Appendix E. Glossary

A

ADDA
The L-amino acid ((2S,3S,8S,9S)-3-amino-9-methoxy-2,6,8-trimethyl-10-phenyldeca-4,6-dienoicacid) that is responsible for microcystin and nodularin molecule's hepatotoxic activity.

Aerosolized
Something that is dispersed as an aerosol; a suspension of liquid or solid particles in a gas.

Akinete
An enveloped, thick-walled, nonmotile, dormant cell formed by filamentous, heterocyst-forming cyanobacteria. These cells are resistant to cold and desiccation and will germinate into new cyanobacterial cells under favorable growth conditions.

Algae
Plural of alga. Algae is a common term used to describe a highly variable group of photosynthetic organisms, often aquatic, that lack true stems, leaves, roots, and flowers. This term is applied to several taxonomic groups, including cyanobacteria.

Algaecide/Algaestatic
Compounds that kill or prevent growth of algae and cyanobacteria.

Allelopathy
The process of inhibiting competitors or grazers through the production of compounds.

Anatoxins
A cyanobacterial toxin class; the most well-known is anatoxin-a. These toxins consist of a bicyclic alkaloid that targets the central nervous system (neurotoxin). An analogue (homoanatoxin-a) and other structural variants have been identified.

Anatoxin-a(s)
Now known as guanitoxin. This toxin was originally associated with *Anabaena*, now associated with *Dolichospermum* and *Sphaerospermopsis*. This cyanobacterial toxin is a guanidine methyl phosphate ester that can target nervous systems (neurotoxin) by irreversibly binding to the acetylcholinesterase enzyme. It causes symptoms including excess salivation.

Aplysiatoxin
A cyanobacterial toxin that is considered to be a dermatoxin, as well as a potential carcinogen, based on primary impacts to the skin. The overall toxin class is referred to here as "aplysiatoxins."

B

Bacteria
Single-celled, microscopic organisms that lack cell walls and an organized nucleus (prokaryotes). They are found in every habitat on the planet. Some are photosynthetic.

Bacteriophage
Viruses that infect bacteria, rather than eukaryotic cells, such as animals.

Benthic
Refers to the bottom of lakes, rivers, and other water bodies. When referring to cyanobacteria, it means those that form mats on sediment surfaces, as well as those that attach to pebbles, cobbles, boulders, and other hard surfaces (for comparison, see Planktonic).

Benthic zone
The region at the bottom of a water body.

Benthos
Organisms that live on or in the bottom of a body of water.

Beta-methylamino-L-alanine (BMAA)
Non-protein amino acid produced by some cyanobacteria that is hypothesized to be a neurotoxin linked to the development of neurodegenerative diseases in humans. This hypothesis is still under investigation and has not been uniformly accepted by the scientific community.

Bioaccumulation
Net accumulation of a contaminant (such as cyanotoxins) in or on an organism from all sources, including water, air, and diet or food sources.

Bioaccumulation factor (BAF)

A ratio of the concentration of a compound in one media compared to another, such as water to tissue.

Biofilm
Microbial growth on a surface. Essentially the same as “periphyton,” but biofilm is more common in engineering or medical applications to describe nonphotosynthetic bacteria growing on a surface.

Biological oxygen demand (BOD)
Biological oxygen demand is the amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter under aerobic conditions at a specified temperature.

Biomass/Biovolume

Respective mass or volume of cells in a unit (for example, volume of water (mg/mL) or spatial area (mg/cm^2). Typically calculated to determine the relative abundance of co-occurring phytoplankton of varying shapes and sizes.

Bloom
A rapid proliferation of algae or cyanobacteria. In the case of cyanobacteria, this term is also used to refer to dense accumulations of these populations, such as a wind-driven scum or benthic mats floating to the surface.

Blue-green algae
A historic term used to describe cyanobacteria. The blue-green color of certain species of cyanobacteria is due to the pigment phycocyanin, hence the common use of the term “blue-green algae.”

Boundary layer
The area above a surface where the velocity of a fluid is less than the free-stream velocity far above the surface.

