

# DRINKING WATER HEALTH ADVISORIES FOR CYANOTOXINS



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Office of Science and Technology, Office of Water  
Planning for and Responding to Cyanotoxins in  
Drinking Water Webinar

Thursday April 25th, 2019

# Presentation Overview

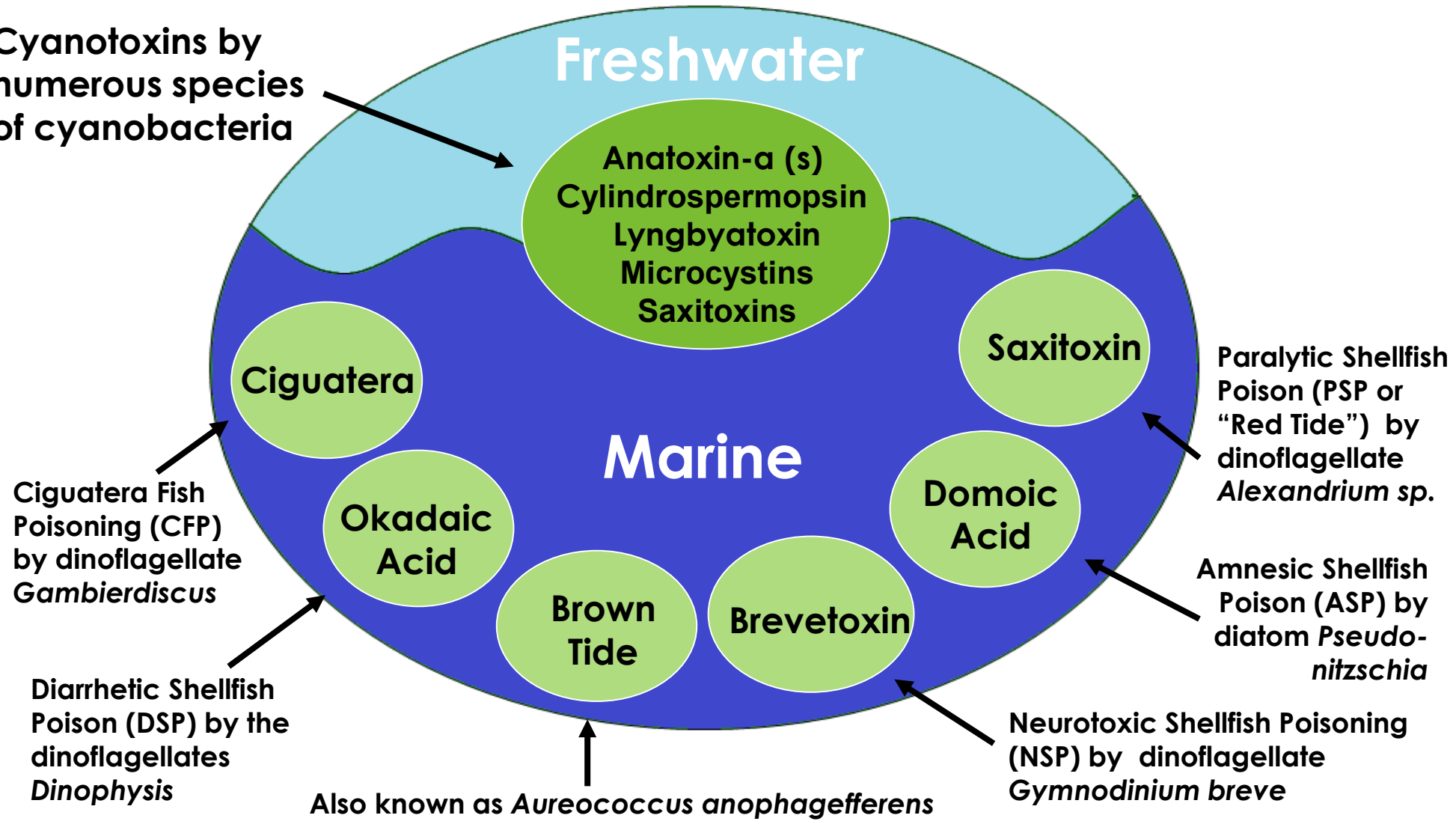
- Overview of cyanotoxins in drinking water
- Discuss the development of the Drinking Water Health Advisories for Cyanotoxins
- Opportunity for Questions

