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ONE HUNDRED THIRTEENTH CONGRESS
Congress of the United States
House of Representatives
COMMITTEE ON ENERGY AND COMMERCE
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MEMORANDUM

November 17, 2014

To: Subcommittee on Environment and the Economy Democratic Members and Staff

Fr: Committee on Energy and Commerce Democratic Staff

Re: Hearing on "Cyanotoxins in Drinking Water"

On Wednesday, November 19, 2014, at 10:15 a.m. in room 2322 of the Rayburn House Office Building, the Subcommittee on Environment and the Economy will hold a hearing on "Cyanotoxins in Drinking Water." Witnesses are expected to discuss freshwater cyanobacteria harmful algal blooms (HABs) and the growing threat these events pose to drinking water sources.

I. BACKGROUND ON HARMFUL ALGAL BLOOMS

Algae, a wide array of plants that grow in water, can multiply rapidly to high concentrations or "blooms," causing significant harm to marine and aquatic ecosystems, coastal communities and human health. Some algae are considered harmful, and when conditions provide those strains with a competitive advantage, harmful algal blooms occur. HABs have been doubling in occurrence every decade since the mid-1900s[1] and anthropogenic nutrient enrichment and global climate change are thought to be fueling events of increased frequency, size and intensity.[2]

Blooms of blue-green algae, also called cyanobacteria, pose particular risks because the organisms produce toxins, called cyanotixins. Microcystins are a class of cyanotoxins, considered by the Environmental Protection Agency (EPA) to be the greatest concern among

[1] A. H. Altieri and K.B. Gedan, *Climate change and dead zones*, Global Change Biology (Nov. 10, 2014).

[2] *Id.*; R.J. Gowen et al., *Anthropogenic nutrient enrichment and blooms of harmful phytoplankton*, Oceanography and Marine Biology: An Annual Review, Vol. 50 (2012).

cyanotoxins.[3] The most common microcystins, named for their unique amino acids, are Microcystin-LR, Microcystin-RR, Microcystin-YR, and Microcystin-LA. The recent contamination event in Toledo, Ohio involved a combination of microcystins.[4]

A. Adverse Human Health Effects

Cyanotoxins can cause liver damage, skin and eye irritation, gastrointestinal illness, neurological effects, cancer, paralysis and death.[5] Exposure to these toxins can occur through direct contact (e.g., swimming and boating), drinking or accidentally ingesting contaminated water, consumption of contaminated fish and other foods, and inhalation of aerosolized toxins.

Every year, toxins released from HABs prompt seasonal closures of shellfisheries around the Pacific, Gulf, and Atlantic coasts in the United States. Likewise, HABs have plagued beachgoers and coastal residents with respiratory distress, skin irritation, and other illnesses.[6]

B. "Dead Zones" and Environmental Effects

Cyanotoxins have ecological effects, causing large scale fish kills[7] and contributing to the deaths of shore birds, manatees, sea lions and dolphins.[8] Non-toxic HABs can also severely

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[3] U.S. Environmental Protection Agency, *Drinking Water Treatability Database, Microcystins* (Nov. 16, 2014) (online at iaspub.epa.gov/tdb/pages/contaminant/contaminantOverview.do?contaminantId=-1336577584).

[4] *Danger From Microcystins in Toledo Water Unclear*, Chemical & Engineering News (Aug. 8, 2014) (online cen.acs.org/articles/92/i32/Danger-Microcystins-Toledo-Water-Unclear.html).

[5] U.S. Environmental Protection Agency, *Nutrient Policy and Data, Health and Ecological Effects* (July 22, 2014) (online at www2.epa.gov/nutrient-policy-data/health-and-ecological-effects). Marine species of algae, such as *Karenia brevis*, *Gambierdiscus toxicus, Alexandrium monilatum* and *Alexandrium fundyense*, are also capable of growing quickly into HABs and have similar adverse effects on humans.

[6] L.C. Backer, et al. *Recreational exposure to aerosolized brevetoxins during Florida red tide events*, Harmful Algae (Mar. 2003); National Oceanic and Atmospheric Administration, National Centers for Costal Ocean Science, *Harmful Algal Blooms* (Sept. 15, 2009) (online at www.cop.noaa.gov/stressors/extremeevents/hab/current/Hab_overview.pdf).

