CLEAN WATER ACTION
CLEAN WATER FUND

Putting Drinking Water First to Address Nutrient Pollution

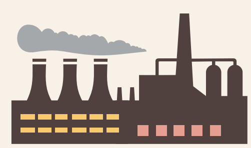
"Nutrient pollution remains one of the greatest challenges to our Nation's water quality and presents a growing threat to public health and local economies — contributing to toxic harmful algal blooms, contamination of drinking water sources, and costly impacts on recreation, tourism, and fisheries."[1]

— Joel Beauvais, Deputy Assistant Administrator, U.S. EPA, September 22, 2016

Since the passage of the Clean Water Act in 1972 the United States has made great progress in cleaning up industrial chemicals and sewage pollution, but has failed to significantly reduce run-off of nutrient pollution into our nation's rivers, lakes, and bays. Nutrient pollution refers to nitrogen and phosphorus, which are essential life elements that have enabled agriculture production in the United States to thrive, but at a huge cost to water quality. The agriculture industry, the largest water polluter in the country, is largely exempt from Clean Water Act protections/programs. When it rains, nutrient-rich fertilizer and animal waste pour into nearby streams and rivers, contributing to toxic algal outbreaks and dead zones downstream. This pollution also seeps into groundwater. Urban storm water runoff, wastewater treatment plant discharges, failing septic tanks, and fossil fuel emissions are other sources of nitrogen and phosphorus pollution.[2] Pollution from nitrogen and phosphorus is one of the most pervasive water quality problems in the U.S.[3] and there is increasing concern about their impact on drinking water.

Sources of Excess Nutrients

AGRICULTURE
Fertilizer runoff (nitrogen and phosphorus) and animal waste



INDUSTRY
Chemical discharge and waste

URBAN LIFE
Sewage and waste runoff

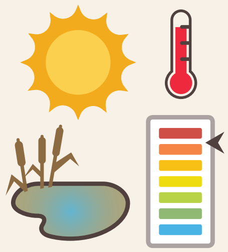
Nutrients and Water Quality

Excess nutrients can cause algae to grow faster than aquatic ecosystems can process, resulting in algal outbreaks that are green, red, or brown, and appear like paint or thick scum on the surface of water. Some algae release toxins that can kill fish and other animals. These toxins can concentrate up food chains when algae are consumed by small fish and shellfish, which can harm larger fish, birds, and other fish-eating animals. Even algal outbreaks that are not toxic can harm fish and other aquatic life because these outbreaks coat surface water in a thick scum that blocks sunlight and reduces available food. When algae die, the decomposition of this organic matter consumes oxygen, which creates hypoxic (low-oxygen) dead zones in rivers, lakes, and bays, which can suffocate and kill fish, crabs, clams, and other organisms. There are over 166 dead zones documented nationwide,[4] the largest one being in the Gulf of Mexico, which in 2017 was measured to be almost the size of New Jersey (8,776 square miles). It was the largest recorded since scientists first measured the bloom in 1985.[5] Runoff from agriculture and land development in the Mississippi River watershed — spanning

Causes of Toxic Algae Outbreak

ENVIRONMENTAL CONDITIONS

- Abundant light
- High temperatures
- High pH levels
- Stagnant water
- Excess nutrients



from northern Minnesota 2,320 miles south to Louisiana — contributes most of the nutrient pollution that flows into the Gulf of Mexico.

Because outbreaks thrive in slow moving or stagnant water, warm temperatures, and increased sunlight, most, but not all, algal outbreaks occur during the warmer summer months. When these outbreaks contain toxic bacteria, they pose a threat to human health and can kill pets or livestock. According to the U.S. Environmental Protection Agency (EPA), in 2016 states reported at least 255 public health warnings such as beach closures or caution advisories between January 1 and August 12, 2016, and between 2006 and 2015, all 50 states and U.S. territories documented harmful algal outbreaks.[6] These closures interfere with recreational activities such as swimming, fishing, or boating, impacting tourism and contributing to economic losses.

