

# CHANGING DYNAMICS IN ALGAL BLOOM TOXINS

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Bloomington, Illinois



# WHAT ARE BLUE-GREEN ALGAE?

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- Also known as cyanobacteria
- Microscopic organisms that are naturally present in lakes and streams
- They are usually present in low numbers, but can grow quickly and become very abundant in warm, shallow, undisturbed surface waters that receive a lot of sunlight
- Can form blooms that discolor the water or produce floating rafts or scums on the surface of the water
- These blooms are primarily a concern during the summer months in Illinois

# WHAT ARE BLUE-GREEN ALGAE?

- Some blue-green algae produce algal toxins
  - Microcystin (most common toxin)
  - Cylindrospermopsin
  - Anatoxin
  - Saxatoxin
- Could pose a health risk to people and animals when exposed to them in large enough quantities
- Health effects could occur when surface scums or waters containing high levels of blue-green algae toxins are swallowed, come in contact with skin, or when airborne droplets containing toxins are inhaled while swimming, boating, waterskiing, tubing, bathing or showering

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- People can get sick from blue-green algal toxins if they have direct contact with a blue green algae bloom, by either
  - Intentionally or accidentally swallowing water,
  - Having direct skin contact (as when swimming, wading, or showering), or
  - Breathing airborne droplets containing the toxins, such as during boating or waterskiing.

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  - Intentionally or accidentally swallowing water,
  - Having direct skin contact (as when swimming, wading, or showering), or
  - Breathing airborne droplets containing the toxins, such as during boating or waterskiing.
- World Health Organization (WHO) recognizes human exposures to microcystin at certain levels should be avoided:
  - 20 µg/L for contact
  - Until 2012, highest concentration observed by IEPA was 17.47 µg/L

# ENVIRONMENTAL CONDITIONS 2011-12

- 2011-12 Winter: Mild with little ice / snow
  - 2012: Uncharacteristically high air temperatures during summer
  - Drought: No, or very little, rainfall
  - Increasing lake temperatures during summer
- 
- EXPECTED UNIQUE LAKE CONDITIONS
  - Began visual monitoring of my lakes



AUGUST 2012  
THE NIGHTMARE BEGINS...

# VISUAL CUES–POTENTIAL PROBLEM #1

- During a routine site visit for a board meeting, I observed elevated blue-green algae, and juvenile fish kills. The management team was notified of the potential concern HAB's were present.

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- Approval for sampling was set in motion, samples were collected and sent to Phycotech for ID by Ann St. Amand.



# PROBLEM #1 - CONFIRMED

- Preliminary results by algal id showed an elevated potential for microcystin toxicity, the management team was notified and they closed the lake to contact.
- Algal samples were sent for lysing and microcystin analysis at GreenWater Labs, Florida.

# PROBLEM #1 - CONFIRMED

- Preliminary results by algal id showed an elevated potential for microcystin toxicity, the management team was notified and they closed the lake to contact.
- Algal samples were sent for lysing and microcystin analysis at GreenWater Labs, Florida.
- Results: POSITIVE for extremely elevated microcystin (well beyond the WHO recommendations)

## Summary of MC Results

<u>Sample</u>	<u>MC levels</u> ( $\mu\text{g/L}$ )
120001-290 (Beach)	2.8
120002-290 (Fisherman's Cove)	14800
LOD/LOQ = 0.15 $\mu\text{g/L}$	<b>WHO: &gt; 20<math>\mu\text{g/L}</math></b>

Submitted by:



Mark T. Aubel, Ph.D.

Date:

8/20/12



# VISUAL CUES—POTENTIAL PROBLEM #2

- Due to high toxicity levels and environmental conditions, I began watching other lakes.
- Visual cues provided concern...again...
- Lake was shut down to contact / activity due to visual cues



# PROBLEM #2 - CONFIRMED

- Samples were taken and sent in for verification.
- Results came back with same M.O... High algal counts of toxin producing algae with HIGH probability of microcystin production.
- Samples were shipped to GreenWater Labs for analysis... SURPRISED? NOPE. HIGHLY elevated microcystin levels discovered in the samples and positive, elevated microcystin levels on other lakes.