C

Caddisfly
Common aquatic insect (order Trichoptera) with a life history comprising aquatic larvae and terrestrial adults.

Carbon-concentrating mechanism
Complex systems and structures of proteins and enzymes used by aquatic photosynthetic organisms to acquire inorganic carbon, which will be synthesized into organic molecules for cellular growth and maintenance.

Carboxysome
Protein-shell microcompartment inside cells used in the process of transforming inorganic carbon into organic carbon.

Chlorophyll
The green pigment used for photosynthesis by all land and aquatic plants, algae, and cyanobacteria (for comparison, see Phycocyanin).

Colony/Colonial
A group of loosely or tightly associated, genetically identical cells that may exist as a unit in the environment.

Congener
The structural variant of a specific cyanotoxin with similar chemical structure and toxicological effects. The term “structural variant” is used in this guidance for congeners and analogues.

Cyanobacteria
A group of photosynthetic prokaryotic microorganisms. Cyanobacteria are often referred to as blue-green algae, but they are taxonomically distinct from true algae or plants. Cyanobacteria are currently considered more similar to gram-negative bacteria.

Cyanopeptides
Nitrogen-containing compounds similar to microcystin, but far less studied, that include cyanopeptolins, anabaenopeptins, microginins, aeruginosins, and aerucyclamide. Many of these compounds can inhibit cellular functions as frequently and at similar nanomolar concentrations in surface waters as more commonly known cyanotoxins.

Cyanotoxin
Toxin produced by cyanobacteria. These toxins include liver toxins (hepatotoxin), nerve toxins (neurotoxin), and skin toxins (dermatoxin). Also sometimes referred to as algal toxin.

Cylindrospermopsin (CYN)
Cyanobacterial toxins that are tricyclic alkaloids and considered to be hepatotoxins based on primary impacts to the liver. They may also be considered cytotoxins (lyse cells) due to impacts on other organs as well. Several structural variants have been identified, and the toxin class is referred to here as “cylindrospermopsins.”

D

Dermatoxin
Toxin with a primary target of the skin.

Designated use
A legally binding definition that identifies an activity or purpose (“fishable/swimmable”) for a water body. To learn more, see Section 2 of the EPA Water Quality Standards Handbook: https://www.epa.gov/sites/default/files/2014-10/documents/handbook-chapter2.pdf.

Drag
The force acting in the opposite direction to a moving object. Drag is the combination of the friction generated by the shape and surface of the object.

E

Ecosystem
A biological community of interacting organisms and their physical environment.

Eddy
A circular movement of water, counter to a main current, causing a small whirlpool.

Endosymbiosis
Symbiosis in which one organism lives within the body or cell of another organism.

Enzyme-linked Immunosorbent Assay (ELISA)
Quantitative antibody- or antigen-based tests, including those for cyanobacterial and algal toxins.

Enumeration
Laboratory method in which microscopic organisms, including cyanobacteria, are quantified by microscopy. Results are usually reported as cell densities (cells/mL) but may also be reported as natural units per unit of volume, such as colonies, filaments/trichomes, or single cells that are an organism’s usual growth form.

Epilimnion
A well-mixed, less dense layer of water near the surface in thermally stratified water bodies. It generally overlies denser, colder waters.

Epiphytic
Growing on the surface of an aquatic plant/algae.

Eukaryotic
Referring to organisms, either microscopic or macroscopic, that have a membrane-bound nucleus and organelles (for comparison, see Prokaryotic).

Eutrophic (Eutrophication)
A water body with high nutrient concentrations (nitrogen, phosphorus, trace minerals) that supports high rates of primary production and potential accumulation of phytoplankton and plant biomass.

Extracellular
Present outside cells. In this document, “extracellular” is typically used in reference to cyanotoxins that have been released from cells (for comparison, see Intracellular). Also sometimes referred to as “dissolved.”

Extracellular polymeric substance (EPS)
Long-chain (polymer) molecules produced by microorganisms. The molecules are excreted outside the cells (extracellular) and accumulate in the environment, forming a mucilaginous covering around the cell. As the EPS production increases, the EPS matrix provides the core structure to many attached biofilms and mats.