Scientific research also indicates that increased temperatures coupled with changes in frequency and intensity of rainfall associated with climate change may also result in more algal outbreaks.[7] Some studies have also found that extreme variability in weather can enhance formation of harmful algal outbreaks; for instance, intense rainfall followed by drought may result in nitrogen and phosphorus persisting in water bodies, increasing potential for algal outbreaks.[8] There is also wide agreement among scientists that the frequency and distribution of algal outbreaks have increased in recent years.[9] EPA's most recent assessment of water quality of lakes found that 35 percent of lakes have excessive nitrogen levels, and 40 percent of lakes have excessive levels for total phosphorus.[10] Additionally, all lakes assessed showed an increase in phosphorus. The assessment also detected the cyanobacteria microcystin in 39 percent of lakes, an increase of 9.5 percent from the assessment five years earlier. EPA's latest National Rivers and Streams assessment also detected an increase in nutrients: 40 percent of our nation's rivers and stream length have elevated phosphorus levels and 28 percent have elevated levels of nitrogen.[11]

Health Risks from Nitrogen and Phosphorus in Drinking Water

Nutrient pollution is an increasing concern for drinking water systems and households that rely on private wells. In 2014, a toxic algal outbreak of the cyanobacteria microcystin in Lake Erie left more than 500,000 people in Toledo, Ohio without drinking water for two days, at an estimated cost of $65 million in lost property values, tourism, recreation, and other benefits.[12] And in the Central Valley in California, 250,000 people who rely on private wells or small water systems are at ongoing risk of consuming nitrate contaminated drinking water because of nitrogen pollution from agriculture.[13]

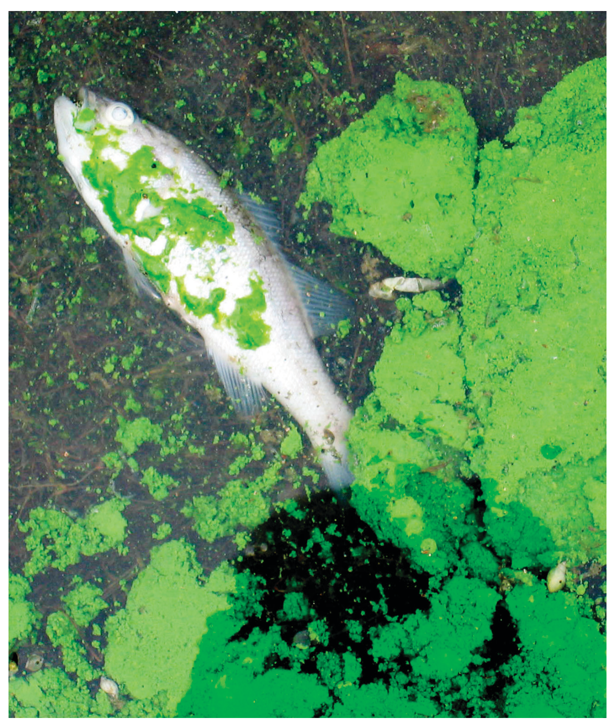


PHOTO: JENNIFER GRAHAM, USGS

Harmful algal blooms and their toxins can kill wildlife and also pose health risks for humans.

PHOTO: J.S. NELSON, USGS/NASA

Landsat satellites captured this image of Lake Erie during a harmful algal bloom event.

Some cyanobacteria produce toxins like microcystin or cylindrospermopsin, which when consumed in drinking water, can cause harm to human health in the form of liver or kidney damage, neurotoxicity, paralysis, and/or gastrointestinal illness.[14] Nitrates in drinking water pose the greatest risk to infants, because of methemoglobinemia, commonly known as blue-baby syndrome, which, if untreated, can lead to coma or death.[15] Nitrates in drinking water also pose a risk to pregnant women, and some studies have linked nitrates to certain cancers and birth defects, however more research is needed on public health risks from nitrates.[16]

Nitrates and cyanobacteria cause other problems in drinking water. Not all cyanobacteria produce toxins, but they can still produce unpleasant taste and odors. They can also interfere with the drinking water treatment process, including increasing the occurrence of potentially harmful disinfectant byproducts.[17] Treating drinking water to remove cyanotoxins and nutrients is expensive and that cost is typically passed on to water customers.

The American Water Works Association (AWWA) has created a self-assessment check-list to help drinking water systems that draw from surface water sources prepare for potential cyanotoxic events.[18] System managers need to understand the conditions that can trigger toxic algal outbreaks. These conditions include high nutrient levels, warm water temperature, low flow and pH. Algal outbreaks can be transported close to drinking water intakes by wind or water currents. Systems also need to be able to effectively monitor for cyanobacteria, and, if necessary, treat for cyanotoxins when they are present in source water or draw raw water from a different intake location.

Managing Nutrient Pollution

Keeping nitrogen and phosphorus out of rivers and lakes that are source waters is the best way to avoid public health risk from contaminated drinking water and increased costs to water utilities and their customers. In September 2016 the EPA Office of Water released a memo, "Renewed Call to Action to Reduce Nutrient Pollution and Support for Incremental Actions to Protect Water Quality and Public Health," which called for states to intensify their efforts to tackle nutrient pollution.[19] While EPA has been working with states for decades to address nutrient pollution, more work remains.

