HAB Research

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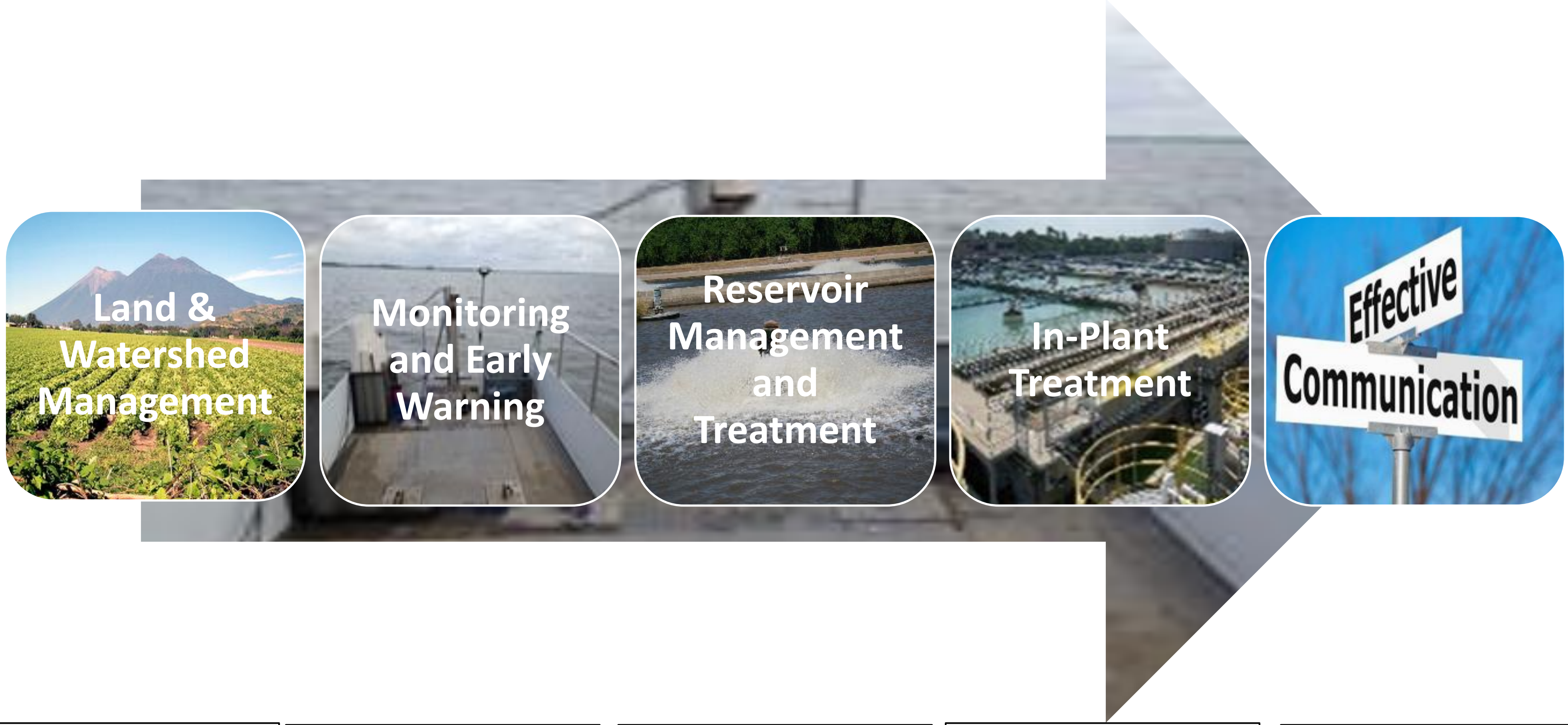
What is an HAB?

- Hazardous Algal Blooms (HAB)
- Cyanobacterial Hazardous Algal Blooms (cHAB)

Management of Blooms Requires a Multi-Barrier Approach

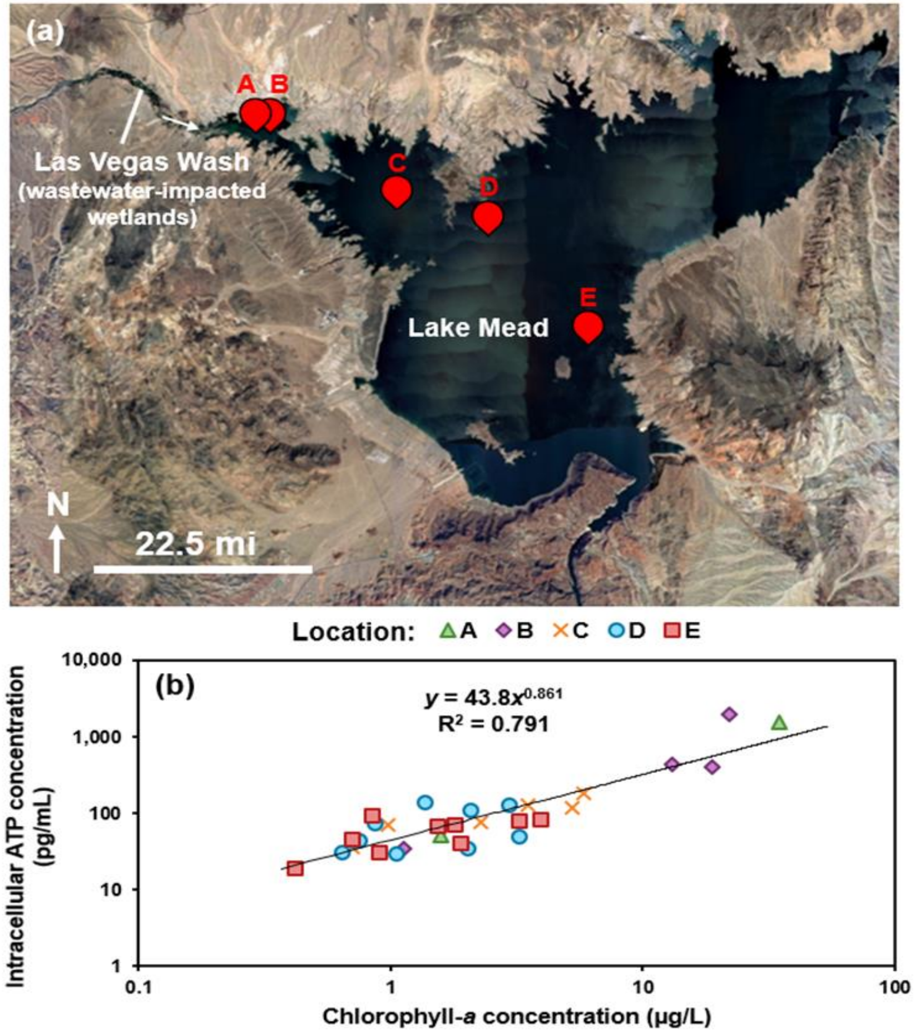


• Source water protection • Nutrient management	• Physical • Chemical • biological parameters	• Aeration • Mixing • Nutrient removal • Treatment	• Chlorine • Ozone • KMnO4 • Activated carbon	Risk communication