## Disclaimer

**The views expressed in this presentation are those of the author and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.**

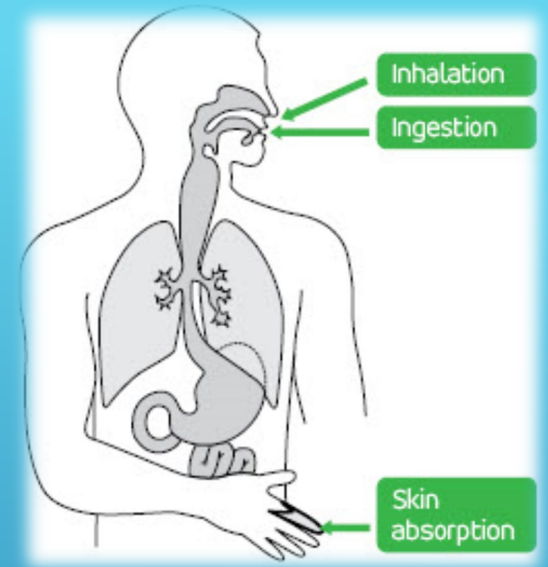
# HABs Toxins

Cyanotoxins by numerous species of cyanobacteria



# Potential Routes of Exposure and Human Health Effects

- Consumption in drinking water and food
  - Ingestion during recreational activities
  - Dermal contact
  - Inhalation of toxins in aerosols
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- Studies have shown that short term and subchronic exposures to cyanotoxins lead to adverse effects including liver and kidney damage and potential reproductive toxicity.



# What are the EPA Drinking Water Health Advisories?

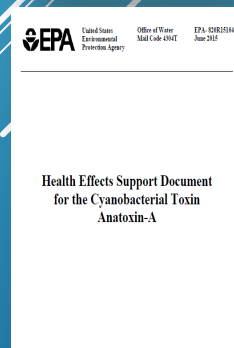
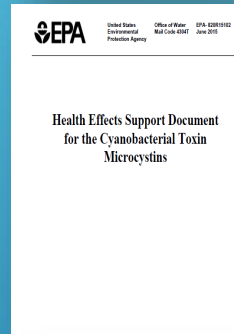
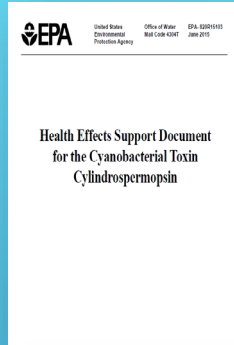
- Health Advisories (HA) are non regulatory concentrations of a chemical in drinking water that is not expected to cause adverse noncarcinogenic effects to occur over specific durations of exposure.
- HAs are developed for pollutants that may affect drinking water quality, but are not regulated under the Safe Drinking Water Act (SDWA).
- HAs are based upon identification of the adverse health effects associated with the most sensitive and meaningful noncarcinogenic endpoint of toxicity over various durations of exposure.
  - One-day HA assumes a single acute exposure (children)
  - Ten-day HA assumes an exposure for up to ten days (children)
  - Chronic HA assumes a lifetime exposure (adults only)





# How the HAs for Cyanotoxins were developed?

- Health Effects Support Documents (HESD) for microcystin (MCs), cylindrospermopsin (CYL) and anatoxin-a (Ana-a)
- Comprehensive review of toxin environmental fate, occurrence, toxicokinetics, animal and epidemiology studies and the characterization of risk.
- Provides the health effects basis for the development of HAs.
- Externally Peer Reviewed (2014 -2015)
  - External peer reviewers concurred that current data are inadequate to develop an HA for anatoxin-a.
- June 2015 – HESDs published along with HAs for Cyanotoxins