F

Filament
Formed by single algae cells that are joined to create a chain or filament. A common morphology of many cyanobacteria. Also known as “trichome.”

G

Gas vesicles
Gas-filled structures in some prokaryotes that can regulate buoyancy.

Glutaraldehyde

A potent solution used to preserve field and laboratory samples for microscopy, such as samples for cyanobacteria identification and enumeration.

Guanitoxin
Currently proposed name for the neurotoxin originally named anatoxin-a(s).

H

Harmful cyanobacterial bloom (HCB)
A rapid proliferation of cyanobacteria where there is an elevated risk to human or animal health due to the production of cyanotoxins and other cyanobacteria-related effects. This term is also used to refer to dense accumulations of cyanobacteria, such as a wind-driven scum or populations at depth, including those on the bottom (benthic mats) that may float to the surface.

Hepatotoxin
Toxin with a primary target of the liver. For cyanotoxins, the most common example is microcystin and its structural variants.

Heterocyte
A specialized nitrogen-fixing cell formed by some cyanobacteria. Nitrogen fixation is very sensitive to oxygen, and the heterocyte structure creates an oxygen-free space. May also be referred to as a “heterocyst” in some cyanobacterial literature.

Hypolimnion
A dense, cold layer of water near the bottom of thermally stratified water bodies where biotic and chemical processes may result in oxygen depletion and internal loading of nutrients.

I

Inorganic
A compound that lacks carbon-hydrogen bonds, though the distinction between organic and inorganic compounds is not clearly defined.

Intracellular
Present within cells. In this document, typically used in reference to cyanotoxins within cyanobacterial cells (for comparison, see Extracellular).

L

Lipopolysaccharide (LPS)
Large molecules containing a lipid and a polysaccharide that are a component of the outer membrane of mainly gram-negative bacteria and cyanobacteria. These molecules may cause irritation to the skin, eyes, ears, and gastrointestinal system.

Littoral (zone)
The nearshore area of a lake where ample sunlight penetrates the water column to the sediments and allows aquatic plants and benthic algae to grow.

Lugol’s solution
An aqueous solution of iodine and potassium iodide that is used as a fixative for staining and short-term storage of phytoplankton samples for microscopy. For longer term sample storage, a preservative like glutaraldehyde or formaldehyde should be added.

Lyngbya wollei toxin (LWT)
Cyanotoxin that acts similarly to saxitoxin and is consider a paralytic shellfish toxin. Distinct chemical structure and mode of action compared to lyngbyatoxin (a dermatoxin).

Lyngbyatoxin
A cyanotoxin that is a potential carcinogen and a known dermatoxin.

Lyse (Lysed, Non-lysed)
To disrupt a cell membrane and therefore destroy a cell, releasing its contents into the environment.

M

Macrophyte
Aquatic plants growing in or near water. They may be emergent (i.e., with upright portions above the water surface),

submerged, or floating.

Mat
A sheet-like accumulation of cyanobacteria that develops on sediments, rocks, plants, or other surfaces in aquatic habitats. The term is used in this document to mean periphyton or biofilm that is large and thick enough to be visible without a microscope.

Matrix
The set of conditions in which something develops or forms, such as the diversity of molecules, particles, cells, and environmental conditions that exist within benthic mats.

Mayfly
Common aquatic insect (order Ephemeroptera) with a life history comprising aquatic larvae and terrestrial adults.

Metalimnion
In a stratified lake, the middle layer of water where temperature decreases rapidly with depth (thermocline). This layer prevents mixing of the upper, warmer epilimnion layer and the lower, colder hypolimnion layer. It acts as a barrier for oxygen diffusion from the surface downward and nutrient diffusion upward.

Metaphyton
Loosely attached, floating, and suspended algae and cyanobacteria that accumulates in shallow areas of water bodies. May consist of detached algae and cyanobacteria that have been transported by waves, wind, and currents to accumulate along the shore or in macrophyte beds.