Developing Guidance for Evaluation and Implementation for Control of HABs in Source Water (#4912)

- Develop authoritative guidance for managers to evaluate and manage the occurrence and risk associated with harmful algal blooms (HABs) in source waters and select control techniques that are appropriate to their needs and capabilities

- Implement a decision tree to support this evaluation as a web-based resource linked to critically reviewed and validated information, guidelines, and regulations



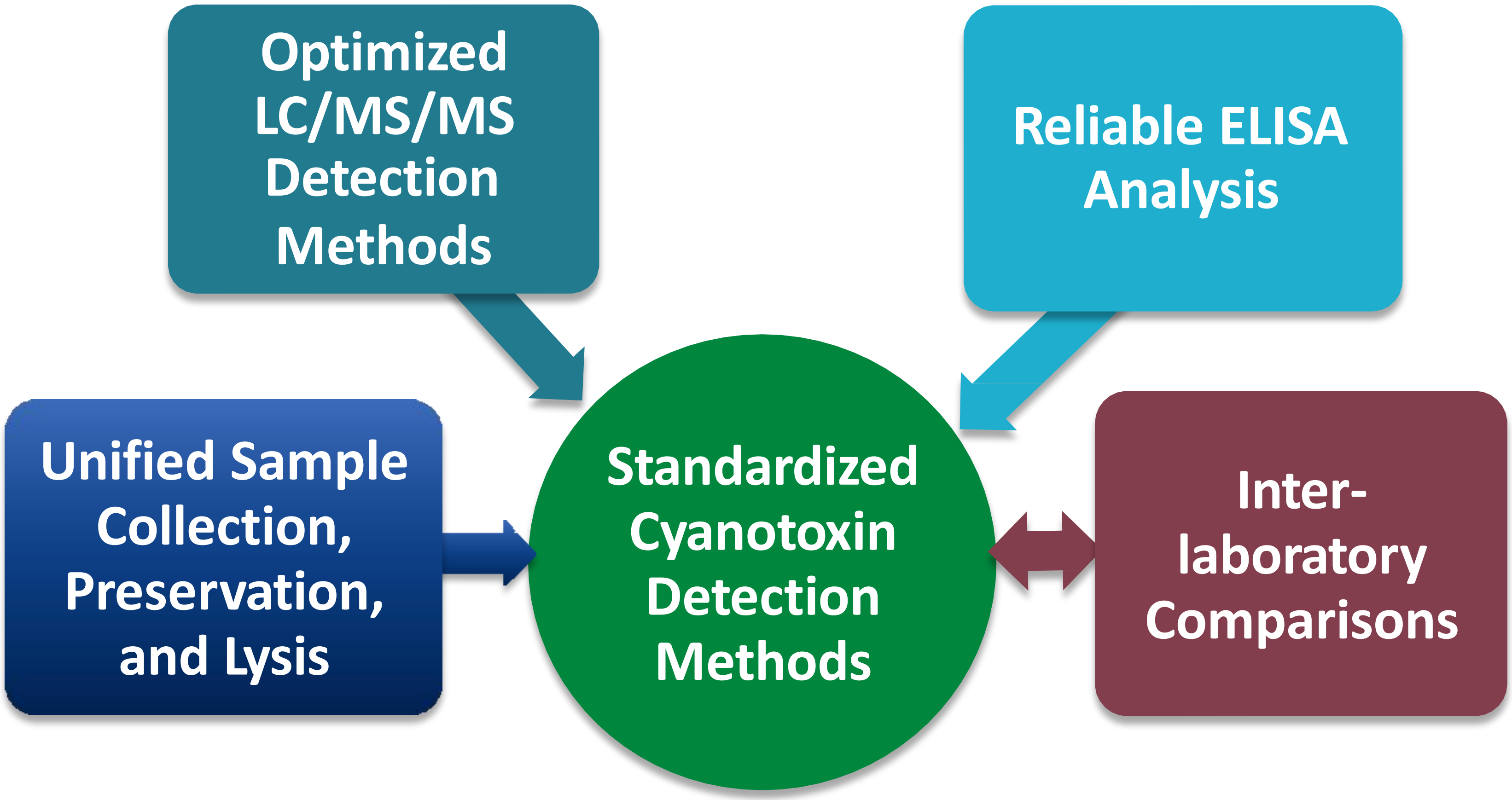
Greenstein, K.E., and E.C. Wert. (2019) Water Research, 154(2019): 171-179

Utility Response to Cyanobacteria/Cyanotoxin Event; Case Studies and Lessons Learned (#4914)

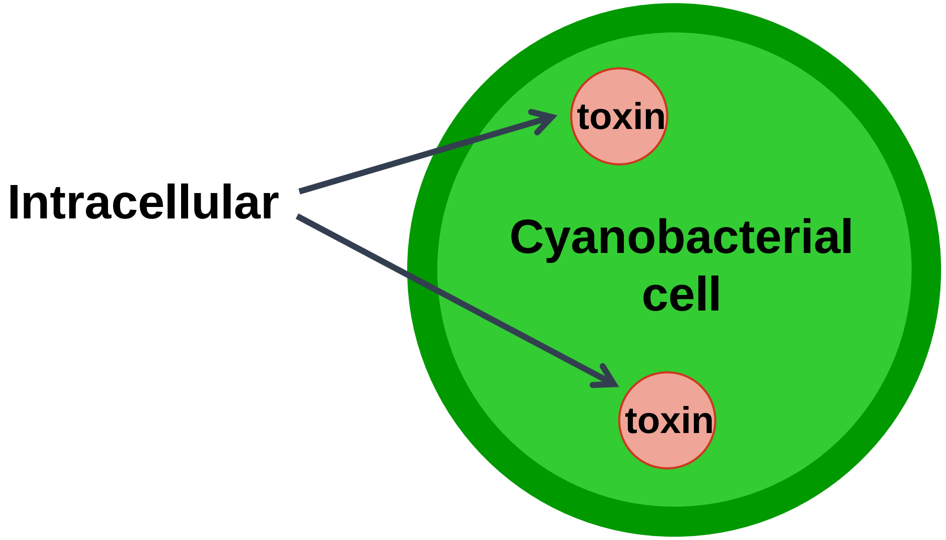
- Develop case studies that document successes and challenges in preventing and/or responding to cyanotoxin events

- Develop the CyanoGuide decision tool

Standardization of Cyanotoxin Analytics (#4716)



What are intracellular and extracellular cyanotoxins?