Increased population, urbanization, and land development, will result in an increase in the rate and impact of nutrient pollution. The Clean Water Act (CWA) does not authorize EPA to regulate nutrient run-off from agriculture or other non-point source pollution. However, the agency can influence the impact of non-point pollution through technical assistance or the use of grants and funding such as CWA section 319, which addresses non-point pollution through state-run pollution management programs. To date, 45 states have identified reducing nutrient pollution as a priority to be addressed through non-point pollution reduction programs. Nationwide, more than 8,600 nutrient-related Total Maximum Daily Load programs (TMDLs[20]) have been established by EPA and states, to guide reductions of nitrogen or phosphorus in more than 5,800 waterbodies.[21] A TMDL is a pollution "budget" that estimates the maximum amount of a certain pollutant, such as nitrogen, that a river or lake can receive without violating water quality standards.[22]

EPA has also provided 30 states with technical assistance to develop numeric nutrient criteria[23] and 23 states have adopted criteria into their water quality standards for nitrogen and/or phosphorus for at least one of their waterbodies.[24]

The U.S. Department of Agriculture (USDA) runs voluntary conservation programs to provide farmers and producers with technical and financial assistance to reduce nutrient pollution run-off. The Environmental Quality Incentives Program (EQIP) is the largest program that funds best management practices for nutrient reduction. Producers have access to support for planning and carrying out conservation practices such as streamside buffer strips and cover crops. The

Impacts of Cyanotoxins on Drinking Water Systems

Increasingly, water systems are monitoring for and addressing cyanotoxins and the algal growth that can cause their formation. Some cyanotoxins are on EPA's list of drinking water contaminants of concern. In 2015, EPA published "Health Advisories" for two cyanotoxins.

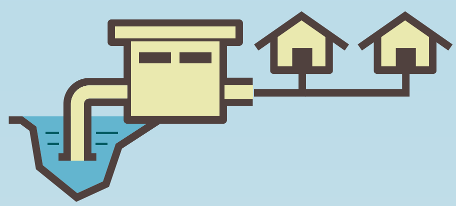
WATER SOURCE → DRINKING WATER SYSTEM → DRINKING WATER

WATER SOURCE

Source water indicators for cyanobacteria:

- Is it affected by drought?
- Are the odors and colors off?
- Does the water stratify thermally?
- Is there an algae growth?
- Is the water stagnant?

DRINKING WATER SYSTEM



How to prepare and monitor for blooms:

- Initiate more frequent and specific monitoring
- Draw water from multiple depths and locations
- Adjust treatment to specifically remove and destroy cyanobacteria and cyanotoxins

Effects of cyanotoxins on water treatment:

- Treatment for cyanobacteria can increase production of harmful byproducts if cyanotoxins are present in the bacteria
- Treatment selection is context-specific and can be difficult to determine

DRINKING WATER

If left untreated, cyanotoxins can lead to:

- Off tastes and odors in the water; not necessarily a health threat if present
- Public health threats
- Increase in water rates due to additional treatment costs

Conservation Stewardship Program (CSP) also provides incentives to encourage producers to adopt land retirement and easements to remove land from production to provide habitat for wildlife and water quality benefits.[25]

Innovative programs like the Source Water Collaborative[26] can also support action to reduce nitrogen and phosphorus pollution. The Source Water Collaborative is made up of diverse stakeholders including regulators, drinking water utility representatives, planners, environmental, and health organizations, and others working together to advance drinking water source protection at the local, state, and federal levels.

Putting Drinking Water First Has Multiple Benefits

State non-point pollution programs and voluntary conservation practices for producers alone are not enough to tackle our country's widespread nutrient pollution problem. Water systems still largely bear the cost of cleaning up nitrogen and phosphorus pollution after it reaches surface or groundwater drinking sources. The cost of removing nitrates from drinking water is more than $4.8 billion per year;[27] the bulk of this cost is borne by utilities and then passed on to consumers. Preventing contamination is a commonsense way to keep pollutants out of drinking water sources before the water reaches drinking water treatment plants. It is also a smart way to avoid increased costs to customers when contamination and regulation leads to the need to install new treatment processes. Water systems and their ratepayers should not be responsible for cleaning up pollution that can be prevented before it enters drinking water sources. Regulating nitrates and cyanotoxins in drinking water is not sufficient to prevent this shift of burden and will not address the many other environmental and economic impacts of nitrogen and phosphorus pollution. Following the "do not drink" advisory for the city of Toledo, Ohio, Congress amended the Safe Drinking Water Act (SDWA) to require EPA to develop a plan to assess and manage the risks associated with toxic algal outbreaks in public water sources.[28] EPA has also established drinking water health advisories for the cyanotoxins microcystin and cylindrospermopsin.[29] These policies are important, but do not help people who rely on private wells to address nitrate pollution, since SDWA only regulates public water systems.

