



Algal Toxins

WHAT ARE ALGAL TOXINS?

Algal toxins, aka cyanotoxins, are a group of naturally occurring, organic compounds produced by cyanobacteria, also called blue-green algae. Blue-green algae are photosynthetic bacteria that are present in low levels in fresh and marine waters. While low levels of blue-green algae are normal, excessive cyanobacteria growth can occur during certain environmental conditions, such as, high nutrient loads, significant sunlight, and warm temperatures. The most commonly detected algal toxins in California are microcystins.

HOW IS ONE EXPOSED TO ALGAL TOXINS?

Exposure to algal toxins mainly occurs from ingestion or inhalation of aerosolized toxins in recreational water. Cyanotoxins are rarely found in drinking water due to treatment processes.

WHAT ARE THE RISKS OF ALGAL TOXINS?

Algal toxins can have various levels of toxic effects depending on the type of toxin, and the levels and duration of exposure. Health effects from exposure to algal toxins in drinking water include gastroenteritis, and liver and kidney damage.

Adverse health impacts, which are rare, have been reported elsewhere from algal toxins in drinking water associated with algal blooms in source water reservoirs. However, while at times algal toxins are present in the SFPUC reservoirs, **they have never been detected in the SFPUC drinking water we deliver.**



Calaveras Reservoir with blue-green algae on surface

HOW CAN I REDUCE POTENTIAL EXPOSURE TO ALGAL TOXINS?

RECREATIONAL WATER:

People can reduce potential exposure to algal toxins by not swimming in waters with high levels of algae (i.e., green water) and not allowing pets to swim or drink water that shows signs of algal growth. In addition, the State of California has an algal toxin advisory program for recreational waters and posts affected water bodies on a website: mywaterquality.ca.gov/habs/where/freshwater_events.html

DRINKING WATER:

Drinking water that is delivered by utilities rarely contains algal toxins as proper treatment will effectively remove algal toxins. SFPUC has high quality water sources and state-of-the-art treatment systems. SFPUC has never detected algal toxins in treated drinking water.

HOW ARE FEDERAL AND STATE REGULATORS RESPONDING TO ALGAL TOXINS IN DRINKING WATER?

Currently, there are no federal or state standards to regulate algal toxins in public water systems, however, in 2015, the United States Environmental Protection Agency (USEPA) issued drinking water health advisories (HAs) for two algal toxins, microcystins and cylindrospermopsin. The HA for microcystins is 0.3 µg/L for children and 1.6 µg/L for others and the HA for cylindrospermopsin is 0.7 µg/L for children and 3.0 µg/L for others. These USEPA advisories apply to fully treated drinking water, not raw reservoir water that has not been treated.

USEPA's Unregulated Contaminant Monitoring Rule 4 (UCMR 4) requires utilities to monitor treated drinking water for algal toxins between 2018 to 2020. SFPUC completed the required UCMR 4 monitoring in 2018 and no algal toxins were detected.

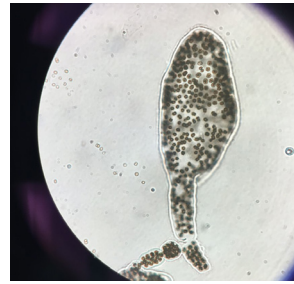
ALGAL TOXIN MONITORING BY SFPUC

SFPUC regularly monitors levels of blue-green algae in source waters and takes precautions to minimize the effect of algal blooms on the drinking water supply. Utilities can control algal toxins in drinking water by various methods, such as, withdraw water from source reservoir at depths with little to no algae/toxins, do not use reservoir with bloom and draw water from another source, apply treatments to reservoir to control algal blooms, treat water with an oxidizing disinfectant (ozone or chlorine), or remove with activated carbon.

In addition to UCMR 4 monitoring, SFPUC has conducted voluntary, proactive algal toxin monitoring at reservoirs and treatment plants since 2007 and on a routine basis since 2015. Monitoring of SFPUC's pristine Hetch Hetchy Reservoir in Yosemite National Park has shown an absence of both blue-green algae and algal toxins. For SFPUC's West Bay reservoirs, SFPUC is conducting baseline monitoring to assess the need, if any, for routine algal toxin monitoring. For SFPUC's East Bay reservoirs, SFPUC developed a monitoring and response plan for the reservoirs and treatment plant which includes biweekly to weekly monitoring of microcystins and quarterly monitoring of cylindrospermopsin, and saxitoxin.

The only toxin that has been detected in SFPUC's local reservoirs is microcystins. Microcystins has been detected up to 23 µg/L near the surface of Calaveras Reservoir in the East Bay, and generally peaks during fall months. Microcystins is typically not detected in the deeper waters that are used by the treatment plants, and microcystins has never been detected in treated drinking water. The SFPUC added powdered activated carbon (PAC) in 2018 and is expected to add ozone treatment in 2025 for East Bay reservoir supplies. Algae and algal toxins are not found in groundwater.

A summary of algal toxin monitoring by SFPUC is provided in SFPUC's triennial Contaminants of Emerging Concern (CEC) Report, 2019 Progress Update (www.sfwater.org/Modules/ShowDocument.aspx?documentID=13956).



*Blue-green algae
Microcystis from
Calaveras Reservoir, as
viewed by microscope
(A. Irons, SFPUC, 2015)*

CONSUMER RESOURCES: REGULATION/HEALTH

- SFPUC: Annual Water Quality Report
www.sfwater.org/index.aspx?page=634
- SFPUC: Webpage on Contaminants of Emerging Concern
www.sfwater.org/index.aspx?page=647
- SFPUC: 2019 Progress Update, Contaminants of Emerging Concern
www.sfwater.org/Modules/ShowDocument.aspx?documentID=13956
- State Water Resources Control Board (SWRCB): Cyanobacteria and Cyanotoxins in Drinking Water
www.waterboards.ca.gov/drinking_water/programs/habs/
- California Water Quality Monitoring Council: HAB Incidents Report Map
www.mywaterquality.ca.gov/habs/where/freshwater_events.html
- Nanoplastic should be better understood. Nature Nanotechnolog Volume 14, page 299 (2019)
<https://www.nature.com/articles/s41565-019-0437-7>
- USEPA: Managing Cyanotoxins in Public Drinking Water Systems
www.epa.gov/ground-water-and-drinking-water/managing-cyanotoxins-public-drinking-water-systems
- CDC: Harmful Algal Bloom – Associated Illness
www.cdc.gov/habs/index.html
- WHO: Toxic Cyanobacteria in Water
www.who.int/water_sanitation_health/publications/toxiccyanobact/en/

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