Illinois' Harmful Algal Bloom Program
The Past, Present, and Future

April 5, 2013 ILMA Conference

Gregg Good, Surface Water Section Manager

Illinois EPA, Bureau of Water, Division of Water Pollution Control

Purpose of Today's Discussion?

- To discuss the need to develop a formalized ***Illinois Harmful Algal Bloom Program*** that would include:
  - *Education*
  - *Surveillance Monitoring and Reporting*
  - *Response Planning and Future Advisory Issuance*
- Past and present monitoring efforts and findings.
- Ongoing activities in other states.
- Illinois HAB Program development progress to date.
- To seek your help in determining where we go from here!

The need for a HAB Program?

Nuff Said!

Palmyra-Modesto Lake, July 2011

The Past

It all Started with Taste & Odor Complaints

Dennis Ross,
Otter Lake
Water
Commission
July 2005

Otter Lake Chronology

- Dennis Ross called Teri Holland, IEPA, and said Otter Lake looked "strange-funky-weird."
- Samples collected on 7/22/05 and 7/27/05 for algal ID and enumeration.
- Cell count of *Cylindrospermopsis raciborski* (toxin producing algae type) was **305,356 cells/mL.**
- Cell count of concern according to the World Health Organization (WHO) is **>100,000 cells/mL**!!
- Saturday, 7/30/05 – **With little info in hand, proactive public safety decision to cancel the 7/31/05 Cardboard Boat Regatta.**
- Follow-up monitoring in raw and finished drinking water found **no toxins.**

World Health Organization (WHO) Guidance Values for Recreational Exposure to Cyanobacteria and Microcystin

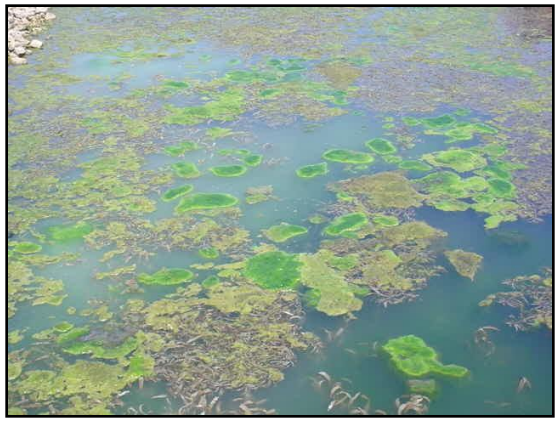
Relative Probability of Acute Health Effects	Cyanobacteria (cells/mL)	Microcystin-LR (ug/L)	Chlorophyll-*a* (ug/L)
Low	<20,000	<10	<10
Moderate	20,000-100,000	10-20	10-50
High	***100,000*** – 10,000,000	***20***-2,000	50-5,000
Very High	>10,000,000	>2,000	>5,000

First Statewide Monitoring Effort Initiated

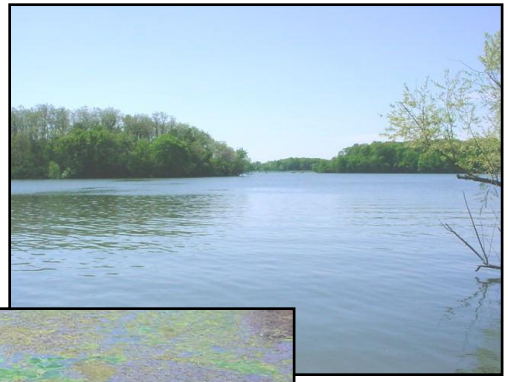
- Secured $9,600 Budget
- Sampled 22 sites across the state the week of 8/8/05
- Algae Identification and Enumeration
- Algal Toxin Analysis (as warranted by ID/enumeration)
  - *Cylindrospermopsin*
  - *Anatoxin*
  - *Saxitoxin*
  - *Microcystin (most common, widely known)*

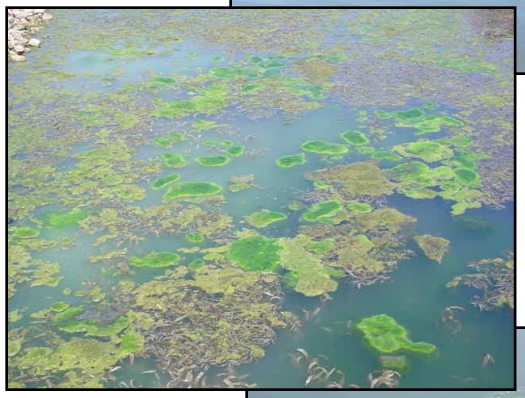
Blue-green Algae Sampling Sites

Total Toxigenic Blue-green Algae Cell Counts



Any Toxins Found? (Raw Water)

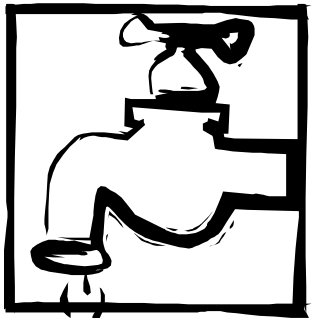




Legend

- Toxins Not Detected
- Toxins Detected at Low Levels
- Toxins Detected at Low Levels
- County Boundary

Any Toxins Found? (Drinking Water)



2005 *Lessons Learned and Questions!*

- Hot, dry summers cause lots of algae problems!!
- Lots of blue greens ***does not always*** equal lots of algal toxins.
- ***"Think twice before you lyse."*** Blue green algae management for PWS vs. Swimming uses can be polar opposites!
- ***Better safe than sorry!!*** Dennis Ross/Otter Lake Water Commission did the right "public safety" thing in canceling the regatta.
- ***Who is responsible*** for advisories? IDPH? IEPA? Lake Owner?
- ***Who's out there*** looking at this stuff in Illinois?
- ***Big Lag Time*** – The time between collection, algal identification and enumeration, toxin analyses, and issuance of an advisory/closure is lengthy.