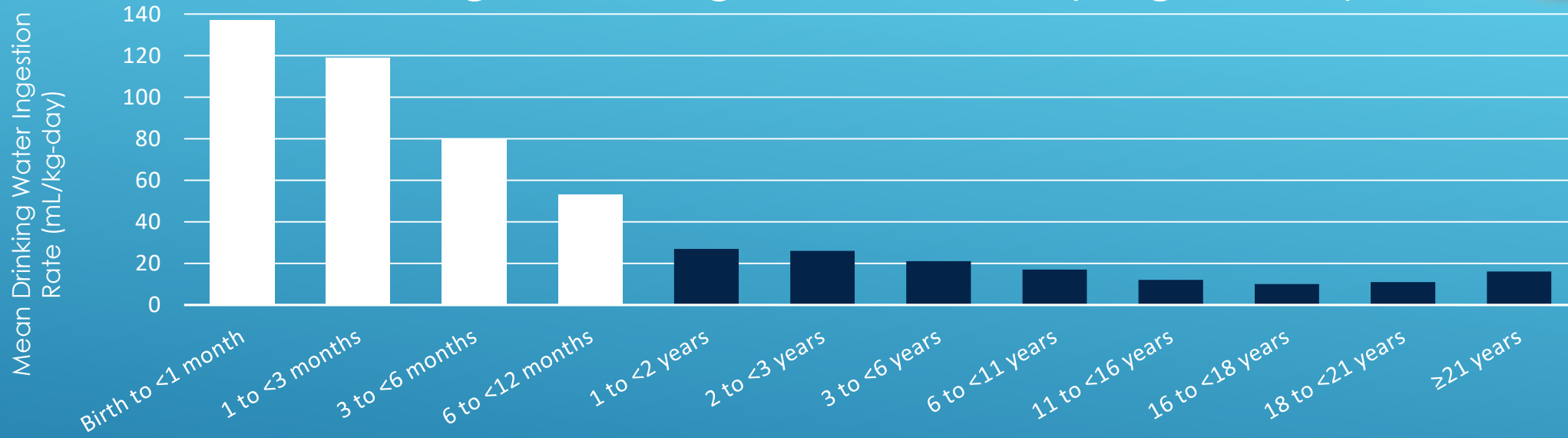
# What are the health effects from exposure to cyanotoxins in drinking water?

- Studies in laboratory animals demonstrate liver and kidney effects following short-term and subchronic oral exposures to MCs and CYL.
- Limited studies evaluating the chronic toxicity of microcystins have shown signs of toxicity, but are limited by study design and by the lack of quantitative data.
- No information regarding the chronic toxicity of cylindrospermopsin is available.
- Limited data from short-term and subchronic animal studies indicate that anatoxin-a is known to cause acute neurotoxicity manifested as loss of coordination, muscular fasciculations, convulsions and death by respiratory paralysis. No data are available on the chronic oral toxicity of anatoxin-a.

# Children's Exposure To Cyanotoxins



## Drinking Water Ingestion Rates by Age Group



- Bottle-fed infants consume large amounts of drinking water compared to their body weight.
- At 6 years and older, exposure on a body-weight basis is similar to that of an adult.
- Infant-specific exposure factors are available from EPA's Exposure Factors Handbook (2011).



# How the HAs values were calculated?

$$HA = \frac{(\text{NOAEL or LOAEL}) \times BW}{UF \times DWI}$$

## 10-day HA for Microcystins:

- For children: **0.3 µg/L**
- For adults: **1.6 µg/L**

LOAEL = 50 µg/kg/day from Heinze, 1999

UF = 1000: 10 intraspecies; 10 interspecies; 10<sup>0.5</sup> LOAEL to NOAEL; 10<sup>0.5</sup> database

DWI/BW = 0.15L/kg/day normalized drinking water intakes per unit body weight over the first year of life  
0.03 L/kg/day based on adult defaults of 2.5 L/day and 80 kg

