Upper Mississippi River Harmful Algal Bloom

Response Resource Manual

February 2020

Upper Mississippi River Basin Association

Table of Contents

Cover Photo Credits:
Top: Shawn Giblin, Wisconsin Department of Natural Resources
Bottom: United States Department of Agriculture - National Agriculture Imagery Program

PURPOSE

The purpose of this *Response Resource Manual* is to provide information to assist the states of the Upper Mississippi River Basin, as well as their federal partners and others, in addressing harmful algal blooms (HABs) on the Upper Mississippi River (UMR). In particular, it is envisioned for use in larger bloom incidents that may impact more than one state. However, the resources it contains may also be valuable for smaller-scale blooms and for information sharing purposes generally.

This *Manual* was developed in consultation with the interagency UMR HAB Work Group, which was formed in early 2016 per the direction of the Upper Mississippi River Basin Association (UMRBA) Board. The *Manual* is considered a working draft and is subject to further updates annually. Any questions regarding the *Manual* may be directed to the UMRBA.

INTRODUCTION: HABs on the UMR

The issue of harmful algal blooms has received increased attention in recent years both within individual states and nationally, particularly due to such incidents as the impact to the water supply of Toledo, Ohio in 2014 and the unprecedented bloom on the Ohio River in 2015.

On the UMR, algal blooms have been observed for many years, and while there has not been any systemic tracking of blooms, they have typically been relatively local in scale and predominantly occurring in lower flow areas such as backwaters. There are indications that cyanobacteria are becoming increasingly dominant in the river's phytoplankton community and the potential presence of cyanotoxins is an ongoing concern for drinking water suppliers using the UMR as source water. HABs are an issue of ongoing significance to the UMR states, federal and other partners, and river users in general.

Whether an incident similar to the 2015 Ohio River bloom could occur on the UMR is unknown, but the UMR states and their partners have expressed a strong interest in being prepared should a large-scale, multi-jurisdictional incident occur.

Current UMR HAB Monitoring

Because HABs occur sporadically in time and space, both on the UMR and in general, it is challenging to implement systemic surveillance monitoring in a practical manner on a large waterbody such as the UMR. As such, the UMR states tend to focus their monitoring in response to reported incidents, rather than on ongoing surveillance monitoring for HABs/algal toxins (see *Section D: Capacities Compilation*). States also are fairly limited in their ability to dedicate staffing specifically to HABs.

There is some ongoing monitoring by public water systems (e.g., Moline Water, American Water) for algal blooms and toxins, and the National Great Rivers Research and Education Center (NGRREC) Great Rivers Ecological Observation Network (GREON) buoys do provide for continuous blue-green algae measurements at their deployment locations. The Unregulated Contaminant Monitoring Rule 4 is currently ongoing (2018-2020) and every surface water system >10,000 population is monitoring for certain algal toxins. This nationwide occurrence study is looking at finished water only. Additionally, the US Army Corps of Engineer's Upper Mississippi River Restoration (UMRR) program's Long-Term Resource Monitoring (LTRM) produces spatially and temporally intensive water quality data (including chlorophyll-*a* and nutrient levels) in the program's study reaches. State ambient water quality monitoring programs also provide this type of affiliated water chemistry information at variety of river locations. Nonetheless, existing monitoring does not currently provide for systemic detection of HAB/algal toxins nor could it fully track a large-scale bloom without augmentation.

In the event of a large scale HAB event on the UMR, monitoring efforts would need to be intensified and collaboration among agencies to leverage resources and personnel would be critical.

Analytical Methods

While states and other UMR partners employ a variety of analytical methods for cyanobacteria and cyanotoxin detection (see *Section D: Capacities Compilation*), a common method across most entities is the use of enzyme-linked immunosorbent assays (ELISA) to detect microcystins as well as other toxins. A few entities also use rapid immunochromatographic test strips/dip sticks as a screening tool. Some

agencies have developed in house capacity to perform other analyses (e.g., mass spectrometric [MS] and high-performance liquid chromatographic [HPLC] methods) or may utilize contract laboratories. Several agencies are exploring or implementing phytoplankton identification and enumeration.

While there currently is no single methodological approach shared by all river partners, it is possible that consensus may emerge as states' programs mature. In the meantime, distinctions among analytical approaches need to be kept in mind during any collaborative sampling which might occur in a large UMR HAB event.

Threshold Values and Advisories

Currently, there are no federal drinking water or contact recreation standards for algal toxins, although the Drinking Water Health Advisories for microcystins and cylindrospermopsin issued in May 2015 by the US Environmental Protection Agency (USEPA) have emerged as widely-recognized thresholds. Additionally, USEPA released recommended recreation criteria later in May 2019. *Section C: Algae/Toxin Guidelines* provides a summary of currently available thresholds and guidelines for algae presence and algal toxins.

There is no single set of action thresholds or conditions applied by all the UMR states in responding to an HAB event. States also each have their own approaches to issuing advisories in collaboration with local health departments. This manual does not seek to establish a common set of action thresholds or advisories for the UMR. Rather, states are encouraged to contact each other when a UMR event triggers action in the originating state and/or appears likely to impact a cross-river or down-river state (*Communications List* included in this manual). This manual provides a place to share states' communication materials regarding HAB (see *Section B: Communication Tools)*.

Remote Sensing and Aerial Imagery

In some settings, such as the Great Lakes, satellite imagery has been employed to monitor and predict HABs. However, the spatial resolution from satellite imagery is not typically detailed enough for application on river systems. While the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), US Geological Survey (USGS), and USEPA are working to improve the applicability of satellite imagery to HABs, it is not currently likely to be a primary source of information for UMR blooms.

In the event of a large scale HAB, there are a number of entities on the UMR that may be able to provide aerial imagery. These entities include USACE, the Civil Air Patrol, a USFWS and USGS-Upper Midwest Environmental Sciences Center (UMESC) partnership, and the University of Iowa, among others (see *Section D: Capacities Compilation)*.

Future Directions and Research

As is true nationwide, both the science and practice surrounding HABs is rapidly evolving. On the UMR, research by multiple partners is ongoing and monitoring technology continues to evolve, as do modeling and predictive approaches. States' HAB programs, and those of partners, will continue to mature in the upcoming years – and that this manual will be periodically updated to reflect new developments.

COMMUNICATION LIST

This HAB communication list is a resource for use by state and federal agencies, as well as other partners, along the Upper Mississippi River (UMR). The list is intended for use as an initial tool to promote communication among various entities in case of a significant HAB event on the UMR. As there is no shared HAB incident definition/action level among UMR entities at this time, each organization is simply encouraged to notify others when an event reaches its own threshold for action and/or appears likely to impact downriver or cross-river areas.

Contact information is organized according to entity function (e.g., entities with primary river presence/HAB role, public water systems, other entities, etc.). The list does not attempt to reach down to localized notification (of local health departments, municipal beaches, etc.), as it is assumed local notifications are the responsibility of individual states. However, public water systems are included here due to their particularly critical nature in order to help ensure these facilities are promptly notified. Links to lists of local health departments for each state are also provided.

State and Federal Agencies with Primary River Presence and/or HAB Role

State Agencies

Illinois			
Illinois Environmental Protection Agency			
Contact Persons	Gregg Good *Primary Contact*	gregg.good@illinois.gov	217-782-7028
	Teri Holland *Surface Water*	teri.holland@Illinois.gov	217-782-3362
	Anthony Dulka *Drinking Water*	anthony.dulka@Illinois.gov	217-782-1020
24-hour Number	800-782-7860 or 217-782-3637 (Emergency Operations Unit)		

Iowa			
Iowa Department of Natural Resources			
Contact Persons	Dan Kendall *Primary Contact*	daniel.kendall@dnr.iowa.gov	515-725-8379
	Diane Moles	diane.moles@dnr.iowa.gov	515-725-0281
	Taroon Bidar	taroon.bidar@dnr.iowa.gov	515-725-0278
24-hour Number	515-725-8694 (Duty Officer)		

Minnesota			
Minnesota Pollution Control Agency			
Contact Persons	Pam Anderson *Primary Contact*	pam.anderson@state.mn.us	651-757-2190
	Lee Engel	lee.engel@state.mn.us	651-757-2339
24-hour Number	800-422-0798 (Duty Officer)		

Missouri			
Missouri Department of Natural Resources			
Contact Persons	Lynn Milberg	lynn.milberg@dnr.mo.gov	573-526-4681
	Chris Radcliffe	chris.radcliffe@dnr.mo.gov	573-522-4680
24-hour Number	573-634-2436 (Duty Officer)		
Dedicated HAB Reporting Email Address	MOHABReport@dnr.mo.gov		

Wisconsin			
Wisconsin Department of Natural Resources			
Contact Persons	Shawn Giblin *Mississippi River Team*	shawn.giblin@wisconsin.gov	608-785-9995
	Gina LaLiberte *State HAB Coordinator*	gina.laliberte@wisconsin.gov	608-264-8955
24-hour Number	800-943-0003 (Wisconsin DNR Spill Hotline)		

State Field Stations*			
Lake City, Minnesota – Minnesota Department of Natural Resources			
Team Leader	Megan Moore	megan.moore@state.mn.us	651-299-4024
La Crosse, Wisconsin – Wisconsin Department of Natural Resources			
Team Leader	Jim Fischer	jamesr.fischer@wisconsin.gov	608-781-6360
Bellevue, Iowa – Iowa Department of Natural Resources			
Team Leader	Dave Bierman	dave.bierman@dnr.iowa.gov	563-872-5495
East Alton, Illinois – Illinois Natural History Survey			
Team Leader	John Chick	chick@illinois.edu	618-468-2850
Jackson, Missouri – Missouri Department of Conservation			
Team Leader	Dave Herzog	Dave.Herzog@mdc.mo.gov	573-243-2659 ext. 1046

*Cooperative state owned and operated field stations have been established for the USACE UMRR-LTRM element and other field data collection, analysis, quality assurance, and applied research. Team leaders are listed for each station and each would need to be contacted to determine potential ability to support monitoring, etc. during an HAB event.

