

Utah Health Status Update: Harmful Algal Bloom Cyanotoxins

March 2018

Cyanobacteria, commonly called blue-green algae, are a diverse group of photosynthetic bacteria. They are a normal part of most aquatic environments, including lakes and reservoirs in Utah. Certain environmental conditions can promote rapid cyanobacterial growth, leading to situations with very high cell densities called blooms. These blooms, often called harmful algal blooms (HABs), can occur year-round, but are most common in the summer when abundant sunlight and warm, stagnant water combine with high nutrient levels. Many species of cyanobacteria can produce a variety of toxins (called cyanotoxins) that can harm people, pets, livestock, and wildlife. In Utah, the most commonly detected cyanotoxins are microcystins, anatoxin-a, and cylindrospermopsin.

Microcystins

Microcystins are the most common freshwater cyanotoxins, both in Utah and worldwide, and can be produced by many different cyanobacterial species. Over 100 microcystin variants exist, which differ in their amino acid composition and resulting toxicity. Microcystins tend to be stable in the environment and typically have a half-life of 4–14 days in surface waters. The primary target organ is the liver, although other systems can be affected. Microcystins

cause toxicity by blocking an essential pathway for protein modification. Health effects that have been associated with acute exposure are listed in Table 1.¹

Cyanotoxins Characteristics and Symptoms

Table 1. Characteristics of and symptoms associated with common cyanotoxins

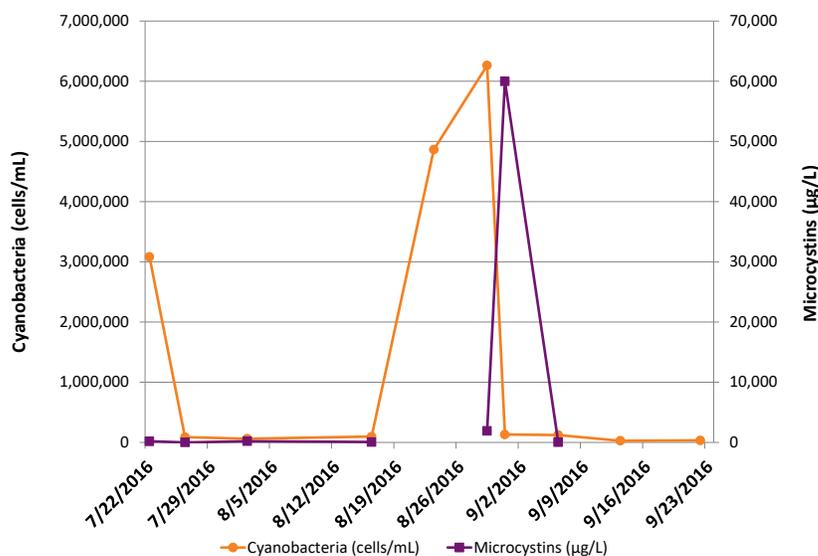
Cyanotoxin	Variants	Target Organ	Acute Health Effects
Microcystins ¹	100+	Liver	Abdominal pain, headache, sore throat, vomiting, nausea, cough, diarrhea, blistering around the mouth, pneumonia, liver damage
Anatoxin-a ²	2	Nervous system	Tingling, burning, numbness, drowsiness, incoherent speech, salivation, respiratory paralysis
Cylindrospermopsin ³	3	Liver, kidney	Fever, headache, vomiting, bloody diarrhea, liver and kidney damage

Source: EPA health effects support documents for microcystins¹, anatoxin-a², and cylindrospermopsin³

In 2016, a HAB in Scofield Reservoir near Price, Utah, resulted in extremely high levels of microcystins (upwards of 60,000 µg/L) (Figure 1). For comparison, the Utah Departments of Health and Environmental Quality recommend a water body be closed to recreation at 2,000 µg/L of microcystins. Microcystins typically remain within the cyanobacterial cell until the cell dies and breaks open. This can be observed in Figure 1, where the maximum microcystins concentration occurs after the bloom has largely died. Thus, the most dangerous period may be after the water has begun to appear safe. While this bloom was not associated with serious human illness, there were bat, waterfowl, and fish deaths (Figure 2).