## 10-day HA for Cylindrospermopsin:

- For children: **0.7 µg/L**
- For adults: **3.0 µg/L**

LOAEL = 30 µg/kg/day from Humpage and Falconer, 2002;2003

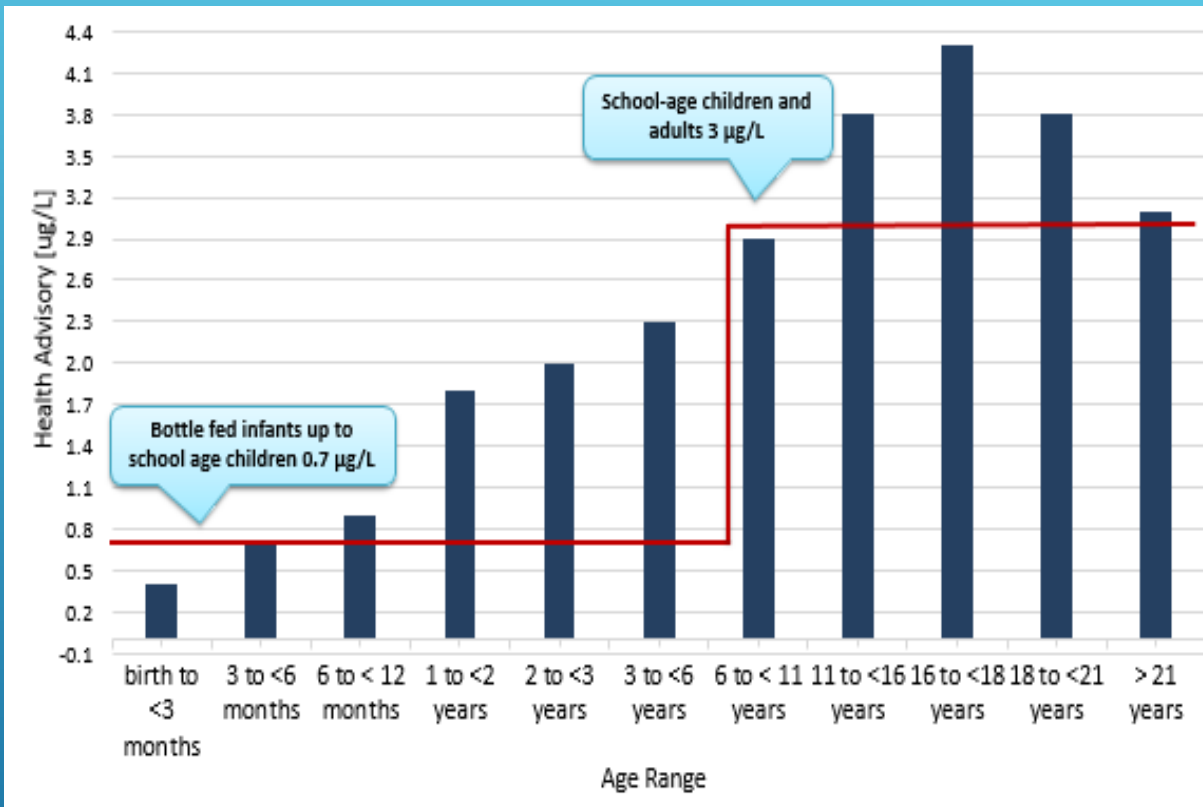
UF = 300: 10 intraspecies; 10 interspecies; 10<sup>0.5</sup> database

DWI/BW = 0.15L/kg/day normalized drinking water intakes per unit body weight over the first year of life  
0.03 L/kg/day based on adult defaults of 2.5 L/day and 80 kg