Federal Agencies

United States Army Corps of Engineers			
St. Paul District			
Contact Persons	Jim Noren	james.b.noren@usace.army.mil	651-290-5626
Rock Island District			
Contact Persons	Leo Keller	thomas.l.keller@usace.army.mil	309-794-5720
St. Louis District			
Contact Persons	Mike Henry	michael.l.henry@usace.army.mil	314-865-6304

United States Environmental Protection Agency			
Region 5 (IL, MN, WI)			
Contact Persons	Peg Donnelly *Surface Water*	donnelly.peggy@epa.gov	312-886-6109
	Micah Bennett *Surface Water*	bennett.micah@epa.gov	312-886-7946
	Tom Poy *Drinking Water*	poy.tom@epa.gov	312-886-5991
	Wendy Drake *Drinking Water*	drake.wedny@epa.gov	312-886-6705
Incident Reporting Number	312-353-2000 (used for spills/incidents/violations – only staffed during business hours)		
Region 7 (IA, MO)			
Contact Persons	Ken Deason *Drinking Water*	deason.ken@epa.gov	913-551-7585
	Amy Shields *Surface Water*	shields.amy@epa.gov	913-551-7396
	Laura Webb *Laboratory*	webb.laura@epa.gov	913-551-7435
	Steve Schaff *Surface Water*	schaff.steve@epa.gov	913-551-7447
24-hour Number	913-281-0991 (EPA Region 7 Emergency Response Line)		

United States Geological Survey			
Upper Midwest Environmental Sciences Center			
Contact Persons	Jeff Houser *UMRR-LTRM Science Director*	jhouser@usgs.gov	608-781-6262
Illinois Water Science Center			
Contact Persons	Kelly Warner *Deputy Director for Science*	klwarner@usgs.gov	217-328-9727

United States Fish and Wildlife Service			
Rock Island Field Office			
Contact Persons	Aleshia Kenney	aleshia_kenney@fws.gov	309-757-5800

Other Entities

Other entities include academic, research, and intergovernmental organizations which may be able to provide assistance and support during a HAB event.

United States Environmental Protection Agency			
Office of Research and Development			
Contact Persons	Joel Allen *Water Monitoring Technologies*	allen.joel@ epa.gov	513-487-2806
	Blake Schaeffer *Remote Sensing*	schaeffer.blake@epa.gov	919-541-5571
	Nick Dugan *Drinking Water Treatment*	dugan.nicholas@epa.gov	513-569-7239
	Christopher Nietch *Risk Characterization Models*	nietch.christopher@epa.gov	513-569-7460
	Jorge Santo Domingo *Cyanobacteria/Toxin Gene Identification*	santodomingo.jorge@epa.gov	513-569-7328
Headquarters			
Contact Persons	Lesley D'Anglada *Drinking Water Health Advisories and Recommended Water Quality Criteria/Swimming Advisories*	danglada.lesley@epa.gov	202-566-1125
	Katherine Foreman *Drinking Water Risk Communication*	foreman.katherine@epa.gov	202-564-3403
	John Healey *Recommended Water Quality Criteria/Swimming Advisories Risk Communication*	healey.john@epa.gov	202-566-0176
Technical Support Center, Office of Groundwater and Drinking Water in Cincinnati			
Contact Person	Tom Waters *Drinking Water Treatment Optimization*	waters.tom@epa.gov	513-569-7611

National Weather Service			
North Central River Forecast Center			
Contact Persons	Steve Buan *Service Coordination Hydrologist*	steve.buan@noaa.gov	952-368-2545

National Great Rivers Research and Education Center			
Great Rivers Ecological Observation Network and Great Lakes to Gulf Virtual Observatory Programs			
Contact Persons	John Sloan	jjsloan@lc.edu	618-468-2820
	Ted Kratschmer	ekratsch@lc.edu	618-468-2840

University of Iowa – IIHR – Hydroscience & Engineering			
Lucille A. Carver Mississippi Riverside Environmental Research Station (LACMRERS)			
Contact Persons	Nathan Young	nathan-young@uiowa.edu	319-384-1732

Western Illinois University			
Alice L. Kibbe Life Science Research Station			
Contact Persons	Sean Jenkins *Station Director*	se-jenkins@wiu.edu	309-298-2045
	Neil Gillespie *Site Manager*	nd-gillespie@wiu.edu	817-677-0336

Metropolitan Council			
Environmental Services			
Contact Persons	Jack Barland	john.barland@metc.state.mn.us	651-602-8341

Upper Mississippi River Basin Association			
Contact Persons	Lauren Salvato	lsalvato@umrba.org	651-224-2880

Public Water Systems Using the UMR as Drinking Water Supply Source

Facility	State	Approx. River Mile	Contact Phone Number(s)	Emergency Phone Number(s)	Contact Person	Email (if available)
St. Cloud Water Treatment Plant	MN	928	320-255-7225	320-255-7225	Lisa Vollbrecht	lisa.vollbrecht@ci.stcloud.mn.us
St. Paul Regional Water Services	MN	863	652-266-1651	651-266-6874	Jim Bode	james.bode@ci.stpaul.mn.us
Minneapolis Water Treatment and	MN	859	612-661-4975	612-661-4949	Annika Bankston	Annika.Bankston@minneapolismn.gov

Facility	State	Approx. River Mile	Contact Phone Number(s)	Emergency Phone Number(s)	Contact Person	Email (if available)
Distribution Services						
East Moline Water Treatment Plant	IL	489	309-752-1520	563-355-6886	Chip Drake	ldrake@eastmoline.com
Moline Water Treatment Plant	IL	486	309-524-2301	309-524-2300	Tony Loete	tloete@moline.il.us
Rock Island Arsenal	IL	484	309-782-5403	515-290-6869	Jim Hayes	Jeff.hayes@fluor.com
Iowa American-Davenport	IA	484	563-468-9201	563-322-8814 ext. 1		
Rock Island Water Treatment Plant	IL	483	309-732-2310	217-685-8336	Jason Upton	upton.jason@rigov.org
Burlington Water Treatment Plant	IA	405	319-754-6501, 319-752-7611	319-752-7611	Ken Gregory	gregoryk@burlingtoniowa.org
Nauvoo Water Treatment Plant	IL	376	217-453-2411	309-337-8781	Barry Cuthbert	wtpnauvoo@frontiernet.net
Keokuk Water Works	IA	365	319-524-2011	319-524-2011	Sherri Samuels	ssamuels@keowaters.org
Hamilton Water Treatment Plant	IL	364	217-847-3774	309-224-8234	Aron Metternich	hamiltonsewer@frontier.com
Warsaw Water Treatment Plant	IL	360	217-256-4512	217-430-0845	Gary Huston	warsawh20@yahoo.com ghuston33@yahoo.com
Quincy Water Treatment Plant	IL	327	217-228-4590	217-257-1102	Randall Koch	rkoch@quincyil.gov
Hannibal Water Treatment Plant	MO	309	573-221-8050	573-221-0955	Matt Munzlinger	mmunzlinger@hannibalbpw.org
Louisiana Water Treatment Plant	MO	283	573-754-6912, 573-754-4591	573-754-0306	*Operator*	louisianawastewater@hotmail.com
Illinois American-Alton	IL	204	618-239-3249	618-910-7242	Randy Pankiewicz	randolph.pankiewicz@amwater.com
Illinois American-Granite City	IL	192	618-239-3249	618-910-7242	Randy Pankiewicz	randolph.pankiewicz@amwater.com
City of St. Louis	MO	190	314-868-5640	314-592-8205	*Operator*	Cskouby@STLWater.Com
Illinois American-East St. Louis	IL	181	618-239-3249	618-910-7242	Randy Pankiewicz	randolph.pankiewicz@amwater.com

Facility	State	Approx. River Mile	Contact Phone Number(s)	Emergency Phone Number(s)	Contact Person	Email (if available)
Jefferson County Water Authority	MO	150	636-933-0106	636-226-7487	*Operator*	jawatertreatment@gmail.com
Chester Water Department	IL	110	618-615-1679	618-826-3315	Tim Crow	chesterwater1@yahoo.com

Local Health Department Lists for UMR States

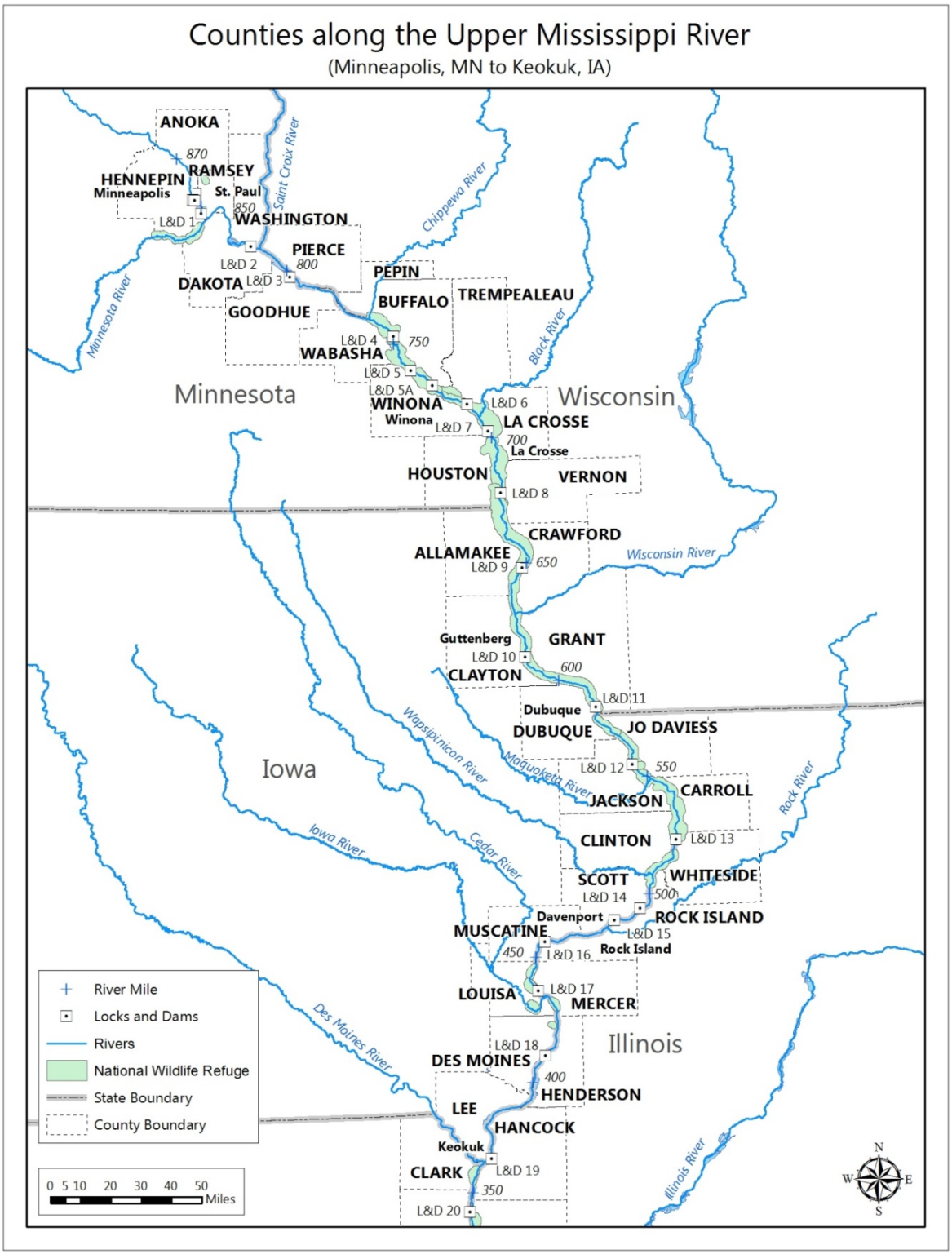
Illinois	Illinois Local Health Departments: https://www2.illinois.gov/epa/topics/water-quality/monitoring/algal-bloom/Pages/default.aspx
Iowa	Iowa Local Health Departments: http://idph.iowa.gov/lphs/local-public-health-agencies
Minnesota	Minnesota Local Health Departments: https://www.health.state.mn.us/communities/practice/connect/findlph.html
Missouri	Missouri Local Health Departments: http://health.mo.gov/living/lpha/lphas.php
Wisconsin	Wisconsin Local Health Departments: https://www.dhs.wisconsin.gov/lh-depts/counties.htm

