Overview of U.S. EPA Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water

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Presentation Overview

- Brief overview of past EPA's Office of Water activities
- Discussion of EPA's *Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water*
- Overview of H.R. 212, Drinking Water Protection Act
- Brief discussion on EPA's OW ongoing activities

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, nutrient, and weather, etc.
- Some species of cyanobacteria produce toxic compounds that can be harmful to humans and animals, known as cyanotoxins
  - Most common cyanotoxins in the US: microcystins, cylindrospermopsin, and anatoxin-a
  - Health effects related to exposure to cyanotoxins in freshwater: liver and kidney toxicity, neurotoxic, and dermatoxic

Cyanotoxin Activities in EPA's Office of Water

- EPA placed algal toxins on the Safe Drinking Water Act's Contaminant Candidate List (CCL):
  - CCL 1 and CCL 2: Cyanobacteria, other freshwater algae, and their associated toxins
  - CCL 3 and Draft CCL 4:Cyanotoxins (including microcystin-LR, cylindrospermopsin, and anatoxin-a)
- 2007 National Lakes Assessment (NLA)
  - 30% of lakes had microcystin detections
  - 1% had detections over 1 µg/L
- Drinking Water Health Advisories (HA) for cyanotoxins
  - Microcystins
  - Cylindrospermopsin
- Development of analytical methods for cyanotoxins
- Information on cyanotoxins
  - Cyanobacteria Harmful Algal Blooms Webpage
  - Cyanobacteria/Cyanotoxins Fact Sheet for Drinking Water Systems

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.

EPA Support to States and Utilities

- Held a public meeting on May 11th, 2015
- The focus of this public meeting was to gather input on additional information the agency can provide to states and public water systems to help them prepare for and respond to potential cyanotoxin health concerns in drinking water
- Based on feedback at the public meeting, EPA determined additional support to states and utilities was needed

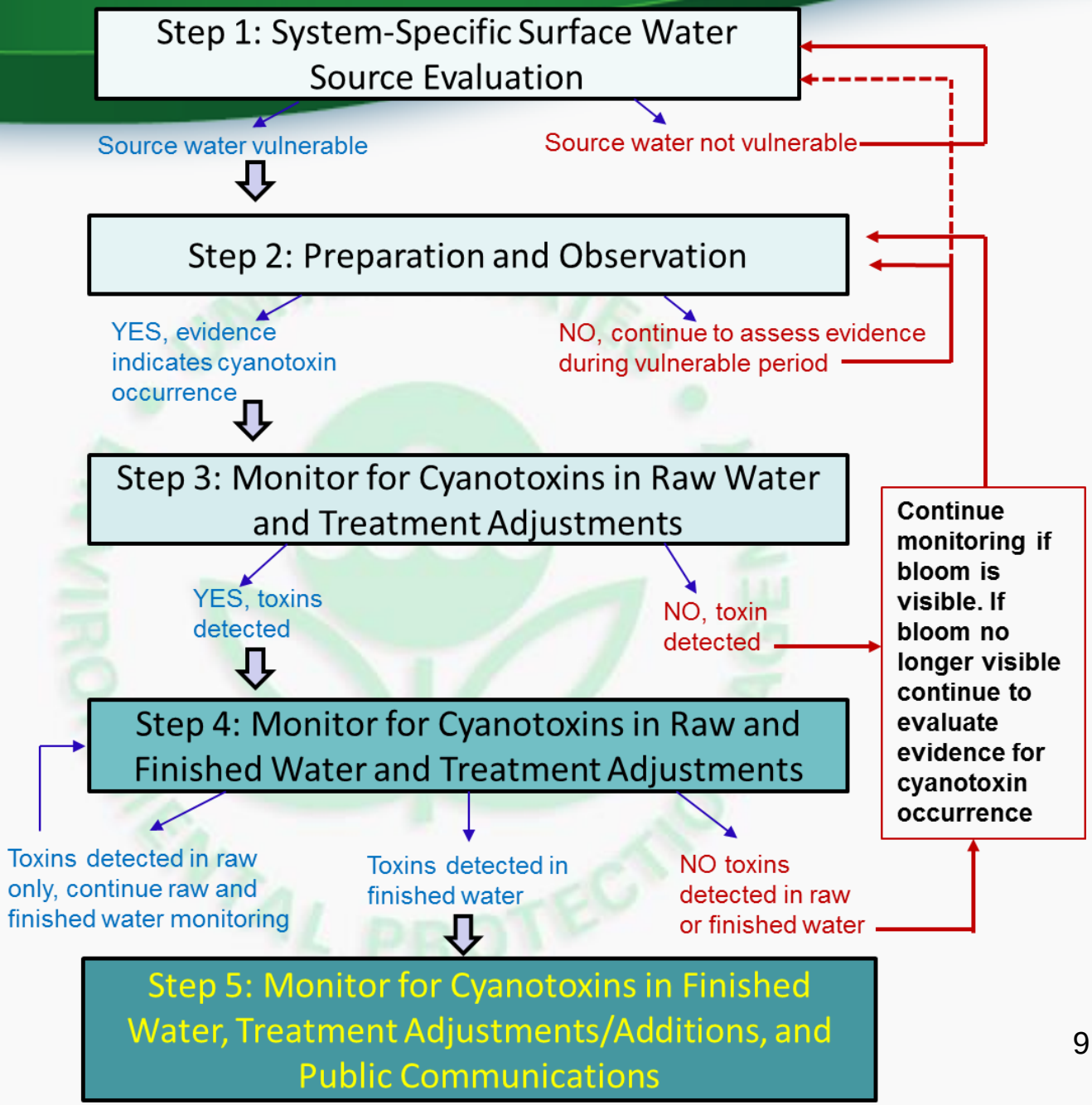
Setting the State: Definitions (*For the purpose of this presentation*)