[7] National Office for Harmful Algal Blooms at the Woods Hole Oceanographic Institution, *Aquaculture Losses* (July 31, 2012) (online at www.whoi.edu/redtide/impacts/aquaculture-losses).

[8] National Oceanic and Atmospheric Administration, National Centers for Costal Ocean Science, *Harmful Algal Blooms* (Sept. 15, 2009) (online at www.cop.noaa.gov/stressors/extremeevents/hab/current/Hab_overview.pdf).

damage these ecosystems by depleting dissolved oxygen, producing dead zones.[9] Dead zones have been documented by scientists in the Gulf of Mexico and Chesapeake Bay every year since the 1970s.[10]

C. **Societal and Economic Impacts**

The National Oceanic and Atmospheric Administration's (NOAA) National Centers for Coastal Ocean Science have estimated that coastal HAB events alone result in economic impacts in the United States of at least $82 million each year.[11] Freshwater HAB events are estimated to cost approximately $2.2 billion in the United States annually.[12] The impacts can vary greatly depending on the nature and location of the event, but even a single significant HAB event can result in tens of millions of dollars of economic harm.[13]

II. FACTORS BEHIND THE RISE IN HABs

Like most plants, algae thrive on warm temperatures and high concentrations of nutrients.[14] Nutrient pollution, called eutrophication, and global climate change have therefore led to more frequent HABs of greater size and intensity.

A. **Nutrient Pollution**

Nitrogen and phosphorus support algae and aquatic plant growth, which in turn provides food and habitat for fish, shellfish and other organisms. Excesses of these nutrients, however,

[9] U.S. Environmental Protection Agency, *Nutrient Policy and Data, Health and Ecological Effects* (July 22, 2014) (online at www2.epa.gov/nutrient-policy-data/health-and-ecological-effects).

[10] J. Biewald, et al., *The Gulf of Mexico's Hypoxic Zone* (Nov. 17, 2014) (online at sitemaker.umich.edu/0072/home); Chesapeake Bay Foundation, *Dead Zones* (Nov. 17, 2014) (online at www.cbf.org/about-the-bay/issues/dead-zones).

[11] National Oceanic and Atmospheric Administration, National Centers for Costal Ocean Science, *Economic Impacts of Harmful Algal Blooms* (Oct. 10, 2012) (online at www.cop.noaa.gov/stressors/extremeevents/hab/current/econimpact_08.pdf).

[12] Dodds, et al., *Eutrophication of U.S. Freshwaters: Analysis of Potential Economic Damages*, Environmental Science & Technology, at 12-19 (2009) (online at pubs.acs.org/doi/abs/10.1021/es801217q).

[13] National Oceanic and Atmospheric Administration, National Centers for Costal Ocean Science, *Harmful Algal Blooms* (Sept. 15, 2009) (online at www.cop.noaa.gov/stressors/extremeevents/hab/current/Hab_overview.pdf).

[14] U.S. Environmental Protection Agency, *Nutrient Pollution: Climate Change and Harmful Algal Blooms* (Mar. 16, 2014) (online at www2.epa.gov/nutrientpollution/climate-change-and-harmful-algal-blooms).

cause algae to grow faster than ecosystems can handle, and create prime conditions for proliferation of HABs.[15]

Agriculture is by far the largest source of nutrient pollution, with excessive fertilizer applications, animal manure concentrations and soil erosion all significantly contributing to nitrogen and phosphorus contamination.[16] Other sources include discharges of improperly treated wastewater from treatment plants and septic tanks, and stormwater runoff.[17] Nitrogen is also released into the air in automobile exhaust and during the burning of fossil fuels from coal-fired power plants and industrial operations.[18]

B. <u>Climate Change</u>

Global climate change has increased the incidence of HABs and will continue to do so for a number of reasons. Because HABs generally bloom during warm periods, climate change lengthens the optimal bloom season.[19] In addition, warming waters prolong and strengthen thermal stratification processes and decrease water viscosity, providing a competitive advantage to strains of harmful algae.[20] Elevated carbon dioxide levels are also conducive to HAB growth, allowing algae floating on the water's surface, which can utilize carbon dioxide from the atmosphere, to grow at greater rates than non-floating algae.[21]

Changes to the oceans from climate change, including acidification and increased upswelling, will increase the incidence of HABs too. Ocean acidification encourages the growth of photosynthetic algae, which benefit from higher carbon dioxide levels in seawater.[22] Additionally, acidification places significant stress on coral and other calcifying species, ultimately leading to domination by macroalgae growths.[23] Upswelling, a process during which

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[15] U.S. Environmental Protection Agency, *Nutrient Pollution: The Problem* (Mar. 16, 2014) (online at www2.epa.gov/nutrientpollution/problem).

