

Science-Informed Decision Making For Public Health Protection During Harmful Algal Blooms in the Lower Kansas River Basin



Jennifer L. Graham
U.S. Geological Survey

EPA Region 10 Webinar

April 28, 2020

Why Harmful Algal Bloom Science Matters

Human Health

- Illness and death (rare cases in humans)
- Multiple exposure routes: recreation, drinking water, foods, aerosols, skin contact

Ecological Health

- Degraded water quality
- Food web alteration
- Mass mortalities of fish, birds, and mammals

Economics and Aesthetics

- Decreased tourism and property values
- Commercial fishery losses
- Increased drinking water treatment costs



Indian River Lagoon, Florida, 2016; Photo by A. Gorichky



Milford Lake, Kansas, 2015; Photo by G. Foster

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- Food web
- Mass mortality

Economic

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- Commercial
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In This Issue:

ET&C FOCUS

Focus articles are part of a regular series intended to sharpen understanding of current and emerging topics of interest to the scientific community.

Are Harmful Algal Blooms Becoming the Greatest Inland Water Quality Threat to Public Health and Aquatic Ecosystems?

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Photo by A. Gorichky



Photo by G. Foster

Decision-Making During Harmful Algal Blooms

Drinking Water


- When and how to alter drinking-water treatment processes and/or sources

Recreation

- When to post and remove advisories

WARNING


Harmful Algae Expected or Present
People & Animals May Get Sick



No water contact, swimming, or wading



No skiing or jet skis



No pets or livestock

- If people or pets contact lake water: wash with clean, potable water afterward
- Avoid areas of algae accumulation
- Do not let people or pets eat dried algae or drink untreated water
- Clean fish well and discard guts

In case of contact with harmful algae: Call doctor or veterinarian if people or animals have nausea, vomiting, diarrhea, rash, irritated eyes, seizures, breathing problems or other unexplained illness.

Report harmful algal blooms to Kansas Department of Health and Environment at:
www.kdheks.gov/algae-illness/
Or call: 785-296-5606

Report possible algal bloom related illness to Kansas Department of Health and Environment at:
www.kdheks.gov/algae-illness
Or call: 877-427-7317



For more information:
Scan this code or visit
kdheks.gov/algae-illness

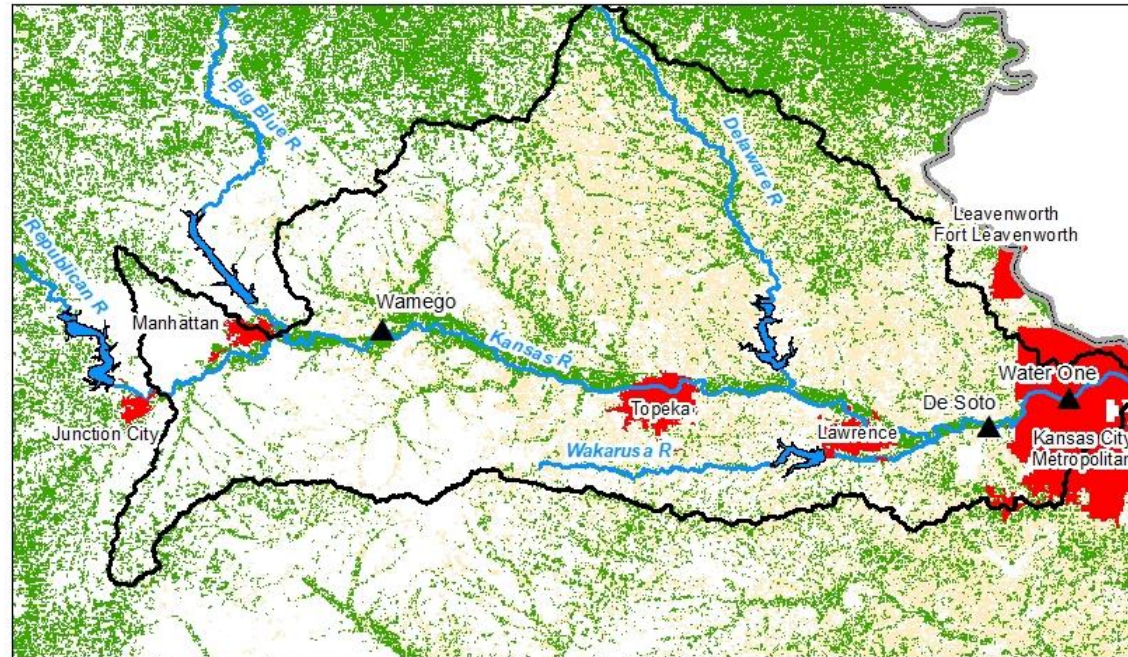
Posted by:

Posted on:





Kansas Department of Health and Environment, 1000 SW Jackson, Topeka, Kansas 66612, 785-296-1500 www.kdheks.gov

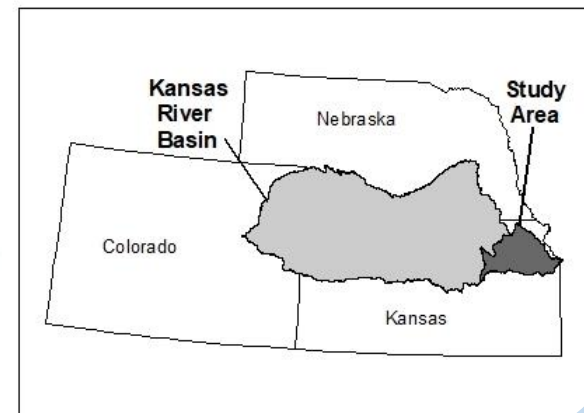
The Lower Kansas River Basin

The Kansas River Serves as a Drinking Water Supply for About 800,000 Kansans



Explanation

-  Cropland
-  Pasture/Grassland
-  Lower Kansas River drainage basin boundary
-  U.S. Geological Survey water-quality and streamflow-gaging station with identifier



2011 Kansas River Transport Event

Milford Lake closes as toxic algae thrive

BY M/ [Toxins \(Basel\)](#). 2015 Feb; 7(2): 353–366.

AUGL Published online 2015 Jan 30. doi: [10.3390/toxins7020353](#)

PMCID: PMC4344628

PMID: [25647780](#)

Human Illnesses and Animal Deaths Associated with Freshwater Harmful Algal Blooms—Kansas

[Ingrid Trevino-Garrison](#),^{1,†} [Jamie DeMent](#),^{2,†} [Farah S. Ahmed](#),¹ [Patricia Haines-Lieber](#),¹ [Thomas Langer](#),¹ [Henri Ménager](#),¹ [Janet Neff](#),¹ [Deon van der Merwe](#),^{3,†} and [Edward Carney](#),^{1,†}



Milford Lake, September 2011
Photo courtesy of E. Looper, USGS

Question: Will cyanotoxins and taste-and-odor compounds from the reservoir affect downstream drinking-water supplies?

Decisions: Customer notification, modification of drinking-water treatment processes, switching source water, finished-water monitoring

Science Approach: Event-based sample collection at key locations along the entire reach of the river for the duration of the event (September-October) to characterize fate and transport

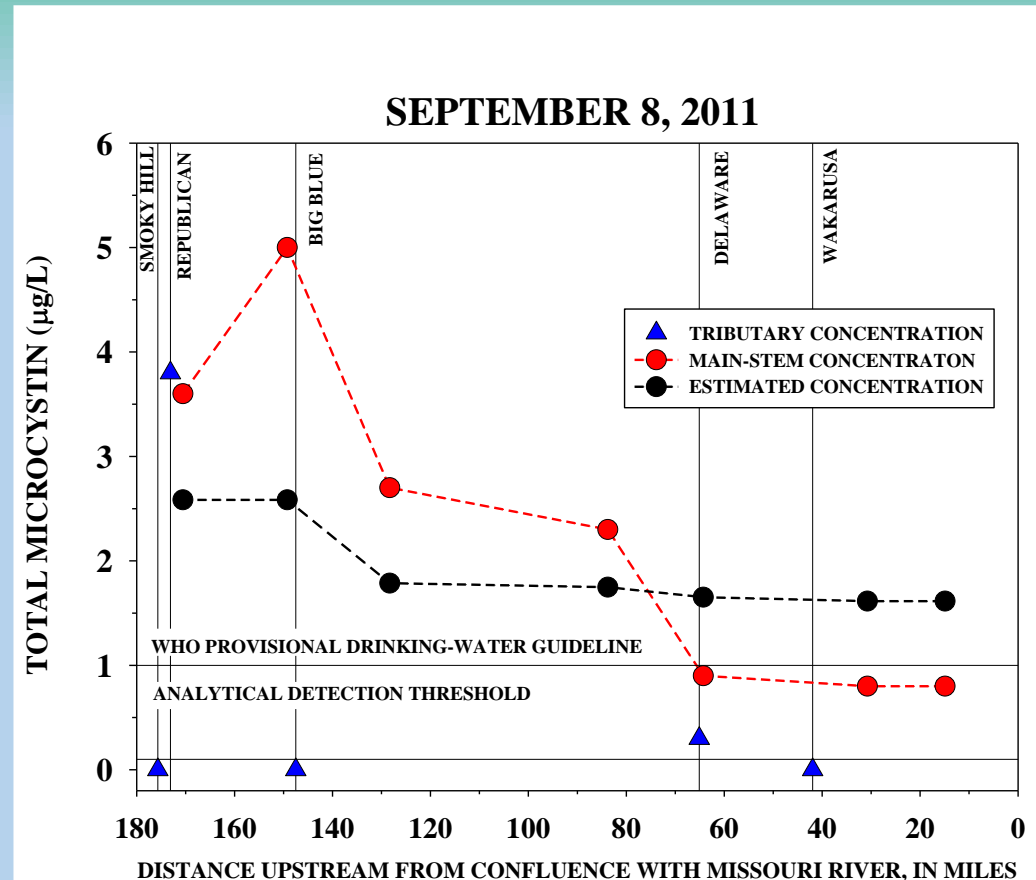
2011 Kansas River Transport Event Outcomes