Scofield Reservoir Harmful Algal Bloom, Utah, 2016

Figure 1. Cyanobacterial cell counts and microcystins concentration during the 2016 Scofield Reservoir harmful algal bloom



Source: Utah Department of Environmental Quality

KEY FINDINGS

- Many species of cyanobacteria can produce a variety of toxins (called cyanotoxins) that can harm people, pets, livestock, and wildlife.
- In 2016, a HAB in Scofield Reservoir near Price, Utah, resulted in extremely high levels of microcystins (upwards of 60,000 µg/L).
- High concentrations of anatoxin-a have not yet been detected in Utah, though it has been consistently found at low levels during HABs.
- In Utah, cylindrospermopsin has been intermittently detected at low concentrations.

Anatoxin-a

Anatoxin-a is a potent neurotoxin produced by many types of cyanobacteria. It was originally called ‘very fast death factor’ due to the rapid onset of symptoms (listed in Table 1).² Anatoxin-a acts by mimicking an important neurotransmitter, and is thought to be responsible for many of the pet and livestock deaths associated with HABs. Unlike microcystins, anatoxin-a is unstable in the environment and rapidly degrades in sunlight (half-life of 1–2 hours), which complicates detection and response. High concentrations have not yet been detected in Utah, though it has been consistently found at low levels during HABs.

Cylindrospermopsin

Cylindrospermopsin is a cyanotoxin that primarily targets the liver and kidneys. Like other cyanotoxins, many different cyanobacterial species can produce it. There is only limited data on the mechanism behind cylindrospermopsin toxicity, though it is thought to involve inhibition of protein synthesis. Table 1 lists symptoms associated with acute exposure.³ Like microcystins, it is relatively stable in the environment, though it is often released into the water before the cells die. In Utah, cylindrospermopsin has been intermittently detected at low concentrations.

More Information

To protect yourself, follow posted advisories and avoid exposure to water and scum around HABs. To see current advisories and learn more, visit habs.utah.gov.

References

1. EPA, 2015 - Health effects support document for the cyanobacterial toxin microcystins (www.epa.gov/sites/production/files/2017-06/documents/microcystins-support-report-2015.pdf).
2. EPA, 2015 - Health effects support document for the cyanobacterial toxin anatoxin-a (www.epa.gov/sites/production/files/2017-06/documents/anatoxin-a-report-2015.pdf).
3. EPA, 2015 - Health effects support document for the cyanobacterial toxin cylindrospermopsin (www.epa.gov/sites/production/files/2017-06/documents/cylindrospermopsin-support-report-2015.pdf).

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Wildlife Deaths Associated with Scofield Reservoir HAB

Figure 2. Bat, fish, and waterfowl deaths associated with the 2016 HAB in Scofield Reservoir. Photographs taken August 28–29, 2016.



Source: Utah Department of Environmental Quality

UDOH ANNOUNCEMENT:

The Hemp Extract Registration Program at the Utah Department of Health recently released preliminary information from a study of hemp extract that was requested by the Utah State Legislature and conducted by researchers at the University of Utah School of Medicine, Division of Pediatric Neurology. <https://health.utah.gov/wp-content/uploads/HempCardStudyReportNov2017.pdf>

