CYANOTOXINS IN DRINKING WATER
Frequently Asked Questions

General Information about cyanotoxins and their health effects

What are cyanobacteria and cyanotoxins and where do they come from?
Cyanobacteria (also called blue-green algae) are water-dwelling bacteria that are able to generate their own energy through photosynthesis (process used by plants and other organisms to convert the light energy captured from the sun into chemical energy that can be used to fuel the organism's activities). Under warm, still, or slow moving water conditions with high levels of nutrients like phosphate and nitrogen, cyanobacteria can reproduce very rapidly. This rapid population growth creates “blooms” that can appear as visible scum on the surface of lakes and rivers. Cyanobacteria can grow in both marine and fresh-water, however only fresh-water varieties can grow in lakes and rivers that communities use as sources of drinking water. Cyanotoxins are naturally occurring toxins produced by several species of cyanobacteria under certain conditions. The types of conditions that cause cyanobacteria to produce toxins are not well understood.

At what levels do cyanotoxins in drinking water become a health concern?
There are no federal regulations for cyanotoxins in drinking water, but other states and countries have developed drinking water standards and guidelines for various cyanotoxins. Oregon has adopted provisional health-based guideline values for the four cyanotoxins of greatest concern in our drinking. Drinking water guideline values are designed to be protective of very young children from birth to 5 years of age. All guideline values are designed to protect against acute or short-term exposure effects. Much less is known about the health effects of chronic or long-term exposure to lower concentrations. OHA has not been able to develop specific guideline values that account for health effects from chronic exposure. The four cyanotoxins are; anatoxin-a, cylindrospermopsin, microcystins and saxitoxins (as shown in Table 1). Microcystins and saxitoxins are two classes of cyanotoxins that each include several variations. In cases where microcystins or saxitoxins occur, the Oregon Health Authority (OHA) Drinking Water Section (DWS) recommends measuring total microcystins or total saxitoxins before comparing the sample value against the provisional guideline values (see Table 1).

Table 1. Provisional Health-Based Water Guideline Values for four Cyanotoxins (ppb or µg/L)[1]

Water use	Anatoxin-a	Cylindrospermopsin	Microcystins	Saxitoxins
Drinking water Adults (age 6 and older)	3	3	1.6	1.6
Drinking water Children (age 5 and younger)	0.7	0.7	0.3	0.3
Non-drinking uses (recreation)	20	20	10	10

[1] Cyanotoxins are measured in parts per billion (ppb) or micrograms per liter (µg/L), which are equivalent

How can cyanotoxins affect my health?

The four cyanotoxins affect different target organs and have varying health effects (as shown in Table 2). Generally, cyanotoxins can be broken down into two categories; hepatotoxins (those that target the liver) and neurotoxins (those that target the nervous system). Microcystins and cylindrospermopsin are primarily hepatotoxins, although cylindrospermopsin can also damage the kidney. Anatoxin-a and saxitoxins are neurotoxins.

Table 2. Target organs and health effects of cyanotoxins

Cyanotoxins	Target Organ	Health Effects	Onset of Symptoms Following Exposure
Anatoxin-a	Nervous system	• Numbness or tingling in fingers and toes • Dizziness • Convulsions • Paralysis • Death (in some cases)	Immediate up to 24 hours
Cylindrospermopsin	Liver and Kidneys	• Nausea • Vomiting • Bloody diarrhea • Abdominal pain • Kidney damage • Protein in urine • Blood in urine • Dehydration • Headache	Up to a week
Microcystins	Liver	• Nausea • Vomiting • Diarrhea • Liver damage • Death (in some cases)	Immediate up to 24 hours
Saxitoxins	Nervous system	• Numbness or tingling around mouth • Numbness spreading to arms and hands • Muscle soreness • Muscle weakness • Paralysis • Difficulty breathing • Death (in some cases)	Immediate up to 24 hours

Will I be able to taste or smell a difference in the water if cyanotoxins are present?

Maybe. Cyanotoxins themselves do not have a taste or odor. However, cyanobacteria often (though not always) produce other non-toxic chemical by-products that have a strong taste and

odor. Two of the more common chemical by-products that create tastes and odors include geosmin and 2-methylisoborneol (MIB).

One study in the Midwestern United States found that 91 percent of 23 lakes with toxic cyanobacterial blooms also had taste and odor present in the water. Because cyanobacteria can and sometimes do produce toxins without causing taste or odor problems, you cannot tell whether or not cyanotoxins are present by smelling or tasting the water. However, if you detect taste and odor problems such as geosmin or MIB in the water, there is a very strong likelihood that cyanobacteria are also in the water. Testing the water for the presence of cyanobacteria or cyanotoxins is the only way to know for sure.

Things to know when using water contaminated with cyanotoxins

Can I wash my food with cyanotoxin-contaminated water?
If the level of any of the four cyanotoxins in your drinking water is above the drinking water guideline value in Table 1, you should not use it to wash, prepare or cook your food.

