2]) >100,000 cells/ml**
- **Biovolume > 10 mm^3/L**
- **Chlorophyll a >50 ppb**
- **Algae mat is present and/or significant concentration of cells are visible throughout the water column**
- **Presence of cyanotoxins, as indicated by test kit or laboratory analyses**

1. Screening parameters are from Ohio EPA Public Water System Harmful Algae Bloom Response Strategy, July 2015.

2. Phycocyanin is a pigment unique to cyanobacteria. Sensors are available which measure the presence of this pigment and report relative cyanobacteria concentrations in cells/ml.

Visual and bottle test

Source of information: Vermont's HAB guidance at
http://healthvermont.gov/enviro/bg_algae/documents/BGA_guide.pdf
Contact in Vermont: Heather Campbell 802-338-4817
heather.campbell@state.vt.us
Contact at Region 8: Bob Clement 303-312-6653
clement.robert@epa.gov

Visual test: Examine algae to determine if there are cyanobacteria/blue-green algae characteristics

It is NOT cyanobacteria if:

• You can see leaf-like structures or roots
• The material is long and stringy, or can be lifted out of the water on a stick
• If it is firmly attached to plants, rock or the bottom (e.g. you can't lift it out)

It MAY be potentially hazardous cyanobacteria if:

• The material consists of small particles that are pinhead size or smaller
• The material is collecting in a layer at the surface or along the shoreline;
the surface layer may appear oily
• The water is murky and colored a brownish green, milky green or blue

Bottle test or float test: Examine algae to determine if it is cyanobacteria/ blue-green algae characteristics

It may be cyanobacteria if the algae float:

Many cyanobacteria can regulate their buoyancy and will float to the top of the water when it is calm. Most other algae don't have this ability. Most debris and plant material will sink or be identifiable as debris. Microscopic animals will swim randomly and often with a jerky motion.

You can check to see if cyanobacteria are present by filling a clear two liter bottle or a bucket with water. The water should be collected away from any debris or large plant material floating along the shoreline. Allow the bucket or bottle to stand in a quiet sunny place, out of the wind. If present, cyanobacteria will often begin to move toward the surface.

Wait 15 – 30 minutes and observe the upper portion of the container. Cyanobacteria, which may be a mix of several different kinds, will tend to accumulate in the upper portion of the water while debris and plant material will be at the bottom. There may be smaller material in the middle, which will remain suspended for some time.

When filling the container from a dense accumulation, minimize skin contact with the material by wearing gloves or a plastic bag over your hands.

Be aware that the concentration of cyanobacteria at a location can change daily, even hourly, as the weather conditions change. If you do the float test routinely, you will begin to become familiar with how the water and cyanobacteria look under different conditions.

Also, cyanobacteria may not always move to the surface in 30 minutes. If there is a bloom in progress, with a large amount of cyanobacteria in the water, at least a portion should move toward the surface. With experience, you will become familiar with how your lake looks and when conditions warrant a closer examination

Cyanobacteria are floating on the top