Breaking News, March 2018

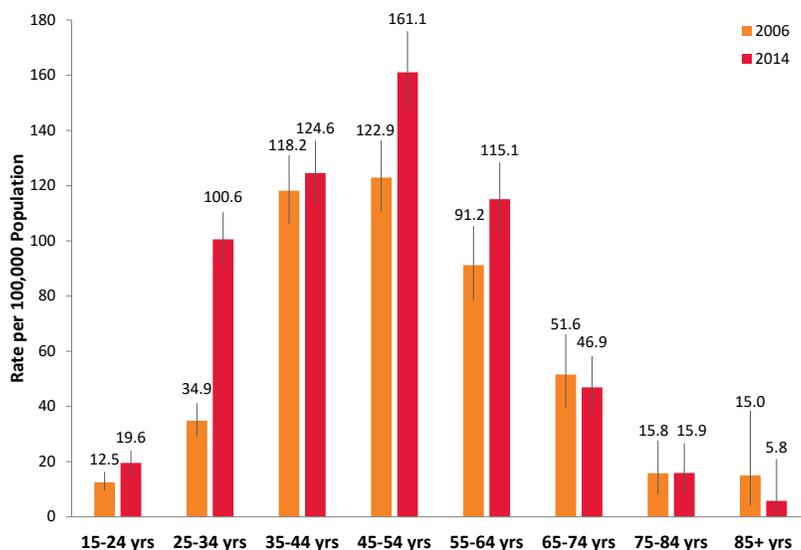
Excessive Alcohol Use and Related Harms

In Utah, a significantly lower prevalence of adults report binge drinking (12.5% of adults aged 18 and older) compared to the national average (16.9% of adults aged 18 and older) (BRFSS 2016). However, the rate of acute inpatient alcohol-attributable hospitalizations have increased over the past decade.

In 2006, the age-adjusted rate of acute inpatient alcohol-attributable hospitalizations in Utah was 54.6 per 100,000. In 2014, the age-adjusted rate was 72.4 per 100,000. This is a 32.6 percent significant increase. By age group, Utahns aged 25–34 had a 188.3 percent significant increase in the rate of acute inpatient alcohol-attributable hospitalizations (34.9 per 100,000 to 100.6 per 100,000). Utahns aged 45–54 had a 31.1 percent significant increase and the highest rate of acute inpatient alcohol-attributable hospitalizations of any age group (122.9 per 100,000 to 161.1 per 100,000). Rates in other age groups did not see a significant increase.

Data include acute inpatient hospitalizations with a primary, 100 percent alcohol-attributable diagnosis (CDC, 2010). Diagnoses sometimes attributed to alcohol use (e.g., falls and motor vehicle crashes) were not included. Therefore, calculated numbers underestimate the true impact of alcohol use.

Rate of Acute Inpatient Alcohol-attributable Hospitalizations per 100,000 Population by Age Group, Utah, 2006 and 2014



Source: Utah Inpatient Hospital Discharge Data, Office of Health Care Statistics

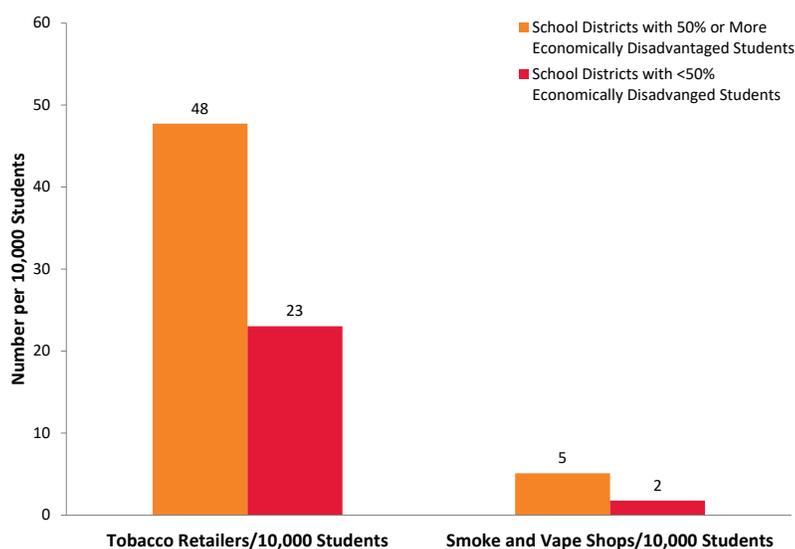
Community Health Spotlight, March 2018

Disparities in Tobacco Retail Density Among Utah School Districts

Tobacco retail density has been linked with higher levels of adolescent susceptibility to tobacco use, greater current tobacco use, lower pro cessation attitudes, and lower tobacco abstinence among adults. Through elaborate displays and advertising inside and outside local retail stores, the tobacco industry ensures continued exposure to their products.