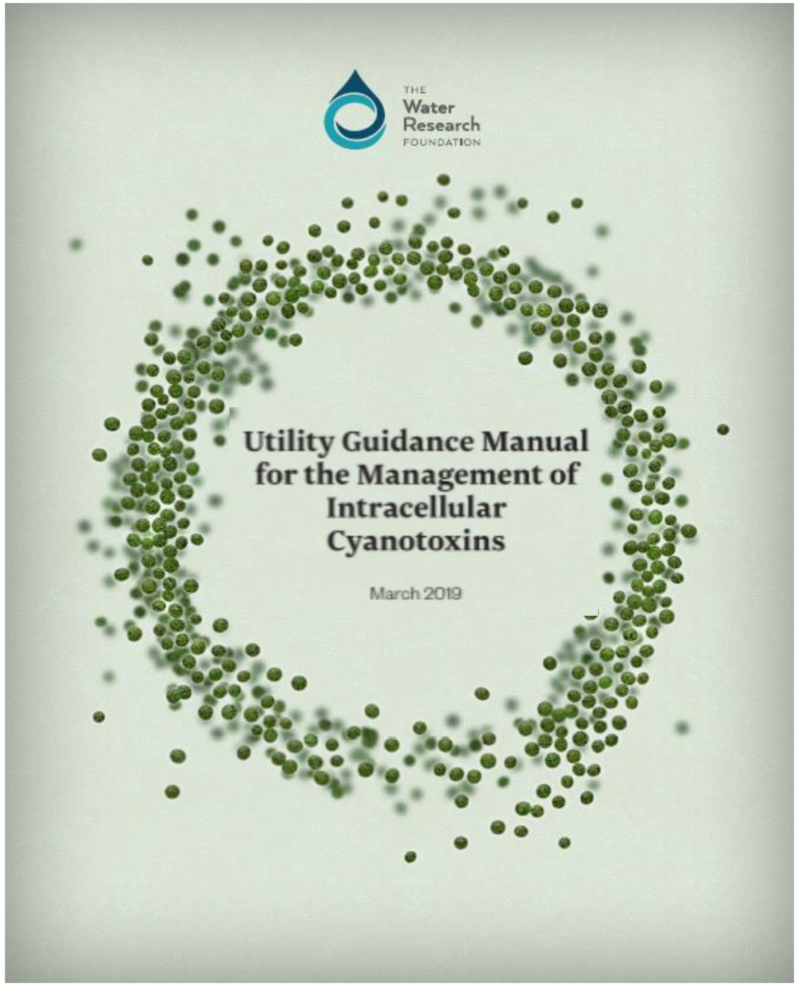


Release of intracellular toxin is important in water treatment

Utility Guidance Manual for the Management of Intracellular Cyanotoxins

- Majority of utilities do not have flexibility to change sources or eliminate pre-filter oxidation

- Present context, summarize existing guidance, provide critical oxidation levels to overcome background demand, cell lysing CT, and oxidation of toxins

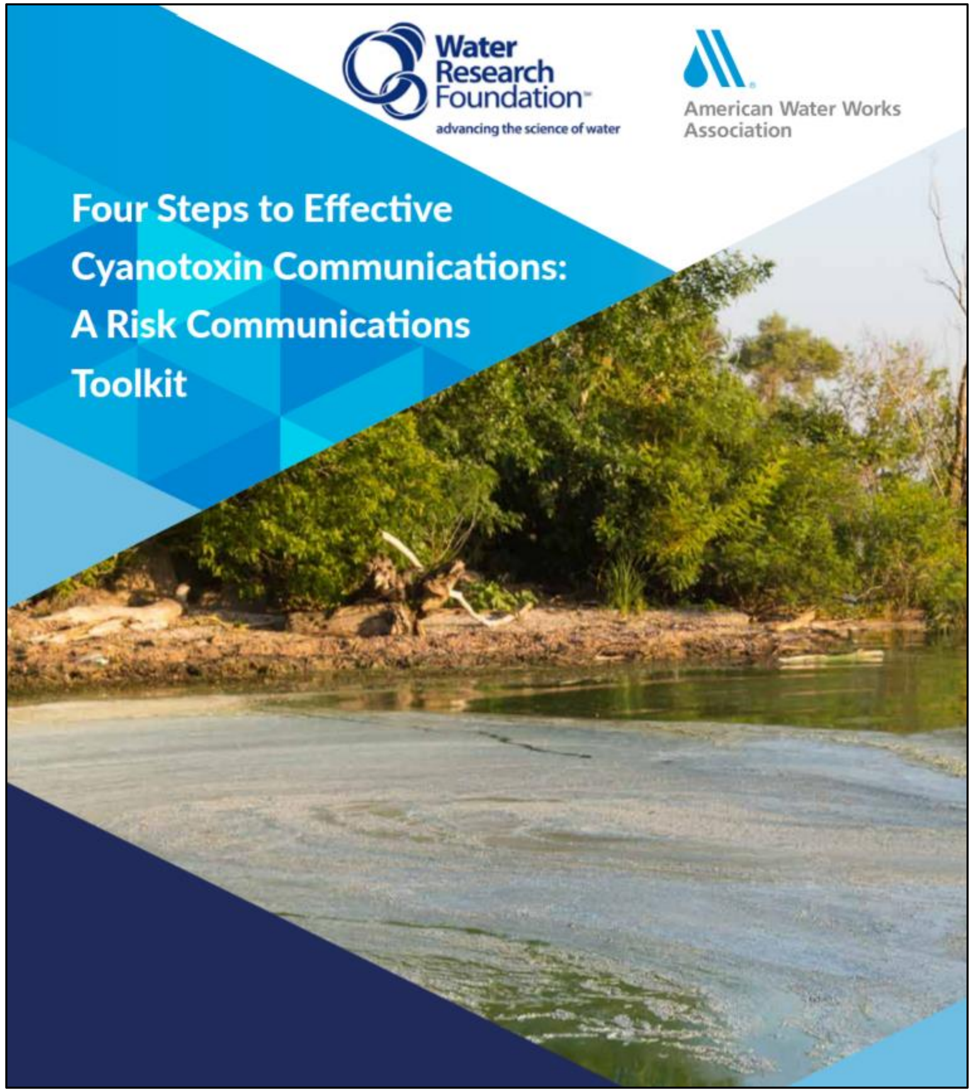


Why are Cyanotoxin Risks so Hard to Talk About?