Study Finding: Cyanotoxins and taste-and-odor compounds may be transported relatively long distances downstream.

Short-Term Decisions: Depended on the capabilities of the drinking-water treatment facility – switched source waters, increased monitoring of finished water, increased call lines, issued press releases

Long-Term Decisions: Investments in science to better understand and predict transport events, infrastructure enhancements, and laboratory capabilities

Other Outcomes: Commitment to improved communication, trusted partnerships



After Graham et al., 2012, USGS SIR 2017-5016

Long-Term Kansas River Study (2012-Present)

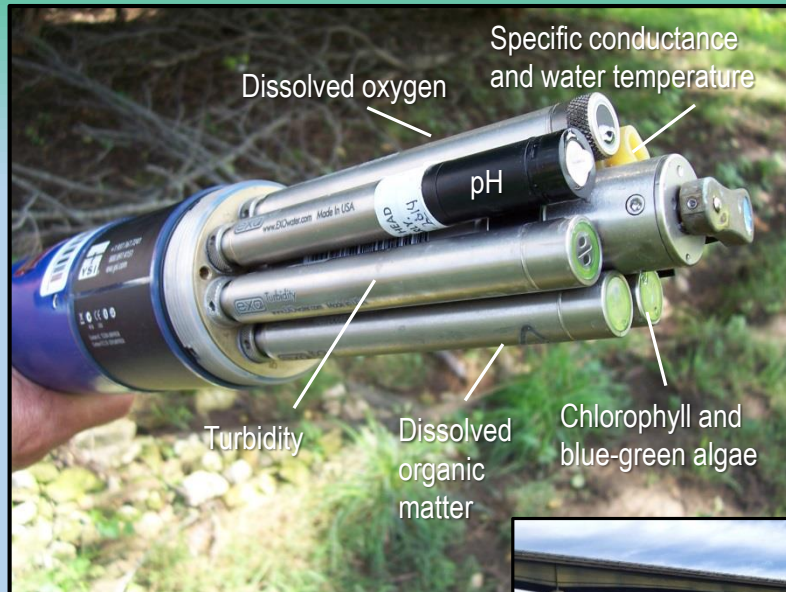


Photo credit: USGS



Photo credit: G. Foster, USGS



Photo credit: J. Graham, USGS

Question: What are the sources, frequency of occurrence, and potential causes? Can an early-warning system be developed?

Decisions: *Advanced notification for customer notification, modification of drinking-water treatment processes, switching source water, finished-water monitoring*

Science Approach: Continuous and discrete water-quality data collection at key locations upstream of drinking-water intakes

