



FACT SHEET

Algal Toxins/Algal Blooms

[December 2015]

GENERAL OVERVIEW

Algal toxins, or 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 water and are essential to the aquatic biology of water. Excessive cyanobacteria growth can occur in certain conditions where water is warm and environmental factors, such as high nutrient loads in source water. These conditions make it possible for algal blooms to occur thereby increasing the likelihood of algal toxins to be present in lakes, rivers, streams, and reservoirs. In addition, the presence of cyanobacteria in source water can affect the taste and odor of drinking water delivered to customers. Although there are no current regulatory standards for cyanotoxins, the United States Environmental Protection Agency (USEPA) has developed health advisories as guidance for public water systems to evaluate and monitor for algal toxins that are linked to human and animal illness. As unregulated contaminants, algal toxins fall into the category of “contaminants of emerging concern (CEC)”. Most recent evaluation of CEC groups by SFDPH and SFPUC in 2013 deemed algal toxins to be a medium priority for SFPUC and recommended to continue watershed management activities that reduce nutrient loads, implement as-needed measures to reduce toxin-producing algae, and develop a protocol to monitor and evaluate the occurrence and decay of algal toxins. Generally, SFPUC has protected watersheds and high water quality sources, which result in bloom levels that are much lower than in other water supplies.

SOURCES

Blue-green algae are naturally occurring and found in all surface waters. They are more abundant in warm water if nutrient supplies are sufficient to support growth. Algal blooms, or rapid growth, occur when water is warm, slow-moving, and nutrient-rich during the late summer or early fall and may produce algal toxins. The following blue-green algae types are commonly found in SFPUC’s reservoirs: *Aphanizomenon*, *Anabaena*, *Coelosphaerium*, *Lyngbia*, *Microcystis*, and *Oscillatoria*. The most commonly detected algal toxins in California are microcystin and anatoxin-a. 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. If the drinking water is contaminated by a toxic cyanobacteria bloom exposure occurs primarily through ingestion.

MONITORING AND TREATMENT

Currently, there are no federal standards to regulate algal toxins in public water systems; however, the USEPA recently issued health advisory values not to exceed the following levels

0.3 µg/L for microcystin and 0.7 µg/L for cylindrospermopsin in drinking water for children younger than school age. The levels for all other ages are not to exceed 1.6 µg/L for microcystin and 3.0 µg/L for cylindrospermopsin based on exposure over a ten-day period. In addition, the following cyanotoxins were included in USEPA's 2014 Contaminant Candidate List for regulatory determination: anatoxin-a (neurotoxin), cylindrospermopsin and microcystin-LR (liver-damaging hepatotoxins). The lack of standard analytical methods and certified toxin standards prevents USEPA from making regulatory determinations and establishing guidelines for algal toxins in drinking water. Prior to this health advisory, the State of California recommended using the World Health Organization's (WHO) health-based guideline of 1 µg/L based on a lifetime of daily exposure for microcystin-LR in drinking water.

The SFPUC conducted preliminary monitoring for algal toxins at reservoirs and treatment plants and results from investigations in 2007 and 2010 were well below international health-based guidelines for drinking water. During October/November 2011, cylindrospermopsin was found at 76 µg/L in the raw (i.e., untreated) water at one of local reservoirs; however, that reservoir was not utilized for drinking water delivery to customers during this period. The high cylindrospermopsin levels were due to an algal bloom caused by the cyanobacteria *Anabaena*. SFPUC has recently in 2015 implemented a new algal toxin monitoring program to better understand their occurrence and effectiveness of existing treatment processes.

The SFPUC regularly monitors levels of blue-green algae in source waters and takes precautions to control and minimize the effect of algal blooms on the drinking water supply. Utilities can control algal toxins in drinking water by various methods: withdraw water from source reservoir at depths with little to no algae/toxins, take reservoir out of service (draw water from another source), apply reservoir treatments to control for algal blooms, treat water with an oxidizing disinfectant (ozone or chlorine) or remove with activated carbon. **To date, there were no detections of algal toxins in treated drinking water in our system.**

HEALTH CONSIDERATIONS

Algal toxins have various levels of toxic effects on wildlife and humans depending on the composition of the organic compound, length and levels 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; however, this has not occurred within the SFPUC drinking water system.

SFPUC has occasionally experienced clogged filters at treatment plants and taste and odor complaints from customers that may be associated with algal blooms. The SFPUC limnologists

monitor the reservoirs supplying drinking water to detect and control algal growth prior to the onset of an algal bloom. SFPUC has high quality water sources and protected watersheds, which result in bloom levels that are much lower than in other water supplies.

REFERENCES

SFPUC: "Annual Report"

<http://sfwater.org/index.aspx?page=634>

SFPUC: "Contaminants of Emerging Concern"

<http://sfwater.org/Modules/ShowDocument.aspx?documentID=5475>

USEPA: "Drinking Water Health Advisory for Two Cyanotoxins"

<https://www.federalregister.gov/articles/2015/06/17/2015-14936/availability-of-health-effects-support-documents-and-drinking-water-health-advisories-for>

USEPA: "Cyanobacterial Harmful Algal Blooms"

<http://www2.epa.gov/nutrient-policy-data/cyanohabs>

USEPA: "Guidelines and Recommendations" and "More Information"

<http://www2.epa.gov/nutrient-policy-data/guidelines-and-recommendations>

CDC: "Harmful Algal Blooms"

<http://www.cdc.gov/nceh/hsb/hab/>

State Water Resources Control Board (SWRCB): "Blue-Green Algae and Harmful Blooms"

http://www.waterboards.ca.gov/water_issues/programs/bluegreen_algae/

SWRCB: "Action Levels for Blue Green Algae Toxins"

http://www.waterboards.ca.gov/water_issues/programs/peer_review/peer_review_cyanotoxins.shtml

WHO: "Toxic Cyanobacteria in Water"

http://www.who.int/water_sanitation_health/resourcesquality/toxcyanbegin.pdf

WHO: "Guideline for Microcystin"

http://www.who.int/water_sanitation_health/dwg/chemicals/microcystin/en/

CONTACT US

If you still have concerns about the quality of water and would like to report emergency water quality issues, please call our 24-hour hotline at 3-1-1 (within SF only) or 415-701-2311. You can also visit <http://www.sf311.org/>.