RESPONSE TOOLS AND RESOURCES:

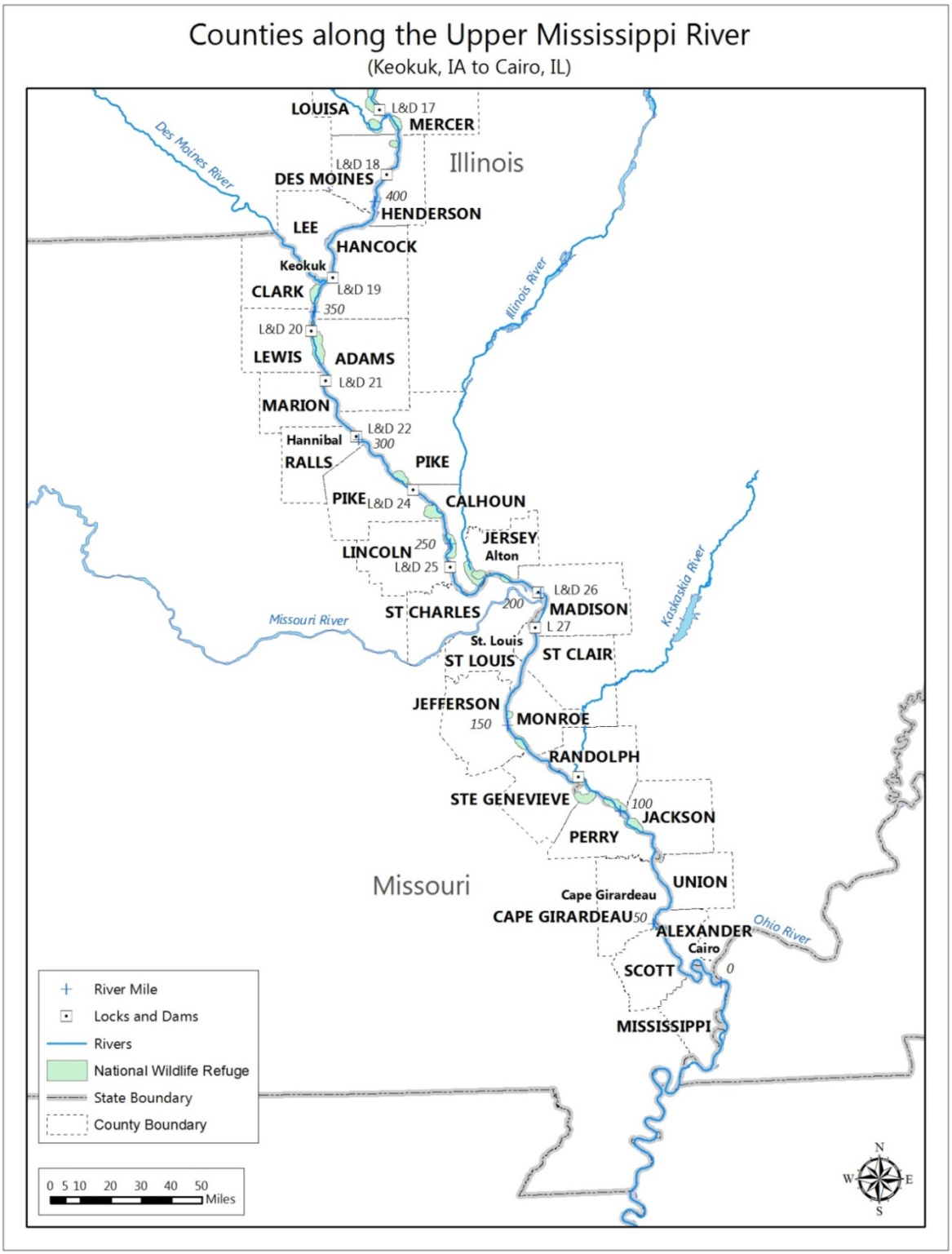
SECTION A – MAPS AND SPATIAL REFERENCES

UMR Overview Map (by 50-Mile Segments)

Counties Along the UMR (North Map)



Counties Along the UMR (South Map)



Upper Mississippi River Mile Points of County Lines

River Mile*	State	County/County
857.9 LDB	MN	Anoka/Hennepin
850.5 LDB	MN	Hennepin/Ramsey
845.3 RDB	MN	Hennepin/Dakota
841.9 RDB	MN	Dakota/Ramsey
835.7 RDB	MN	Ramsey/Dakota
833.1 LDB	MN	Ramsey/Washington
811.6 LDB	MN/WI	Washington/Pierce
807.1 RDB	MN	Dakota/Goodhue
779.3 LDB	WI	Pierce/Pepin
773.2 RDB	MN	Goodhue/Wabasha
763.4 LDB	WI	Pepin/Buffalo
741.9 RDB	MN	Wabasha/Winona
721.8 LDB	WI	Buffalo/Trempealeau
713.0 LDB	WI	Trempealeau/La Crosse
701.0 RDB	MN	Winona/Houston
691.3 LDB	WI	La Crosse/Vernon
673.8 RDB	MN / IA	Houston/Allamakee
667.6 LDB	WI	Vernon/Crawford
637.3 RDB	IA	Allamakee/Clayton
630.7 LDB	WI	Crawford/Grant
600.6 RDB	IA	Clayton/Dubuque
580.6 LDB	WI / IL	Grant/Jo Daviess
567.0 RDB	IA	Dubuque/Jackson
548.9 LDB	IL	Jo Daviess/Carroll
532.8 RDB	IA	Jackson/Clinton
524.7 LDB	IL	Carroll/Whiteside
511.5 LDB	IL	Whiteside/Rock Island
506.6 RDB	IA	Clinton/Scott
469.5 RDB	IA	Scott/Muscatine
448.8 RDB	IA	Muscatine/Louisa
448.8 LDB	IL	Rock Island/Mercer
425.6 RDB	IA	Louisa/Des Moines
425.5 LDB	IL	Mercer/Henderson
395.9 RDB	IA	Des Moines/Lee
390.6 LDB	IL	Henderson/Hancock

(Continued)

* LDB = Left Descending Bank
RDB = Right Descending Bank

Upper Mississippi River Mile Points of County Lines (continued)

River Mile*	State	County/County
361.5 RDB	IA / MO	Lee/Clark
351.0 RDB	MO	Clark/Lewis
347.3 LDB	IL	Hancock/Adams
328.5 RDB	MO	Lewis/Marion
312.4 LDB	IL	Adams/Pike
306.1 RDB	MO	Marion/Ralls
297.4 RDB	MO	Ralls/Pike
275.4 LDB	IL	Pike/Calhoun
258.1 RDB	MO	Pike/Lincoln
236.4 RDB	MO	Lincoln/St. Charles
217.9 LDB	IL	Calhoun/Jersey
208.5 LDB	IL	Jersey/Madison
195.5 RDB	MO	St. Charles/St. Louis
182.3 LDB	IL	Madison/St. Clair
171.2 LDB	IL	St. Clair/Monroe
79.4 LDB	IL	Jackson/Union
75.2 RDB	MO	Perry/Cape Girardeau
55.4 LDB	IL	Union/Alexander
47.8 RDB	MO	Cape Girardeau/Scott
25.9 RDB	MO	Mississippi/Scott

* LDB = Left Descending Bank
RDB = Right Descending Bank

Upper Mississippi River Locks and Dams

Lock Name	River Mile	Address	Emergency Phone	Contact Phone
Upper St. Anthony Falls	853.7 RDB	1 Portland Ave. Minneapolis, MN 55401-2528	612-333-5336	612-333-5336
Lower St. Anthony Falls	853.4 RDB	1 Portland Ave. Minneapolis, MN 55401-2528	612-332-6864	612-332-3660
Lock & Dam 1	847.6 RDB	5000 W River Pkwy. Minneapolis, MN 55417-1681	612-724-2971	612-724-2971
Lock & Dam 2	815.2 RDB	1350 Dam Rd. Hastings, MN 55033-1145	651-437-3150	651-437-3150
Lock & Dam 3	796.9 RDB	4330 Lock & Dam Rd. Welch, MN 55089-9644	651-388-5794	651-388-5794
Lock & Dam 4	752.8 LDB	Main St. Alma, WI 54610-0325	608-685-4421	608-685-4421
Lock & Dam 5	738.1 RDB	12554 Hwy 61 Minnesota City, MN 55959-9756	507-689-2101	507-689-2101
Lock & Dam 5A	728.5 LDB	W679 State Hwy 35 Fountain City, WI 54629-7214	507-452-2789	507-452-2789
Lock & Dam 6	714.1 LDB	W24055 Lock and Dam Rd. Trempealeau, WI 54661-0406	651-290-5964	651-290-5964
Lock & Dam 7	702.5 RDB	33018 US Hwy 61 La Crescent, MN 55947-3404	651-290-5186	651-290-5186
Lock & Dam 8	679.2 LDB	Near WI Hwys 35 & 56 Genoa, WI 54632-0265	651-290-5035	651-290-5035
Lock & Dam 9	647.9 LDB	24545 State Hwy 35 Eastman, WI 54626-9723	608-874-4311	608-874-4311
Lock & Dam 10	615 RDB	5 Lock and Dam Ln. Guttenberg, IA 52052-0849	563-252-1261	563-252-1261
Lock & Dam 11	583 RDB	11 Lime St. Dubuque, IA 52001	563-582-1204	563-582-1204
Lock & Dam 12	556.7 RDB	12401 N Riverview Bellevue, IA 52031	319-872-3314	563-872-3314; 563-872-4919
Lock & Dam 13	522.5 LDB	4999 Lock Rd. Fulton, IL 61252	815-589-3313; 815-589-2144	815-589-3313; 815-589-2144
Lock & Dam 14	493.3 RDB	25549 182nd St. Pleasant Valley, IA 52767	563-332-0907; 309-794-4359	563-332-0907; 309-794-4359
Lock & Dam 15	482.9 LDB	Rodman Ave., Rock Island Arsenal Rock Island, IL 61201	309-794-5266	309-794-5266; 309-794-5810
Lock & Dam 16	457.2 LDB	33109 102nd Ave. W Muscatine, IA 52761-9204	309-537-3191	309-537-3191; 309-537-3412
Lock & Dam 17	437.1 LDB	173 Lock and Dam Rd. New Boston, IL 61272	309-587-8125	309-587-8125; 309-587-8579
Lock & Dam 18	410.5 LDB	N 1675th St. Gladstone, IL 61437	309-873-2246	309-873-2246
Lock & Dam 19	364.3 RDB	525 N Water St. Keokuk, IA 52632	319-524-2631	319-524-2631; 319-524-0691

