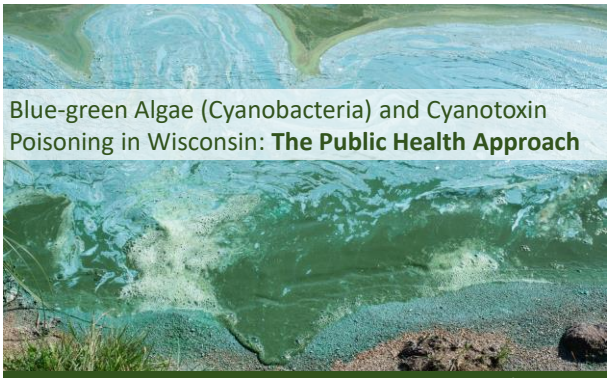
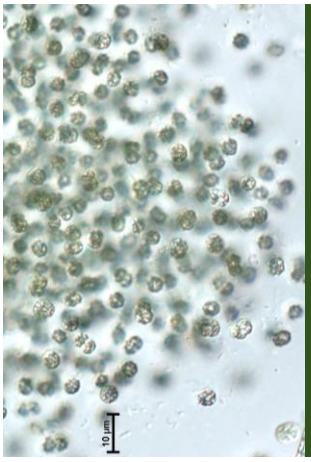


Blue-green Algae (Cyanobacteria) and Cyanotoxin Poisoning in Wisconsin: **The Public Health Approach**

Blooms & the Big Lake Workshop
April 29, 2019
Presented by Amanda Koch, MPH,
Waterborne Diseases Epidemiologist

Wisconsin Department of Health Services
Division of Public Health
Bureau of Environmental and Occupational Health

Human and Animal Health Effects



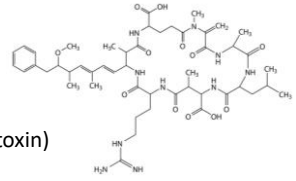
Not all cyanobacteria are harmful.

- Helped create the Earth's atmosphere
- Over 2,600 described species
  - Estimated >6,000 species
  - About 50 are known to be toxin-producers

Cyanobacterial Toxins

Various toxin types

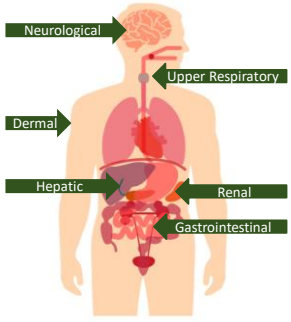
- **Hepatotoxins**
  (e.g., microcystin-LR, cylindrospermopsin)
- **Neurotoxins**
  (e.g., anatoxin-a, saxitoxin)
- **Dermatotoxins**
  (e.g., lipopolysaccharide endotoxins)



Cyanobacterial Toxins

Signs and symptoms depend largely on:

- Route(s) of exposure
- Species and toxin type(s) present
- Cyanobacterial cell and toxin concentrations
- Vulnerability (behaviors, body size, preexisting conditions)



How are people exposed?

- Activities
  - Recreational
  - Personal use
  - Occupational
- Exposure routes
  - Dermal
  - Ingestion
  - Inhalation

Dermal contact

- Rash
- Hives
- Skin blisters
- Lesions most common under swimsuits

Ingestion

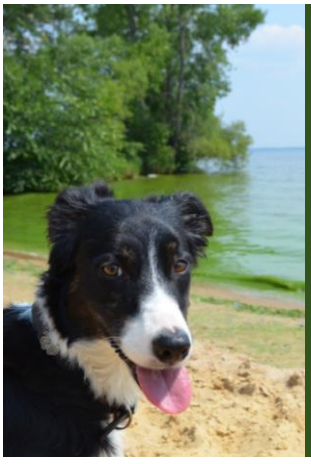
- Abdominal pain
- Nausea
- Diarrhea
- Vomiting
- Numb lips
- Tingling fingers and toes
- Dizziness

Inhalation

- Influenza-like illness
- Runny eyes
- Runny nose
- Sore throat
- Asthma-like symptoms

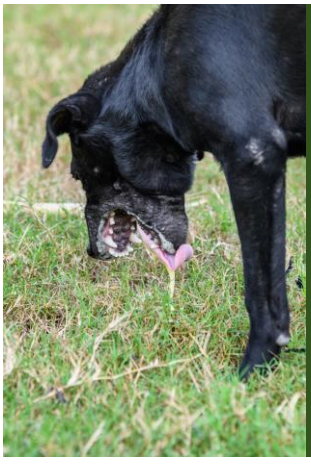
Animals

- Particularly vulnerable due to their behaviors and smaller size
- Often serve as sentinels for human illness