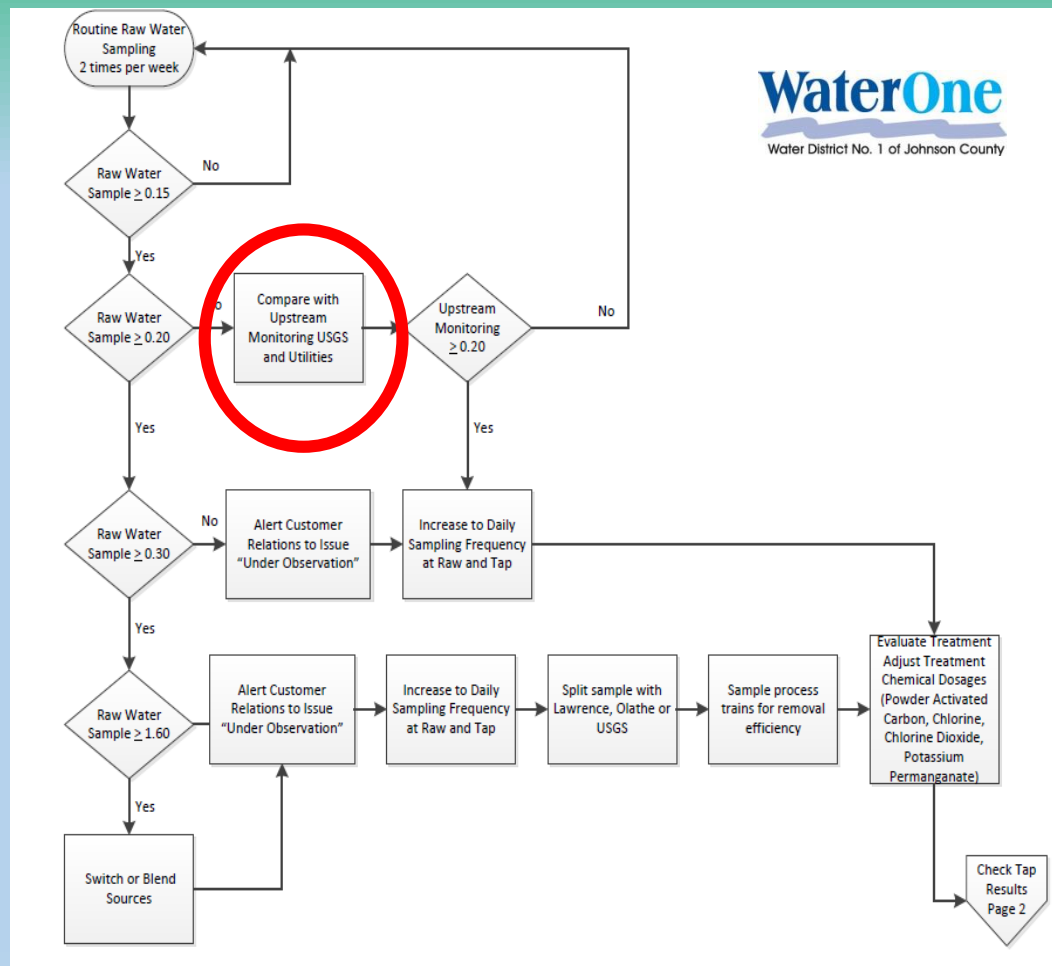
Long-Term Kansas River Study Outcomes

Study Findings: Cyanotoxins in the river are associated with events in upstream reservoirs; Continuous water-quality data and models provide information on changing water-quality conditions that may affect drinking-water treatment processes.

Short-Term Decisions: Increased monitoring through the treatment train, increased monitoring at intakes, considerations for drinking-water treatment processes

Long-Term Decisions: Incorporation of continuous water-quality monitoring data and models into formal decision-making processes, Investment in source-water protection

Other Outcomes: Joint presentations presenting the case study from the perspective of scientists and drinking-water utilities.



Courtesy of M. Wirth, Johnson County WaterOne

Milford Lake Recreational Monitoring

July 20, 2016 at 3:54 pm



July 20, 2016 4:09 pm



Question: Are samples collected by the Kansas Department of Health and Environment recreational monitoring representative of the entire waterbody?

Decisions: When, where, and for how long will recreational advisories be posted?

Science Approach: Sample collection throughout the lake by 3 separate entities using their routine protocols.