(Continued)

Upper Mississippi River Locks and Dams (continued)

Lock Name	River Mile	Address	Emergency Phone	Contact Phone
Lock & Dam 20	343.2 RDB	N Front St. Canton, MO 63435	573-288-3320	573-288-3320; 573-288-2100
Lock & Dam 21	324.9 LDB	W Lock and Dam Rd. Quincy, IL 62301	217-222-0918	217-222-0918; 217-222-0352
Lock & Dam 22	301.2 RDB	Riverview Dr. New London, MO 63459	573-221-0294	573-221-0294; 573-221-6463
Lock & Dam 24	273.4 RDB	350 N First St. Clarksville, MO 63336-0038	573-242-3524	573-242-3524
Lock & Dam 25	241.4 RDB	10 Sandy Slough Rd. Winfield, MO 63389	636-566-8120; 636-630-5803	636-566-8120
Melvin Price Locks & Dam 26	200.5 RDB	1 Lock and Dam Way East Alton, IL 62024-2400	608-874-4311	636-899-1543; 618-462-1713
Locks 27 (Chain of Rocks)	185.5 LDB	3291 W 20th St. Granite City, IL 62040-1227	563-252-1261	618-452-7107

RESPONSE TOOLS AND RESOURCES:
SECTION B – COMMUNICATION TOOLS

UMR States' Public Information Websites

Illinois	IL EPA Program Page: https://www2.illinois.gov/epa/topics/water-quality/monitoring/algal-bloom/Pages/default.aspx
Iowa	State Park Beach Monitoring Page: http://www.iowadnr.gov/Things-to-Do/Beach-Monitoring Iowa Department of Public Health Page: https://idph.iowa.gov/Environmental-Health-Services/Reportable-Conditions/Harmful-Algal-Blooms
Minnesota	MPCA Program Page: https://www.pca.state.mn.us/water/blue-green-algae-and-harmful-algal-blooms Minnesota Department of Health (MDH) Program Page: https://www.health.state.mn.us/diseases/hab/index.html
Missouri	State page hosted by Department of Natural Resources: https://dnr.mo.gov/env/cyanobacteria.htm
Wisconsin	WI Department of Natural Resources: http://dnr.wi.gov/lakes/bluegreenalgae/ WI Department of Health Services: https://www.dhs.wisconsin.gov/water/bg-algae/index.htm

USEPA Information Websites

USEPA CyanoHABs Websites: https://www.epa.gov/cyanohabs https://www.epa.gov/nutrientpollution/harmful-algal-blooms https://www.epa.gov/water-research/cyanobacteria-assessment-network-cyan
USEPA Freshwater CyanoHABs Newsletters: https://www.epa.gov/cyanohabs/epa-newsletter-and-collaboration-and-outreach-habs#news *To sign up for the newsletter, send an email to Lesley D'Anglada (Danglada.Lesley@epa.gov*
Monitoring and Responding to Cyanobacteria and Cyanotoxins in Recreational Waters: https://www.epa.gov/cyanohabs/monitoring-and-responding-cyanobacteria-and-cyanotoxins-recreational-waters
Communicating about Cyanobacterial Blooms and Toxins in Recreational Waters https://www.epa.gov/cyanohabs/communicating-about-cyanobacterial-blooms-and-toxins-recreational-waters#temp

Example Press Releases

Illinois: 2019 Blue-Green Algae Press Release

Illinois Officials Caution Residents Recreating in Illinois Lakes or Rivers to be Aware of Blue-Green Algae

SPRINGFIELD – As temperatures begin to rise, the Illinois Environmental Protection Agency and Department of Public Health are reminding residents to be cautious if they are planning activities on Illinois lakes and rivers, now and throughout the summer. Water conditions are ideal for blue-green algae growth. Blue-green algae (also known as cyanobacteria) are microscopic organisms that naturally occur in lakes and streams. Rapid growth of algae is referred to as a "bloom." While most blue-green algae are harmless, some can produce toxic chemicals that cause sickness or other health effects in people and pets, depending on the amount and type of exposure.

Sensitive individuals, including young children, the elderly, and people with compromised immune systems are most at risk to adverse health effects attributable to algal toxins. Individuals are most often exposed to algal toxins while swimming or participating in other recreational activities in and on the water. The most common routes of exposure are direct skin contact, accidental ingestion of contaminated water, or accidental inhalation of water droplets in the air. Symptoms of exposure to algal toxins include rashes, hives, diarrhea, vomiting, coughing, or wheezing. More severe symptoms may result from longer or greater amounts of exposure.

People who plan to recreate in or on Illinois lakes or rivers this summer are advised to avoid contact with water that:

- looks like spilled, green or blue-green paint;
- has surface scums, mats, or films;
- is discolored or has green-colored streaks; or
- has greenish globs suspended in the water below the surface.

People are also advised to keep children and pets out of the water. Do not allow pets to drink from the water and do not allow them to lick their fur after swimming in water containing a blue-green algae bloom. If you or your pet has contact with water you suspect may have a blue-green algae bloom, rinse off with clean, fresh water as soon as possible.

Activities near, but not in or on a lake or river, such as camping, picnicking, biking, and hiking are not affected. With all activities, wash your hands before eating if you have had contact with lake water or shore debris.

you are concerned you have symptoms that are a result of exposure to algal toxins, contact your ealth care provider or call the Illinois Poison Center at 1-800-222-1222. If your pet experiences mptoms that may be a result of exposure, contact your veterinarian.

For additional information about harmful algal blooms, please visit:

Illinois Environmental Protection Agency Harmful Algal Bloom website: https://www2.illinois.gov/epa/topics/water-quality/monitoring/algal-bloom/Pages/default.aspx

Iowa: 2014 Blue-Green Algae Press Release

AVOID BLUE-GREEN ALGAE BLOOMS

MEDIA CONTACT: Mary Skopec at 515-725-3434 or 319-400-0442 (cell) or Mary.Skopec@dnr.iowa.gov

DES MOINES – A reported chemical spill on the Des Moines River above Saylorville Lake Wednesday turned out to be a blue-green algae bloom, according to DNR investigators.

"It's the time of year we start to see algae blooms, both green and blue-green," said Mary Skopec, of the DNR's beach monitoring program. "The heavy rainfall and floods washed nutrients into water bodies. Once the weather turns hot, and the water is stagnant, you'll start to see blooms around the state."

Not all blooms are toxic, but blue-green algae can produce toxins. "The toxins are bound in the cells, so when the algae die, it's released to the water," Skopec said.

The DNR tests for bacteria and algal toxins (microcystins) levels at state park beaches at least once per week between Memorial Day and Labor Day. Results Thursday showed elevated levels of microcystins at Denison State Park. To find test results by lake, search for beach monitoring at www.iowadnr.gov or call the Beach Hotline at 319-353-2613.

Results from the Des Moines River were slightly elevated but well below levels of concern for recreation. "However, blooms can form rapidly," said Skopec.

The Iowa DNR and Iowa Department of Public Health recommend staying away from cloudy, blue-green areas on lakes and rivers. The blooms usually float to the surface and can be many inches thick, especially near shorelines.

People can get sick from water containing blue-green algal blooms. They should avoid swimming in areas with obvious bright blue-green color. "Likewise, people should keep their livestock and pets out of those areas," said Skopec, "because if they ingest the water or lick algae off their fur, they could have impacts on their health."

People can get sick from intentionally or accidentally swallowing the water, by having direct skin contact (as when swimming, wading or showering) or by breathing airborne droplets (as when boating or waterskiing). Sickness from exposure to blue-green algal blooms is not contagious, and cannot be spread from person to person.

The following symptoms can show up within hours or days, but normally show up within one week:

- Rash, hives, or skin blisters (especially on the lips and under swimsuits).
- Gastrointestinal symptoms such as stomach pain, nausea, vomiting, diarrhea, severe headaches and fever.
- Runny eyes and nose, cough, and sore throat, chest pain, asthma-like symptoms or allergic reactions.
- Exposure to large amount of the toxin from blue-green algae can cause liver damage.

People who think they have been exposed to the toxins should contact their health provider.

Talking points to media: Blue-green algal blooms occur when algae that are normally present grow exuberantly. Within a few days, a bloom can cause clear water to become cloudy. The blooms usually float to the surface and can be many inches thick, especially near the shoreline.

Both humans and animals can get sick from exposure to water containing blue-green algal blooms. People can get sick from being exposed to the toxins within blue-green algal blooms, either by intentionally or accidentally swallowing water, by having direct skin contact (as when swimming, wading, or showering), or by breathing airborne droplets containing the toxin, such as during boating or waterskiing. Any sickness from exposure to blue-green algal blooms cannot be spread from one person to another, nor from an animal to a person.

Symptoms may take hours or days to show up in people, but normally show up within one week after exposure.

Symptoms of exposure to blue-green algae can include

- *Rash, hives, or skin blisters (especially on the lips and under swimsuits).*
- *Gastrointestinal symptoms such as stomach pain, nausea, vomiting, diarrhea, severe headaches, and fever.*

- *Runny eyes and nose, cough, and sore throat, chest pain, asthma-like symptoms, or allergic reactions.*
- *Exposure to large amount of the toxin form blue-green algae can cause liver damage.*

People who believe that they may have gotten sick from exposure to blue-green algal blooms should see their health care provider.