Can I irrigate or water my garden or crops with cyanotoxin-contaminated water?
Yes. Water containing cyanotoxin levels less than the non-drinking water use guideline values (shown in Table 1) can be used for irrigation as long as precautions are taken to make sure no children or animals drink the irrigation water. Allow food crops irrigated with cyanotoxin-contaminated water to dry completely in sunlight before harvesting and eating it. Water should not be used for irrigation if cyanotoxin levels are greater than the non-drinking water use guideline values (Table 1).

What about bathing, showering and brushing my teeth?
Cyanotoxins do not easily enter the body through the skin. Bathing, swimming, showering and brushing teeth with water that has levels less than the non-drinking water use guidelines (Table 1) is safe as long as you avoid swallowing the water. Supervise small children when bathing, swimming, or brushing teeth to ensure that they do not accidentally swallow the water. Don't use water for these purposes if it has cyanotoxin levels are greater than the non-drinking water use guidelines (Table 1).

What about washing dishes, utensils and food preparation areas?
Only a very small amount of water clings to smooth surfaces. Water containing cyanotoxin levels up to the non-drinking water use guidelines (shown in Table 1) may be safely used to wash and sanitize dishes, tables and eating utensils.

What about general cleaning and laundry?
Very little water remains on washed surfaces and in laundered fabrics. Because these articles are not placed in the mouth, water having cyanotoxin levels less than the non-drinking water use guidelines (shown in Table 1) may be safely used for general cleaning and washing of clothing, bedding and linens.

What about my pets?
Dogs are especially sensitive to cyanotoxins. Due to confirmed cases of dog deaths related to exposure to cyanotoxins in Oregon, OHA recommends dogs have the same acute toxicity value

as children 5 years and younger. Do not allow your dogs to drink water that contains cyanotoxins at levels greater than the children specific guideline values (Table 1).

Learning about cyanotoxin levels in your drinking water

How can people on municipal or public water systems learn about the levels of cyanotoxins in their drinking water?
Because cyanotoxins are not federally regulated contaminants, public drinking water providers are not required to routinely monitor drinking water for cyanotoxins. However, OHA's DWS strongly encourages providers who are potentially affected by harmful algae blooms to monitor and test for cyanotoxins weekly until the bloom is gone. The public will be notified if toxin levels are found over the drinking water guidelines (shown in Table 1). If you are concerned about cyanotoxins entering your drinking water, contact your water provider to inquire about testing and results.

What about private surface water intake owners?
If you draw in-home water directly from a river, stream or lake through a private water intake, you will need to watch for signs of cyanobacterial blooms upstream from or near the intake. Testing your water for cyanotoxins is the only way to know for sure if the water is safe to drink. Visit our website to see pictures of a cyanobacterial bloom at: http://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms.

You can sign-up for email notifications from OHA's Harmful Algae Bloom Surveillance Program (HABS) to receive notification whenever a managed Oregon waterbody has a cyanobacterial bloom. If you have identified what you believe to be a bloom upstream from your private water intake, or you want to get your water tested for cyanotoxins in the event of an identified bloom, contact us at: 971-673-0400 or general.toxicology@state.or.us. We can help you decide which toxins to test for and which labs to use.

Removing cyanotoxins from drinking water

For Public Drinking Water System Operators:
Cyanotoxins can be reduced or removed entirely from drinking water, but treatment processes are expensive and require careful maintenance and monitoring. Current treatments proven to reduce cyanotoxins include activated carbon, slow sand filtration, conventional filtration, membrane filtration, advanced UV and ozone. Chlorine can degrade some toxins with increased contact times. If installing additional treatment for your system is not possible, you should consider using a different source for drawing water. Water to be used for drinking, beverage-making or food preparation can be obtained from a known safe source and used on a temporary basis. Non-drinking uses of water pose much less hazard, but are not entirely safe if levels of cyanotoxins are greater than those shown in Table 1.

Not all kinds of treatment are effective, and no single treatment method can remove all contaminants from water. Before deciding on treatment equipment, call for information and advice from OHA DWS at 971-673-0405 or see the algae resources for drinking water website at;

http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Operations/Treatment/Pages/algae.aspx.

Important Information for People with Private Surface Water Intakes:

Can boiling water destroy cyanotoxins?

NO! Boiling contaminated water does not remove cyanotoxins and can, in fact, increase toxin levels.

Are there private well treatment options?

In-home treatment methods have generally not been proven effective in removing cyanotoxins from drinking water. If your water is found to have cyanotoxins at levels greater than the drinking water guidelines (shown in Table 1), OHA recommends finding an alternate source of drinking water until the cyanobacterial bloom responsible for the toxins subsides.

Where can I get more information?

Private surface water intake owners that have questions and concerns about cyanotoxins in their water may contact the Oregon Public Health Division at 971-673-0400, or by email at general.toxicology@state.or.us. Or visit our website at: http://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms.

US EPA (Environmental Protection Agency) – Cyanobacteria website: http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/cyanohabs.cfm

CDC (Centers for Disease Control and Prevention) Harmful Algae Bloom website: http://www.cdc.gov/nceh/hsb/hab/default.htm