- The complexity of the EPA risk management framework
- The uncertainty regarding when to communicate the need for internal utility actions
- The uncertainty regarding the information that will be used to trigger a Health Advisory/Alert

4 Steps to Effective Cyanotoxin Communications: A Risk Communications Toolkit

1. Understand the Challenges of Cyanotoxin Communication
2. Address Internal Management Questions
3. Communicate Proactively with the Community
4. Select, Modify, and Deliver Effective Message Products



Thank you

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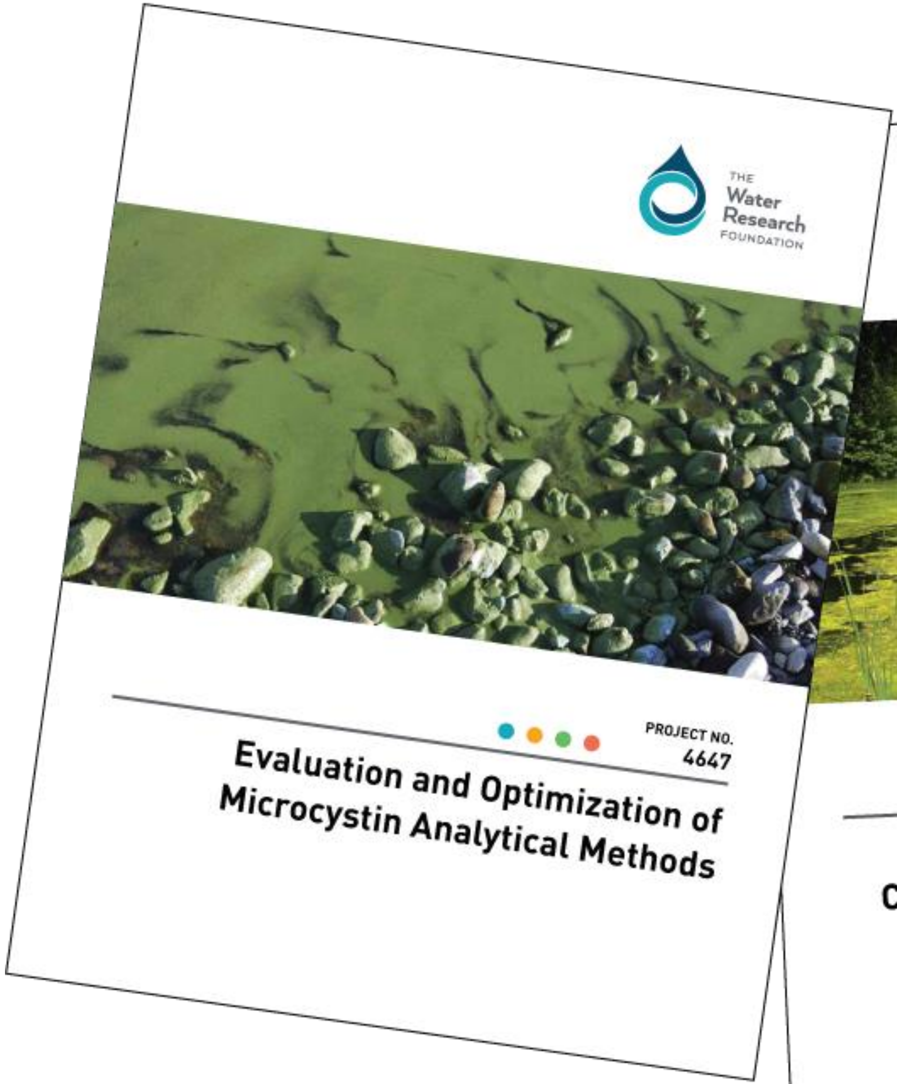
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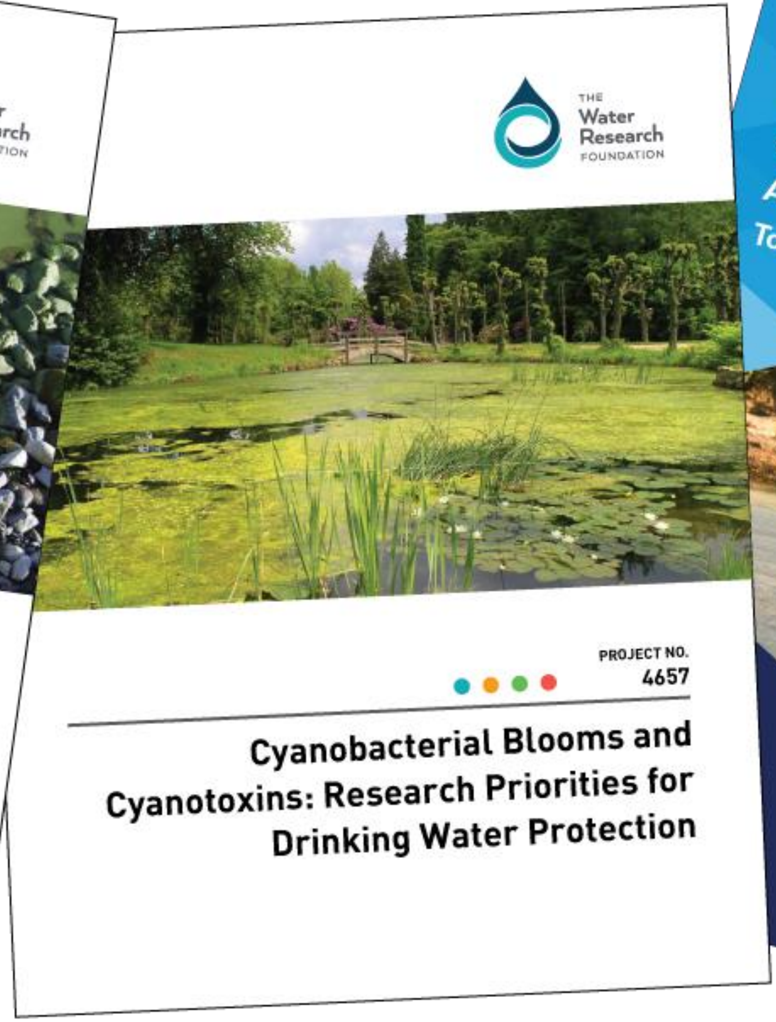
Evaluation and Optimization of
Microcystin Analytical Methods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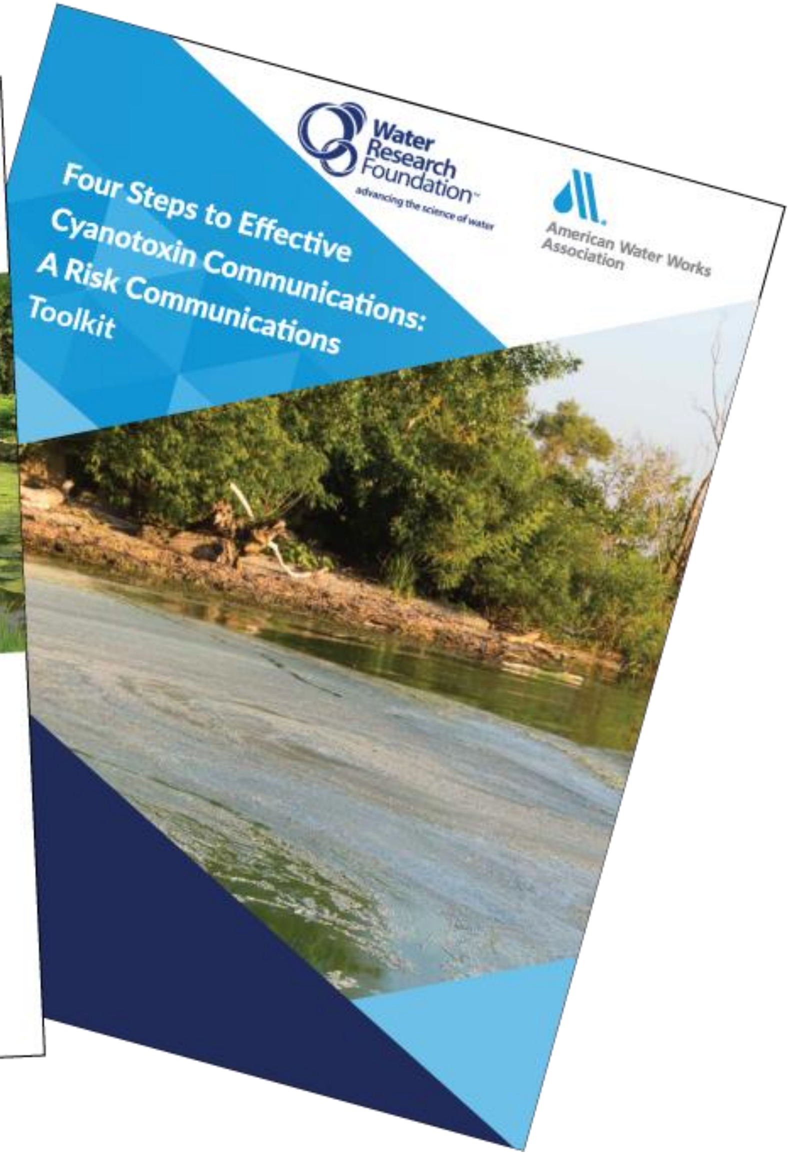
Cyanobacterial Blooms and
Cyanotoxins: Research Priorities for
Drinking Water Protection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Four Steps to Effective
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Toolkit

