Introduction to U.S. EPA Harmful Algal Bloom and Cyanotoxin Drinking Water Activities

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Presentation Overview

- Overview of Harmful Algal Blooms and their impacts on drinking water systems
- Recap of the 2015 Bloom Season
- Overview of EPA's *Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water*
- Brief discussion of H.R. 212, Drinking Water Protection Act
- Discussion on EPA's ongoing activities focusing on drinking water

Overview of Harmful Algal Blooms

- Cyanobacteria, also referred to as blue-green algae, are found naturally in surface water and can rapidly multiply, causing harmful blooms
  - Factors affecting bloom formation: light, temperature, nutrients, and weather, etc.
  - Some species of cyanobacteria produce toxic compounds that can be harmful to humans and animals, known as cyanotoxins
- Some species can make multiple toxins and different species can produce the same toxins. Toxins are not always produced, making it difficult to know if a bloom is toxic just by looking at it.
  - Common cyanotoxins in the US: microcystins, cylindrospermopsin, and anatoxin-a
  - Health effects related to exposure to cyanotoxins in freshwater: liver and kidney toxicity along with neurologic and dermatologic effects

Overview of Harmful Algal Blooms

- The prevalence and duration of HABs in freshwater is rapidly expanding in the U.S. and worldwide.
  - Algal blooms can cause hypoxia, leading to fish kills
  - Challenges in treatment of water used for drinking
  - Loss of drinking water, recreational/fishing uses
  - Toxins at levels that may be of concern for human health

- Cyanobacterial blooms can cause water quality problems.
  - Potentially producing cyanotoxins
  - Increasing solid loading
  - Increasing natural organic matter (NOM)
  - Producing unpleasant tastes and odors (T&O)