Microcystin(s) (MCs)
These cyanobacterial toxins are monocyclic heptapeptides and considered to be hepatotoxins, based on primary impacts to the liver. The overall toxin class is referred to here as “microcystins.” Globally, microcystins are the most commonly occurring cyanobacterial toxins. As of 2020, more than 200 structural variants (with different accessory amino acids) of microcystin have been identified. Microcystins are abbreviated as MC- followed by two letters designating the structural variant—for example, MC-LR, which contains leucine (L) and arginine (R).

Micronutrient
A substance, such as a vitamin or mineral, that is essential in minute amounts for the proper growth and metabolism of a living organism. Common micronutrients for algae and cyanobacteria include iron, zinc, copper, cobalt, and vitamin B12.

Morphological
The physical features of an organism.

Motile
Capable of motion.

N

Neurotoxin
Toxin with a primary target of the nervous system. The four major neurotoxic cyanotoxins (with their variants) are anatoxin-a, guanitoxin/anatoxin-a(s), saxitoxin, and possibly BMAA.

Nitrogen fixation
The process of transforming nitrogen in the atmosphere into molecular forms that can be assimilated into organic molecules for cellular growth and maintenance.

Nutrient
A substance that an organism requires to grow. Nutrients are often divided into two classes, macronutrients and micronutrients. Macronutrients are needed in larger quantities for growth and survival. For algae, macronutrients are considered carbon, hydrogen, nitrogen, phosphorus, and sulfur.

O

Oligotrophic
A water body with low nutrient concentrations.

Organic
In general, molecules and compounds that contain carbon molecules and are synthesized or generally used by living organisms.

P

Paralytic
Relating to paralysis.

Periphyton
Microbial (algae, cyanobacteria, other bacteria, etc.) growth on a submerged surface. Essentially the same as “biofilm.” Periphyton has a long history in aquatic sciences, while biofilm is more common in engineering or medical contexts to describe nonphotosynthetic bacteria growing on a surface.

Photosynthesis/Photosynthetic
The biochemical process in which cyanobacteria, algae, and plants use solar energy to convert carbon dioxide and water to carbohydrates and oxygen.

Phycocyanin Pigment/Phycocyanin
Blue-green, water-soluble pigment that gives blue-green algae, or cyanobacteria, their name. Phycocyanin is an accessory pigment that assists the chlorophyll molecule in capturing light for photosynthesis.

Phycoerythrin
One of several accessory pigments that assist the chlorophyll molecule in capturing light for photosynthesis. They are found in some cyanobacteria, as well as cryptophytes and red algae.

Phytoplankton
A general term referring to the small photosynthetic organisms floating in open areas of water. Phytoplankton may be unicellular or multicellular and prokaryotic or eukaryotic. Phytoplankton communities commonly include cyanobacteria and algae.

Plankton/Planktonic
Organisms that live suspended in the water column with limited powers of locomotion and instead rely on drift by the tides, currents, and wind (for comparison, see Benthic).

Polymeric
Adjective of “polymer,” a chemical compound or mixture of compounds formed by polymerization and consisting essentially of repeating structural units.

Pore space
The space between mineral particles in sediments that is occupied by either air or water.

Pore water
The water found between particles of soil, sediment, or rocks.

Primer
Short strands of nucleic acids that are specific to individual taxa.

Prokaryotic
Referring to microscopic, single-celled organisms lacking a membrane-bound nucleus and organelles. Includes bacteria and cyanobacteria (for comparison, see Eukaryotic).

R

Remote sensing
The use of satellites, airplanes, drones, buoys, floating sensor packages, or underwater data collectors to observe and obtain information about the earth’s surface and aquatic systems.

Respiration
The physical and chemical processes that produce energy in living cells. An electron acceptor, such as oxygen, is needed for this process, and waste products, such as carbon dioxide, are produced. Though cyanobacteria produce oxygen through photosynthesis during the day, they also respire and can rapidly remove oxygen from the water at night when very large blooms are present.