2006 Toxin Monitoring Effort

- ***Same*** - % of sites with >100,000 Cells/mL in more "normal" 2006 year as compared to "drought" year of 2005.
- ***Same*** – All toxin hits in 2005 and 2006 were Microcystin

2005-2006 Microcystin Summary

	2005	2006
N	12	10
Minimum	0.09 ug/L	0.15 ug/L
Maximum	***8.00 ug/L***	***8.20 ug/L***
Median	0.15 ug/L	0.70 ug/L
Average	1.78 ug/L	2.35 ug/L

Lets Keep Looking!!
2007 and 2008 Planned Effort

- Applied for and received a Supplemental Section 106 Monitoring Grant for two more years of monitoring effort.
- Like 2005 and 2006, approximately $8,000-$10,000 of lab work.

2007-2008 Effort

- A different approach:
  - *Collection at public access and hot spots from lakes in our ALMP.*
  - ***No phytoplankton*** *identification/enumeration.*
  - ***Just Microcystin*** *analysis – money goes farther!*
- New Lab - Iowa DNR in Iowa City.
- ***2007 - 165*** samples collected in July, August, Sept/Oct.
- ***2008 - 179*** samples collected in July, August, Sept/Oct.

2007-2008 Microcystin Summary

	2007	2008
N	165	179
Minimum	0.12 ug/L	0.15 ug/L
Maximum	***10.77 ug/L***	***17.47 ug/L***
Median	0.20 ug/L	0.15 ug/L
Average	0.75 ug/L	0.64 ug/L
% Non-Detects	44%	57%

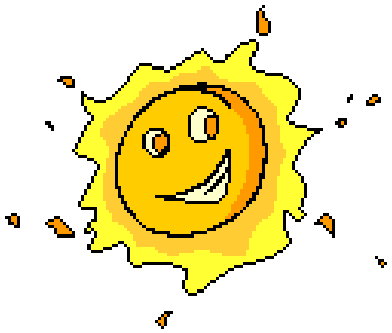
Overall Four-Year Microcystin Conclusions 2005-2008

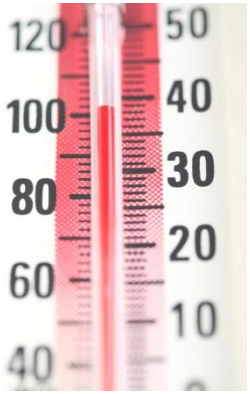
- Out of 366 total samples, 49.5% were non-detects, meaning **50.5% had detects.**
- **Highest concentration was 17.47 ug/L** (9/18/2008 at West Frankfort Old Reservoir).
- Of 185 samples with detects:
  - 0 samples (0%) in "high" or "very high" range
  - 3 samples (1.6%) in "moderate" range
  - **182 samples (98.4%) in "low" range**
- So the relative probability of acute health effects from 2005-2008 was "Low" – ***This was Good News!***
- Yet ~50% of the samples had detects of Microcystin – ***This was Concerning News!***

Final Four-Year Conclusionary Statement

Teri Holland, Illinois EPA, 2009

*"Algal species capable of producing microcystins are present in Illinois waters, **and given the right conditions**, blooms could produce toxins at much higher concentrations."*





Year 2009

2010 – The Clinton Lake Experience

- Clinton Lake near Clinton, Illinois (46 miles NE of Springfield). Power Plant "cooling" lake.
- Public Beach and Fisheries Managed by IDNR.
- July 4th, 2010, **report of a dog death** (7 year old, 10 lb. poodle) due to ingestion of algae-laden water.
- Vet said the death was **"consistent with"** toxic algae poisoning.
- Incident reported to IDNR and IEPA emergency management folks.
- State inexperienced in **"What do we do next?"**
- Sample collection effort on July 9, 2010
  - IEPA Field Staff noted usual summer lake-like conditions
  - No paint-like or algal scums
  - No other dog or human sicknesses reported
  - Very hot day and weekend
  - Lake water temp **33 degrees C** (when normal lakes were at about 28 degrees C)

IDNR Advisory – July 9, 2010

IDNR issues advisory for Clinton Lake, urges lake users to be cautious

State agencies testing for potential toxic algae

SPRINGFIELD, IL – The IDNR and IEPA are sampling water at Clinton Lake for potential blue-green algae blooms. Blue-green algae are common in central Illinois waters, but some can produce chemicals that can have a toxic effect on humans, pets and livestock.

The samples have been collected and will be submitted for positive identification. Until testing is complete, boaters, swimmers and other lake users are advised not to ingest lake water and refrain from swimming in areas of the lake where stagnant water or algae blooms are present.

July 12-July 14, 2010

- IDNR becomes aware that a **12-year old girl was reported sick** supposedly from swimming in the water on July 4 **after** hearing of the advisory issued on July 9.
- Took her to the hospital. Symptoms had been nausea, headache, dehydration. First report of human illness!
- IDNR receives U of I autopsy report: *probable* cause of dog death was **heat stroke, not toxic algae!**
- Only one report of human sickness (12-year old girl) despite 4,000-5,000 people used the beach July 4th weekend.
- Iowa DNR test results for Microcystin Very Low:
  - <0.20 ug/L, <0.20 ug/L, 1.06 ug/L, 0.24 ug/L
- **Final Conclusions: Dog Death and Girl Illness NOT due to microcystin!**
- IDNR Amended Advisory – "Samples Show Low to No Toxicity."

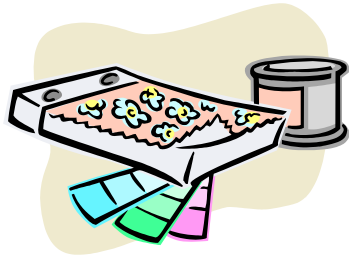
Final Statement
Gregg Good to Tim Hickman, IDNR
(E-mail September 16, 2010)

"I just wanted to express my gratitude to you and EVERYONE involved for taking a very proactive approach towards this "dead dog, sick young lady, was it algal toxins or not?" event at Clinton Lake. The cooperation from all was just outstanding. ***I'm confident in our joint assessment that algal toxins were not the culprit.***

Unfortunately, our organizations will probably be working together on similar cases like this at some point down the road, as algae will always be there when you mix nutrients, impounded waters, and warm summer temperatures together! I believe we've learned a lot from this incident, and we'll be even better prepared to respond the next time around."