Select WRF Projects

- Alternative and Innovative Methods for Source Water Management of Algae and Cyanobacteria (4094)
- Evaluation of Integrated Membranes for Taste-and-Odor and Toxin Control (4016)
- International Guidance Manual for the management of Toxic Cyanobacteria (3148)
- Treating Algal Toxins Using Oxidation, Adsorption, and Membrane Treatment (2839)
- Optimizing Conventional Treatment for the Removal of Cyanobacteria and Toxins (4315)
- Cyanotoxin Guide for Utility Managers (Project 4548)
- CyanoTOX Field Validation and Enhancement Related to Chemical Kinetics and ELISA Kinetics (4672)
- Benthic Cyanobacteria: Aesthetic and Toxic Risk (4738)
- Management of Treatment Sludge Impacted by Cyanobacteria (4523)

Preparedness for Harmful Algal Blooms

Cheryl Norton

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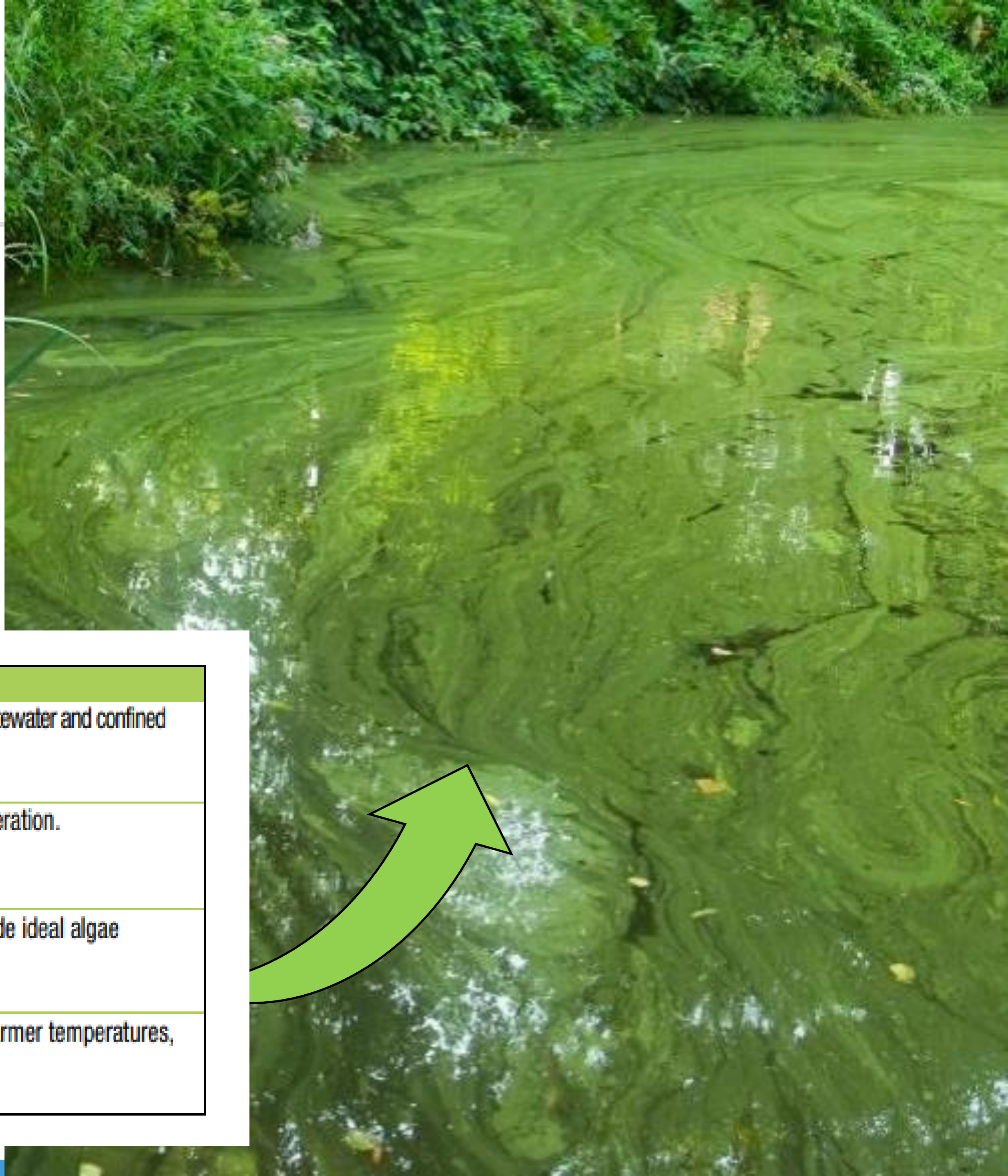
AMERICAN WATER

Overview

- *Cyanobacteria* are commonly known as blue-green algae.
- They can be frequently found in freshwater systems forming thick mats and can produce harmful toxins known as *cyanotoxins*.