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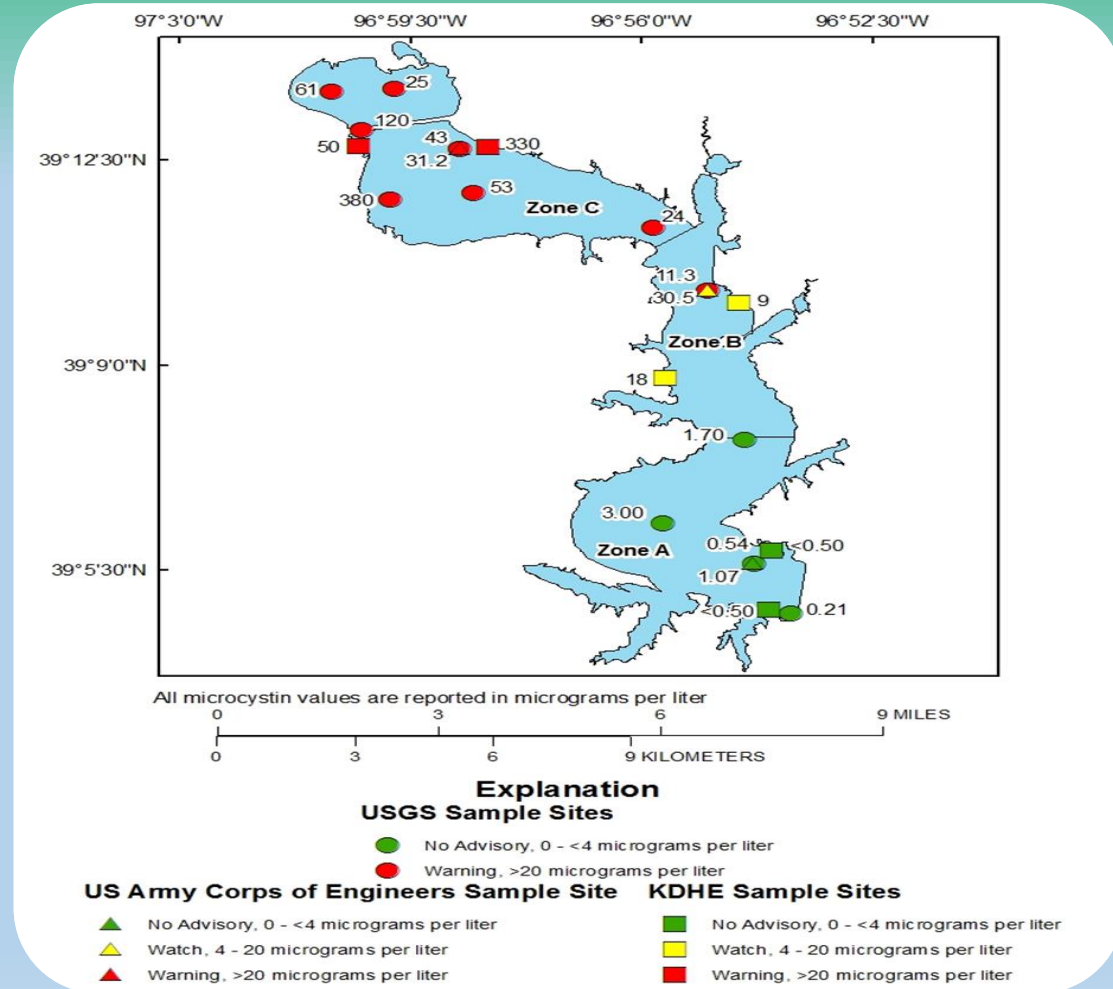
Kansas Department of Health and Environment, 1000 SW Jackson, Topeka, Kansas 66612, 785-296-1500 www.kdheks.gov

Milford Lake Recreational Monitoring Study Outcomes

Study Findings: *From a public health perspective, results from all sampling approaches were similar (from a scientific perspective results were substantially different)*

Decisions: No modification of KDHE recreational strategy, webcams to demonstrate temporal variability

Other Outcomes: Additional study of spatiotemporal variability, joint presentations presenting the case study from the perspective of scientists and regulators.



After Foster et al., 2016, USGS SIR 2016-5168

Test Strips May Be Effective for Rapid Detection of Relatively High Concentrations of Cyanotoxins

- Tests take a minimum of 45 minutes, and there are several critical steps
- Interpretation is difficult and highly subjective
- Work better at higher cyanotoxin concentrations