Dogs

- Most common victims
- Deaths are well-documented



Symptoms in Animals

- Lethargy
- Vomiting
- Drooling
- Diarrhea
- Weakness
- Difficulty breathing
- Seizures

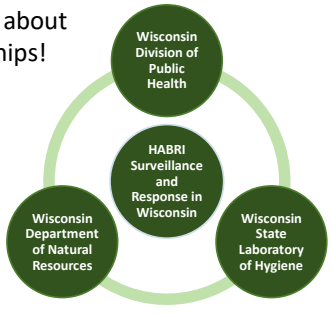
DPH HAB Program

DPH HAB Surveillance Program

- Established in 2008 through the CDC's Harmful Algal Bloom Illness Surveillance System project (HABISS)
- Supported by CDC and the Great Lakes Restoration Initiative
  - Council of State and Territorial Epidemiologists (CSTE) Applied Epidemiology Fellowship Program
  - Other staffing and program support

DPH HAB Surveillance Program

We're all about partnerships!



DPH HAB Surveillance Program

We're all about partnerships!

DPH HAB Surveillance Program

Conducts surveillance of health effects related to HAB exposure.

Investigates reports of human and animal illnesses.

DPH HAB Surveillance Program

Coordinates water sampling and analysis.

Helps local public health issue health advisories and beach closures.

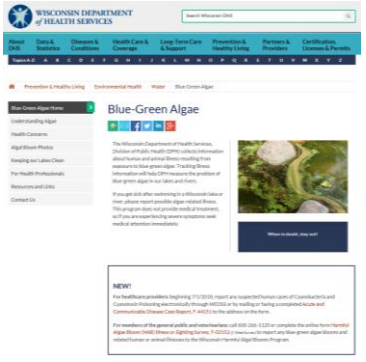
Provides education and outreach.

DPH HAB Surveillance Program

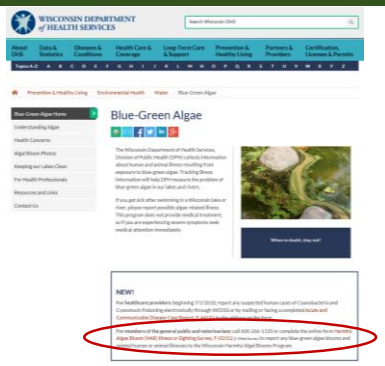
Illness complaint reporting methods

- Online case-reporting tool on DPH blue-green algae website
- Direct contact with program staff
- Referrals from DNR, local health departments, and lake associations
- Wisconsin Poison Center
- Clinicians

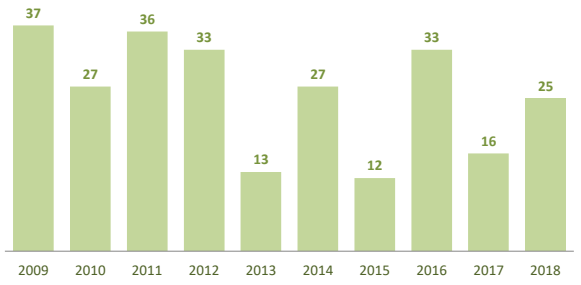
DPH HAB Surveillance Program



DPH HAB Surveillance Program



Annual Health Complaints



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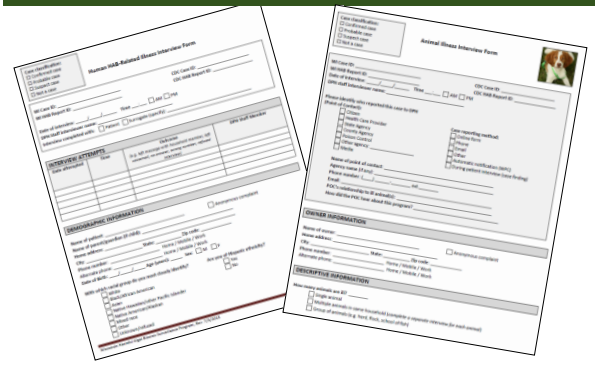