Year 2011 - Microcystin Test Kits

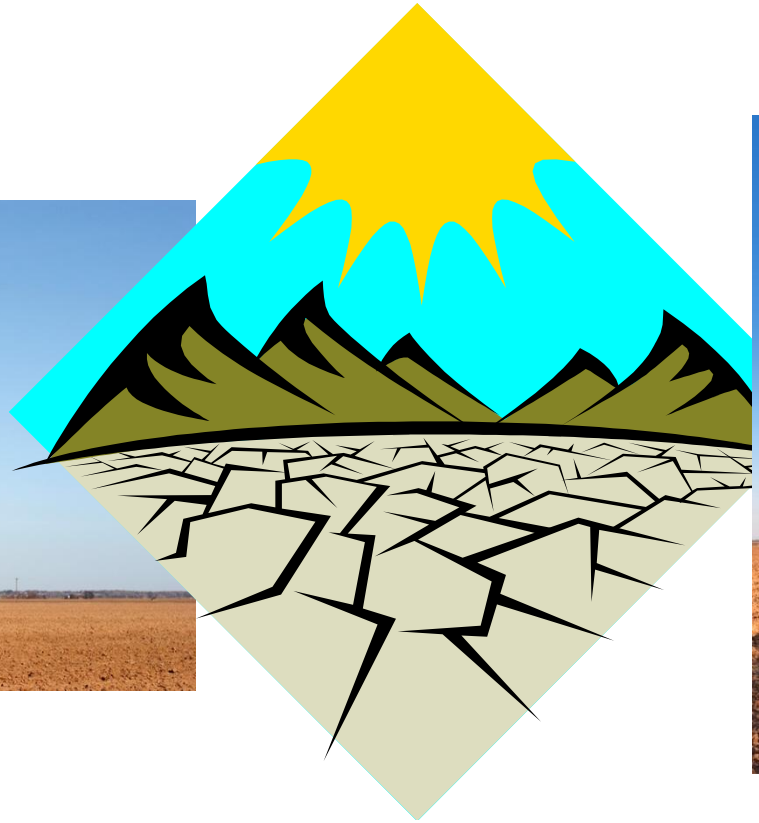
- IEPA purchased and began utilizing *"Abraxis Microcystin Dipstick for Recreational Water"* Test Kits.
- Test Kits provide a quick result in ranges of 0, 0-1.0, 1.0-2.5, 2.5-5.0, and 5.0-10.0 ug/L Microcystin.
- One-year shelf life, ~$24/test
- About ~40 total usages in 2011 and 2012
- Summary: **A very useful tool!** So far whenever we've had laboratory Microcystin analyzed where we've also used a test kit, test kit results were corroborated.

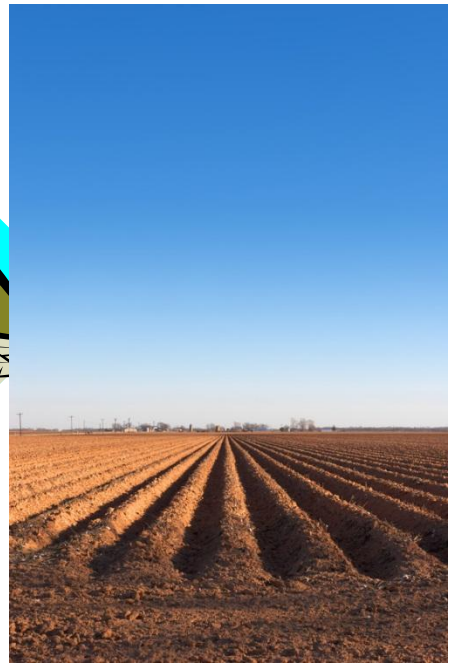


The Drought of 2012……

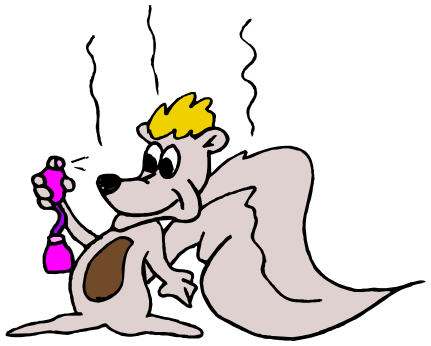
……where the fun began again!

(Usually, Teri and I like it when we are right, but not this time!)





It Starts with Lake Le-Aqua-Na (NW Illinois)



- July 10, 2012 – Round 2 ALMP monitoring visit by Diane Tancl, IEPA.
- Lake was green as green could be, “sewer smell,” no dissolved oxygen (but no fish kill – go figure!)
- Test Kit screen result was ***>10 ug/L*** from algal scum taken near boat launch site.
- Called a favor into Keith Loftin, USGS-Kansas, leading algal toxin expert. Agreed to analyze a sample.