- The algal blooms produced by toxin producing algae are known as *harmful algal blooms* or *HABs*.
- The health effects of these toxins can be acute or chronic.

Contributing Factor	
Nutrients	Runoff from agriculture, roads and stormwater, including point sources like wastewater and confined animal feed operation discharges, is a source of nutrients.
Seasonal	Warm water conditions (late summer and autumn) promote algae proliferation.
Still Water	Calm, clear water (reservoirs, lakes, quarries, slow moving rivers) provide ideal algae habitat.
Extreme Weather	Stronger storms increasing runoff, droughts concentrating nutrients, warmer temperatures, and longer growing season all aid algae growth.

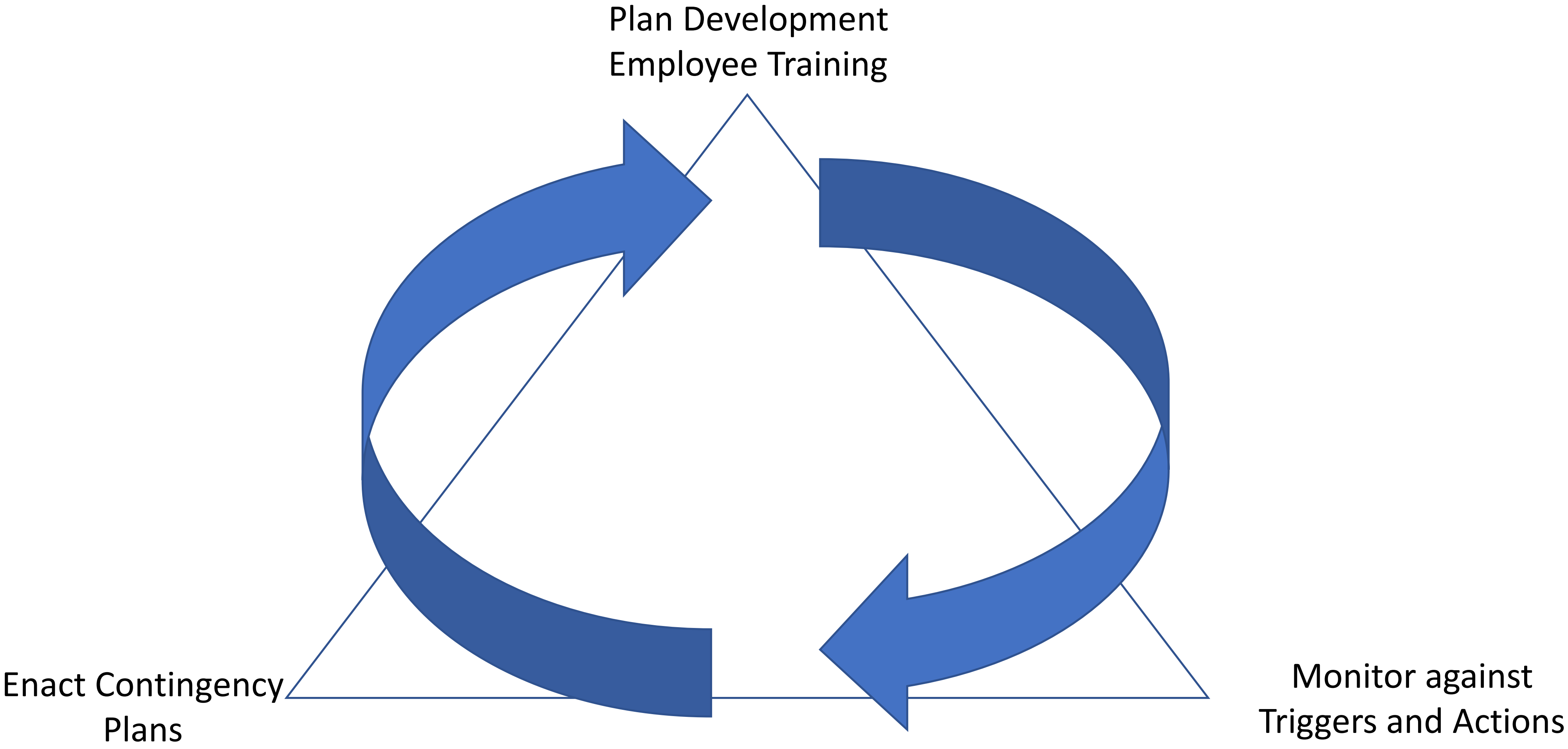


Potential Water Quality Issues

- Increased raw water turbidity
- Increased disinfectant demand
- Shortened filter runs
- Taste and odor issues leading to customer complaints
- Low oxygen levels
- Fluctuating pH levels

All these issues could lead to higher operating costs and require more operational vigilance.