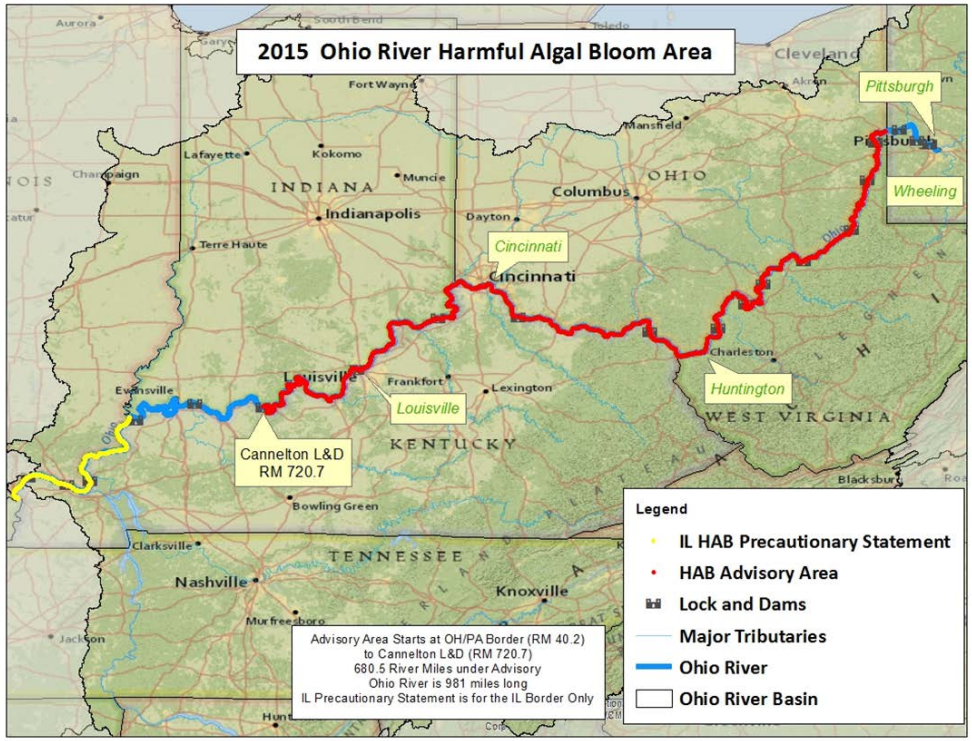
Recap of the 2015 Bloom Season

- In June 2015, EPA released:
  - Health Advisories for microcystins and cylindrospermopsin
  - Health Effect Support Documents for microcystins, cylindrospermopsin, and anatoxin-a
  - *Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water*
- Drinking water systems were challenged by harmful algal blooms
- Large blooms occurred:
  - Lake Erie had a record breaking bloom
  - Ohio River had a 650-mile long bloom
- No Do Not Drink orders were reported during the 2015 bloom season

Recap of the 2015 Bloom Season

Ohio River 2015

- Borders or flows through six states: Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia
- Source of drinking water for over 5 million people



Lake Erie 2015

- Most severe bloom of this century in Lake Erie
- Began mid-July and reached max biomass in mid-August

Citations:

Ohio River: Ohio River Valley Water Sanitation Commission www.orsanco.org

Lake Erie: NOAA-Great Lakes Environmental Research Laboratory
http://www.glerl.noaa.gov/res/waterQuality/#hab

EPA's Ten-Day Health Advisories for Cyanotoxins

- **Exposure pathway**: oral ingestion of drinking water
- **Exposed life stage and population**: children and adults

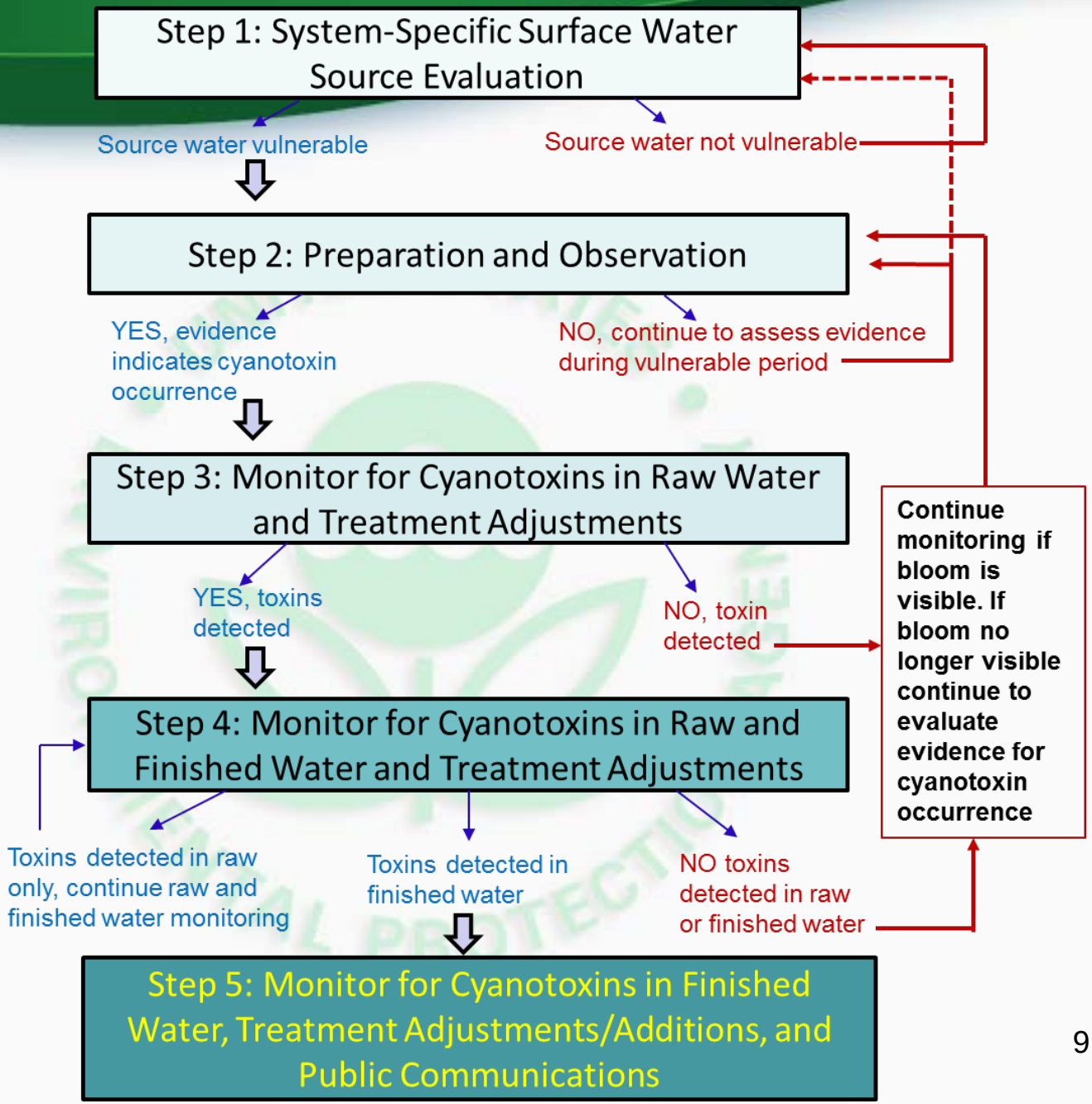
chemical	10-day advisory	
	Bottle-fed infants and pre-school children	School-age children and adults
microcystins	0.3 µg/L	1.6 µg/L
cylindrospermopsin	0.7 µg/L	3 µg/L