Minnesota: 2016 Blue-Green Algae Press Release

News Release

Minnesota Pollution Control Agency

MDH Minnesota Department of Health

For release: May 26, 2016
Contact: Risikat Adesaogun, MPCA, 651-757-2056 or Doug Schultz, MDH, 651-201-4993

Note to editors: *Photographs of blue-green algal blooms are available on the MPCA's Flickr account.*

Blue-green algae: If in doubt, stay out

St. Paul, Minn.—With Memorial Day right around the corner, the unofficial start of summer is here. While water enthusiasts and pets enjoy swimming and boating when the weather is calm and sunny, these conditions are also perfect for growing blue-green algae, which can be harmful to both people and animals.

Last summer, blue-green algal blooms were reported in lakes across the state, from near the Iowa border all the way to the Canadian border. The Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Health (MDH) staff jointly investigated two reported human illnesses and multiple dog deaths following exposure to blue-green algae. Blooms typically begin to form in June when the weather warms, but with the mild spring weather this year, blooms may already be present in Minnesota lakes.

People and pets at risk

The appearance of a blue-green algal bloom and the unpleasant smell that occasionally accompanies a bloom typically keep most people out of the water. However, people can become sick after they swim, boat, water ski or bathe in water that has toxic blue-green algae. During these activities, people are exposed to the toxins by swallowing or having skin contact with water or by breathing in tiny droplets of water in the air. “In most people, symptoms are mild and may include vomiting, diarrhea, rash, eye irritation, cough, sore throat and headache,” said MDH Epidemiologist Stephanie Gretsch.

Dogs are at particular risk, as they are more likely to wade in the areas of a lake where algal scum accumulates and humans avoid. Dogs are usually exposed to larger amounts of toxins from algae because they tend to swallow more water than humans while swimming, especially when retrieving toys from the water. They also lick their coats upon leaving the water, swallowing any algae that may be on their fur. Dogs exposed to blue-green algae can experience symptoms such as vomiting, diarrhea, rash, difficulty breathing, general weakness, liver failure and seizures. In the worst cases, it can cause death. If your dog experiences any of these symptoms after visiting a lake, seek veterinary care immediately.

Tips to protect yourself and your pets

Not all blue-green algae are toxic, but there is no way to tell whether a bloom is toxic by looking at it. Harmful blooms often look like pea soup, green paint or floating mats of scum and sometimes have a bad smell. However, harmful blooms aren’t always large and dense and can sometimes cover small portions of the lake with little visible algae present. Before you or your children or pets enter the water, take a closer look at the lake and check for algae in the water or on shore to help determine if a bloom recently happened.

“If it looks and smells bad, don’t take a chance. We usually tell people: If in doubt, stay out,” said Pam Anderson, MPCA Water Quality Monitoring Supervisor. “If you’re not sure, it’s best for people and pets to stay out of the water.” If you do come into contact with blue-green algae, wash off with fresh water immediately,

paying special attention to the areas your swim suit covered. Rinse off pets with fresh water if you think they swam in water where blue-green algae were present.

Addressing the algae problem

There are currently no short-term solutions to fix a blue-green algal bloom. Once a bloom occurs, the only option is to wait for the weather to change to disrupt the algae's growth. "With intermittent rain, followed by high temperatures, blue-green algal blooms will be common on many Minnesota lakes this summer," said Steve Heiskary, an MPCA Research Scientist.

The key to solving algae problems is to improve overall water quality by reducing how much phosphorus gets into lakes. Phosphorus is a nutrient that encourages plant growth, and it is present in soil and plants. Runoff from urban and agricultural land contains phosphorus. Excess phosphorus in lakes provides the food necessary to produce algal blooms. Aside from limiting applications of fertilizers that contain phosphorus, homeowners can help protect our lakes by sweeping up lawn clippings and soil off sidewalks and pavement, and cleaning up pet waste, so that rain storms don't wash the material into nearby lakes and rivers.

More information on blue-green algae, including how to report a possible human or animal illness, is available on the MDH Harmful Algal Blooms website.

Broadcast version

The Minnesota Pollution Control Agency and the Minnesota Department of Health are advising the public to stay out of algae-laden water. This year's mild spring weather has created ideal conditions for algal blooms.

Certain species of blue-green algae contain potent toxins that can quickly become deadly to both people and animals. Keep pets and children away from waters with a pea soup or green paint appearance. Water may also have a foul odor. Symptoms can include vomiting, diarrhea, headache, eye irritation, and seizures. If you or your pets experience these symptoms, seek medical or veterinary assistance immediately.

#

The mission of the MPCA is to protect and improve the environment and enhance human health.

St. Paul • Brainerd • Detroit Lakes • Duluth • Mankato • Marshall • Rochester • Willmar
www.pca.state.mn.us • Toll-free and TDD 800-657-3864

Wisconsin: 2016 Press Release

Blue-green algal bloom season is underway

Published by Central Office July 5, 2016

Contact(s): Gina LaLiberte, DNR statewide blue-green algae coordinator, 608-221-5377, Gina.Laliberte@wisconsin.gov

MADISON, Wis. - Those heading out to lakes are reminded to be on the lookout for blue-green algae blooms beginning to form on lakes and ponds across the state.

The Wisconsin Department of Natural Resources has received reports of blooms on some southern lakes and blooms will continue to appear throughout the state as the summer months continue.

Blue-green algae blooms tend to grow when there is a lot of sunlight, water temperatures are high, and there is little wind. The blooms peak from July to September.

"Blue-green algae are in all lakes in Wisconsin, but they only become a problem when they form nuisance-level growth, called blooms, on some lakes," said Gina LaLiberte, DNR's statewide blue-green algae coordinator. "Actively growing blooms are usually green and have a 'pea soup' appearance, but they may contain blue, white, red, or brown scums that may be foamy or in mats. These blooms may cause illnesses for those who accidentally ingest or inhale water containing algae, or have prolonged skin contact with the algae."

Jordan Dieckman, a waterborne disease fellow with the Wisconsin Department of Health Services, said common symptoms of exposure to blue-green algae blooms include rashes, gastrointestinal ailments and respiratory irritation. People experiencing symptoms that may be due to blue-green algal exposure should contact their health care provider or the Poison Control Center at 1-800-222-1222.

Public health officials encourage people to avoid swallowing any water and to always wash off after swimming in any lake, pond or river. Dogs should always be rinsed off with clean water to remove algae from their coat. If people have any doubts about the appearance of water, they should stay out. They should ensure that children and pets do not swim in or drink water with an algae bloom.

Not all blue-green algae outbreaks have heavy surface scum. People should avoid conditions when water is opaque and green like this seen in Lake Monona in 2015.

"A good rule for identifying risk from blue-green algae is that if adults are in knee-deep water and can see their feet clearly, the risk of illness is low to moderate, but it's still a good idea to avoid swallowing water that could contain other bacteria and pathogens," LaLiberte said. "When you can't see your feet, keep children and dogs out of the water and consider having the whole family pursue another activity that day."

People are also encouraged to help out by reporting potential algae-related illnesses in both people and animals to the Wisconsin Department of Health Services by filling out an online questionnaire [www.dhs.wisconsin.gov/water/bg-algae/index.htm] (exit DNR) or calling 608-266-1120.

Animals have a higher risk of dying after exposure to blue-green algal toxins because they are smaller in size and may ingest large amounts of toxins from drinking lake, pond, or river water or licking algae from their coat. Symptoms in dogs can include lethargy, loss of appetite, vomiting, diarrhea or even seizures. If your animal shows any of these symptoms contact your veterinarian immediately.

Blooms tend to grow when there is a lot of sunlight, water temperatures are high, and there is little wind. The blooms peak from July to September.

While not all cyanobacteria produce toxins, the presence of blue-green algae blooms in lakes, ponds or rivers may indicate a potential health hazard, LaLiberte said.

Wisconsin: 2014 Early Season Press Release

Blue-green algae blooms appearing in southern lakes, will continue northward

Published by Central Office June 17, 2014

MADISON -- Those heading out to lakes are advised to be on the lookout for blue-green algae blooms beginning to form on lakes and ponds across the state. Reports show blooms are forming on southern lakes and will gradually appear northward as the summer months continue.

"Blue-green algae have 'pea soup' appearance in lakes and contain green, blue, white, red, or brown scums that may be foamy or in mats," says Gina LaLiberte, a research scientist with the Wisconsin Department of Natural Resources. "These blooms may cause illnesses for those who come in contact with them or accidentally ingest water containing algae."

The most commonly reported symptoms of exposure to blue-green algae blooms include rashes, gastrointestinal ailments, and respiratory irritation, according to Mark Werner, a toxicologist with the Department of Health Services. People experiencing symptoms that may be due to blue-green algal exposure should contact their health care provider or the Poison Control Center at 1-800-222-1222.

Public health officials encourage people to always wash off after swimming in any lake, pond or river. Dogs should always be rinsed off with clean water to remove algae from their coat. If people have any doubts about the appearance of water, they should stay out. They should ensure that children and pets do not swim in or drink water with an algae bloom.

"A good rule for identifying blue-green algae is that if adults are in knee-deep water and can see their feet, the risk from blue-green algae is low to moderate, but it's still a good idea to avoid swallowing water," LaLiberte says. "When you can't see your feet, keep children and dogs out of the water, and consider having the whole family pursue another activity that day."

People are also encouraged to help out by reporting potential algae-related illnesses in both people and animals to the Wisconsin Department of Health Services by filling out an electronic form [www.dhs.wisconsin.gov/eh/bluegreenalgae/ (exit DNR) or calling 608-266-1120.

Animals have a higher risk of dying after exposure to blue-green algae toxins because they are smaller in size and may ingest large amounts of toxins from drinking lake, pond, or river water or licking algae from their coat. Symptoms in dogs can include lethargy, loss of appetite, vomiting, diarrhea or even seizures. If your animal shows any of these symptoms contact your veterinarian immediately.

Blooms tend to grow when there is a lot of sunlight, water temperatures are high, and there is little wind, with the number of blooms peaking from July to September.

Some bloom-forming blue-green algae species produce toxins that can cause rashes or gastrointestinal illness with ingestion. If ingested in high levels the toxins can harm the neurological system, liver or kidneys of people, pets, livestock and wildlife. Not all cyanobacteria produce toxins, but the presence of blue-green algae blooms in lakes, ponds, or rivers serves as an indication the public can use to identify a potential health hazard, according to LaLiberte.

The DNR will be hosting an online blue-green algae chat July 1 at noon where participants can logon and ask a panel of experts questions on blue-green algae and ways to stay safe this summer when spending time on the water.

More information is available by searching the DNR website dnr.wi.gov for "blue-green algae."

FOR MORE INFORMATION CONTACT: Gina LaLiberte, DNR research scientist
gina.laliberte@wisconsin.gov 608-221-5377

Last Revised: Tuesday, June 17, 2014

Wisconsin: 2011 Hunting Dogs Press Release

Blue green algae a threat to hunting dogs

Published by Central Office August 9, 2011

MADISON -- The estimated 50,000 or more Wisconsin waterfowl hunters whose favorite hunting partner has four legs, a tail, and doesn't mind swimming in cold water may want to take some precautions against their friend coming down with serious illness from ingesting water containing potentially toxic blue-green algae.

