The Public Health Issue:
In the summer of 2010 Ohio’s local health departments, local physician offices, Poison Control Centers and the state health department received reports of illness from people who had contact with HAB-contaminated waters. In August of 2014 the City of Toledo, Ohio issued a “Do Not Drink” advisory after city officials detected unsafe levels of microcystin in the finished drinking water servicing some 500,000 residents.

Several of Ohio’s inland lakes have experienced cyanobacteria blue-green algae blooms, commonly referred to as Harmful Algal Blooms (HABs). Depending on the causative organism, water conditions, and other environmental factors, neurotoxins, hepatotoxins, cytotoxins, dermatoxins and gastrointestinal toxins can be produced by cyanobacteria. These toxins are released to the water as the bacteria die and their cells lyse.

Water samples from various Ohio lakes have detected the presence of microcystin, anatoxin-a, cylindrospermopsin and saxitoxin. Both humans and animals can experience illness from exposure to these toxins through their drinking water, and during recreational activities and other water uses.

Exposure and Clinical Presentation:

<table>
<thead>
<tr>
<th>Route of Exposure</th>
<th>Symptoms/Signs</th>
<th>Time to symptom onset*</th>
<th>Differential Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swallowing water contaminated with cyanobacteria or toxins</td>
<td><strong>Hepatotoxins</strong>&lt;br&gt;(microcystins, cylindrospermopsin)&lt;br&gt;Elevated AST/ALT, GGT&lt;br&gt;Gastroenteritis&lt;br&gt;Acute hepatitis&lt;br&gt;Kidney damage&lt;br&gt;Malaise&lt;br&gt;Headache&lt;br&gt;Anorexia</td>
<td>Minutes to hours</td>
<td>Other hepatotoxin poisoning, other microbial infections/toxins&lt;br&gt;Viral hepatitis&lt;br&gt;Viral Gastroenteritis&lt;br&gt;Hepatotoxic drug ingestion (acetaminophen)</td>
</tr>
<tr>
<td>Swallowing water contaminated with cyanobacteria or toxins</td>
<td><strong>Neurotoxins</strong>&lt;br&gt;(anatoxin-a, anatoxin-a[s], saxitoxin)&lt;br&gt;Paresthesia&lt;br&gt;Tremor&lt;br&gt;Fasciculations&lt;br&gt;Hypersalivation&lt;br&gt;Diarrhea&lt;br&gt;Ataxia&lt;br&gt;Motor weakness&lt;br&gt;Respiratory and muscular paralysis</td>
<td>Minutes to hours</td>
<td>Pesticide poisoning, other toxin poisoning</td>
</tr>
<tr>
<td>Skin contact with water contaminated with cyanobacteria or toxins or contact with animals contaminated with cyanobacteria</td>
<td><strong>Dermal toxins</strong>&lt;br&gt;(Lyngbyatoxins, lipopolysaccharide endotoxins)&lt;br&gt;Rash, hives&lt;br&gt;Skin blistering&lt;br&gt;Allergic reactions</td>
<td>Minutes to hours</td>
<td>Other dermal allergens, non-allergic urticaria, photosensitivity reactions</td>
</tr>
<tr>
<td>Inhaling aerosolized droplets contaminated with cyanobacteria or toxins</td>
<td>Upper respiratory irritation&lt;br&gt;Rhinitis&lt;br&gt;Possible allergic reaction</td>
<td>Unknown, but likely an acute reaction</td>
<td>Other airborne allergens, upper respiratory infection, flu</td>
</tr>
</tbody>
</table>

* Symptom onset times are primarily extrapolations from laboratory animal data and events.
Diagnosis and Lab Testing:
Approach a potential HAB illness as a diagnosis of exclusion, ruling out other more likely differential diagnoses. Currently there is no laboratory diagnostic testing which can confirm the presence of cyanotoxins in human clinical specimens. In the absence of laboratory confirmation, presumptive diagnosis can be made based upon exposure history, clinical signs and symptoms, and ruling out other diagnoses. In cases where exposure to hepatotoxins is suspected, a standard liver panel is recommended (AST (SGOT), ALT, ALP, GGT, albumin and bilirubin). Tests for ruling out other diagnoses should also be performed.