Lake Le-Aqua-Na, July 10, 2012

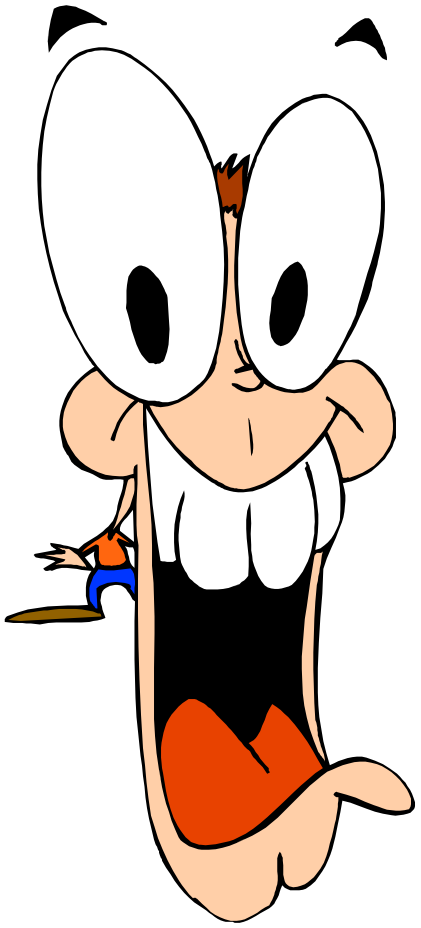
Lake Le-Aqua-Na, July 10, 2012

Lake Le-Aqua-Na Happenings and Results

- Based on test kit result above 10 ug/L, the terrible smell, and general lake appearance, the following day on July 11, 2012, IDNR ***closed the beach*** to recreational usage.
- Keith Loftin results - ***48 ug/L!***
- ***New Illinois Record***
- Keith Loftin – *"One of the higher values I have analyzed this year."*

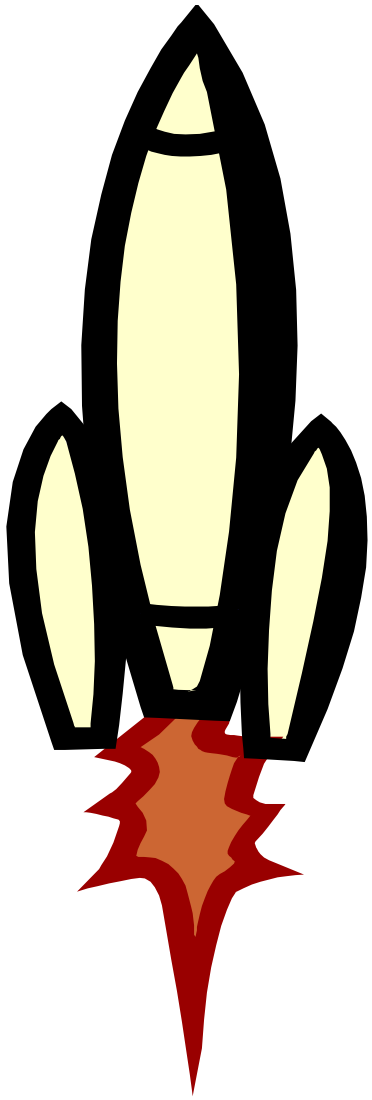
Enter Candlewick Lake (NE Illinois)

- Candlewick Lake, Boone County, Illinois
- Sample collections in August 2012 for algae ID/enumeration and toxin analysis
- Microcystin level of ***14,800 ug/L*** (remember that ***>20 ug/L*** is "High")
- Candlewick Lake ***closure*** to all uses issued by Candlewick Lake Association
- ***YIKES!!***



Enter Westlake (NC Illinois)

- Westlake, Winnebago County, Illinois
- Sample collections in August 2012 for algae ID/enumeration and toxin analysis.
- Microcystin level of ***31,500 ug/L*** (remember that ***>20 ug/L*** is “High”)
- Westlake ***closure*** to all uses issued by Westlake Association.
- ***YIKES … thru the Roof Value!***