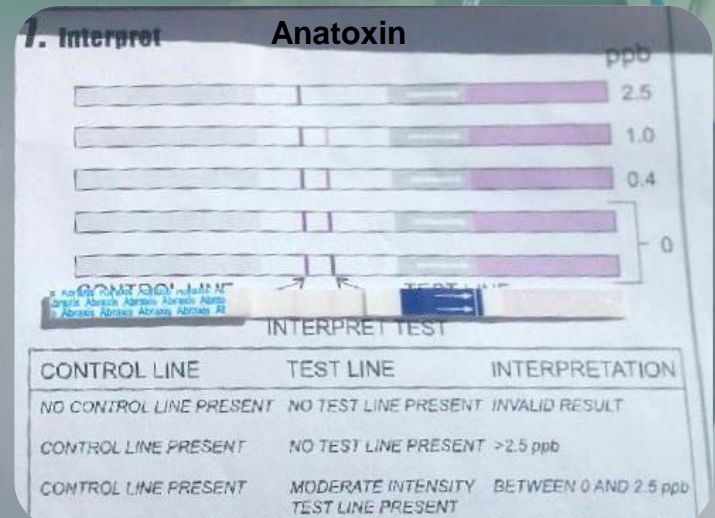


Photo Credit: C. Churchill, USGS

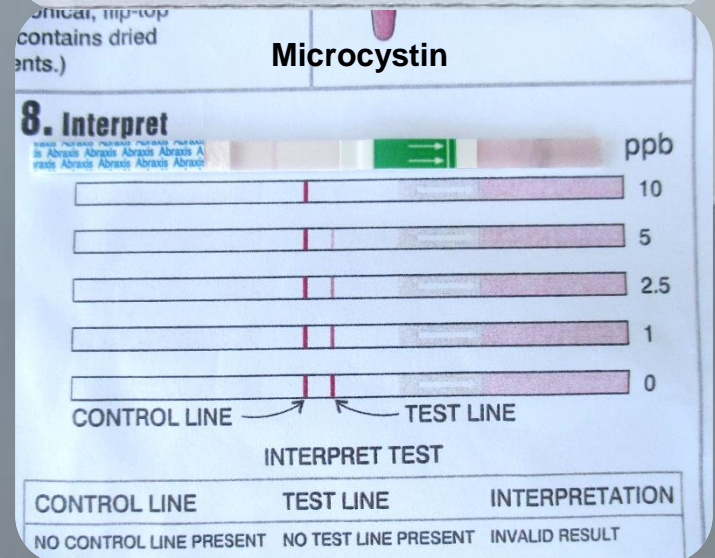
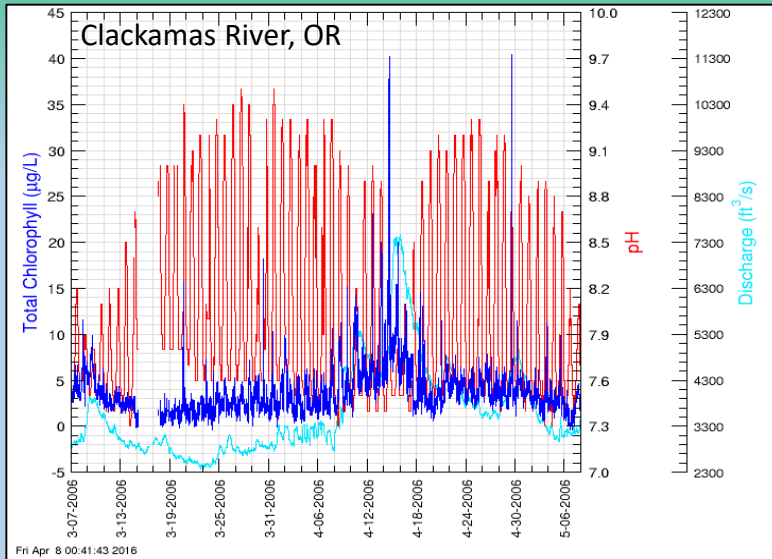
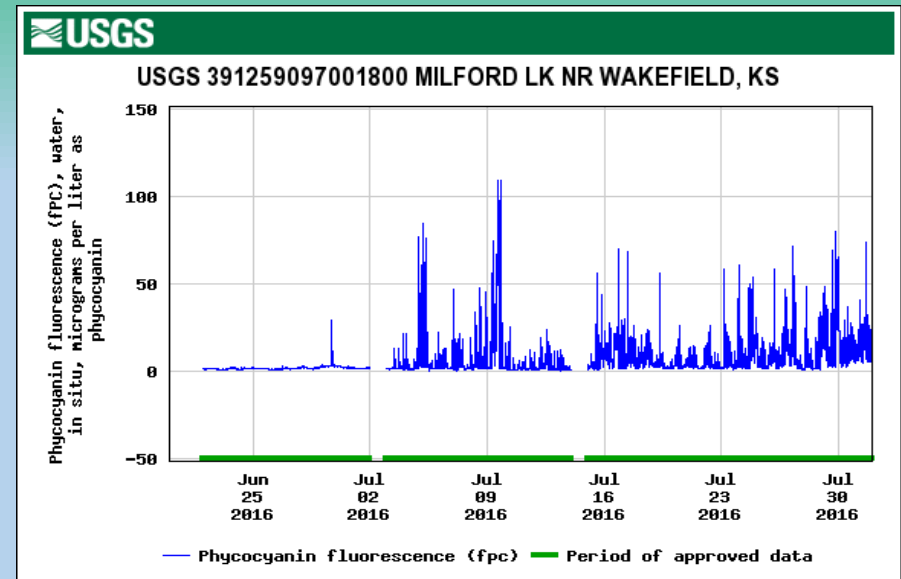


