Freshwater Harmful Algae Blooms and Public Health

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Focus

• Cyanobacteria & Toxins (Cyanotoxins)
• Cyanobacteria Toxins & Health Effects List
• 2019 – Summary of Human and Animal HAB-Reported Health Effects
• Challenges
• HAB Task Force Efforts to Prevent Human & Animal HAB Exposure
Health Effects - Cyanotoxins

Most common HAB associated exposure is while swimming or participating in other recreational activities

Routes of Exposure-

• Ingestion – when accidentally swallowing contaminated water
• Dermal – by direct contact
• Respiratory and/or Aspiration
• Others – less common
  • Ingestion of cyanotoxin-contaminated drinking water
  • Consumption of cyanotoxins - contaminated food
  • Skin through cosmetic applications,
  • Medically – example renal dialysis – uses of contaminated water
Health Effects

Four major cyano-toxins:

- Microcystin
- Cylindrospermopsin
- Saxitoxin
- Anatoxin-a group

Known Hepatotoxin

Patients present with:
- Hepatomegaly, gastroenteritis (diarrhea, nausea, vomiting, abdominal pain), fever, malaise, headache, and elevated liver enzymes

Symptoms onset: Minutes to hours
Could be similar to:
- Acute viral hepatitis and other Toxic Hepatitis

Known Neurotoxins:

Patients present with:
- Tremor, twitching, muscles cramps, motor weakness, paresthesia, cardiac or respiratory paralysis

Symptoms onset: Minutes to hours
Could be similar to:
- Pesticide poisoning and other toxin poisoning

Other toxins/chemical irritants:

Lippopolysaccharides (chemical irritants)
Dermatoxins (lyngbyatoxin) – produce only by lyngbya spp
Health Impacts of Cyanotoxins

Note: Not all cyanotoxins lead to all of these health impacts. These listed impacts are caused by microcystins or cylindrospermopsin, the two cyanotoxins that EPA has issued Health Advisories for.

**IN HUMANS**

**Brain**
- Source: Ingestion
- Symptoms:
  - Headache
  - Incoherent speech
  - Drowsiness
  - Loss of coordination

**Respiratory System**
- Source: Inhalation
- Symptoms:
  - Dry cough
  - Pneumonia
  - Sore throat
  - Shortness of breath
  - Loss of coordination

**Digestive System**
- Source: Ingestion, drinking contaminated water, or eating contaminated fish
- Symptoms:
  - Abdominal pain
  - Nausea
  - Vomiting
  - Diarrhea
  - Stomach cramps

**Body**
- Source: Contact, e.g. swimming
- Symptoms:
  - Irritation in eyes, nose, and throat
  - Blisters around the mouth
  - Skin rash, including tingling, burning and numbness
  - Fever
  - Muscle aches (from ingestion)
  - Weakness (from ingestion)

**Organs**
- Source: Ingestion
- Symptoms:
  - Kidney damage
  - Abnormal kidney function
  - Liver inflammation

**Nervous System**
- Source: Ingestion
- Symptoms:
  - Tingling
  - Burning
  - Numbness

**IN PETS**

**Symptoms:**
- Vomiting
- Fatigue
- Shortness of breath
- Difficulty breathing
- Coughing
- Convulsions
- Liver failure
- Respiratory paralysis leading to death
Cyanobacteria Toxins & Health Effects List

Purpose
• Educate
• Protect public health
• Hybrid management approach - potentially toxigenic genera compared with advisory thresholds

Development of current version
• EPA/CDC genera lists
• Other states and HAB research papers

Validation by the HAB Community
• Handout & poster - 10th US HAB Symposium
• EPA & CDC requested feedback of the HAB community by March 31, 2020
• GOAL – Mid-Atlantic list of potentially toxigenic cyanobacteria which has been validated by the HAB community


2019 HAB Symposium Poster Session – Gulf Shores, Alabama; copies of list handed out with poster for feedback. From Left – Leah, Todd, Amani, Margaret
2019 Summary of Human and Animal HAB - Reported Health Effects

• VDH received 8 human health complaints possibly related to HAB exposure in public and private waterbodies; no follow-up conducted (except for one); complaints usually reported well after-the-fact - (patients feel well; water condition changes quickly)

• 7/8 were skin and eye irritation

• 1/8 GI symptoms – patient had underlying medical condition might presents similar symptoms and signs

• All human health complaints to the HAB hotline – all connected to Lake Anna

• None of these are considered “HAB-related health illness”
North Carolina – Three Dogs Died

NC - 3 dogs died due to swimming in a pond contained blue – green algae; August 2019

- Outrage over the dog deaths – for pets and HAB exposure
- Many calls to test private lakes/ponds
- 3 dog/1 cat deaths were reported in Virginia

AFTER NC

- Un-confirmed linkage to HAB exposure -
- One report received two days after dog died - HAB TF worked with DSI, veterinary epi, and TJ health director - water sampled – HAB not found
- Other reports were few weeks after the pet's deaths (water status changed – bodies were not available)
- CDC/EPA resources made available for public, physician, and veterinarian references

A North Carolina woman took her three dogs to a pond to play. Within hours, her pups had died from toxic algae

Every state felt this impact! Everyone cared!!

- Pets like dogs are more susceptible to get infected because of:
  - Their small bodies
  - High risk to drink from impacted water
  - They lick their fur – ingestion of cyanotoxin

The first dog experienced the symptoms 15 m after leaving the pond, followed by the 2nd, and the 3rd dog. The 3 dogs died few hrs after exposure

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Physician Reference

Cyanobacteria blooms. *When in doubt, it’s best to stay out!*

**What are cyanobacteria?**
- Cyanobacteria, sometimes called blue-green algae, are microscopic organisms that live in all types of water.