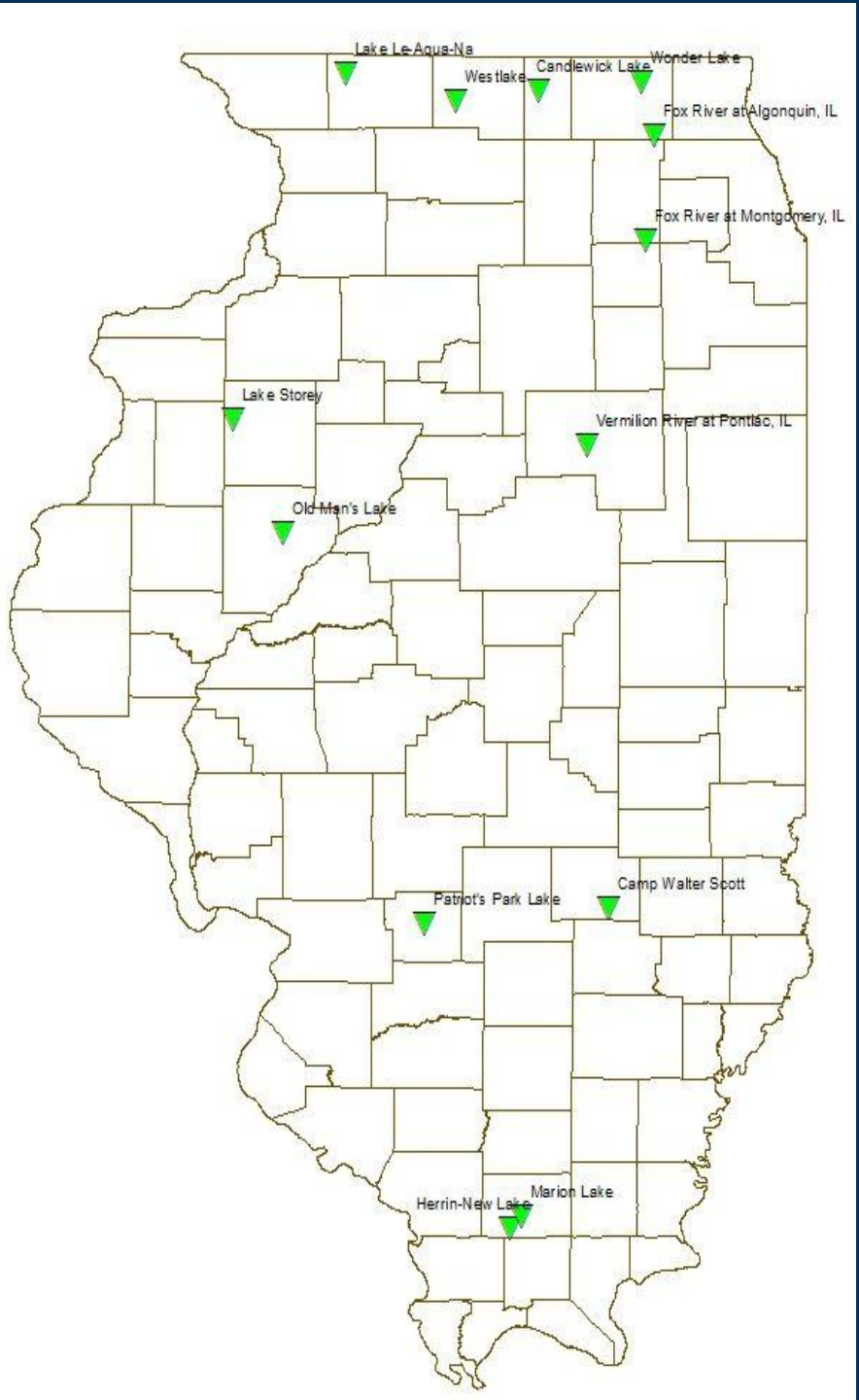


Enter USGS Illinois Water Science Center, Champaign, Illinois

- USGS heard at a Governor's Drought Task Force that a drought-related finding of high algal toxins was being reported in several northern Illinois lakes.
- USGS contacted IEPA on Monday, August 27, offering to conduct a joint project of algal identification, enumeration, and toxin analysis.
- By August 28 p.m., USGS and IEPA laid out a joint plan of action.
- Sample collection on Wednesday August 29 and Thursday August 30, 2012.

Map of Locations Sampled

- Small survey of lakes and rivers, Aug. 29-30
- Sampling by the IEPA and the USGS
- Algal samples will be analyzed stepwise by the USGS Kansas Organic Lab
- Initial results expected by end of September



USGS

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Lake Le-Aqua-Na, Wednesday, August 29, 2012

Lake Le-Aqua-Na, Wednesday, August 29, 2012

Candlewick Lake, Wednesday, August 29, 2012

Candlewick Lake, Wednesday, August 29, 2012

Candlewick Lake, Wednesday, August 29, 2012

Westlake, Wednesday, August 29, 2012

Westlake, Wednesday, August 29, 2012

Westlake, Wednesday, August 29, 2012

Enter Wonder Lake (NE Illinois)

- IEPA heard from Wonder Lake who had heard about Le-Aqua-Na, Candlewick, and Westlake.
- Yet another Northern Illinois impoundment with algal problems!
- Right before **Labor Day Weekend** (Friday, August 31-Monday, Sept 3), 2012.
- Wonder Lake Master Property Owners Association (WLMPOA) **"wondered"**(pun intended) what to do?
- **Lake closed** to ALL uses Friday, August 31th.
- **HUGE CONFLICT** – Lake Use prohibited before a holiday weekend including a scheduled National Ski Team performance!!

Dick Hilton

IEPA Fact Sheet

http://www.epa.state.il.us/water/surface-water/blue-green-algae.html

USGS

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

State of Illinois
Pat Quinn, Governor

Illinois Environmental Protection Agency
John Kim, Interim Director

BLUE-GREEN ALGAE and ALGAL TOXINS

Background
Blue-green algae are microscopic organisms that are naturally present in lakes and streams. Some blue-green algae can produce algal toxins that could pose a health risk to people and animals when they are exposed to them in large enough quantities. This fact sheet answers questions about blue-green algae and algal toxins.

What are blue-green algae?
Blue-green algae, also known as cyanobacteria, are microscopic organisms that are naturally present in lakes and streams. They are usually present in low numbers. However, blue-green algae can grow quickly and become very abundant in warm, shallow, undisturbed surface water that receive a lot of sunlight. When this occurs, they 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.

Are blue-green algae or algal toxins harmful to my health?
Some blue-green algae produce algal toxins (e.g., microcystin, cylindrospermopsin, anatoxin, saxatoxin; the most common is microcystin) that 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.

Recreational contact such as swimming and household contact such as bathing or showering with water not visibly affected by a blue - green algae bloom is not expected to cause health effects.

How do I know if I am being exposed to blue-green algae?
People should suspect that blue-green algae are present in water that is visibly discolored or that has surface scums. Colors can include shades of green, blue-green, yellow, brown, or red. Water affected by blue-green algae blooms often is so strongly colored that it can develop a paint-like appearance (see photos below).

The presence of toxins from algae can only be verified through laboratory analysis. Unpleasant tastes or odors are not reliable indicators of blue-green algae toxins or other toxic substances, because the algae may or may not also produce chemicals that affect the taste or odor of drinking water. Similarly, the absence of unpleasant tastes and odors does not guarantee the absence of blue-green algal toxins.

Can you get sick from blue-green algal toxins?
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, by having direct skin contact (as when swimming, wading, or showering), or by breathing airborne droplets containing the toxins, such as during boating or waterskiing.

People should avoid contact with water that is discolored or has scum on the surface and restrict the access of their pets and livestock to this water. Pets can get sick if they have been swimming in water where algal blooms have been and ingest significant amounts of toxins by licking themselves after leaving the water.

Are children more vulnerable than adults to blue-green algal toxins?
Yes. Because of their comparatively low body weight, it takes fewer toxins to make children sick from exposure to blue green algae. In addition, children tend to have more sensitive skin than adults, so a skin rash or reaction is more likely. Children should always be supervised when swimming in any body of water.