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<u>Sample</u>	<u>MC levels</u> ( $\mu\text{g/L}$ )
120003-290 (Main Lake)	7400
120004-290 (Beach)	31500
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# COMMON FACTORS OF BOTH COMMUNITIES

- No 'rules' in place for lake closures
- No budget for blue-green algae monitoring (it wasn't expected)
- Both have a history of previous blue-green algae blooms on the lake
- Both have (or had) a sewage treatment facility discharge into the lake at some point
- Very similar geography (latitude)
- No educational system in place for the membership
  - No awareness of blue-green algae (and associated toxicity) concerns.

# ACTIONS BY THE ASSOCIATION

- Both Association leaders recognized the concern and took action to protect their membership.
  - Lake closed to all contact
  - Warning signs posted
  - E-blasts sent

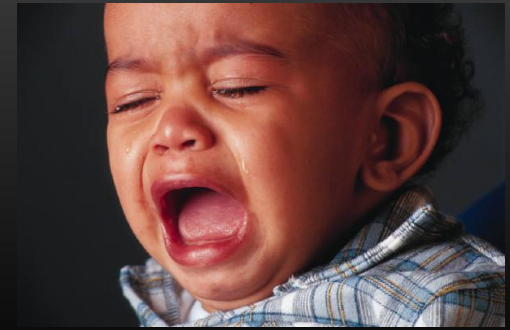


# OH BOY...HERE IT COMES!

- Public out “cry” about the unfair closure of the lake.
- The Association doesn’t have a right to shut the lake down.

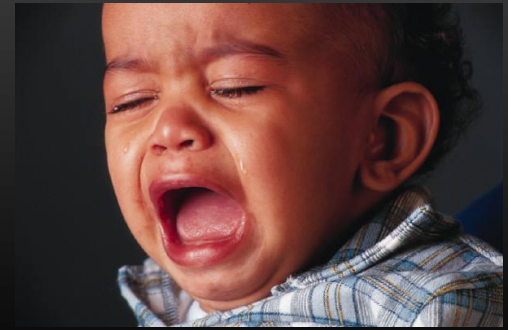


# OH BOY...HERE IT COMES!



- I didn't feel the lake should be closed to swimming.
- False assumptions that boating would actually be beneficial to break up some of these algae mats and hopefully move them to the dam
- The fish are safe to catch and eat because they are in the deeper, cooler water of the lake and can't be affected by the algae bloom
- We need to just 'wait and see' after the winter freeze and not close the lake.
- My pontoon boat will not get sick and it can't be unsafe for me to boat around the lake in an aluminum boat
- The release of the IEPA fact sheet supported the actions the communities took to close the lake down. This was a POSITIVE thing at a much needed time

# OH BOY...HERE IT COMES!



- Misconception that toxicity is only associated with where algae is visible on the lake and that the samples from the open water where there is no algae visible are okay, even knowing that the wind blows it around the lake.
- Assumptions that testing should be done away from the algal mats and the tests will hopefully show that the toxins are where the algae is visibly located and not so prevalent in the main body of water.
- I'm a doctor and I can't find one place toxic algae killed someone

EVEN WITH THIS VISUAL CONDITION...






























EVEN WITH THESE TEST RESULTS...

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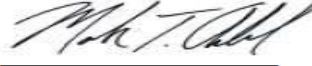
LOD/LOQ = 0.15  $\mu\text{g/L}$

Submitted by:   
Mark T. Aubel, Ph.D.  
Date: 8/20/12

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# EVEN WITH THESE TEST RESULTS...

## Summary of MC Results

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<u>Sample</u>	<u>MC levels</u> ( $\mu\text{g/L}$ )
Beach	17
Fisherman's Cove	9650

LOD/LOQ = 0.15  $\mu\text{g/L}$

Submitted by:   
Mark T. Aubel, Ph.D.  
Date: 9/13/12


## Summary of MC Results

Sample MC levels

### Summary of MC Results

<u>Sample</u>	<u>MC levels</u> ( $\mu\text{g/L}$ )
WLV Dam	4.9
WLV East Cove	10050

LOD/LOQ = 0.15  $\mu\text{g/L}$

Submitted by:   
Mark T. Aubel, Ph.D.  
Date: 8/28/12

# EVEN WITH THESE TEST RESULTS...

## Summary of MC Results

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<u>Sample</u>	<u>MC levels</u> ( $\mu\text{g/L}$ )
Beach	15
Fisherman's Cove	28
Inlet Cove	73
Marina	21
The Dip	23

LOD/LOQ = 0.15  $\mu\text{g/L}$

Submitted by:   
Mark T. Aubel, Ph.D.

