KITSAP PUBLIC
HEALTH DISTRICT

345 6th Street, Suite 300
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March 27, 2017

Eric Baker, Policy Manager
Kitsap County Board of Commissioners
614 Division Street
Port Orchard, WA 98366

RE: LONG LAKE CYANOTOXIN INFORMATION

Dear Mr. Baker,

The Kitsap Public Health District (KPHD) is writing to provide information about cyanobacteria, cyanotoxins, and the history of KPHD advisories for Long Lake as you requested. Please see the following data summary:

Cyanobacteria

Cyanobacteria, also known as blue-green algae, are photosynthetic, unicellular bacteria that are ubiquitous in surface waters worldwide. When water conditions are conducive for growth, cyanobacteria cells can multiply in waters to collectively form a "bloom," known as a cyanobacteria harmful algal bloom (CHAB). CHABs are visible and can resemble paint on the water.

Cyanobacteria can encase toxins in their cellular walls, releasing the toxins when the cell dies or if their cell wall ruptures [1]. The bacteria can also produce a suite of secondary metabolites, of which toxins are included [2]. The toxins, called cyanotoxins, are harmful to humans and are responsible for documented pet, livestock, and wildlife illnesses and deaths due to ingestion of contaminated waters. The cyanobacterial toxins of concern in Washington State lakes are microcystins and anatoxin-a [3].

Health effects of cyanotoxins

Exposure to cyanotoxins can occur around any affected waterbodies that are used for recreation, drinking, or agriculture. The most likely pathways of exposure to toxins are skin contact, ingestion, and inhalation [3]. The symptoms of toxicity from cyanobacteria vary by toxin type and depend on exposure route and dosage.

- **Skin contact:** People visiting a waterbody while a CHAB is in-progress is at risk for direct contact of toxins through skin contact. Examples of activities that will increase risk are swimming, fishing, and wading in the water.

- **Ingestion:** Ingestion (or incidental ingestion) of an impaired water body can occur through recreational activities (such as water-skiing) [5], food (fish from a waterbody with a CHAB may have eaten toxic cyanobacteria) [6], drinking water, and nutritional supplements (toxic species may be accidentally collected with targeted algal species) [7]. Furthermore, pets and wildlife are at greater risk for toxin effects because they can swallow cells while grooming themselves, drink contaminated water, eat toxic fish from the waterbody, and do not know to avoid the contaminated water.

- **Inhalation:** People may be exposed to toxins without going into the water by breathing in aerosolized contaminated water [4]. Water can become aerosolized through land irrigation, recreational activities, and wind or wave action.

Adverse health effects from microcystin toxins can include abdominal pain, vomiting, diarrhea, liver inflammation and hemorrhage, acute pneumonia, acute dermatitis, kidney damage, and tumor growth promotion [5]. Toxin effects can present as tingling, burning, numbness, drowsiness, incoherent speech, salivation, and respiratory paralysis that leads to death [5]. The effects from each of the cyanotoxins can take place within minutes to days following exposure.

Cyanobacteria at Long Lake

The Kitsap Public Health District (KPHD) began monitoring cyanobacteria in the mid-1990s. Toxin analysis was contracted through a private lab between 1995 through 2007, and transitioned to analysis through the King County Environmental Laboratory contracted by the Washington State Department of Ecology in 2007. Reported toxin levels only include two of four common toxins found in cyanobacteria, microcystin and anatoxin-(a). The two other common cyanobacteria toxin types, saxatoxin and anatoxin-(b), do not have established laboratory techniques that efficiently quantify toxin concentration levels.

The “Potentially Toxic Algae Advisory” language is used to describe the condition of an active cyanobacteria bloom in the lake and the presence of toxins has not been confirmed. This condition is no less dangerous to human or animal health than a “Toxic Algae Advisory” due to the inability to test for all toxins associated with cyanobacteria blooms as stated previously.

A summary of cyanobacteria advisories is shown in Table 1. When looking at this table, it is important to note that there was a change of analysis method in 2007.

TABLE 1. A HISTORY OF KPHD CYANOBACTERIA ADVISORIES AT LONG LAKE

YEAR	ADVISORY	EFFECTIVE DATES
1998	Potentially toxic	8/1/1998 – end date not reported
2001	Potentially toxic	6/14/01-11/13/01
2002	Potentially toxic	9/12/02-9/20/02
	Toxic	9/20/02- end date not reported
2003	Potentially toxic	8/13/03-8/26/03
2004	Potentially toxic	Documented in Staff report
2009	Potentially toxic	5/27/09 & 8/13/09 – end dates not reported
2011	Potentially toxic	7/27/11-11/10/11
	Toxic	11/10/11-12/31/11
2012	Potentially toxic	5/29/12-8/6/12
	Toxic	8/6/12-11/9/12
2013	Potentially toxic	5/29/13-12/15/13
2014	Potentially toxic	8/27/14-8/29/14 and 9/16/14-9/30/14
	Toxic	8/29/14-9/16/14
2016	Potentially toxic	7/6/16-11/10/16

*Years of no reported cyanobacteria advisories do not mean that there was not a cyanobacteria presence at Long Lake; rather, it means that the cyanobacteria conditions were not discussed in the Health District's Annual Water Quality Reports dating back to 1999.

Additional References

1. https://www.epa.gov/sites/production/files/2014-08/documents/cyanobacteria_factsheet.pdf
2. Carmichael, W.W. (1992), Cyanobacteria secondary metabolites—the cyanotoxins. Journal of Applied Bacteriology, 72: 445–459. doi:10.1111/j.1365-2672.1992.tb01858.x
3. Hardy, J. (2008), Washington State Recreational Guidance for Microcystins (Provisional) and Anatoxin-a (Interim/Provisional).
4. Koreivienė J, Anne O, Kasperovičienė J, Burškytė V. Cyanotoxin management and human health risk mitigation in recreational waters. Environ Monit Assess, 2014;186(7):4443-59.
5. Antoniou, M., de la Cruz, A. and Dionysiou, D. (2005) Cyanotoxins: New Generation of Water Contaminants. Journal of Environmental Engineering, ASCE, 1239-1243.
6. Ibelings BW, Chorus I. Accumulation of cyanobacterial toxins in freshwater "seafood" and its consequences for public health: a review. Environ Pollut. 2007;150(1):177-92.

7. Heussner AH, Mazija L, Fastner J, Dietrich DR. Toxin content and cytotoxicity of algal dietary supplements. Toxicol Appl Pharmacol. 2012;265(2):263-71.

Please let me know if you have additional questions or concerns, you can reach me at john.kiess@kitsappublichealth.org or 360-728-2290.

Sincerely,

John Kiess, R.S.
Environmental Health Director
Kitsap Public Health District