Illinois Environmental Protection Agency
Office of Community Relations
1021 N. Grand Avenue East
Springfield, Illinois 62702

August 2012

Wonder Lake Happenings

- Saturday, September 1, WLMPOA board revised their closure to open up "non-contact" uses (e.g., boating).
- IEPA sampled the lake on Tuesday, September 4, after the Labor Day weekend. ***Samples collected at three lake sites.***
- All three samples analyzed using the Test Kits ***showed <1 ug/L Microcystin. Unbelievable!***

OR

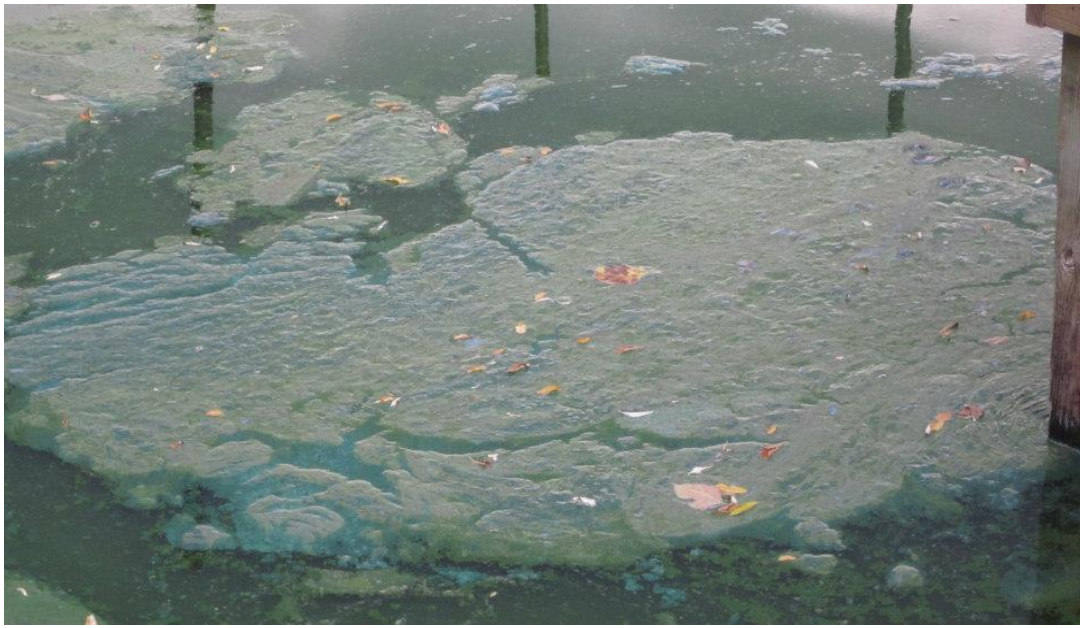
Wonder Lake, Tuesday, September 4, 2012

Wonder Lake, Tuesday, September 4, 2012

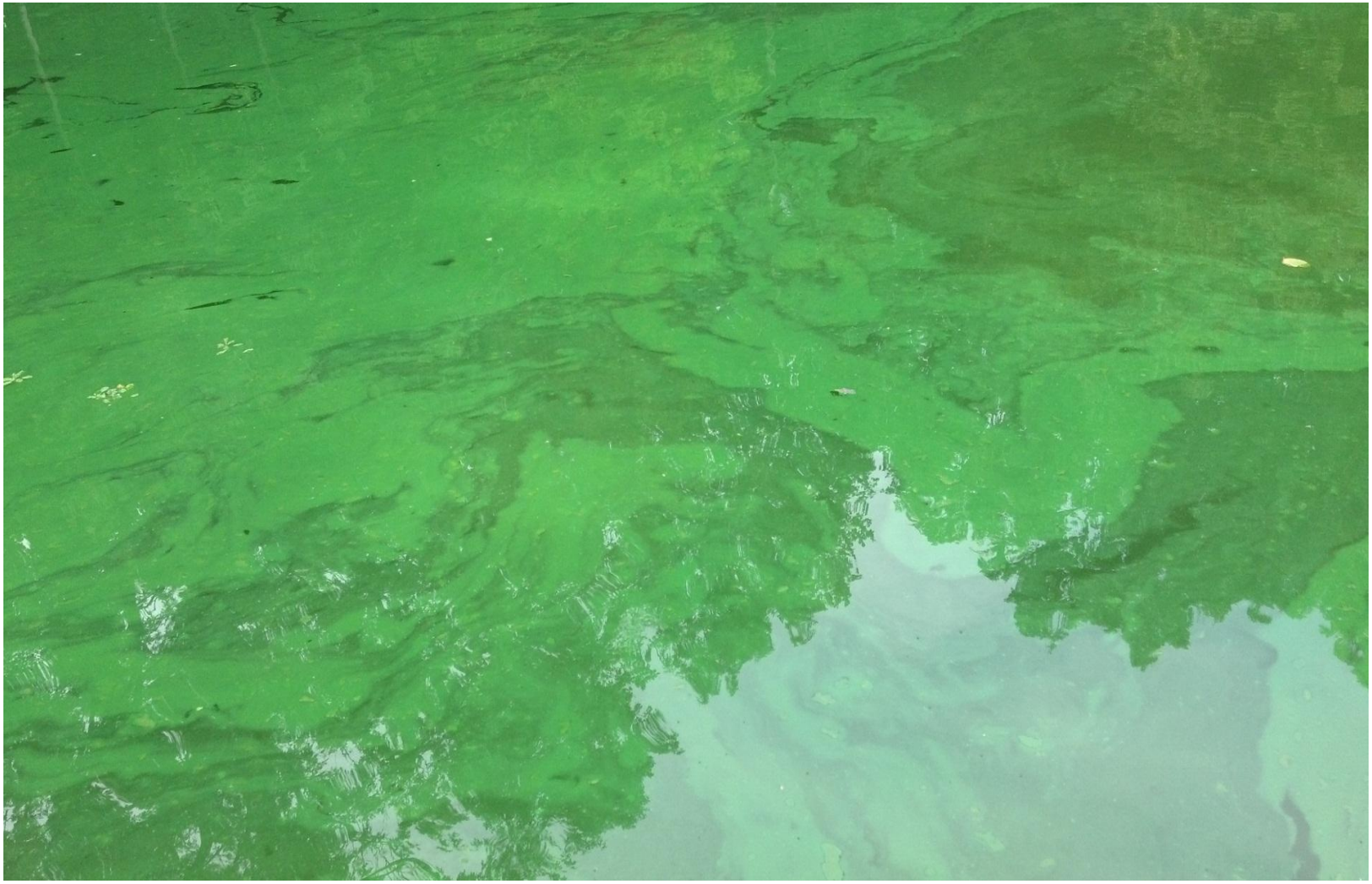
Wonder Lake, Tuesday, September 4, 2012

Camp Walter Scott Lake

- Small Church Camp lake located 100 miles SW of Springfield, and South of Effingham, IL
- Mike Bundren, IEPA Marion, alerted by IDPH, ran a test kit sample on July 18, 2012
- Result of the test kit: ***>10 ug/L***
- **Voluntary Closure**