A comparison of retail density in Utah school districts by students' socioeconomic status shows that overall tobacco retail density and availability of smoke and vape shops is higher in districts with 50% or more socioeconomically disadvantaged students compared to districts where the rate is less than 50% (see graph). In addition, students from socioeconomically disadvantaged districts are nearly twice as likely to attend schools with a tobacco retail location within 1,000 feet of their school compared to students in less disadvantaged districts (20.5% vs 10.9%). Tobacco license and point-of-sale advertising restrictions as well as strict enforcement of laws that prohibit sales to minors are effective strategies to reduce exposure to tobacco products and tobacco-related disparities.

Tobacco Retail Density by Combined School Districts and Students' Economic Status per 10,000 Students, Utah, 2017



Source: Utah Department of Health Tobacco Prevention and Control Program

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Monthly Health Indicators Report

(Data Through January 2018)

Monthly Report of Notifiable Diseases, January 2018	Current Month # Cases	Current Month # Expected Cases (5-yr average)	# Cases YTD	# Expected YTD (5-yr average)	YTD Standard Morbidity Ratio (obs/exp)
Campylobacteriosis (<i>Campylobacter</i>)	34	30	34	30	1.1
Shiga toxin-producing <i>Escherichia coli</i> (<i>E. coli</i>)	0	3	0	3	0.0
Hepatitis A (infectious hepatitis)	30	0	30	0	150.0
Hepatitis B, acute infections (serum hepatitis)	3	0	3	0	15.0
Influenza*	Weekly updates at http://health.utah.gov/epi/diseases/influenza				
Meningococcal Disease	0	0	0	0	0.0
Pertussis (Whooping Cough)	7	60	7	60	0.1
Salmonellosis (<i>Salmonella</i>)	20	22	20	22	0.9
Shigellosis (<i>Shigella</i>)	3	4	3	4	0.8
Varicella (Chickenpox)	19	28	19	28	0.7
Quarterly Report of Notifiable Diseases, 4th Qtr 2017	Current Quarter # Cases	Current Quarter # Expected Cases (5-yr average)	# Cases YTD	# Expected YTD (5-yr average)	YTD Standard Morbidity Ratio (obs/exp)
HIV/AIDS†	17	31	113	121	0.9
Chlamydia	2,441	2,077	10,088	8,279	1.2
Gonorrhea	638	372	2,548	1,307	2.0
Syphilis	30	16	118	66	1.8
Tuberculosis	8	7	29	32	0.9
Medicaid Expenditures (in Millions) for the Month of January 2018‡	Current Month	Expected/Budgeted for Month	Fiscal YTD	Budgeted Fiscal YTD	Variance - over (under) budget
Mental Health Services§	\$ 23.3	\$ 23.1	\$ 98.6	\$ 99.7	\$ (1.2)
Inpatient Hospital Services	\$ 15.2	\$ 14.3	\$ 137.3	\$ 139.0	\$ (1.6)
Outpatient Hospital Services	\$ 2.7	\$ 2.7	\$ 24.6	\$ 26.6	\$ (2.1)
Nursing Home Services	\$ 10.7	\$ 9.9	\$ 120.8	\$ 124.3	\$ (3.5)
Pharmacy Services	\$ 8.7	\$ 8.7	\$ 69.5	\$ 70.8	\$ (1.4)
Physician/Osteo Services	\$ 4.9	\$ 5.3	\$ 35.6	\$ 37.0	\$ (1.4)
Medicaid Expansion Services	\$ 4.8	\$ 4.9	\$ 17.5	\$ 18.8	\$ (1.3)
TOTAL MEDICAID#	\$ 204.1	\$ 203.6	\$ 1,490.7	\$ 1,495.4	\$ (4.7)