- 10-Day Health Advisory value is considered protective of non-carcinogenic adverse health effects over a 10-day exposure in drinking water.
- For those systems who choose to do so, it provides an opportunity to take actions to reduce exposure in finished drinking water by refining treatment processes to minimize public health risks.
- Additional information on health advisories: https://www.epa.gov/nutrient-policy-data/guidelines-and-recommendations

Managing Cyanotoxins in Drinking Water

- In June 2015, EPA *Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water*
- This document assists interested states and utilities manage risks from cyanobacterial toxins in drinking water, recognizing the most appropriate course of action will vary on a case by case basis
- Available online at: https://www.epa.gov/nutrient-policy-data/recommendations-public-water-systems-manage-cyanotoxins-drinking-water

Potential Cyanotoxin Management Steps



Step 1: System-Specific Surface Water Source Evaluation

- Key objective: Determine if source water is vulnerable to harmful algal blooms
- Potential information to consider when conducting a system-specific evaluation:
  - Evaluation of source waters at or near the intake:
    - Source Water Characteristics
    - Water Quality Parameters
    - Source Water Assessment Information
    - Climate and Weather Information
    - Land Use
    - Nutrient Levels

Step 2: Preparation and Observation

Preparation

- Potential actions to consider if a system is determined to be vulnerable in Step 1:
  - Determine when (e.g., which seasons) systems are most vulnerable to HABs
  - System Evaluation
    - Assess status of treatment plant operations and maintenance during pre-harmful algal bloom season
      - If source water is vulnerable and existing treatment is not sufficient to remove cyanotoxins from peak blooms, evaluate whether supplemental treatment (e.g., coagulant) might be needed during bloom season, or
      - If source water is vulnerable and existing treatment is frequently challenged by cyanotoxins, consider whether long-term treatment enhancements are needed

Step 2: Preparation and Observation

Observation

- Key observation objective: Identify potential cyanotoxin occurrence in source and raw water
- 3 Key Potential Observations:
  1. Visual: Visually confirm the presence of a bloom at intake structure or confirm public reports of blooms near raw water intake
  2. System effects: Track changes in treatment plant operations, water quality parameters, etc.
  3. Indicators: Indicator occurrence in source water and raw water at intake