Camp Walter Scott Lake
Tuesday, September 4, 2012



USGS/IEPA Study - Microcystin Results

Analysis	Collection Date	Lake/Location	Result (Microcystin ug/L)	WHO Recreational Advisory Level
USGS-Kansas	**8/29/12**	**Candlewick (RPV-99)**	**4,800**	**Very High**
USGS-Kansas	**8/29/12**	**Westlake (RPZK-99)**	**62**	**High**
USGS-Kansas	**8/29/12**	**Westlake (RPZK-98)**	**1,700**	**High**
USGS-Kansas	8/29/12	Le-Aqua-Na (RPA-99)	6.7	Low
USGS-Kansas	8/29/12	Herrin (RNCZ-99)	0.23	Low
USGS-Kansas	8/29/12	Vermilion R. @ Pontiac (DS-19)	<0.10	Low
USGS-Kansas	8/29/12	Vermilion R. @ Pontiac (DS-19)	<0.10	Low
USGS-Kansas	8/29/12	Marion Reservoir (RNL-99)	<0.10	Low
USGS-Kansas	8/30/12	Patriot's Park Lake (ROY-99)	9.8	Low
USGS-Kansas	8/30/12	Fox R. @ Algonquin (DT-06)	1.4	Low
USGS-Kansas	8/30/12	Fox R. @ Algonquin (DT-06)	1.1	Low
USGS-Kansas	8/30/12	Fox R. @ Montgomery (DT-38)	0.95	Low
USGS-Kansas	8/30/12	Fox R. @ Montgomery (DT-38)	0.62	Low
USGS-Kansas	8/30/12	Fox R. @ Montgomery (DT-38)	0.17	Low
USGS-Kansas	9/4/12	Wonder Lake (RTZC-97)	0.93	Low
USGS-Kansas	9/4/12	Wonder Lake (RTZC-98)	0.56	Low
USGS-Kansas	9/4/12	Wonder Lake (RTZC-99)	0.88	Low
USGS-Kansas	**9/4/12**	**Camp Walter Scott Beach (RCS-99)**	**1,500**	**High**

Did Cell Count and Microcystin Expected Relationships Exist in 2012 ?

Kinda, Sorta, Not Really!

Collection Date	Lake/ Location	Result (Microcystin ug/L)	WHO Rec. Advisory Level	*Result (Total Cyano-bacteria cells/mL)*	*WHO Rec. Advisory Level*
8/29/12	Candlewick (RPV-99)	4,800	Very High	*84,573,082*	*Very High*
8/29/12	Westlake (RPZK-98)	1,700	High	*302,526*	*High*
9/4/12	Camp Walter Scott Beach (RCS-99)	1,500	High	*3,528,833*	*High*
8/30/12	Patriot's Park Lake (ROY-99)	9.8	Low	*572,012*	*High*
8/29/12	Le-Aqua-Na (RPA-99)	6.7	Low	*1,178,963*	*High*
9/4/12	Wonder Lake (RTZC-99)	0.88	Low	*467,627*	*High*

So, the HAB History in Summary…..

- 8-year “on and off” IEPA, IDNR, and USGS involvement since 2004.
- Nothing substantial found from 2005-2008.
- No activity in 2009.
- Then the 2010 Clinton Lake “dead dog, sick girl” incident.
- 2011 purchase and use test kits.
- Then the 2012 drought, including microcystin values of *1,500 ug/L, 1,700 ug/L, 4,800 ug/L, 14,800 ug/L, and 31,500 ug/L, and several voluntary lake closures by lake owners (not the State of IL).*
- ***A definite public health concern!!***

Huge Questions that have Popped Up!

Tom Hornshaw, IEPA Toxicologist, has all the answers!! ☺

"Can I eat the fish?"

"Can I eat the vegetables out of my lake-watered garden?"

"Can I ski, or will toxin filled water aerosols get up my nose?"

"Can this occasional, uncontrollable twitch in my neck be caused by algal toxins?"