Planning is Key



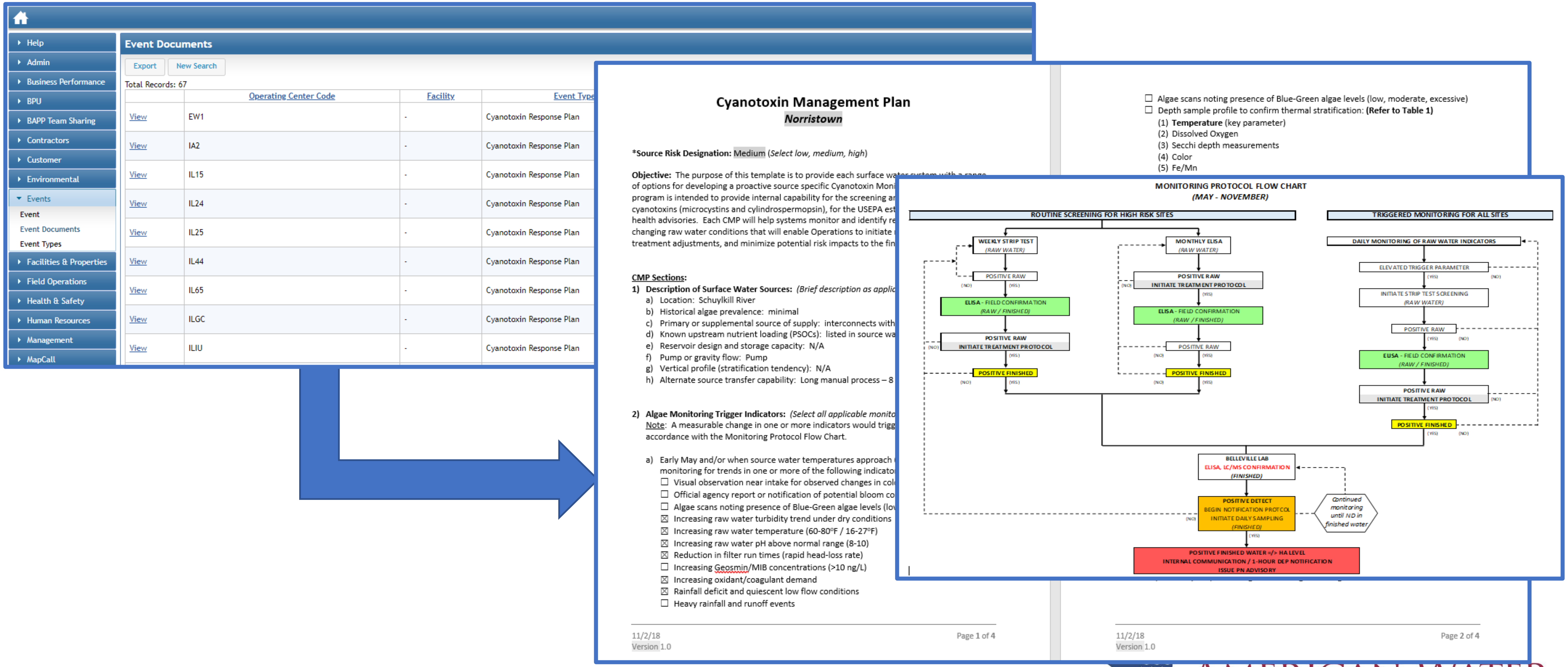
Triggers for Monitoring

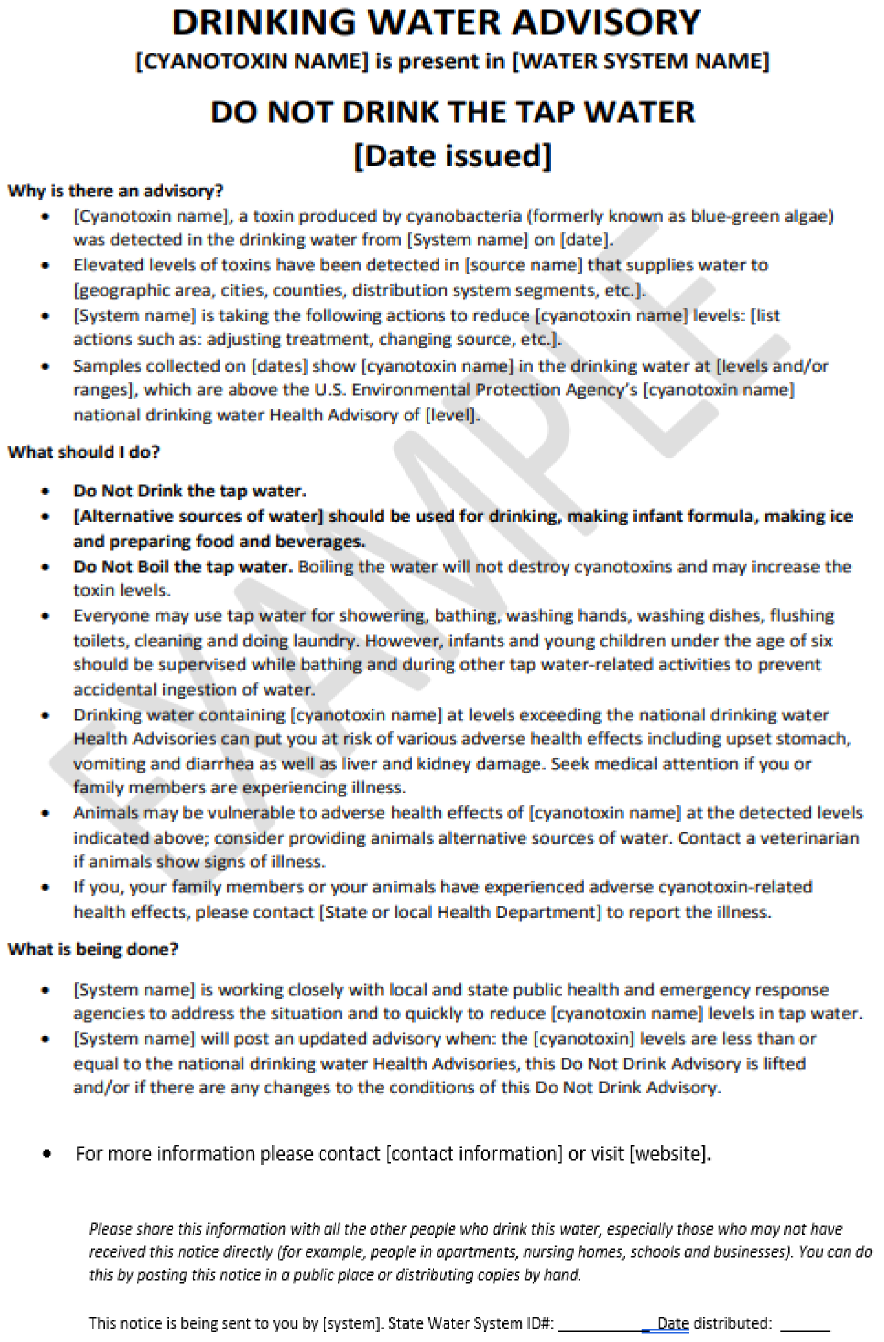
All American Water surface water systems have developed a monitoring/sampling plan as part of their Cyanotoxin Action Plan.