"Working together with dogs is part of a long and rich tradition for many waterfowl hunters," said Kent Van Horn, DNR Migratory Game Bird Ecologist. "Sometimes, care of these furry hunting companions requires extra awareness. While not widespread, potential toxicity from blue-green algae is still a concern for waterfowl hunting dogs."

Recent cases included three Wisconsin dog deaths from blue-green algae poisoning reported in 2008, two in 2009, and thankfully none in 2010.

With about 80,000 waterfowl hunters, Wisconsin has the third highest number of waterfowl hunters in the country. About 60 percent of Wisconsin waterfowl hunters use dogs to retrieve their harvested ducks and geese.

What is commonly referred to as blue-green algae are actually cyanobacteria, microscopic organisms that are true bacteria. They are present in all lakes, marshes, ponds and ditches across Wisconsin but live unrecognized except for when the right conditions develop and the cyanobacteria grow quickly, creating "blooms" across the water surface that look like paint, thick scum, or "pea soup." When blooms occur, cyanobacteria can release toxins that can cause illness and even death in many animals ingesting them, including dogs and humans. While blooms of blue-green algae occur most frequently in summer, blooms have been observed in Wisconsin in fall and winter. During the fall waterfowl hunting season, toxic bloom conditions can develop on warm fall days or on lakes that are in fall turn over.

Cyanobacteria "bloom densities" can develop in surface waters with high concentrations of nutrients, particularly phosphorus. Blooms tend to grow when there is a lot of sunlight, the temperature is warm, the water is shallow and there is little wind. Sometimes when the wind kicks up, blue-green algae will pile up on the windward side of the lake.

Hunters should be on the lookout for the following conditions in the field: a green "pea soup" appearance, surface water blooms that are green, blue, red, or brown in color, or foamy scum layers, mats or blobs.

Hunters should adhere to the following advice of the Wisconsin Veterinary Medical Association to help protect their dog's health:

- Provide a good supply of clean fresh water for your dog to drink while hunting.

- Don't let dogs submerse themselves in water that has a bloom.
- If your dog does get in water with a bloom, wash your dog thoroughly before it starts to groom or lick itself.
- Be sure to wear gloves when you wash your dog and avoid direct contact with any "algae" present.

After potential exposure, watch your dog for signs of lethargy, loss of appetite, vomiting, diarrhea or even seizures. If your animal shows any of these symptoms contact your veterinarian immediately. More information on blue-green algae in Wisconsin can be found on the Blue-Green Algae In Wisconsin Waters page of the DNR website and [blue-green algae page of the Department of Health website (exit DNR).

FOR MORE INFORMATION CONTACT: Kent Van Horn, DNR Migratory Game Bird ecologist (608) 266-8841: Gina LaLiberte DNR research scientist (608) 221-5377

Last Revised: Tuesday, August 09, 2011

RESPONSE TOOLS AND RESOURCES:
SECTION C – ALGAE/TOXIN GUIDELINES

Drinking Water Advisories/Guidelines

Federal

Currently there are no Federal drinking water standards for the algal toxins. In 2015 USEPA issued Drinking Water Health Advisories for two algal toxins, microcystins and cylindrospermopsin. These advisories are based on a 10-day exposure and are as follows:

USEPA Finished Drinking Water Health Advisories for Algal Toxins

Age Group	Microcystins (ug/L)	Cylindrospermopsin (ug/L)
Children under 6 years	0.3	0.7
Children over 6 years and adults	1.6	3.0

State

Of the UMR states, only Minnesota has its own values for algal toxins in drinking water, which include a health-based value (HBV) of 0.1 ppb (ug/L) for microcystin-LR. While this value is specific to microcystin-LR, the Minnesota Department of Health (MDH) recommends this guidance also be used for total microcystins. MDH has also established a risk assessment advice (RAA) level of 0.1 ppb (ug/L) for anatoxin-a in drinking water. *(Note: An RAA contains greater uncertainty than an HBV because the available information is more limited.)*

Minnesota Drinking Water Values for Algal Toxins

State	Microcystin-LR (ug/L) *Health-Based Value*	Anatoxin-a (ug/L) *Risk Assessment Advice*
Minnesota	0.1	0.1

While not a UMR state, Ohio has been very active in the adoption of cyanotoxin guidelines and their approach may be regionally relevant. They have several resources on their website that may be useful to the UMR states: https://epa.ohio.gov/ddagw/HAB. As such, Ohio's guidelines are included here for reference as they appear in Ohio EPA's 2019 Public Water System Harmful Algal Bloom Response Strategy. Note that Ohio has incorporated the USEPA advisories for microcystins and cylindrospermopsin.

Ohio EPA Finished Drinking Water Advisories for Algal Toxins

Advisory Level/ Age Group	Microcystins* (ug/L)	Cylindrospermopsin (ug/L)	Anatoxin-a (ug/L)	Saxitoxins* (ug/L)
Do Not Drink – children under 6 years and sensitive populations	0.3	0.7	20	0.2
Do Not Drink – children 6 and older and adults	1.6	3.0	20	0.2
Drinking Water- Do Not Use**	20	20	300	3

* Microcystins and saxitoxins thresholds are intended to be applied to the total concentrations of all reported congeners/variants of those cyanotoxins.

** Drinking water "do not use" thresholds are based on recreational no contact advisory thresholds.

Recreational Advisories/Guidelines

Federal

In May 2019, USEPA released recommended human health recreational ambient water quality criteria or swimming advisories for microcystins and cylindrospermopsin.

Recommended Recreational Criteria/Swimming Advisories for Cyanotoxins

Microcystins (ug/L)[a,b]	Cylindrospermopsin (ug/L)[a,b]
8	15

a) Swimming advisory: not to be exceeded on a single day.
b) Recreational criteria: on a 10-day assessment period (not a rolling 10-day period) over the course of a recreation season.

State

A few of the UMR states have recreational water guidelines/action levels that inform their follow-up activities and communication to the public, as listed below.

UMR State Recreational Thresholds

State	Recreational Water Guidance/Action Level
Illinois	Microcystins ≥ 8 ug/L
Iowa	Microcystin ≥ 20 ug/L
Missouri	Microcystin ≥8 ug/L Cylindrospermopsin ≥15 ug/L Anatoxin-a ≥20 ug/L Saxitoxin ≥10 ug/L Microcystis or Plantothrix ≥40,000 cells/mL All other genera ≥100,000 cells/mL
Wisconsin	> 100,000 cells/mL or scum layer

Included below for reference are also the Ohio EPA guidelines for recreational use.

Ohio EPA Guidelines for Algal Toxins in Recreational Waters

Advisory Type	Microcystin (ug/L)	Cylindrospermopsin (ug/L)	Anatoxin-a (ug/L)	Saxitoxin (ug/L)
Informational Sign	<6	<5	<80	<0.8
Recreational Public Health Advisory	6	5	80	0.8
Recreational No Contact Advisory	20	20	300	3

Lastly, as many states derive their guidance from World Health Organization (WHO) recommendations, shown below are WHO guidelines for recreational waters.

WHO Guidelines for HABs in Recreational Waters

Guidance Level	Concentration	How Guidance Level Derived	Health Risks
Low probability of health effects	20,000 cells/ml or 10 ug/L of chlorophyll-*a* with cyanobacteria dominant	Human bathing epidemiological study	Short term- skin irritations, gastrointestinal illness
Moderate probability of health effects	100,000 cells/ml or 50 ug/L of chlorophyll-*a* with cyanobacteria dominant	Provisional drinking water guideline value for microcystin and other cyanotoxins	Potential for long term illness as well as short term health effects
High probability of health effects	Cyanobacteria scum formation in areas where whole body contact occurs	Inference from oral animal lethal poisonings and human illness case histories	Potential for acute poisoning

RESPONSE TOOLS AND RESOURCES:
SECTION D – CAPACITIES COMPILATION

1 - Overview of Program Functions*

States	**Illinois EPA** Beach/Stream/Lake Michigan monitoring Citizen reports Response to reports Drinking water intake monitoring Lab analysis Public education	**Iowa DNR** Beach/stream/lake monitoring Citizen reports Response to reports Public education Drinking water intake monitoring Lab analysis Public education Coordination w/USACE on large reservoirs	**Minnesota PCA** Citizen reports Response to reports Tracking of blooms and animal deaths Public education **Minnesota Department of Health** Lab analysis Investigations into reported illnesses or animal deaths; reports to OHHABS	**Missouri DNR** Citizen reports Response to reports Drinking water monitoring if bloom in vicinity of intake Lab analysis Public education	**Wisconsin DNR** Citizen reports Response to reports Public education Lab analysis Limited bloom tracking
Federal Agencies	**USEPA Region 5** State and Tribal 106 Program Support Lab analysis (selected microcystins and nodularin analysis in drinking water following EPA Method 544)	**USEPA Region 7** Urban lakes monitoring Monitoring on tributaries to Mississippi and Missouri Rivers Incident response Lab analysis Tribal support Collaborating with NOAA, USGS	**USEPA ORD** Remote sensing/satellite imagery Development and testing of new water monitoring technologies Technical support for drinking water treatment questions	**USGS-UMESC** Long term water quality, ecological resource, and land cover data collection Lab analysis of water quality samples Research Hosts GREON buoys GIS/spatial analysis branch	**USACE-Rock Island District** Reservoir monitoring Citizen reports Response to reports Public education and notification **USACE-St. Louis District** Water quality management
Other Partners	**City of Moline Public Water System** Monitoring of raw and finished water	**National Great Rivers Research and Education Center** Continuous monitoring via GREON Compilation and display of Mississippi River water quality data via Great Lakes to Gulf (GLTG) virtual observatory Laboratory analysis Research Environmental education			

*May include both HAB-specific and related functions. See later tables for greater detail regarding functions and capacities.

