Monitoring, Sampling and Testing Procedures

Monitoring, sampling, and testing for cyanobacteria and its associated toxins is not currently required by OHA or EPA, however, because of cyanotoxin health concerns, it is strongly encouraged that some level of water body monitoring for blooms as well as toxin testing should occur. See exhibit 1 for health effects.

**Monitoring of lake or water body for HAB’s**

- Harmful Algae Blooms (HABs) monitoring should be designed to identify if a bloom is occurring and if the associated bloom is toxic.
- Identify who is monitoring lake or water body for HABs. This may be a state or federal agency such as the US Forest Service (USFS), Bureau of Reclamation, US Army Corps of Engineers (ACE), Portland General Electric (PGE) or other power companies, Bureau of Land Management (BLM), County Parks and Recreation departments. Refer to the HABs maps on OHA’s algae resources for drinking water webpage for relevant contact information for these agencies.
- Local communication and coordination between lake and/or reservoir owners in addition to other water providers within the system is highly encouraged. Water body managers and local stakeholders should develop partnerships to facilitate and coordinate efforts which could include: who is monitoring, who is testing for ID and enumeration as well as toxin testing, and establish communications protocols regarding how this information is shared.
- Water providers may choose to monitor lake/reservoir for HABs themselves. This could include sampling of the lake for ID enumeration as well as toxins, toxin testing should be done weekly on blooming water body. See Exhibit 2 for an example of water body Monitoring Guidelines.
- Water providers work with Drinking Water Services (DWS) to be notified regarding HABs blooms in their source water.
- Recreational advisories and warnings for HABs are posted online here or by calling (877) 290-6767 and press 0, or you can sign up be on an email list serve by emailing, Hab.health@state.or.us

**Sampling and Testing Procedures for HAB’s**

- Collect a grab sample at the bloom site to be analyzed for identification and enumeration (to determine the presence of toxin-producing species). See Exhibit 3 for a list of cyanobacteria and associated toxins.
- If an algal species is present that is a potential toxin producer, and cell densities are above World Health Organization (WHO) action levels, as referenced in the Table 1 below, toxin testing should ideally be conducted at the bloom site to determine if bloom is toxic or not.

**Table 1. WHO Cyanobacteria Cell Count Action Levels that trigger toxin sampling for Drinking Water**

<table>
<thead>
<tr>
<th>Species</th>
<th>Action Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Microcystis</em> spp.</td>
<td>2,000 cells/mL</td>
</tr>
<tr>
<td>Combination of all potentially toxic cyanobacteria species present</td>
<td>15,000 cells/mL</td>
</tr>
</tbody>
</table>
• If the blooming water body has not been tested for toxins, water providers have two options: 1) PWS can test the water body themselves (or work collaboratively with other water utilities/stakeholders to do the testing) on a weekly basis at the densest blooming location. If toxins are detected at any level in the blooming water body, toxin testing at the nearest PWS intake should occur weekly until the bloom is gone. Option 2) Collect a raw water sample at the intake to the water treatment plant weekly for associated toxins until bloom is gone. If the raw water sample detects toxins, collect raw and finished water samples weekly until the bloom is gone.

• OHA Sample Guidelines for Cyanobacterial Harmful Blooms in Recreation Waters can be found [here](#).

• USGS Sampling Guidelines field manual is available [here](#).

---

**Toxin testing at water system treatment plant**

If cyanobacteria and associated toxins are detected you are advised to:

• Collect samples of raw and finished water weekly at your intake/water treatment plant to be tested for associated toxins. Finished water sampling should be done at entry point to distribution system.

• To determine what toxins to test for, see Exhibit 3.

• Refer to individual lab instructions for sampling instructions such as hold times, preservation, shipment, etc. For a list of labs that can perform algae testing see [here](#).

• OHA has developed acute toxicity values for cyanotoxins in drinking water (see Table 2). Public water systems should consult with OHA’s Drinking Water Services to determine the appropriate response if cyanotoxins are detected at any level in finished water.