In our work, Clean Water Action advocates for Putting Drinking Water First, which means making decisions about upstream activities with a focus on potential drinking water impacts downstream. Putting Drinking Water First not only results in better drinking water protection but leads to better choices which can prevent other environmental and economic impacts. This is certainly true when it comes to excessive nutrients. Curbing nitrogen and phosphorus pollution at the source will prevent public health risks from drinking water and lead to better water quality and other community benefits.

PHOTO: NICHOLAS AUMEN, USGS

Aerial view of algae bloom in Lake Okeechobee in Florida.

NOTES

1 Joel Beauvais, Deputy Assistant Administrator, EPA, Memorandum to State Environmental Commissioners, State Water Directors, "Renewed Call to Action to Reduce Nutrient Pollution and Support for Incremental Actions to Protect Water Quality and Public Health," September 22, 2016, https://www.epa.gov/sites/production/files/2016-09/documents/renewed-call-nutrient-memo-2016.pdf (hereafter cited as "Beauvais memo, September 22, 2016")

2 https://www.epa.gov/nutrientpollution/sources-and-solutions

3 U.S. EPA, Office of Water, FY 2016-2017 National Water Program Guidance, EPA 420-R-15-008, April 2015, p.15, https://www.epa.gov/sites/production/files/2015-04/documents/2016-2017_nwpg_final.pdf

4 https://www.epa.gov/nutrientpollution/effects-environment

5 http://www.noaa.gov/media-release/gulf-of-mexico-dead-zone-is-largest-ever-measured

6 U.S. EPA, *Draft Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcystins and Cylindrospermopsin*, EPA 822-P-16-002, December 2016 p. 4-5

7 Jerry M. Melillo, Terese Richmond, and Gary W. Yohe, Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program, October 2014, pp. 79, 198, 216

8 H.W. Paerl and J. Huisman, "Climate Change: A Catalyst for Global Expansion and Harmful Cyanobacteria Blooms," Environmental Microbiology Reports, vol. 1, no. 1 (February 2009), pp. 27-37

9 National Office for Harmful Algal Blooms at Woods Hole Oceanographic Institution, "Recent Trends: National Changes," July 11, 2016, https://www.whoi.edu/redtide/regions/us-recent-trends

10 EPA, National Lakes Assessment 2012: A Collaborative Survey of Lakes in the United States, EPA-841-R-16-113, December 2016

11 U.S EPA, Office of Water ad Office of Research and Development, National Rivers and Streams Assessment 2008-09: A Collaborative Survey, EPA 841-R-16-007, March 2016, https://www.epa.gov/sites/production/files/2016-03/documents/nrsa_0809_march_2_final.pdf

12 M. Bingham, S.K. Sinha, and F. Lupi, Economic Benefits of Reducing Harmful Algal Blooms in Lake Erie, Environmental Consulting and Technology, Inc. submitted to the International Joint Commission, October 2015

13 http://groundwaternitrate.ucdavis.edu/

14 National Science and Technology Council, Subcommittee on Ocean Science and Technology, *Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy: An Interagency Report*, Interagency Working Group on the Harmful Algal Bloom and Hypoxia Research and Control Act, February 11, 2016

15 https://www.des.nh.gov/organization/commissioner/pip/factsheets/ard/documents/ard-ehp-16.pdf

16 https://www.waterboards.ca.gov/gama/docs/coc_nitrate.pdf

17 https://www.epa.gov/ground-water-and-drinking-water/cyanotoxins-drinking-water

18 http://www.waterrf.org/PublicReportLibrary/4548a.pdf

19 Beauvais memo, September 22, 2016

20 *Id.*

21 https://ofmpub.epa.gov/waters10/attains_nation_cy.control#tmdls_by_state

22 https://www.epa.gov/tmdl

23 Beauvais memo, September 22, 2016

24 https://www.epa.gov/nutrient-policy-data/state-progress-toward-developing-numeric-nutrient-water-quality-criteria

25 https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/

26 https://sourcewatercollaborative.org/

27 Marc Ribaudo, Jorge Delgado, and LeRoy Hansen, et al., Nitrogen in Agricultural Systems: Implications for Conservation Policy, USDA, ERS, ERR-127, Washington, DC, September 2011

28 P.L. 114-45

29 https://www.epa.gov/sites/production/files/2016-11/documents/cyanotoxins_-_drinking_water_advisories.pdf

Summer 2018

CLEAN WATER ACTION | CLEAN WATER FUND

1444 Eye Street NW, #400, Washington DC 20005-6538 | 202.895.0420 | **www.cleanwater.org**