Risk communication
The formal and informal process of communication among and between regulatory agencies and organizations responsible for risk assessment and management and the various parties that are potentially at risk from or are otherwise interested in the information. Risk communication includes actions, words, and other messages that are responsive to the concerns and values of its recipients, and it is intended to help people make more informed decisions about threats to their health and safety.

S

Saxitoxin (STX)
Cyanobacterial toxins that are highly polar, nonvolatile, tricyclic perhydropurine alkaloids. The overall toxin class is referred to here as “saxitoxins.” They target the central nervous system (neurotoxins) by binding to sodium channels. Also known as “paralytic shellfish poisons/toxins (PSP/PST),” because these toxins can accumulate in marine shellfish and cause paralytic shellfish poisoning in humans that consume them.

Secondary metabolite
Small organic molecules produced by an organism that are not currently known to be essential for their growth, development, or reproduction.

Senescence
The state of being old and the life stage from full maturity to death.

Source water
Groundwater or surface water body that provides water to public drinking water supplies or private wells. For public drinking water, surface-sourced water (and some groundwater under the influence of surface water) requires filtration, disinfection, and other treatment, and finished water is distributed to consumers. Regulation of public water suppliers is mandated through the federal Safe Drinking Water Act.

Sp./Spp.
Abbreviations for a single species (sp.) or multiple species within a genus (spp.).

Stratification/Stratified
The division of the vertical water column into distinct layers of different densities due to variations in salinity or temperature. Stratification due to temperature is referred to as thermal stratification, frequently observed in deep lakes.

Structural variant
Cyanotoxins with similar chemical composition and toxicological effects. Also sometimes referred to as “congener” or “analogue.”

Substrate
The surface or material on or from which an organism lives, grows, or obtains its nourishment.

Surfactant
A compound added to induce aggregation of particles by reducing the surface tension between them, such as polyaluminum chloride or chitosan. These help in flocculating particles, including cells.

T

Taste and odor compounds
Several cyanobacteria and some diatoms produce compounds, including geosmin and methylisoborneol, that impart unsavory taste and odor to drinking water or fish tissue.

Taxa
Plural of taxon—a unit to classify organisms together, such as species, genus, class, order, or phylum.

Taxonomy (Taxonomist)
The science of classifying and identifying organisms into specific categories based on internal and external morphologies and, more recently, genetic information.

Thermocline
A thin, distinct layer of water between the well-mixed upper and lower waters (the epilimnion and hypolimnion, respectively) in a thermally stratified water body (see also Metalimnion).

Toxicity threshold
A concentration (level or dose) of a toxin that must be exceeded for an adverse health effect to be expected during typical exposure scenarios. Values are generally expressed as a concentration (amount of toxin per unit; volume or biomass ingested).

Toxigenic
Capable of producing toxin or toxic effect.

Toxin
A poisonous substance that is a specific product of the metabolic activities of a living organism.

Toxin class
Group of cyanotoxins including structural variants with similar structure and mode of action. In this document this includes

microcystins, anatoxins, saxitoxins, cylindrospermopsins, and aplysiatoxins.

Turbid/Turbidity
A description or measure related to water clarity due to the concentration of suspended particles in the water.

Turbulence/Turbulent
Fluid motion characterized by unpredictable and chaotic speed and direction of flow. The irregular flow is characterized by spiraling and vertical water velocities.

U

Uncertainty factor
Component of toxicity threshold equations, which may account for limitations of underlying assumptions or applicability of research studies.

W

Water column
A vertical expanse of water extending between the surface and the bottom of a water body.

Water quality standards (WQS)
Provisions of state, territorial, authorized tribal, or federal law approved by USEPA that describe the desired condition of a water body and the means by which that condition will be protected or achieved. See the USEPA website for more information on developing WQS at https://www.epa.gov/standards-water-body-health/what-are-water-quality-standards. USEPA's Water Quality Standards Academy is a free online tool to help you understand the key concepts of the Water Quality Standards: https://www.epa.gov/wqs-tech/water-quality-standards-academy.