- Source water – water from lakes, reservoirs, rivers, or streams that is used as a drinking water source
- Raw water – water that enters the drinking water intake, but has not yet received any treatment
- Finished water – “water that is introduced into the distribution system of a public water system and is intended for distribution and consumption without further treatment, except as treatment necessary to maintain water quality in the distribution system. . . .” (40 CFR 141.2)

Managing Cyanotoxins in Drinking Water

- In June 2015, EPA released a support document titled *Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water*
- The document is intended to assist interested states and utilities manage the risks from cyanobacterial toxins in drinking water, recognizing the most appropriate course of action will vary on a case by case basis

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 prior to 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

Preparation (Cont'd)

- Monitoring
  - Prepare for possible future cyanotoxin monitoring by ordering necessary lab materials for screening tests or setting up contracts with outside labs
- Communication
  - Establish partnerships with primacy agencies, state, and local public health officials

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

Step 2: Visible Observation of Blooms

- Potential actions to consider when assessing/collecting information on visible blooms (note, not all blooms are visible):
  - Location: Identify locations to monitor for presence of blooms and implications for the PWS (e.g., a bloom near a raw water intake vs. a bloom 50 meters away from an intake)
  - Evaluate whether the public can assist with collecting information on blooms

Step 2: Observation of System Operation

- Potential actions to consider when assessing/collecting information on changes in system operations:
  - Examine raw water quality parameters (e.g., pH changes, turbidity)
  - Evaluate potential treatment changes (e.g., shortened filter run times, increased chlorine demand, etc.)
  - Investigate consumer complaints (e.g., taste and odor concerns)
  - Communicate with nearby/upstream systems (e.g., blooms in source water or cyanotoxin occurrence in their raw water)

Step 2: Observation of HAB Indicators

- Important information to collect on indicators of system vulnerability to HABs
  - Examine available data to determine if there has been an increase in nutrient concentrations (nitrogen <u>or</u> phosphorus) in source water
  - Examine other source water indicator data (pH, temperature, cyanobacterial cells, chlorophyll a levels, phycocyanin, phosphorus, nitrogen)
  - Participate/organize watershed monitoring programs collecting source water indicator data
  - Seek out secondary data on bloom occurrence in source water (e.g., satellite remote sensing, local or regional program surface water monitoring data) and information on intake characteristics