2 – Agency/Program Websites

States	**Illinois** IL EPA Program Page: https://www2.illinois.gov/epa/topics/water-quality/monitoring/algal-bloom/Pages/default.aspx HAB Reporting Form: https://www2.illinois.gov/epa/Documents/epa.state.il.us/water/algal-bloom/forms/bloom-report-form.pdf	**Iowa** State Park Beach Monitoring Page: http://www.iowadnr.gov/Things-to-Do/Beach-Monitoring Water Monitoring Page: http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring	**Minnesota** MPCA Program Page: https://www.pca.state.mn.us/water/blue-green-algae-and-harmful-algal-blooms Minnesota Department of Health (MDH) Program Page: https://www.health.state.mn.us/diseases/hab/index.html	**Missouri** Page hosted by MO Department of Natural Resources (includes previously listed LMVP and DHSS information): https://dnr.mo.gov/env/cyanobacteria.htm	**Wisconsin** WI Department of Natural Resources: http://dnr.wi.gov/lakes/bluegreenalgae/ WI Department of Health Services: https://www.dhs.wisconsin.gov/water/bg-algae/index.htm
Federal Agencies	**USEPA** USEPA Program Page: https://www.epa.gov/cyanohabs https://www.epa.gov/nutrientpollution/harmful-algal-blooms	**USACE-UMRR (via USGS)** USACE-UMRR LTRM data: http://www.umesc.usgs.gov/ltrmp.html			**USACE-St. Louis District** http://www.mvs.usace.army.mil/Missions/Centers-of-Expertise/Environmental-and-Munitions/Environmental_Quality_and_HTRW/
Other Partners	**National Great Rivers Research and Education Center** Great Rivers Ecological Observation Network (GREON): http://www.ngrrec.org/GREON/ Great Lakes to Gulf (GLTG) Virtual Observatory: https://greatlakestogulf.org/#/				

3 - Spatial Scope, UMR-Specific Presence, and Staffing/Field Presence

<table>
<tr><td rowspan="2">States</td><td><u>Illinois EPA</u>
Spatial Scope: Statewide, with focus on recreational-access areas, source water, and surface water intakes.
UMR Presence: None ongoing (only Ohio & Fox Rivers currently have), but IL EPA will respond to reports statewide.
Staffing/Field Presence: IL EPA regional & headquarters staff respond to reports, subject to their availability. Lake Co Health Department staff monitor Lake County beaches routinely.</td><td><u>Iowa DNR</u>
Spatial Scope: Statewide, focus on recreational-access areas (beaches) and source water and surface water intakes.
UMR Presence: None ongoing, but will respond to reports statewide. Has done some river-specific sampling (e.g., Davenport water intake).
Staffing/Field Presence: One full time staff to coordinate Ambient lake monitoring and beach monitoring programs. One full time Beach Lead technician to run laboratory toxin analysis and collect samples. Three seasonal techs also. Contract field staff through the University of Iowa Hygienic Laboratory for streams. Contract field staff through Iowa State University for lakes.</td><td><u>Minnesota PCA</u>
Spatial Scope: Statewide
UMR Presence: None specific, but will respond to reports statewide.
Staffing/Field Presence: No dedicated staffing for HAB. Have 6 crew leads for ambient water quality monitoring, including lakes, streams, and rivers. No beach monitoring program for inland lakes/streams.</td><td><u>Missouri DNR</u>
Spatial Scope: Statewide (14 lakes in 2017)
UMR Presence: None specific, but will respond to reports statewide.
Staffing/Field Presence: No dedicated staff for HAB. Have field staff in five regional offices, statewide environmental emergency response staff, and water quality monitoring staff in central office that may respond to HAB events. Central office has test kits.</td><td><u>Wisconsin DNR</u>
Spatial Scope: Statewide
UMR Presence: Have sampling kit(s) at the La Crosse WI DNR office
Staffing/Field Presence: Sampling kits staged with staff/in offices statewide, including at La Crosse office. Kits are designated for use by DNR staff when illnesses suspected to be HAB-related are reported to and evaluated by Department of Health Services. Sampling for other purposes can be coordinated through Gina.LaLiberte@wisconsin.gov. On UMR, can also work in collaboration with UMRR-LTRM field station in La Crosse.</td></tr>
<tr><td colspan="5">Note: State-based UMRR-LTRM field stations at Lake City, MN (Minnesota DNR); La Crosse, WI (Wisconsin DNR); Bellevue, IA (Iowa DNR); Alton, IL (Illinois NHS); and Jackson, MO (Missouri DC) could potentially provide support in incident sampling.</td></tr>
<tr><td>Federal Agencies</td><td><u>USEPA Region 5</u>
Spatial Scope: Region-wide.</td><td><u>USEPA Region 7</u>
Spatial Scope: Region-wide, at select streams and urban lakes.
UMR Presence: None specific, but can respond to incidents region-wide at</td><td><u>USEPA ORD</u>
Spatial Scope: Primarily a lakes and reservoirs focus, limited engagement in rivers to date (for satellite</td><td><u>USGS-UMESC (role in USACE-UMRR Program)</u>
Spatial Scope: For USACE UMRR-LTRM monitoring (in collaboration with state-</td><td><u>USACE-Rock Island District</u>
Spatial Scope: USACE-managed reservoirs</td></tr>
</table>

	UMR Presence: None at this time. **Staffing/Field Presence:** Regional staff in Chicago has field equipment for surface water monitoring.	request of state or tribe. Also, has monitored on tributaries to UMR **Staffing/Field Presence:** Field staff located in Kansas City, KS, but has assets (e.g. boats, sondes, mobile lab) that can be deployed in incident response.	imagery component, resolution is a challenge) **UMR Presence:** None specific, but monitoring technologies and potentially remote sensing could be applied. **Staffing/Field Presence:** None ongoing for UMR.	based field stations), primarily in UMR study pools – 4, 8, 13, 26, Open River. **UMR/Field Presence:** For UMRR program, see state-based field stations as described under "states" above. .	within the Rock Island District. **UMR Presence:** No river-based monitoring at this time. **USACE-St. Louis District** **Spatial Scope:** 300 UMR miles and 5 reservoirs within the district (in IL and MO).
Other Partners	**City of Moline Public Water System** **Spatial Scope:** City of Moline/Quad Cities area intake monitoring, as well as a continuous monitor upstream (though this continuous monitoring does not currently include HAB-specific parameters). **UMR Presence:** Moline intake is on Sylvan Slough of the UMR in the Quad Cities, intake monitoring takes place here **Staffing/Field Presence:** City of Moline staff	**National Great Rivers Research and Education Center** **Spatial Scope:** GREON – seven, soon to be eight buoy-mounted continuous monitoring stations located across UMR basin. GLTG – data compilation on upper and lower river, as well as basin **UMR Presence:** Five of the GREON buoys are placed, seasonally, on the mainstem UMR and backwaters, two on tributaries. **Staffing/Field Presence:** NGRREC staff, plus staff at host locations for buoys. Additional field staff on river year-round working on other projects (mostly in several pools north of St. Louis).			

4 – Parameters, Sampling Frequency, Sampling and Analytical Methods, Laboratories Used

	Illinois EPA	Iowa DNR	Minnesota PCA	Missouri DNR	Wisconsin DNR
States	**Parameter Focus:** Microcystin and cylindrospermopsin at surface intakes and some blooms. Microcystins routinely for recreational samples **Sampling Frequency:** Routine lake beach and intake sampling 4x during June through October. Routine beach sampling in Lake Co. every two weeks Memorial Day through Labor Day. Routine streams approximately every 6 weeks during June through Oct. As needed in response to blooms. **Sampling Methods:** Abraxis strip tests for screening **Analytical Methods:** ELISA for microcystins and cylindrospermopsin **Laboratories Used:** IL EPA laboratory	**Parameter Focus:** *Beaches* – total microcystins and limited cylindrospermopsin; *Lakes* – Total microcystins, chlorophyll-*a*, phycocyanin, phytoplankton identification and nutrients; *Streams* – nutrients, chlorophyll-*a*, sediment, microcystins (response based). **Sampling Frequency:** Weekly beach samples during the primary recreational season (Memorial Day to Labor Day); Lakes – 3x during summer; Streams – Monthly **Sampling Methods:** Beaches – composite of nine samples in beach area. Sample Tuesday/Wednesday using Abraxis ELISA kits **Analytical Methods:** ELISA **Laboratories Used:** Iowa DNR water quality lab, Iowa State University Limnology Lab	**Parameter Focus:** Microcystin. Also did some paired saxitoxin monitoring in July 2007. Study in 2016 includes microcystin and anatoxin. 2017 National Lakes Assessment included microcystin and anatoxin. **Sampling Frequency:** In response to reports – limited to animal deaths or human illness. Other sampling limited to NLA. **Sampling Methods:** Laboratory analysis. Also, experimenting with test strips. **Analytical Methods:** ELISA-for laboratory for both microcystin and anatoxin. Abraxis test strips for microcystin, anatoxin-a, and cylindrospermopsin. **Laboratories Used:** MDH laboratory	**Parameter Focus:** Microcystin, cylindrospermopsin, saxitoxin, anatoxin-a. **Sampling Frequency:** Response only, no continuous monitoring. If toxins are found, monitoring will be determined on a case-by-case basis based upon waterbody use. **Sampling Methods:** Abraxis dipstick test kits maintained in central laboratory. If screening indicates presence of toxins, samples collected and sent to state lab for ELISA testing according to Abraxis collection recommendations. **Analytical Methods:** ELISA – have in-house capacity. Developing cyanobacteria ID and enumeration abilities. **Laboratories Used:** Missouri DNR laboratory. Would utilize contract lab if ID or counts are desired.	**Parameter Focus:** Microcystins, anatoxins, cylindrospermopsins, saxitoxin, phytoplankton enumeration, water chemistry. **Sampling Frequency:** In response to reports, with priority for human and animal illnesses confirmed by Wisconsin Department of Health Services as consistent with cyanobacterial exposure symptoms (no routine ongoing monitoring). Bloom confirmation and/or identification by WI DNR staff via photographs or occasional submitted sample. **Sampling Methods:** Response monitoring sampling kits staged for sample collection by DNR staff and laboratory analysis by Wisconsin State Laboratory of Hygiene. For selected State Parks, enhanced surveillance pilot program using microcystin test strips (funded by Wisconsin Department of Health Services). **Analytical Methods:** Microcystin, cylindrospermopsin, and saxitoxin by ELISA. Anatoxin-a by receptor-binding assay. By HPLC-MS/MS: microcystins (LA, LR, RR, YR), anatoxin-a, homoanatoxin-a, cylindrospermopsin, deoxycylindrospermopsin. Also, cyanobacterial identification and enumeration. **Laboratories Used:** Wisconsin State Laboratory of Hygiene