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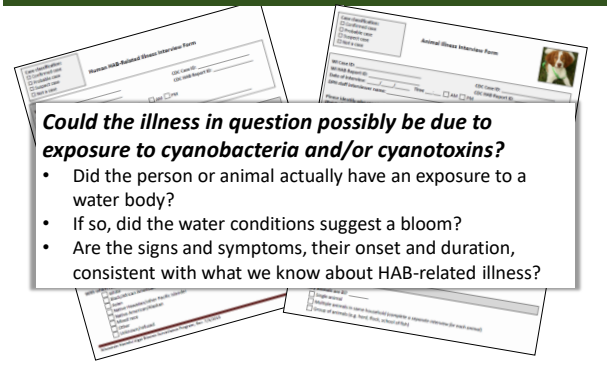
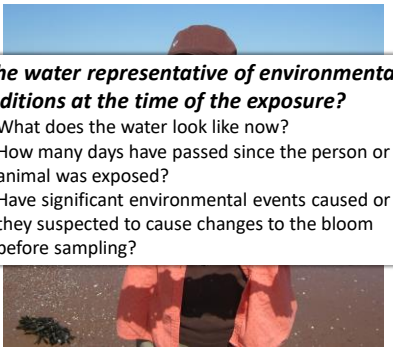


Could the illness in question possibly be due to exposure to cyanobacteria and/or cyanotoxins?

- Did the person or animal actually have an exposure to a water body?
- If so, did the water conditions suggest a bloom?
- Are the signs and symptoms, their onset and duration, consistent with what we know about HAB-related illness?

DPH HAB Surveillance Program

DPH HAB Surveillance Program



Is the water representative of environmental conditions at the time of the exposure?

- What does the water look like now?
- How many days have passed since the person or animal was exposed?
- Have significant environmental events caused or are they suspected to cause changes to the bloom before sampling?

DPH HAB Surveillance Program

Harmful Algal Bloom Surveillance Program
Field Staff Sampling Protocol

Wisconsin Division of Public Health
Wisconsin Department of Natural Resources

2018 Update

When to use this kit:
For Response Monitoring by DNR staff when these three criteria are met:

- illnesses suspected to be related to HAB exposure are reported.
- DHS Division of Public Health partners determine the case histories, symptoms, and environmental conditions are consistent with HAB exposure.
- full cyanobacterial identification and enumeration, cyanotoxin analysis, water chemistry, and coliform bacteria testing are required.

Use may be warranted in other situations with public health impact but consult with the Statewide Blue-green Algae Coordinator before using the kit.

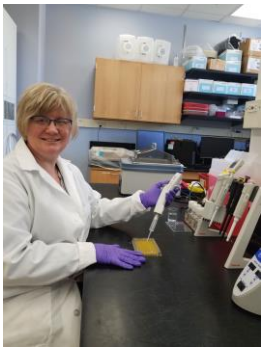
When NOT to use this kit:

- Confirmation of bloom presence only.
- Cyanobacterial identification and/or enumeration without requirement for cyanotoxin analysis, water chemistry, or E. coli testing.

Consult with the Statewide Blue-green Algae Coordinator for photo identification, or seek identification and enumeration services from the Wisconsin State Laboratory of Hygiene (WSLH).

If non-DNR entities (county staff, homeowners) are seeking cyanobacterial testing, please refer them to the Statewide Blue-green Algae Coordinator. They can seek services from WSLH, but if testing results are going to be used for beach monitoring or other public health issues, the coordinator needs to brief them on availability of messaging resources and the need to work with local public health officials.

DPH HAB Surveillance Program



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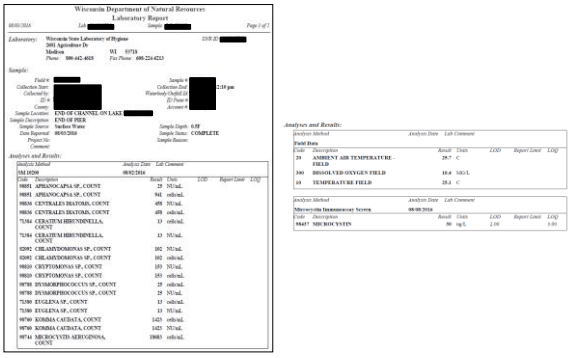

Wisconsin Department of Natural Resources
Laboratory Report

Laboratory: Wisconsin State Laboratory of Hygiene
2601 Agriculture Dr
Madison WI 53718
Phone: 800-442-4618 Fax Phone: 608-224-6213

Sample:
Field #:
Collection Start:
Collected by:
ID #:
County:
Sample Location: END OF CHANNEL ON LAKE
Sample Description: END OF PIER
Sample Source: Surface Water
Date Reported: 08/03/2016
Project No:
Comment:
Sample Depth: 0.5ft
Sample Status: COMPLETE
Sample Reason:

Analyses and Results:

Analysis Method	Analysis Date	Lab Comment
SM 10200	08/02/2016	

Code	Description	Result	Units	LOD	Report Limit	LOQ
90851	APHANOCAPSA SP., COUNT	25	NU/mL			
90851	APHANOCAPSA SP., COUNT	941	cells/mL			
90836	CENTRALES DIATOMS, COUNT	458	NU/mL			
90836	CENTRALES DIATOMS, COUNT	458	cells/mL			
71384	CERATIUM HIRUNDINELLA, COUNT	13	cells/mL			
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82092	CHLAMYDOMONAS SP., COUNT	102	NU/mL			
82092	CHLAMYDOMONAS SP., COUNT	102	cells/mL			
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90790	DYSMORPHOCOCUS SP., COUNT	25	cells/mL			
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71380	EUGLENA SP., COUNT	13	NU/mL			
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90741	MICROCYSTIS AERUGINOSA, COUNT	18683	cells/mL			

Analyses and Results:

Analysis Method	Analysis Date	Lab Comment
Field Data		

Code	Description	Result	Units	LOD	Report Limit	LOQ
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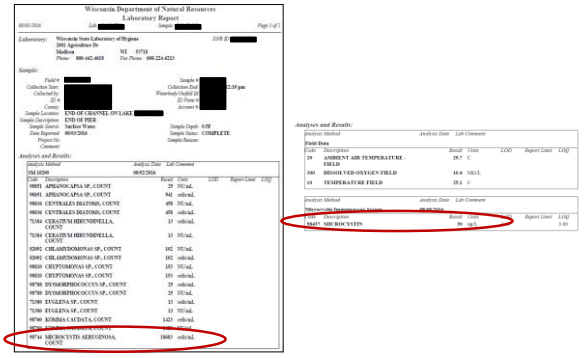
300	DISSOLVED OXYGEN FIELD	10.4	MG/L			
10	TEMPERATURE FIELD	25.1	C			

Analysis Method	Analysis Date	Lab Comment
Microcystin Immunoassay Screen	08/08/2016	

Code	Description	Result	Units	LOD	Report Limit	LOQ
90437	MICROCYSTIN	50	ug/L	2.00		5.00

DPH HAB Surveillance Program



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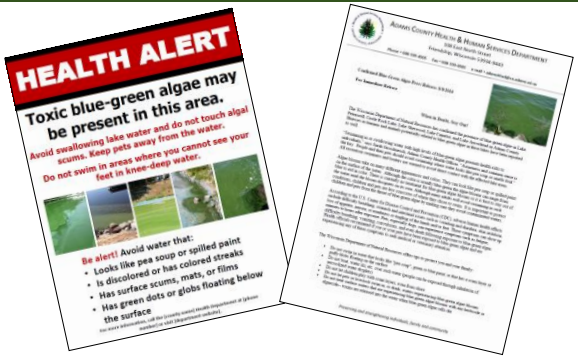


HAB-Related Illness Case Studies

Human Illness Case Study

- In August 2017, DPH received faxed report from the Wisconsin Poison Center (WPC).
- 17-year-old male became ill with gastro-intestinal illness the day after recreating in Lake A for less than 30 minutes

Human Illness Case Study

- DPH interviewed the family the following week
  - Father also ill
- Exposure location: near shoreline of county park
- Activities: swimming near shoreline, dunking, playing catch in waist-deep water

Human Illness Case Study

- Signs and symptoms:
  - First sign: headaches within 1 hour of exposure
  - Following morning: abdominal cramping and diarrhea lasting <24 hours
  - No known ill contacts
  - Did not seek medical care
- Environmental conditions:
  - Murky green, "pea soup" water with rotten egg odor
  - Three dead carp present

Human Illness Case Study

- Water Sampling
  - Too late for illness response sampling
  - Other data available?
    - Citizen monitoring at deep hole on day of exposure:
      Secchi depth: 2.5 ft
      Trophic state index: 64
      Clarity: murky
      Color: green
    - Unknown conditions at shallower shoreline locations

Human Illness Case Study

Conclusion

- Signs and symptoms characteristic of cases of HAB-related gastrointestinal illness
- There was observational and environmental evidence of a bloom
- Lab-based HAB data unavailable

Human Illness Case Study

Conclusion

- Signs and symptoms characteristic of cases of HAB-related gastrointestinal illness
- There was observational and environmental evidence of a bloom
- Lab-based HAB data unavailable

→ ***Probable cases***

Animal Illness Case Study

Two dogs died within 1 hour of each other on the same day after swimming in the same lake.