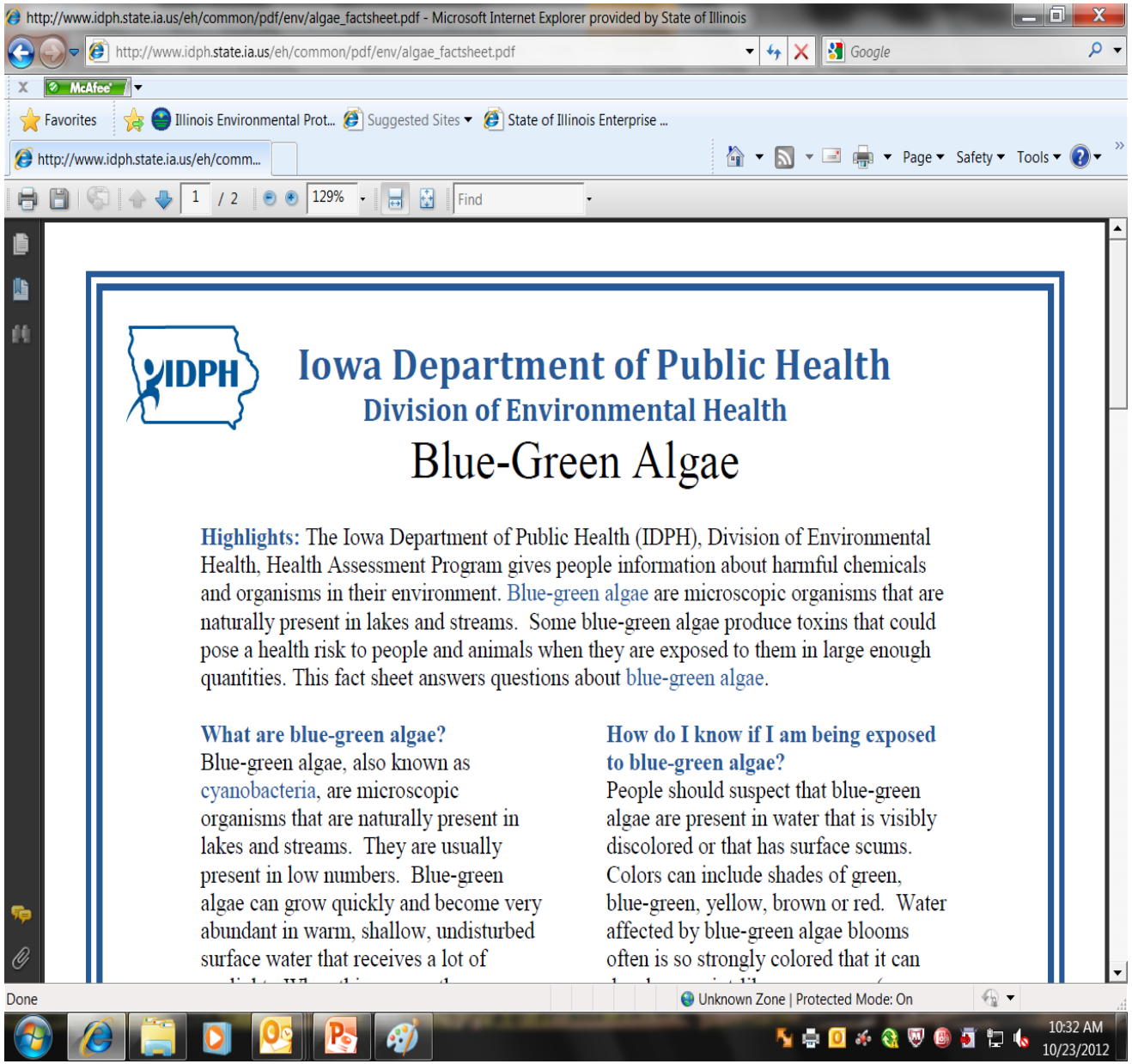
"What are other states doing?"

Kansas Department of Health and Environment

Oregon Health Authority
Surveillance Sampling and Advisory Guidelines

Wisconsin Department of Health Services

Iowa Department of Public Health



Indiana State Department of Health

Progress Since Fall 2012

January 16, 2013, meeting to share information, listen to experts, share experiences, seek input for the future. 70-80 in attendance:

- Gregg Good, IEPA, Summary of HAB Issue
- Dave McMillan, IEPA, PWS Issues
- Joe Rush, JadEco, Homeowner Education and Recent Experiences
- Tom Hornshaw, IEPA, HAB Health Risks (fish, veggies, aerosols)
- Val Beasley, U of I VetMed, Pets and Livestock
- Keith Loftin, USGS National HAB Expert
- Cyndi Wagner, IDEM HAB Coordinator
- Open Discussion

Progress Since January 16, 2013, Meeting

- ***Public Safety Goal*** (as opposed to Research)
  - Provide HAB Education
  - Monitoring/Analysis – Accurate & Fast Results (~6-7 days)
  - Provide Results for Local Decision-Making

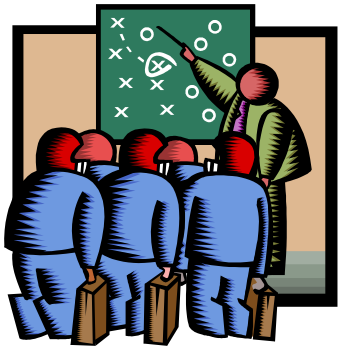
- ***Decision to "KISS"*** – Keep it Simple Stupid!
  - Just Microcystin, no other Toxins right now
  - Just Toxin Analysis, no ID/Enumeration of Algae right now

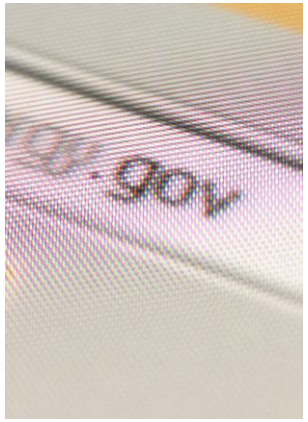
- ***Secured a Laboratory*** – Iowa DNR Elisa Testing
- ***Secured Funding*** – Illinois Partners for Conservation
- ***Test Kits Purchased*** – IEPA SWS and VLMP Coordinator Staff
- ***Other IEPA Section Lookout*** - Public Water Supply and Field Operations Staff Notified

- ***SOPs Developed*** - for Microcystin Sampling and Shipment
- ***"HAB Report Form" Developed*** - for Submittal to Determine need for IEPA/VLMP Coordinator Personal Investigation

What has yet to be done?

- ***Nail Down a Monitoring Design***
  - ALMP Lakes? Once? Five Times? All or Subset?
  - VLMP Lakes? Subset?
  - Known Hypereutrophic Lakes that are PWS Sources?
  - Lakes with Past Hits?
  - Coordination with USGS Proposed Program?
  - As Report Form Investigations Warrant?
- ***Develop a HAB Website*** – Fact Sheet, Presentations, Educational Materials, Report Forms, SOPs, etc.
- ***Create a Signage Program?***
- ***Figure out a Data Management Strategy***
- ***Develop a Formal Advisory Program*** **-** Coordination with IDPH, IDNR, and IDOA like the Fish Contaminant Advisory Program.
- ***Staffing*** – This is a new, potentially huge program being run with existing resources, so bear with us!





Next Step

Where do we go from here?

Comments/Suggestions?