Federal Agencies	**USEPA Region 5** **Parameter Focus:** Microcystins and nodularin **Sampling Frequency:** None at this time **Sampling Methods:** None at this time. **Analytical Methods:** EPA Method 544 **Laboratories Used:** The Region 5 Analytical Services Branch is available to analyze water samples and now offers selected microcystins and nodularin analysis in drinking water following EPA Method 544	**USEPA Region 7** **Parameter Focus:** Currently, microcystin (for urban lakes monitoring). Expanding in 2016 to include cylindrospermopsin and BGA identification. **Sampling Frequency:** In response to reports. Urban Lake monitoring monthly during recreational season. **Sampling Methods:** Field test kits (for laboratory analysis). **Analytical Methods:** ELISA; exploring the FlowCam Cyano for fast ID and calculated counts. **Laboratories Used:** USEPA Region 7 lab; mobile lab could also be used.	**USEPA ORD** **Parameter Focus:** Presence of cyanobacteria (not toxins directly) as observed via remote sensing.	**USGS-UMESC** **Parameter Focus:** Via UMRR-LTRM, has extensive chlorophyll-*a* data for study pools. Phytoplankton collected and archived, but not typically analyzed. Two recent theses provide background info on distribution and abundance of blue green algae in a subset of study reaches. GREON buoy parameters include water temperature, oxygen, conductivity, turbidity, chlorophyll-*a*, blue-green algae, nitrate and weather info. **Sampling Frequency:** For LTRM water chemistry and phytoplankton frequency varies from monthly to quarterly. GREON monitoring is continuous during deployment period. **Sampling Methods:** No specific, routine sampling for algal toxins. Phytoplankton samples (for archiving) are collected via grab sample from depth of 0.2 m and occasional microcystin samples are taken from the same grab sample. **Analytical Methods:** No specific, routine analysis for algal toxins. See NGRREC section for GREON methods. UMESC's Aquatic Ecosystem Health (AEH) branch has capability to use eDNA for cyanobacteria monitoring/detection. **Laboratories Used:** USGS-UMESC laboratory.	**USACE-Rock Island District** **Parameter Focus:** Microcystin-LR **Sampling Frequency:** Weekly reservoir monitoring during use season. **Sampling Methods:** Grab sampling for lab analysis. Looking into the use of on-site test kits. **Analytical Methods:** Not stated **Laboratories Used:** Not stated **USACE-St.Louis District** **Parameter Focus:** Microcystin toxicity and cyanobacterial enumeration for recreational waters, and Cylindrospermopsin for multi-purpose reservoirs (public water supply) **Sampling Frequency:** Event driven. **Sampling Methods:** Consistent with USGS guidelines, see: http://pubs.usgs.gov/sir/2008/5038/pdf/SIR2008-5038.pdf **Analytical Methods:** enzyme-linked immunosorbent assay (ELISA) kits **Laboratories Used:** St. Louis District IDIQ Environmental Laboratory

Other Partners	**<u>City of Moline Public Water System</u>** **Parameter Focus:** Microcystin (will also soon be getting in-house chlorophyll-*a* and phycocyanin analytical capability) **Sampling Frequency:** Sampling frequency driven by river conditions **Sampling Methods:** Grab samples from intake and finished water. **Analytical Methods:** ELISA- MC **Laboratories Used:** City of Moline, confirmation samples sent out to labs in Peoria and Florida.	**<u>National Great Rivers Research and Education Center</u>** **Parameter Focus:** GREON parameters include water temperature, oxygen, conductivity, turbidity, chlorophyll-*a*, blue-green algae, nitrate and weather info. GLTG data compilation largely nutrient-focused. **Sampling Frequency:** GREON continuous monitoring, hourly sample collection from April through October **Sampling Methods:** GREON uses continuous monitoring technology (primarily sonde-mounted probes). **Analytical Methods:** In vivo fluorometric sensor – total algae (chlorophyll-*a* and phycocyanin). Also collect continuous UV nitrate and other water quality parameters. **Laboratories Used:** GREON **c**ontinuous monitors; NGRREC laboratory.			

5 – Data Turnaround and Availability

States	**Illinois EPA** **Data Turnaround Time:** Field test kits: usually within 24 hrs. Laboratory analysis: 48 hours to 14 days. **Data Availability:** Shared internally and upon request. Routine results uploaded to AWQMS/WQX and Drinking Water Watch http://water.epa.state.il.us/dww/index.jsp	**Iowa DNR** **Data Turnaround Time:** Regular reporting is on Friday (so 48 hours from last sample), but can be done in 6 hours in an emergency. **Data Availability:** Shared with public on website (see Table 2 above) and using an internal and external listserv. Uploaded to STORET/WQX annually. Also, results are made available internally and shared with Iowa Department of Public Heath for disease-tracking purposes.	**Minnesota PCA** **Data Turnaround Time:** Batch processed at the end of season (so not structured for incident response). **Data Availability:** All data is available in EQuIS and uploaded to EPA STORET.	**Missouri DNR** **Data Turnaround Time:** 1 to 3 days. **Data Availability:** Available on request or at online searchable databases: water quality data search or sampling results search system.	**Wisconsin DNR** **Data Turnaround Time:** Enumeration results can be available in 1-3 days. ELISA and anatoxin-a receptor-binding assay: 1-2 days (for cases of extreme illness or animal deaths). Toxins via HPLC-MS: batch processed at end of season. **Data Availability:** Results (primarily cyanobacterial density) communicated to local public health officials who issue advisories based on WHO recreational guidelines. Results shared internally and with Department of Health Services for entry into OHHABS.
Federal Agencies	**USEPA Region 5** **Data Turnaround Time:** 45 days for peer-reviewed data, preliminary data (non-peer reviewed) available in 14 days by request. **Data Availability:** PDF reports and spreadsheets of data (electronic data deliverables) are made available to clients via email or full data packages can be made available to clients via the R5 laboratory Sharepoint site. .	**USEPA Region 7** **Data Turnaround Time:** Generally, MC results w/in 24 hours **Data Availability:** kcwaters.org for urban data, WQX for all data.	**USEPA ORD** **Data Turnaround Time:** Satellite data can be available about 24 hours after overpass. **Data Availability:** Daily, weekly, and true color satellite data available to states for use and beta testing	**USGS-UMESC** **Data Turnaround Time:** LTRM water quality data is uploaded via an annual update – in some cases, data can be provided sooner if requested. **Data Availability:** USACE UMRR-LTRM data available at: http://www.umesc.usgs.gov/ltrmp.html	**USACE-Rock Island District** **Data Turnaround Time:** Not stated. **Data Availability:** Not stated. **USACE-St. Louis District** **Data Turnaround Time:** 48 hours **Data Availability:** Contact district staff. Not available online, as is event-driven sampling.

Other Partners	**<u>City of Moline Public Water System</u>** **Data Turnaround Time:** Not stated. **Data Availability:** Shares data with other water suppliers, Illinois EPA.	**<u>National Great Rivers Research and Education Center</u>** **Data Turnaround Time:** Continuous data published immediately on https://greatlakestogulf.org/#/. **Data Availability:** GREON data, along with other data is posted via the GLTG website.			

6 – Other Capacities and Future Work

States	**Illinois EPA** **Other Capacities:** Coordinate sampling efforts with ORSANCO, UMRBA and others as needed. Work with the Illinois Department of Public Health to issue precautionary statements when necessary. **Future Work:** Phytoplankton identification and enumeration; improved coordination among state agencies	**Iowa DNR** **Other Capacities:** Disease report tracking at Department of Public Health. Coordinate with USACE, Universities – Iowa State and University of Iowa. U of Iowa has hyperspectral capability on airplanes. **Future Work:** Expanded cylindrospermopsin analysis, expanded microcystin analysis (streams), also potentially anatoxin. Suggested interagency comparison of phytoplankton enumeration results to phytoplankton pigments (chlorophyll-*a*, phycocyanin, etc.) analysis.	**Minnesota PCA** **Other Capacities:** Have health advisory for microcystin-LR. Can work with University of Minnesota (in cases of animal death, etc.). Does not do modeling, but can obtain needed info from USGS and Met Council. No remote sensing for HAB. **Future Work:** Continuing sampling during National Lakes Assessment (NARS). Developing recreational guidance values and a beach manager document.	**Missouri DNR** **Other Capacities:** Have formed HAB work group to develop more of statewide response based upon waterbody uses and who manages/owns the waterbody. **Future Work:** Continue development of response plan guidance; development of online map of reported blooms.	**Wisconsin DNR** **Other Capacities:** Collaborate with Wisconsin Department of Health Services in regard to illness reports. Local health officials issue advisories and/or notifications **Future Work:** Continue State Parks enhanced surveillance pilot program using microcystin test strips. Monitoring & communication plan for Lake Winnebago (drinking water source). Monitoring in lower Green Bay.
Federal Agencies	**USEPA Region 5** **Other Capacities:** Convenes triannual calls with R5 states and conducted a R5 workshop in 2016. **Future Work:** None at this time.	**USEPA Region 7** **Other Capacities:** Mobile lab, emergency response boats, and sondes. **Future Work:** Looking to host Region 7 HAB workshop in the near future.	**USEPA ORD** **Future Work:** Quantifying frequency, extent, and magnitude of cyanoHABs in satellite resolvable lakes annually.	**USGS-UMESC** **Other Capacities:** Preserved phytoplankton samples are available if others want to review. In partnership with USFWS, can utilize 80-megapixel natural color digital aerial camera and a cooled, high-resolution thermal camera. Allows USFWS-UMESC partnership to produce aerial and thermal orthomosaics of areas/ targets of interest for GIS analysis. If interested in testing capability out on actual HABs, particularly between or near Twin Cities and La Crosse, contact Larry Robinson (lrobinson@usgs.gov). In addition to	**USACE-Rock Island District** **Other Capacities:** Could engage with other districts for aerial imagery. Have capacity to do flow modeling. **USACE-St. Louis District** **Other Capacities:** Incident response capabilities include: Sampling Boats, Data sondes (DO, Temp, Conductivity, pH). Note: Chlorophyll-*a* and BGA sondes being evaluated. **Future Work:** Presently monitoring progress of, and

				being able to acquire and mosaic the imagery, UMESC also has the ability to interpret and map the imagery. **Future Work:** Potential aerial imagery collection and interpretation during HAB, in collaboration with USFWS, as described above.	participating on, Harmful Algal Bloom and Hypoxia Research and Control Act (HABHRCA) Interagency Working Group efforts and impact on programmatic needs as regulating legislation develops.
Other Partners	**City of Moline Public Water System** **Other Capacities:** Microscope cameras can capture images of algae in intake vicinity. Continuous monitoring station in UMR Pool 14 upstream of Quad Cities **Future Work:** Soon adding phycocyanin probe to continuous monitoring station. May add chlorophyll-*a* probe in future years to said station.	**National Great Rivers Research and Education Center** **Other Capacities:** Environmental education, college internship program – could potentially support collaborative work with states and others. Great Lakes to Gulf application platform can be readily modified to fit other purposes given proper resources, ag conservation practitioners, large network of research collaborators at a variety of institutions. **Future Work:** GLTG could act as data host site for HAB-related information coming from multiple agencies. May add orthophosphate to GREON sensors.			