Case Definition:
**CDC case definition summary for selected toxins** (for complete description see CDC Proposed Case Definitions for Algal Toxin-related Diseases)
- Suspect Case Exposure to water with a confirmed algal bloom AND onset of associated signs and symptoms within a reasonable time after exposure AND without identification of another cause of illness.
- Probable Case Meets criteria for Suspect Case AND there is laboratory documentation of a HAB toxin(s) in the water.
- Confirmed Case Meets criteria for a Probable Case combined with professional judgment based on medical review.

<table>
<thead>
<tr>
<th>Freshwater Cyanotoxins</th>
<th>Type of Toxin</th>
<th>Causative organism</th>
<th>Vector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatoxin-a</td>
<td>Neurotoxin</td>
<td>Anabaena spp.</td>
<td>Contaminated fresh water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aphanizomenon spp.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Planktothrix spp.</td>
<td></td>
</tr>
<tr>
<td>Anatoxin-a(s)</td>
<td>Neurotoxin</td>
<td>Anabaena flos-aquae</td>
<td>Contaminated fresh water</td>
</tr>
<tr>
<td>Cylindrospermopsin</td>
<td>Hepatotoxin</td>
<td>Cylindrospermopsis</td>
<td>Contaminated fresh water and possibly fish</td>
</tr>
<tr>
<td></td>
<td></td>
<td>raciborskii, Aphanizomenon ovalisporum</td>
<td></td>
</tr>
<tr>
<td>Aplysiatoxin</td>
<td>Dermal toxin</td>
<td>Lyngbya spp.</td>
<td>Contaminated fresh or marine waters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Planktothrix spp.</td>
<td></td>
</tr>
<tr>
<td>Microcystins</td>
<td>Hepatotoxin</td>
<td>M. aeruginosa</td>
<td>Contaminated fresh water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anabaena spp.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Planktothrix spp.</td>
<td></td>
</tr>
<tr>
<td>Saxitoxins</td>
<td>Neurotoxin</td>
<td>Anabaena circinalis</td>
<td>Contaminated fresh water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lyngbya woliei</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aphanizomenon flos-aquae</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cylindrospermopsis raciborskii</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Planktothrix spp.</td>
<td></td>
</tr>
</tbody>
</table>

Treatment and Patient Management:
Symptomatic, supportive care. There are currently no known antidotes for exposures to the group of toxins associated with cyanobacteria. Follow-up laboratory testing as indicated.
Patient Education:
Community education outreach efforts are currently being pursued by the state agencies involved addressing Ohio HABs. Please refer to the following links for more information regarding Harmful Algal Blooms:

- Ohio Department of Health: Blue-Green Algae/Cyanobacteria Harmful Algal Blooms (HABs) fact sheet: [http://www.odh.ohio.gov/~media/ODH/ASSETS/Files/eh/HABs/HABfactsheet.ashx](http://www.odh.ohio.gov/~media/ODH/ASSETS/Files/eh/HABs/HABfactsheet.ashx)
- Ohio Department of Health: Odors and Your Health fact sheet: [http://www.odh.ohio.gov/~media/ODH/ASSETS/Files/eh/HAS/odors.ashx](http://www.odh.ohio.gov/~media/ODH/ASSETS/Files/eh/HAS/odors.ashx)
- Ohio Environmental Protection Agency Harmful Algal Bloom Website: [http://epa.ohio.gov/habalgae.aspx](http://epa.ohio.gov/habalgae.aspx)
- Centers for Disease Control and Prevention, Environmental Hazards & Health Effects, Harmful Algal Blooms HABs: [http://www.cdc.gov/nceh/hsb/hab/default.htm#Cyanobacteria](http://www.cdc.gov/nceh/hsb/hab/default.htm#Cyanobacteria)