- Dogs had no connection
- Dogs swam at different beaches on Lake B (Beach A, Beach B)
- Lake known for blooms, but no blooms were visually observed
- Owner of one dog went to the media

Animal Illness Case Study

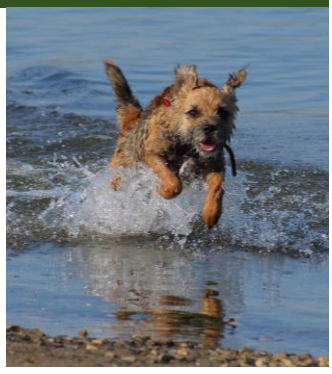
Cavalier King Charles Spaniel

- **Activities at Beach A**: swimming, playing fetch
- **Exposure duration**: 1 hour
- **Signs of illness**:
  - First sign: loss of balance 40 minutes into swimming
  - During walk home: loose stool and frequent urination
  - At home: salivation and frothing at the mouth, vomiting, panting, unconsciousness
- **Environmental conditions**: brown and murky water; no observed algal bloom

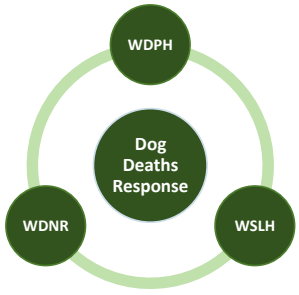
Animal Illness Case Study

Border Terrier

- **Activities at Beach B**: swimming, playing fetch
- **Exposure duration**: 20-25 min.
- **Signs of illness**:
  - First sign: ataxia/staggering approximately 20 minutes after returning home
  - Other signs/symptoms at home: twisting/turning, convulsions, unconsciousness
- **Environmental conditions**: brown and murky water; no observed algal bloom



Animal Illness Case Study



Animal Illness Case Study

Animal Illness Case Study

WDPH	Interviewed dog owners and served as point-of-contact between investigation partners
WDNR	Collected and analyzed water samples at Beach A and Beach B where dogs were exposed
WSLH	Analyzed water samples and dogs' stomach contents for cyanobacteria and cyanotoxins

Animal Illness Case Study

Local Health Dept. — Collected and analyzed water samples for cyanobacteria and cyanotoxins

Local Lake Assoc. — Shared results from routine monitoring at Beach A on day of dogs' exposures

Vets — Received, examined, and attempted to treat animals during ER visits; performed necropsies and additional post-mortem testing on both dogs

Animal Illness Case Study

Water sample analysis

- **Low** cyanobacterial cell counts with either **non-detectable** or **very low** levels of cyanotoxins

Stomach content analysis

- Cavalier King Charles Spaniel: **non-detectable** cyanotoxins
- Border Terrier: **non-detectable** cyanotoxins

Post-mortem analyses and necropsies

- Ruled out cyanotoxin exposure
- Identified possible other causes of death

Animal Illness Case Study

Water sample analysis

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Stomach content analysis

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- Border Terrier: **non-detectable** cyanotoxins

Post-mortem analyses and necropsies

- Ruled out cyanotoxin exposure
- Identified possible other causes of death

Not a case!

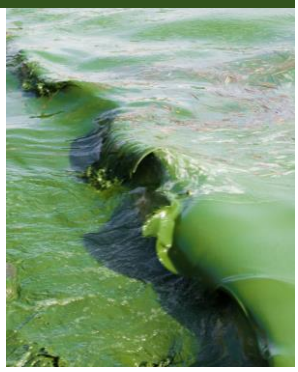
Public Health Importance

Public Health Importance

- Emerging public health problem worldwide.
- Projected increases in severity and magnitude.
- Health impacts are still poorly understood.

Public Health Challenges

- Poor recognition of cases
- Failure to associate illness with algal bloom exposure
- Challenging to diagnose
  - Non-specific symptoms
  - Medical attention not sought
  - Low case recognition among doctors and vets
  - No available diagnostic test



Illness Prevention

How Can I Help?

How Can I Help?

- Become familiar with the signs and symptoms and risky water conditions.

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- Educate others.

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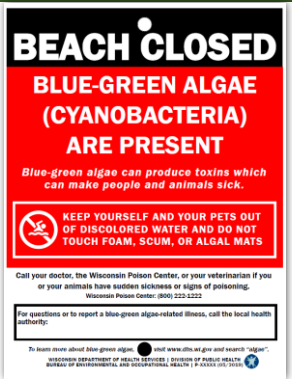
- Encourage others to report suspected illnesses.

How Can I Help?

- Become familiar with the signs and symptoms and risky water conditions.
- Educate others.
- Report suspected illnesses.
- Encourage others to report suspected illnesses.
- Report obvious blooms to the Wisconsin DNR.

HAB signage on the way!

HAB signage on the way!



Questions?

Amanda Koch, MPH
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DPH HAB Program Coordinator
Amanda.Koch@dhs.wi.gov

Wisconsin Division of Public Health
Harmful Algal Blooms Program
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