[16] U.S. Environmental Protection Agency, *Nutrient Pollution: Sources and Solutions* (Mar. 16, 2014) (online at www2.epa.gov/nutrientpollution/sources-and-solutions).

[17] *Id.*

[18] *Id.*

[19] B. Dale, et al., *Climate Change and Harmful Algal Blooms*, Ecological Studies, Ecology of Harmful Algae (2006).

[20] U.S. Environmental Protection Agency, *Impacts of Climate Change on the Occurrence of Harmful Algal Blooms* (May 2013) (online at www2.epa.gov/sites/production/files/documents/climatehabs.pdf).

[21] *Id.*

[22] National Oceanic and Atmospheric Administration, Pacific Marine Environmental Laboratory Carbon Program, *What is Ocean Acidification?* (online at www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F).

[23] O. Hoegh-Guldberg, et al., *Coral Reefs Under Rapid Climate Change and Ocean Acidification*, Science, at 1740 (Dec. 14, 2007).

surface waters are replaced with nutrient-rich waters from greater depths, raises nutrient availability and further fuels algal growth and HABs.[24]

Furthermore, climate change has increased extreme weather events.[25] According to NOAA, HABs have occurred after extreme weather events including floods, hurricanes, and droughts.[26] Heavy precipitation and flooding increase nutrient runoff and pollution.[27] In droughts, lower water levels can concentrate nutrients and allow them to stay in the water longer, enhancing the conditions favorable to algal growth. Droughts have also increased salinity in freshwater ecosystems, allowing toxic marine algae to move to inlands waters. Freshwater fish kills from marine algae have been documented in the southwestern and south central United State since 2000.[28] Storm surges and rising sea-levels driven by climate change will flood coastal and low-lying areas, creating new areas of shallow, stable waters favorable to HAB events and the inland movement of marine algae.[29]

III. FEDERAL REGULATORY STATUS OF MICROCYSTINS

The process for regulating drinking water contaminants under the 1996 Safe Drinking Water Act (SDWA) amendments has proven to be an obstacle to the development of new federal standards.[30] No new drinking water standards have been developed under the process since it was established.[31] Therefore, it is not surprising that there are currently no national guidelines, standards, or regulations concerning HABs or microcystins. The World Health Organization has published a provisional drinking water guideline for Microcystin-LR, intended to form a basis

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[24] U.S. Environmental Protection Agency, *Impacts of Climate Change on the Occurrence of Harmful Algal Blooms* (May 2013) (online at www2.epa.gov/sites/production/files/documents/climatehabs.pdf).

[25] Intergovernmental Panel on Climate Change, *Fifth Assessment Synthesis Report*, at Section 1.4, Extreme Events (Nov. 1, 2014) (online at www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_LONGERREPORT.pdf).

[26] National Oceanic and Atmospheric Administration, *Why do harmful algal blooms occur?* (Oct. 10, 2014) (online at oceanservice.noaa.gov/facts/why_habs.html).

[27] U.S. Environmental Protection Agency, *Impacts of Climate Change on the Occurrence of Harmful Algal Blooms* (May 2013) (online at www2.epa.gov/sites/production/files/documents/climatehabs.pdf).

[28] *Id.*

[29] *Id.*

[30] U.S. Environmental Protection Agency, *Nutrient Policy and Data, Policies and Guidelines* (Oct. 31, 2014) (online at www2.epa.gov/nutrient-policy-data/policies-and-guidelines).