Program Enrollment for the Month of January 2018	Current Month	Previous Month	% Change** From Previous Month	1 Year Ago	% Change** From 1 Year Ago
Medicaid	279,522	278,807	+0.3%	288,371	-3.1%
PCN (Primary Care Network)	12,730	13,177	-3.4%	14,378	-11.6%
CHIP (Children's Health Ins. Plan)	19,277	19,272	+0.0%	18,951	+1.7%
Health Care System Measures	Annual Visits			Annual Charges	
	Number of Events	Rate per 100 Population	% Change** From Previous Year	Total Charges in Millions	% Change** From Previous Year
Overall Hospitalizations (2016)	297,106	8.7%	+3.0%	\$ 8,638.0	+8.4%
Non-maternity Hospitalizations (2016)	198,257	5.7%	+2.0%	\$ 7,466.1	+9.2%
Emergency Department Encounters** (2016)	756,376	22.8%	+7.6%	\$ 2,286.3	+21.7%
Outpatient Surgery (2016)	491,566	14.7%	+4.9%	\$ 3,000.6	-0.3%
Annual Community Health Measures	Current Data Year	Number Affected	Percent/Rate	% Change** From Previous Year	State Rank** (1 is best)
Obesity (Adults 18+)	2016	538,700	25.3%	+3.3%	10 (2016)
Cigarette Smoking (Adults 18+)	2016	187,400	8.8%	-3.3%	1 (2016)
Influenza Immunization (Adults 65+)	2016	176,300	54.9%	-6.9%	41 (2016)
Health Insurance Coverage (Uninsured)	2016	265,500	8.7%	-1.1%	n/a
Motor Vehicle Traffic Crash Injury Deaths	2016	257	8.4 / 100,000	+2.0%	16 (2016)
Poisoning Deaths	2016	703	23.0 / 100,000	-1.1%	33 (2016)
Suicide Deaths	2016	612	20.1 / 100,000	-1.5%	47 (2016)
Diabetes Prevalence (Adults 18+)	2016	153,300	7.2%	+2.9%	8 (2016)
Poor Mental Health (Adults 18+)	2016	362,000	17.0%	+6.3%	21 (2016)
Coronary Heart Disease Deaths	2016	1,631	53.5 / 100,000	-1.3%	4 (2016)
All Cancer Deaths	2016	3,113	102.0 / 100,000	-1.3%	1 (2016)
Stroke Deaths	2016	927	30.4 / 100,000	+2.4%	32 (2016)
Births to Adolescents (Ages 15-17)	2015	489	6.9 / 1,000	-11.7%	13 (2015)
Early Prenatal Care	2015	38,803	76.4%	+0.2%	n/a
Infant Mortality	2015	257	5.1 / 1,000	+3.2%	12 (2015)
Childhood Immunization (4:3:1:3:3:1)	2016	37,100	73.6%	0.0%	26 (2016)

* Influenza activity was widespread during January 2018. As of January 31, 2018, 1,257 influenza-associated hospitalizations have been confirmed since the start of the influenza season on October 1, 2017. More information can be found at <http://health.utah.gov/epi/diseases/influenza/surveillance/index.html>.

† Diagnosed HIV infections, regardless of AIDS diagnosis.

‡ This state fiscal year (SFY) 2018 report includes supplemental payments to better match the SFY 2018 Medicaid Forecast Budget which costs have not been included in previous years.

§ The SFY 2018 Medicaid Forecast Budget includes Mental Health and Substance Abuse services together while this report only accounts for Mental Health services. This is to stay consistent with the previous years reports.

Medicaid Expansion Services was added to the Medicaid program in SFY 2018. Total Medicaid costs exclude the Prism Project.

** Relative percent change. Percent change could be due to random variation.

†† Treat and release only.

†† State rank based on age-adjusted rates where applicable.

Notes: Data for notifiable diseases are preliminary and subject to change upon the completion of ongoing disease investigations. Active surveillance for West Nile Virus will start in June for the 2018 season.