Steps 3-5: Monitoring, Treatment Adjustments, and Communication

- Key objectives:
  - Determine if cyanotoxins have reached or are likely to reach the raw water intake
  - Determine the effectiveness of cyanotoxin removal via drinking water treatment operations
  - Adjust or consider additional treatment to reduce risks from cyanotoxins in drinking water
  - Confirm whether cyanotoxins are detected in finished water
  - Reduce risks from cyanotoxins in drinking water
  - Inform the public of the need to take actions to reduce their risks

Step 5: Monitor for Cyanotoxins in Finished Water, Treatment Adjustments and Public Communications

Low Level	Medium Level	High Level
Microcystins: ≤ 0.3 µg/L	Microcystins: > 0.3µg/L ≤ 1.6 µg/L	Microcystins: > 1.6 µg/L
		
Communication		
Continue communication with State primacy agency and local health officials on monitoring results.	Notify local public health agency, primacy agency and the public. Recommend use of alternative sources for bottle-fed infants and young children of pre-school age.	Notify local public health agency, primacy agency and the public. Recommend 'Do Not Drink/ Do Not Boil Water' advisory for all consumers.
Treatment Actions		
Modify treatment as necessary to keep algal toxins below HA values.	Adjust existing treatment to reduce the concentration to below 0.3 µg/L as soon as possible. Modify or amend treatment as necessary.	Adjust existing treatment to reduce the concentration to below 0.3 µg/L as soon as possible. Modify or amend treatment as necessary.
Monitoring		
Continue sampling raw and finished water at least 2-3 times per week until levels are below quantification in at least 2-3 consecutive samples in raw water, then return to Step 3.	Continue sampling raw and finished water daily until finished water levels are below quantification in at least 2-3 consecutive samples.	Continue sampling raw and finished water at least daily until finished water levels are below quantification in at least 2-3 consecutive samples.

H.R. 212 (Drinking Water Protection Act)

- On August 7th, 2015, the President signed H.R. 212 (Drinking Water Protection Act)
- Directed the EPA to develop and submit a strategic plan for assessing and managing risks associated with algal toxins in drinking water provided by public water systems

- Strategic Plan was developed with input from:
  - Various EPA Offices and Regions
  - Federal partners from the Interagency Working Group established by the Harmful Algal Bloom and Hypoxia Research and Control Act Amendments of 2014
  - Stakeholders through a listening session webinar

Algal Toxin Risk Assessment and Management Strategic Plan for Drinking Water

- Includes steps and timelines for:
  - **Assessing Human Health Effects.** Evaluating and summarizing risks to human health from drinking water systems contaminated with algal toxins
  - **Listing of Algal Toxins.** Developing and maintaining list of algal toxins which may have adverse human health effects
  - **Publishing Health Advisories**. Determining whether to publish additional health advisories for the list of algal toxins
  - **Providing Treatment Options.** Evaluating and providing guidance on feasible treatment options
  - **Providing Analytical and Monitoring Approaches.** Developing and providing guidance on analytical methods and monitoring techniques, particularly monitoring frequency