<table>
<thead>
<tr>
<th></th>
<th>Anatoxin-a</th>
<th>Cylindrospermopsin</th>
<th>Microcystin (total)</th>
<th>Saxitoxin (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adults</strong></td>
<td>3</td>
<td>3</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Children (5 and younger)</strong></td>
<td>0.7</td>
<td>0.7</td>
<td>0.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

• Water utilities are encouraged to work together with other water utilities/stakeholder in your basin to find opportunities to reduce sampling burden and cost, such as sampling at the first water treatment plant downstream of the blooming water body that has detected toxins. Test results should be shared with all water utilities/stakeholders in your basin. See [HABs maps](#) for historical bloom locations & water utilities/stakeholders contact information per basin.

• Consider additional testing of the blooming water body periodically for algal species identification and cell counts if not already being done by another organization to determine bloom progression.

• Contact your state drinking water regulator to consult with regarding toxin testing and results, [contact list online](#) or call (971) 673-0405.

• Initiate a public communications plan to address customers concerns. See Exhibit 4 for some FAQ’s regarding HAB’s.

---

**When toxin testing at treatment plants can be discontinued**

• Once the bloom has subsided, as evidenced by the cell counts and toxin levels falling below levels (see Table 1 for cell count action levels and Table 2 for acute toxicity values), monitoring will return to pre-bloom or routine monitoring. In addition, if toxins are present, sampling efforts will continue until all toxins are absent.
regardless of cell counts. Once toxins are no longer present, monitoring will return to pre-bloom or routine monitoring levels.

- Communicate with water systems/stakeholders in the basin to convey the bloom has subsided.

### Public Notification

- Utilities should be prepared to communicate to their customers regarding various scenarios that could arise when HAB’s are identified in the watershed of the water utility’s source water. Scenarios include: 1) HABs in water body in/or upstream of your intake 2) Algal toxins detected in your raw water at your intake, 3) toxins detected (but lower than acute levels) in your finished water, 4) toxin detected above acute levels in finished water.

- Public water systems should consult with OHA Drinking Water Services to determine the appropriate response if cyanotoxins are detected at any level in finished water. See exhibit 5 for public notice template.

- See Exhibit 4 for some general talking points.

### Treatment Options

1. **Reduce introduction of algal cells into the treatment process**
   - **Don’t recycle backwash water** – Backwash water can contain high concentrations of algal cells that may rupture and release toxins.
   - **Consider taking WTP offline and completely cleaning basin or affected areas**. This may be helpful if you are dealing with an in-plant bloom and need to remove the algae growing in basins/filters or other treatment processes.
   - **Use alternate source water**: If toxins are detected in source or finished water, consider using alternate source if available such as well water, emergency intertie, etc.

2. **Remove intact algal cells and prevent lysing of cells during coagulation, sedimentation/clarification and filtration**
   - **Minimize preoxidation** – Preoxidation with chlorine and ozone can cause algae cells to rupture, thus releasing toxins. (In some cases, preoxidation will be necessary to meet Giardia and virus inactivation requirements, so preoxidation can only be reduced and not eliminated).
   - **Adjust coagulation, sedimentation, and filtration** – Careful monitoring and adjustment of coagulation and filtration processes (chemical dosages, loading rates, detention times, etc) may improve algae removal. Intact cells removed by these processes will significantly reduce the possibility that toxins will be present in the finished water.
   - **Optimize filtration**: Slow filter loading rates, conduct frequent backwashing of filters.

3. **Reduce or remove algal toxins by oxidation or absorption**
   - **Absorb toxins: Powdered activated carbon**: Activated carbon has also proven to remove many soluble toxins very well at a dose of 25 mg/L with a contact time of 30 minutes. **Granular Activated Carbon** (GAC) is effective at removal of toxins but must be replaced at a more frequent interval than in normal operation.
   - **Adjust post-filtration disinfection** – Once the algae cells are removed from the water, soluble toxins can be destroyed by chlorine or ozone, which are strong oxidants. Effectiveness varies depending upon the dose and the algal toxin type. For more detailed information on water treatment processes to remove algae and their toxins, see OHA’s [algae resources for drinking water website](#).
   - **Increase chlorine contact time**-See Exhibit 6 for CT table for removal of microcystin using chlorine.
   - **Ozone treatment**-Table 5.4 on page 87 of this link ([Treating Algal Toxins using Oxidation, Adsorption and Membrane Technologies](#), Water Research Foundation, 2010) shows the dose needed to achieve 80% removal of microcystin.