Photo Credit: C. Churchill, USGS

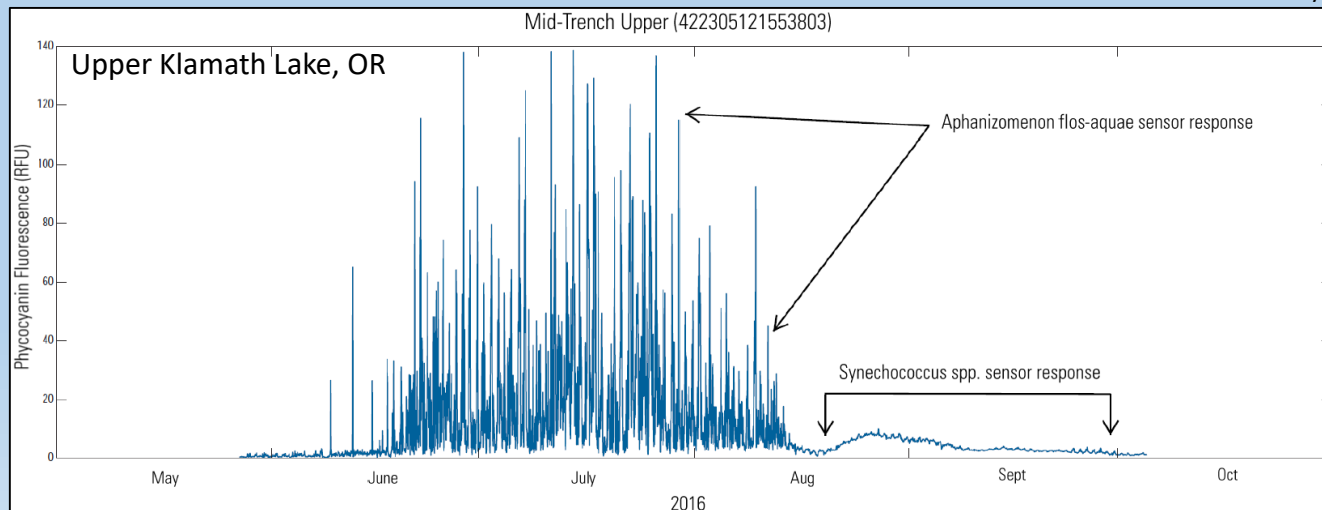
Diurnal or Noisy Patterns in Algal Fluorescence May Be Indicative of Potentially Harmful Algal Blooms