Algal Toxin Risk Assessment and Management Strategic Plan for Drinking Water

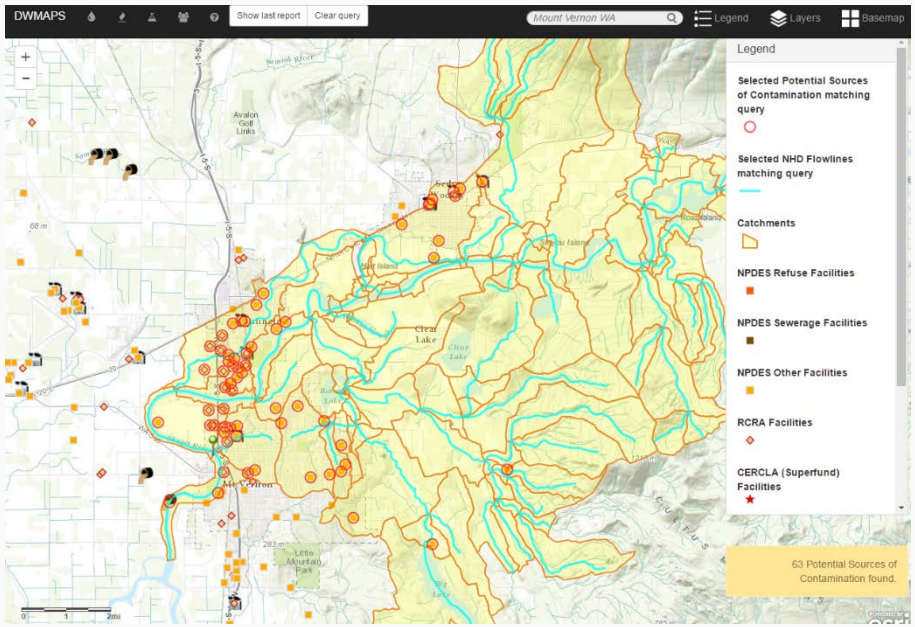
- Includes steps and timelines for (continued):
  - **Summarizing the Causes of HABs.** Summarizing factors that cause toxin-producing HABs to proliferate and release toxins
  - **Recommending Source Water Protection.** Evaluating and recommending feasible source water protection practices
  - **Strengthening Collaboration and Outreach.** Entering into cooperative agreements and provide technical assistance to affected States and PWSs
- Identifies information gaps
- Assembles and publishes information from each federal agency that has examined algal toxins or addressed public health concerns related to HABs

EPA's Office of Water Ongoing Activities

- Development of cyanotoxin management plan templates to help utilities nationwide manage cyanotoxins
  - The templates, based on real-world plans developed for 4-5 systems, are anticipated to be completed in 2016
  - *Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water* released in June 2015 that will be used to inform development of the templates
- Cyanotoxins are included on the draft fourth Contaminant Candidate List (CCL4)
- Cyanotoxins are included on the proposed fourth Unregulated Contaminant Monitoring Rule (UCMR4)
  - ADDA ELISA method development for UCMR4
- Development of a document focused on water treatment optimization for cyanotoxins

EPA's Office of Water Ongoing Activities

- Drinking Water Mapping Application to Protect Source Waters (DWMAPS)
  - Online mapping tool developed by the EPA that can provide utilities, Source Water Collaboratives, watershed groups, and other information on source water assessments and information to prioritize source water protection measures



EPA's Office of Water Ongoing Activities

- Development of Recreational Ambient Water Quality Criteria (AWQC) for cyanotoxins
  - Clean Water Act Section 304(a) recommended recreational water quality criteria values protective of human health given a primary contact recreational exposure scenario through incidental ingestion during recreational activities.
  - The recreational AWQC will recommend values for microcystins and cylindrospermopsin. Expected Date: Draft Fall 2016
- Outreach and Communication efforts including:
  - EPA's Cyanobacteria Harmful Algal Blooms Webpage
  - Monthly Freshwater HABs Newsletter
  - Video on ELISA Lab Techniques for Detecting Microcystins in Water : https://www.youtube.com/watch?v=YOWNA6VSQkA&feature=youtu.be
  - Continued support for Regional HABs Source Water Protection Workshops to support states, tribes and others in managing cyanotoxins

EPA's Cyanotoxin Management Goals

- Continue to engage in cyanotoxin issues challenging drinking water
- Continue to support states and utilities in cyanotoxin management efforts
- Collaborate where appropriate to best provide useful, accurate, and timely technical assistance
- Following the presentations we welcome feedback on the future direction of managing and mitigating cyanotoxins in drinking water

Contact Information

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CyanoHABs website
https://www.epa.gov/cyanohabs