**What is a cyanobacteria bloom?**
- Cyanobacteria grow quickly, or bloom, when the water is warm, slow-moving, and full of nutrients.

**What are some characteristics of cyanobacteria blooms?**
- Cyanobacteria usually bloom during the summer and fall. However, they can bloom anytime during the year.
- When a bloom occurs, scum might form on the water’s surface.
- Blooms can be many different colors, from green or blue to red or brown.
- As the bloom dies off, you might smell an odor that is similar to rotting plants.

**What is a toxic bloom?**
- Sometimes, cyanobacteria produce toxins.
- The toxins can be present in the cyanobacteria cells or in the water.

**Other important things to know:**
- Swallowing water that has cyanobacteria or cyanobacterial toxins in it can cause serious illness.
- Dogs might have more severe symptoms than people, including collapse and sudden death after swallowing the contaminated water while swimming or after licking cyanobacteria from their fur.
- There are no known antidotes to these toxins. Medical care is supportive.

You cannot tell if a bloom is toxic by looking at it.

To report a cyanobacteria bloom or related health event:
- Call your local or state health department

For more information:
- [https://www.cdc.gov/habs/general.html](https://www.cdc.gov/habs/general.html)
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https://www.cdc.gov/habs/pdf/habsveterinarian_card.pdf
WHEN IN DOUBT, KEEP PETS OUT!

Don’t let your pets swim in, play in, or drink discolored or scummy water.

Find out why at www.cdc.gov/habs
Challenges of Confirming Reported Health-Effects to HABs

- Reports typically are well after exposure
- Dog necropsy difficult to perform or no body is available
- Outreach to Physicians and Veterinarians on the questions to ask of patients or pet owners to ensure proper diagnostics can be performed
- Difficulty to biologically link health problem to HAB exposure both in human and animals - due to limitation of diagnostic tools
- Gap in CDC HAB Case Definition – difficulty to meet the requirements
- OHHABS form is long: 6 and 5 pages for human and animal respectively

Research presented in 2019 - US HAB symposium - Greenwater lab in Florida confirmed cyanotoxins in 6 dogs using ELISA and other techniques to test (vomitus, blood, urine, bile, liver, kidney, hair) - link below:
- Step forward for future discussion

https://www.cdc.gov/habs/ohhabs.html
HAB Task Force Efforts to Prevent Human & Animal HAB Exposure

Waterborne website: swimhealthyva.com supports HAB Surveillance MAP – update weekly and as needed – we use HAB Crowd Sourcing – only for Lake Anna

• HAB Online Submittal Form
• Talking points
• Map for State Poison Control Centers
• Shared CDC sites for useful materials and resources
Outreach and Education

- Educational signage
- Brochures
- Warning signage
- HAB sampling Kits with supplies and instruction to help partners for HAB sampling
# HAB Virtual Toolkit - Resources

## Harmful Algal Bloom Guidance & Resources

**HAB Webpage, Surveillance, Map & General Information**

- [Harmful Algal Bloom - Main Page](http://www.harmfulalgaevir.com)
- [Harmful Algal Bloom Surveillance Map](http://www.vdh.virginia.gov/environmental-epidemiology/harmful-algal-bloom-surveillance-map/)
- [HAB Online Report Submittal Form](http://www.vdh.virginia.gov/environmental-epidemiology/harmful-algal-bloom-online-report-form/)
- [VDH Brochures: Harmful Algal Blooms and other Organisms in Coastal Waters](http://www.vdh.virginia.gov/content/uploads/sites/12/2016/04/HABs_Brochure.pdf)
- [Cyanobacteria (Blue-Green Algae)](http://www.vdh.virginia.gov/content/uploads/sites/12/2016/02/Cyanobacteria_Brochure.pdf)

## Resources for Environmental Health Specialists

- [HAB Public Notification](http://www.vdh.virginia.gov/environmental-epidemiology/public-notification-templates/)
- [HAB Signs](http://www.vdh.virginia.gov/environmental-epidemiology/hab-recreational-awareness-advisory-signs/)
- [VDH – Template Social Media Posts](http://www.esa.gov/sites/production/files/2017-07/social-media-issue-advisory.docx)
- [Lifting an Advisory](http://www.esa.gov/sites/production/files/2017-07/social-media-lift-advisory.docx)

## CDC – HAB Associated Illness and Syndromes

- [CDC – HAB Associated Illness and Syndromes](http://www.cdc.gov/habls/illness.html)

## VDH – Marine Toxins and Associated Syndromes


## VDH – Cyanobacteria Toxins and Health Effects


## Other Resources

- [Fox complete forms to DEE (804-864-8113)](http://www.vdh.virginia.gov/content/uploads/sites/12/2016/02/VDH-MicrocystisGuidance.pdf)
- [HAB Human Screening Form](http://www.vdh.virginia.gov/content/uploads/sites/12/2017/07/Harmful-Algal-Bloom-Health-Survey_Final.pdf)
- [HAB – Human Screening Form](http://www.cdc.gov/habls/ohhab.html)

## Additional Resources

- [CDC – CDC HABS Online Guidance and Training Resources](http://www.cdc.gov/habls/pdf/ohhab-human-form.pdf)
- [CDC – CDC HABS Online Guidance and Training Resources](http://www.cdc.gov/habls/pdf/ohhab-human-form-guidance.pdf)
- [CDC – CDC HABS Case and event definitions – table 3-14-17.pdf](http://www.cdc.gov/habls/pdf/ohhab-case-and-event-definitions-table-3-14-17.pdf)
Thank You!