Courtesy of K. Carpenter, USGS

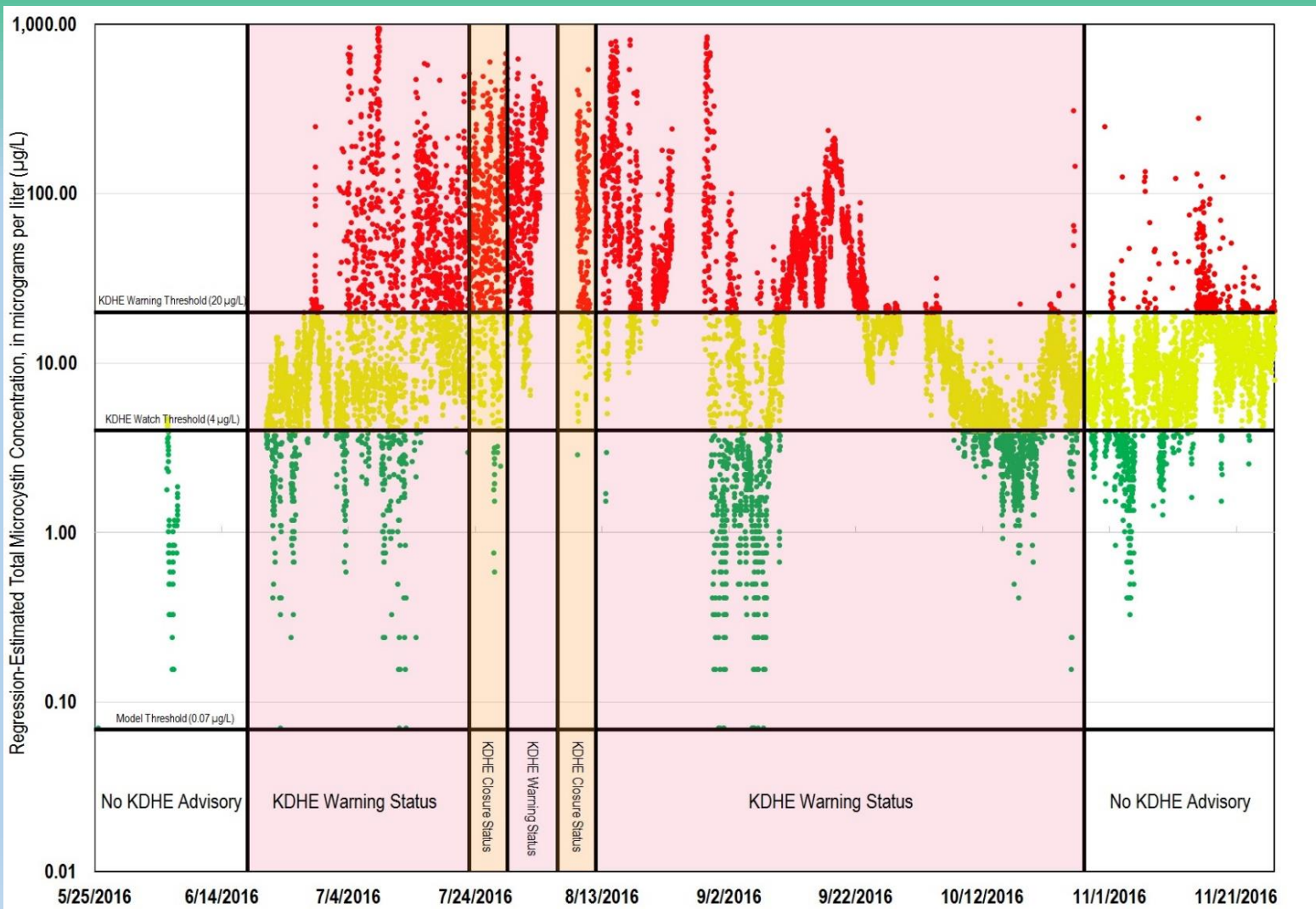


Courtesy of G. Foster, USGS



Courtesy of O. Stoken, USGS

Sensor Data Can Be Used to Develop Models to Estimate Cyanotoxin Concentrations in Real Time



Conclusions and Lessons Learned

- Good communication and trusted partnerships are essential
- Decision-maker needs should be incorporated into study designs
- Ongoing dialog between decision-makers and scientists improves outcomes



Photo credit: G. Totzke, WaterOne

WaterOne and USGS at the KU Environmental Engineering Conference

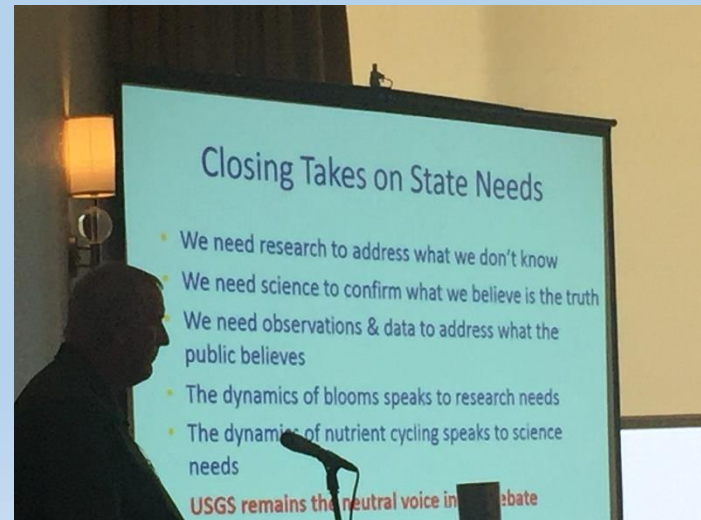


Photo credit: C. Anderson, USGS

KDHE and USGS at the NAWQA Spring Liason Meeting



Photo credit: B. Brink



Photo credit: D. Obrecht, University of Missouri

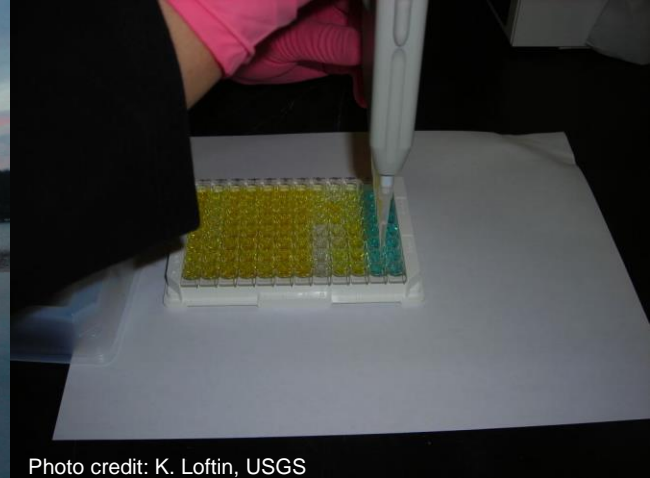


Photo credit: K. Loftin, USGS



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