Date: 9/26/12

## Summary of MC Results

Sample MC levels

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<u>Sample</u>	<u>MC levels</u> ( $\mu\text{g/L}$ )
120005-290 (Dam)	245
120006T-290 (Main Lake)	21

LOD/LOQ = 0.15  $\mu\text{g/L}$

Submitted by:   
Mark T. Aubel, Ph.D.

Date: 9/14/12

# UN-DOCUMENTED BUT CLAIMED...

- Property owner claims she received 'sores' all over her legs and arms when pushing their boat into the lake (through algal blooms)
- Property owner ended up with gastrointestinal diarrhea after being exposed to the lake during the bloom. They felt it was algae related
- Property owner... WORST summer allergies observed this year, during the blooms
- 3 swans were found dead during the blooms
  - 2 were 'found eaten on the shore' so they were 'assumed' to have died from 'natural causes' then washed to shore and scavenged.
  - 1 was seen having convulsions and 'drowning'. A property owner jumped into the lake (in the algal bloom) pulled the swan to the shore and proceeded to give it 'mouth to mouth'. Actually documented in a public safety report.

(I know what you are thinking, and NO.... YOU CAN'T MAKE THIS STUFF UP!)

EVEN THROUGH ALL OF THIS... SOME  
PROPERTY OWNERS FEEL THE ASSOCIATION  
WAS WRONG IN CLOSING THE LAKE

WHAT'S NEEDED?

# WE NEED INFO / UNDERSTANDING ON...

“To fish or not to fish?” ..... THAT is the question.

- Fishing advisories:
  - Consumption, catch and release ‘contact’
- Boating concerns:
  - Wake -vs- no wake –vs- no boating at all risk assessment
  - Main lake boating –vs- boating in windblown coves with algal mats
  - Aerosolization of microcystin??? What are the risks? Is there info on this at levels like we observed this year? We understand aerosolization with irrigation, but what about boating? Does boating activity put more than boaters at risk with wind drift?
- CLEAR definition of what ‘No Contact’ means... (touching fish, or no swimming???)
- Need clearer info on medical affects of acute and chronic exposure to toxicity (compiled and written for anyone to understand) as it relates to ingestion, absorption, and inhalation.

# PROBLEMS TO OVERCOME...

- Public attitude:
  - Laissez faire attitude on the health risks. Some perceive they are not 'real' risks. Some perceive toxic algae isn't even a concern.
  - These samples were several orders of magnitude ABOVE World Health Organization guidelines for 'high' levels of microcystin.... Not just 'slightly elevated'
  - "What about property values if this information gets out?"
- Compilation of concise information on specific health risks
- Compilation of educational materials ...
  - 'as a community, where do we go for information / guidance on how to handle this problem'
    - What to do if you get a toxic bloom in your community (monitoring and safety protocols)
    - Preventative programs (education and water quality)

# HOW DO WE MOVE FORWARD IN SCIENCE?

- Short-term and long-term goals need to be created.
  - Short-term goals: 1-3 years
    - Educational Program – Create understanding and awareness
    - Develop less expensive monitoring methods
    - Develop a 'plan of action' for guidance to new problem areas
  - Long-term: 3 years +
    - Improve water quality through reduced nutrients and improved aquatic macrophyte communities

Goals are DYNAMIC and need to be evaluated and reprioritized with research discoveries as well as changing environmental conditions (Upward trend in frequency and magnitude of toxic blooms)



# WHAT SHOULD YOU BE DOING?

- Develop an educational program for your community – Even if you haven't observed a problem in the past.

This should include:

- Health risks from particular lake recreation activities
  - Visual cues (photos of conditions)
- 
- Create a plan of action should you observe elevated conditions including:
    - A monitoring program
    - A public notification process
    - Develop a protocol for lake closures and re-opens

# QUESTIONS / DISCUSSION