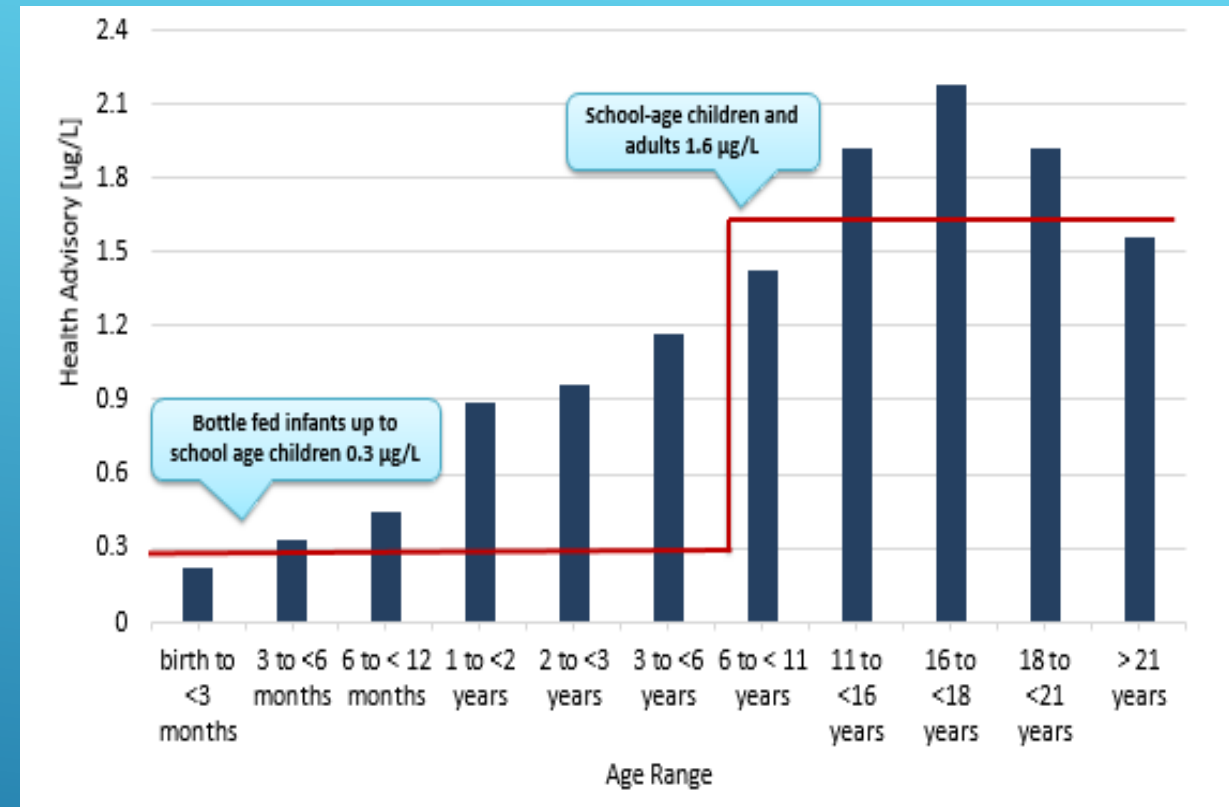
# What are the EPA HAs for MCs and CYL?

Ten-day Health Advisory	Toxin		Population
	Microcystins	Cylindrospermopsin	
Bottle-fed infants and pre-school children	0.3 µg/L	1.6 µg/L	Bottle-fed infants and young children of pre-school age - groups with higher intake per body weight relative to adults
School age children and adults	0.7 µg/L	3 µg/L	School age children (children older than or equal to 6 years) through adulthood - children's intake of DW relative to body weight in this age group is almost the same as those of an adult (>21 years)

# HAs for Cylindrospermopsin



# HAs for Microcystins



# Mean Drinking Water Ingestion Rates By Age Groups

# What do the values mean?

- Ten-day HAs for bottle-fed infants and young children of pre-school age (0.3/0.7 µg/L):
  - Considered protective of non-carcinogenic adverse health effects (liver effects for MCs/kidney effects for CYL) for bottle-fed infants and young children of pre-school age over a ten-day exposure to MCs/CYL in drinking water.
- Ten-day HAs for school age children and adults (1.6/3µg/L)
  - Considered protective of non-carcinogenic adverse health effects (liver effects for MCs/kidney effects for CYL) for children of school age through adults over a ten-day exposure to MCs/CYL in drinking water.

# What happens if you exceed the HAs levels?

- If a PWS confirms concentrations above the HA values, EPA recommends that within 24 hours the PWS consult with their primacy agency as well as the local public health agency to decide when and how to notify consumers and advise them to use alternate sources of drinking water, and /or issue a 'Do Not Drink/Do Not Boil Water' advisory.