Systems have developed triggers for performing monitoring and should consider the following:

- ✓ Visible bloom
- ✓ Increased turbidity
- ✓ Increased nutrient level
- ✓ Increased cyanobacterial cell count
- ✓ Increased chlorophyll-a or phycocyanin levels
- ✓ Increased raw water temperature
- ✓ Increased pH
- ✓ Shortened filter runs
- ✓ Taste and Odor events
- ✓ Coagulant demand
- ✓ Increased oxidant demand
- ✓ Decreased residual

American Water Site Specific Cyanotoxin Management Plans





DRINKING WATER ADVISORY

[CYANOTOXIN NAME] is present in [WATER SYSTEM NAME]

DO NOT DRINK THE TAP WATER

[Date issued]

Why is there an advisory?

- [Cyanotoxin name], a toxin produced by cyanobacteria (formerly known as blue-green algae) was detected in the drinking water from [System name] on [date].
- Elevated levels of toxins have been detected in [source name] that supplies water to [geographic area, cities, counties, distribution system segments, etc.].
- [System name] is taking the following actions to reduce [cyanotoxin name] levels: [list actions such as: adjusting treatment, changing source, etc.].
- Samples collected on [dates] show [cyanotoxin name] in the drinking water at [levels and/or ranges], which are above the U.S. Environmental Protection Agency's [cyanotoxin name] national drinking water Health Advisory of [level].

What should I do?

- **Do Not Drink the tap water.**
- **[Alternative sources of water] should be used for drinking, making infant formula, making ice and preparing food and beverages.**
- **Do Not Boil the tap water.** Boiling the water will not destroy cyanotoxins and may increase the toxin levels.
- Everyone may use tap water for showering, bathing, washing hands, washing dishes, flushing toilets, cleaning and doing laundry. However, infants and young children under the age of six should be supervised while bathing and during other tap water-related activities to prevent accidental ingestion of water.
- Drinking water containing [cyanotoxin name] at levels exceeding the national drinking water Health Advisories can put you at risk of various adverse health effects including upset stomach, vomiting and diarrhea as well as liver and kidney damage. Seek medical attention if you or family members are experiencing illness.
- Animals may be vulnerable to adverse health effects of [cyanotoxin name] at the detected levels indicated above; consider providing animals alternative sources of water. Contact a veterinarian if animals show signs of illness.
- If you, your family members or your animals have experienced adverse cyanotoxin-related health effects, please contact [State or local Health Department] to report the illness.

What is being done?

- [System name] is working closely with local and state public health and emergency response agencies to address the situation and to quickly to reduce [cyanotoxin name] levels in tap water.
- [System name] will post an updated advisory when: the [cyanotoxin] levels are less than or equal to the national drinking water Health Advisories, this Do Not Drink Advisory is lifted and/or if there are any changes to the conditions of this Do Not Drink Advisory.

- For more information please contact [contact information] or visit [website].

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools and businesses). You can do this by posting this notice in a public place or distributing copies by hand.

This notice is being sent to you by [system]. State Water System ID#: ___________ Date distributed: ______

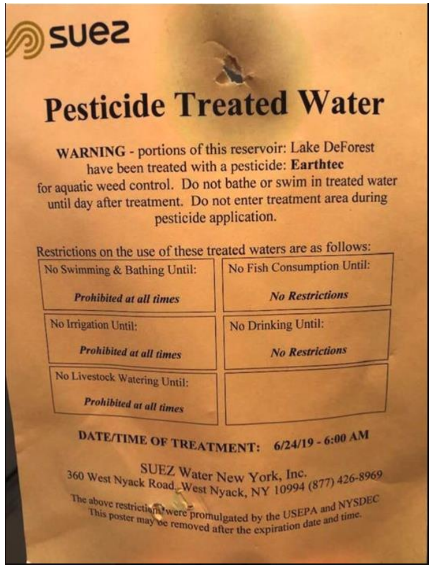
External Communication

- Identify key state regulator contacts for cyanotoxins
- Communicate early in the process as necessary
- Have templates ready if needed
- Review your consecutive systems communication

THANK YOU

Algae Lessons Learned

- Algae is not limited to a season
- Algae is a problem even if nontoxic or dead
- Algae evolves
- The public doesn’t want algae OR algaecides



A Holistic Approach

Prevention	Monitoring – Environment	Monitoring – Water Quality	Monitoring – Treatment	Treatment
Watershed management	Wind	Dissolved oxygen	Filter performance	Copper Sulfate
Wildlife management	Air temperature	pH	Chemical demand	Aeration
Shore stabilization	Water temperature	Phosphorous	Flow rates	
Stormwater management	Sunlight	Nitrogen	Treated water quality	Activated Carbon
Forest preservation	Precipitation	Taste/Odor		Ozone
	Water level	Visual		
		Algae counts		