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

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

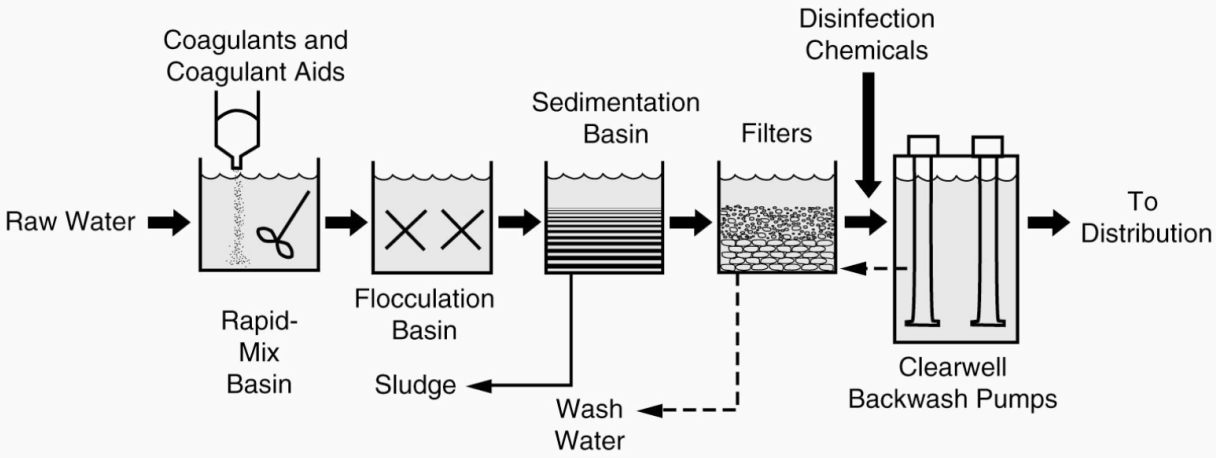
Steps 3-5: Monitoring, Treatment Adjustments, and Communication

- 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)
- Treatment strategies for cyanotoxins must also consider other treatment objectives
  - Turbidity removal
  - Disinfection
  - Disinfection by-products (DBPs) control
  - T&O control
  - Corrosion control

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

Treatment Strategies Being Used or Considered to Address Cyanotoxins

1. Removing intact cells first
2. Minimizing pre-oxidation
3. Adding/Increasing powdered activated carbon (PAC)
4. Increasing post-chlorination
5. Installing permanent treatment – Ozone, granular activated carbon (GAC), biological filtration, membranes, UV with hydrogen peroxide, etc.



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

- 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
- 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
- Transmitted to Congress in November 2015

H.R. 212 Strategic Plan

- Includes steps and timelines to assess:
  - **Human health effects.** Evaluating and summarizing risks to human health from drinking water systems contaminated with algal toxins
  - **List of algal toxins.** Developing and maintaining list of algal toxins which may have adverse human health effects
  - **Health advisories**. Determining whether to publish additional health advisories for the list of algal toxins
  - **Treatment options.** Evaluating and providing guidance on feasible treatment options
  - **Analytical and monitoring approaches.** Developing and providing guidance on analytical methods and monitoring techniques, particularly monitoring frequency

H.R. 212 Strategic Plan

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

EPA's Ongoing Activities

- Developing 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
  - Templates are being developed to account for different source waters, treatment systems, and system sizes
  - *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
- Included cyanotoxins on the proposed draft UCMR 4 list

EPA's Ongoing Activities

- Regional Workshops focusing on HABs and/or Source Water Protection Activities
  - Region 5 HABs CWA/SDWA Workshop (April 27th-28th)
  - Region 3 Algae Summit (April 27th-28th)*
  - Region 4 Source Water Protection meeting with HABs on the agenda (June 2016)*
  - *EPA HQ not involved
- Public meeting on April 29th in Chicago, IL
  - seeking information on state, utility and public experience in managing risks from cyanotoxins in drinking water and input on lessons learned after the release of the June 2015 recommendations document
  - Registration: https://www.eventbrite.com/e/us-epa-public-meeting-managing-cyanotoxins-in-drinking-water-tickets-22748127261?utm_term=eventurl_text

EPA's Future Efforts

- Continue to engage in cyanotoxin issues challenging drinking water, including
  - evaluating drivers of cyanotoxin occurrence
  - determining public health risks related to existing and emerging toxins
  - developing tools to assist in tracking cyanobacterial blooms
  - evaluating and developing appropriate analytical methods
- Continue to support states and utilities in cyanotoxin management efforts
  - Collaborating where appropriate to best provide useful, accurate, and timely technical assistance

Contact Information

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CyanoHABs website
https://www.epa.gov/nutrient-policy-data/cyanohabs