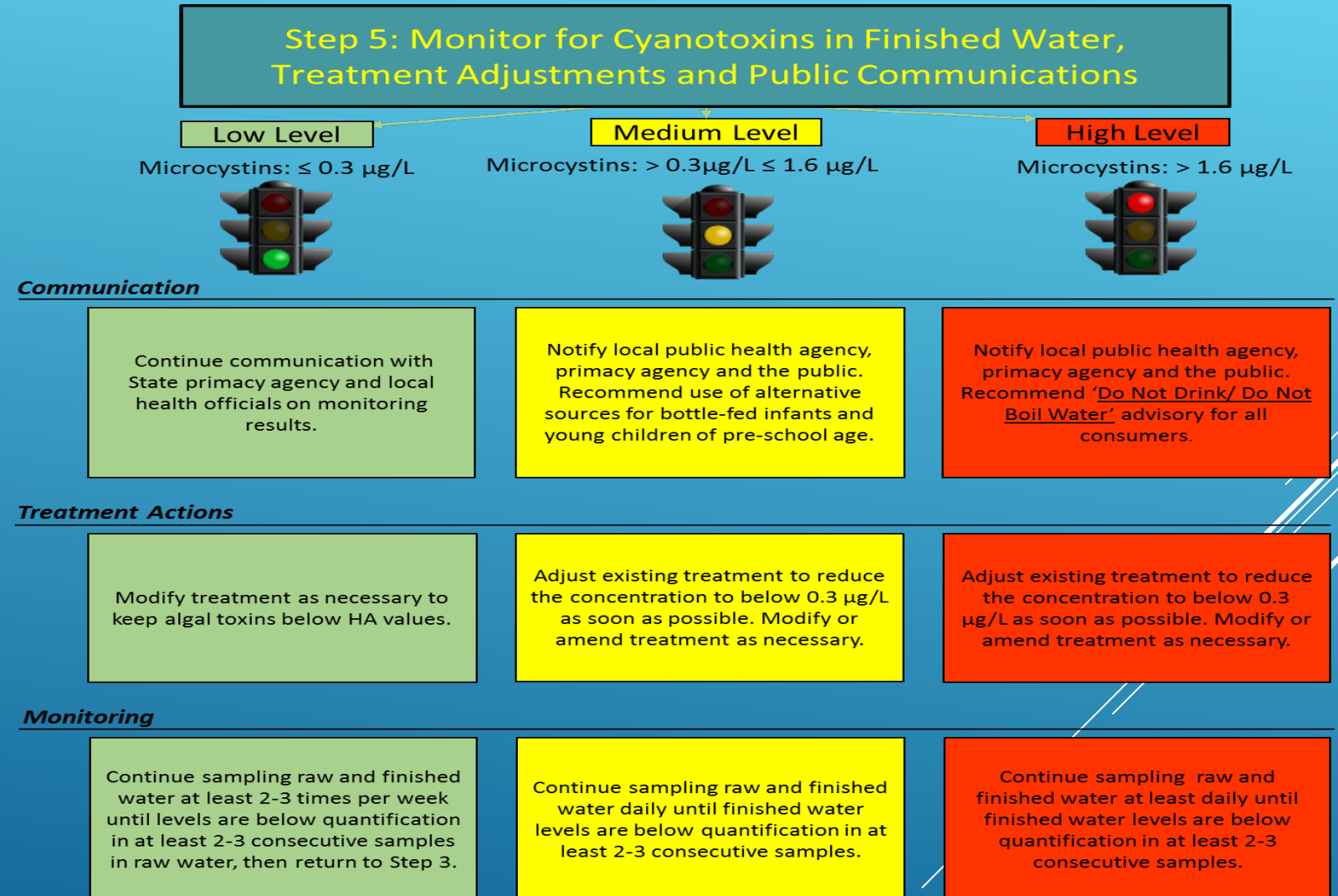


# Are there concerns for breast-fed infants or pregnant women?

- There are no human data to quantify risk to pregnant woman or to evaluate the transfer of cyanotoxins across the placenta.
- Data are also not available on the transfer of cyanotoxins through the milk from nursing mothers.
- Populations such as pregnant women and nursing mothers, may be more susceptible than the general population to the health effects of cyanotoxins.
- As a precautionary measure, individuals that fall into these susceptible groups may want to consider following the recommendations for children pre-school age and younger.

# How to manage cyanotoxins in drinking water?

Stay tuned for information on the recommended steps to manage cyanotoxins in drinking water by Katie Foreman next.



# Contact Information

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EPA CyanoHABs Website  
<https://www.epa.gov/nutrient-policy-data/cyanohabs>

EPA Cyanotoxins in Drinking Water webpage  
<https://www.epa.gov/ground-water-and-drinking-water/cyanotoxins-drinking-water>