HAB Case Reporting Requirements:
Pursuant to Ohio Administrative Code (OAC) Chapter 3701-3-02 and the ODH Infectious Disease Control Manual ([www.odh.ohio.gov/pdf/idcm/intro1.pdf](http://www.odh.ohio.gov/pdf/idcm/intro1.pdf)) healthcare providers are required to submit reports of human illness related to exposure to HABs to the local health district where the ill individual resides. Reports are to be made under Class C - "waterborne disease outbreaks; report single cases of toxin poisoning associated with exposure to water with a confirmed algal bloom by the end of the next business day to the local public health department where the patient resides."

WHO must report? Healthcare providers (physicians, hospitals, infection control professionals, local public health providers) with knowledge of a case or suspect case of HAB exposure and illness are required to report.

WHAT must be reported? Healthcare providers must submit the HAB-related human illness form to the local health district where the ill individual resides.

WHEN must a report be made? Class C – must be sent by the end of the next business day to the local public health department.

WHERE must the report be made? Healthcare providers should send the case information to the local health jurisdiction where the patient resides. A listing of local health departments may be found at: [http://www.odh.ohio.gov/localhealthdistricts/localhealthdistricts.aspx](http://www.odh.ohio.gov/localhealthdistricts/localhealthdistricts.aspx)

ODH, with assistance from the Centers for Disease Control and Prevention, has developed case definitions and the following human illness reporting form for HAB-related illnesses:


Animal Illness:
Reports of suspected domestic animal illness associated with exposure to HAB should be reported to the Local Health District. Local health districts receiving reports from veterinarians should contact the ODH Zoonotic Disease Program (ZDP) at 614-752-1029, select option two (2). Completed animal illness report forms can be faxed to the ODH ZDP at 614-644-1057.

HAB-related animal illness report: [http://www.odh.ohio.gov/~media/ODH/ASSETS/Files/alert/beach%20monitoring/current/habrelatedanimalillnessreportform.ashx](http://www.odh.ohio.gov/~media/ODH/ASSETS/Files/alert/beach%20monitoring/current/habrelatedanimalillnessreportform.ashx)
Where can I get more information?
For a complete listing of the ODH-created public health documents, visit the ODH HAB webpage, Documents and Resources section at: http://www.odh.ohio.gov/odhprograms/eh/HABs/HABDocumentsResources.aspx

Ohio Department of Health
Bureau of Environmental Health
246 N. High Street
Columbus, Ohio 43215
Phone: (614) 466-1390
Fax: (614) 466-4556

To view a listing of current advisories or sampling data, report a potential algal bloom, or learn more about Ohio’s HAB response strategy visit Ohio EPA’s www.Ohioalgaeinfo.com for more information.

Additional Resources:
Centers for Disease Control and Prevention (CDC)
http://www.cdc.gov/nceh/hsb/hab/default.htm

Ohio EPA
Ohio EPA Harmful Algal Bloom Advisories website: Ohio Algae Information for Recreational Waters
http://epa.ohio.gov/habalgae.aspx

State of Ohio Harmful Algal Bloom Response Strategy For Recreational Waters (June, 2015)

U.S. EPA
Nutrient Policy and Data: Cyanobacteria/Cyanotoxins
http://www2.epa.gov/nutrient-policy-data/cyanobacteriacyanotoxins

Toxicological Reviews of Cyanobacterial Toxins: Microcystins LR, RR, YR and LA (External Review Draft)
http://cfpub2.epa.gov/ncea/cfm/recordisplay.cfm?deid=160548

World Health Organization
Toxic cyanobacteria in water: A guide to their public health consequences, monitoring and management

Cyanobacteria and cyanotoxins in drinking-water

State Guidance
Vermont

Wisconsin Department of Health Services, Blue-Green Algae
www.dhs.wisconsin.gov/eh/bluegreenalgae/

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