[31] U.S. Government Accountability Office, *Safe Drinking Water Act: Improvements in Implementation are Needed to Better Assure the Public of Safe Drinking Water* (July 12, 2011) (online at www.gao.gov/assets/130/126572.pdf) GAO-11-803T.

for the development of national standards, setting the limit for safety at one microgram/liter.[32] Rep. Kaptur recently introduced legislation, referred to the Subcommittee on Environment and the Economy, to require EPA to publish a microcystin health advisory, something short of a drinking water standard.[33]

The standard setting process under SDWA requires EPA to identify contaminants that present the greatest public health concern (published on the contaminant candidate list, or CCL) and then make regulatory determinations (decisions as to whether or not to initiate regulatory proceedings) for at least five contaminants every five years based on a cost-benefit analysis.[34] The first CCL, published in 1998, included cyanobacteria and their toxins.[35] Both were listed again on the CCL 2 in 2005.[36] CCL 3 included cyanotoxins, with special emphasis on three – Microcystin-LR, Anatoxin-a, and Cylindrospermopsin.[37]

The Unregulated Contaminant Monitoring program (UCM) was created to provide the data needed to make regulatory determinations for chemicals listed on the CCL. Under the UCM program, EPA issues an Unregulated Contaminant Monitoring Rule (UCMR) every five years with a list of chemicals about which data is collected. In 2001, EPA convened a meeting to explore adding cyanotoxins to the UCM program to provide the data needed to make regulatory determinations on these chemicals. That meeting revealed that there was no standardized test for the range of cyanotoxins, and EPA has cited that as a reason these toxins have not been included in the UCM. [38] Without data from the UCM, it is unlikely that EPA will have the data necessary to make a regulatory determination for these toxins and move to regulate them under SDWA.

A 2011 report by the Government Accountability Office (GAO) found that EPA has "made limited progress in prioritizing drinking water contaminants on the basis of greatest public

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[32] U.S. Environmental Protection Agency, *Nutrient Policy and Data, Policies and Guidelines* (Oct. 31, 2014) (online at www2.epa.gov/nutrient-policy-data/policies-and-guidelines).

[33] H.R. 5439, the Safe and Secure Drinking Water Act of 2014, 113th Cong. (2014) (online at www.congress.gov/bill/113th-congress/house-bill/5439).

[34] Safe Drinking Water Act Amendments of 1996, Pub. L. No. 104-182.

[35] U.S. Environmental Protection Agency, *Water: Contaminant Candidate List, CCL1 List and Regulatory Determinations* (Oct. 20, 2014) (online at water.epa.gov/scitech/drinkingwater/dws/ccl/ccl1.cfm).

[36] U.S. Environmental Protection Agency, *Water: Contaminant Candidate List, CCL2 List and Regulatory Determinations* (Oct. 20, 2014) (online at water.epa.gov/scitech/drinkingwater/dws/ccl/ccl2.cfm).

[37] U.S. Environmental Protection Agency, *Water: Contaminant Candidate List 3* (Nov. 13, 2014) (online at water.epa.gov/scitech/drinkingwater/dws/ccl/ccl3.cfm).

[38] U.S. Environmental Protection Agency, *Nutrient Policy and Data, Policies and Guidelines* (Oct. 31, 2014) (online at www2.epa.gov/nutrient-policy-data/policies-and-guidelines).

health concern."[39] Instead, many of the CCL decisions have been aimed at "low-hanging fruit" or contaminants with minimal public exposure.[40] Similarly, regulatory determinations have been made for contaminants with the greatest data availability – not public health concerns.[41] The GAO found that developing data sufficient to meet statutory standards to make regulatory determinations for the contaminants on the current CCL could take EPA decades.[42]

IV. WITNESSES

The following witnesses have been invited to testify:

Panel One

Dr. Peter C. Grevatt
Director
Office of Groundwater and Drinking Water
U.S. Environmental Protection Agency

Panel Two

The Honorable Craig W. Butler
Director
Ohio Environmental Protection Agency

John Donahue
General Manager
North Park (IL) Public Water District
President
American Water Works Association

Lynn Thorp
National Campaigns Director
Clean Water Action

[39] U.S. Government Accountability Office, *Safe Drinking Water Act: EPA Should Improve Implementation of Requirements on Whether to Regulate Additional Contaminants* (May 27, 2011) (online at www.gao.gov/assets/320/318967.pdf) GAO-11-254.

[40] *Id.*

[41] *Id.*

[42] *Id.*