UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF LOUISIANA

GULF RESTORATION NETWORK, MISSOURI COALITION FOR THE ENVIRONMENT, IOWA ENVIRONMENTAL COUNCIL, TENNESSEE CLEAN WATER NETWORK, MINNESOTA CENTER FOR ENVIRONMENTAL ADVOCACY, SIERRA CLUB, WATERKEEPER ALLIANCE, INC., PRAIRIE RIVERS NETWORK, KENTUCKY WATERWAYS ALLIANCE, ENVIRONMENTAL LAW & POLICY CENTER, and the NATURAL RESOURCES DEFENSE COUNCIL, INC., Plaintiffs, - v. - LISA P. JACKSON, Administrator of the United States Environmental Protection Agency, and THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, Defendants.	Civil Action No.:

<u>COMPLAINT FOR DECLARATORY AND INJUNCTIVE RELIEF</u>

INTRODUCTORY STATEMENT

1. Plaintiffs Gulf Restoration Network ("GRN"), Missouri Coalition for the Environment ("MCE"), Iowa Environmental Council ("IEC"), Tennessee Clean Water Network ("TCWN"), Minnesota Center for Environmental Advocacy ("MCEA"), Sierra Club, Waterkeeper Alliance, Prairie Rivers Network, Kentucky Waterways Alliance, Environmental Law & Policy Center ("ELPC"), and Natural Resources Defense Council, Inc. ("NRDC") (collectively "Plaintiffs") assert violations of the Administrative Procedure Act ("APA") by defendants Lisa P. Jackson, Administrator of the United States Environmental Protection

Agency, and the United States Environmental Protection Agency (collectively "EPA"), for EPA's July 29, 2011 denial of a July 30, 2008 petition submitted pursuant to the APA, 5 U.S.C. § 553(e), for EPA to establish under section 303 of the Clean Water Act ("CWA"), 33 U.S.C. § 1313, revised or new state water quality standards and total maximum daily loads ("TMDLs") to address excessive nitrogen and phosphorous (collectively "nutrient") pollution in the waters of the Mississippi River Basin and northern Gulf of Mexico ("Petition").[1] A copy of the Petition is attached to this complaint as Exhibit A and incorporated herein by reference.

2. Excessive nutrient pollution in the Mississippi River Basin and northern Gulf of Mexico causes or contributes to a massive low-oxygen "dead zone" in the Gulf of Mexico, as well as extensive water quality degradation and impairments that cause substantial harm to aquatic life, human health, and the economic, aesthetic, and recreational values of rivers, lakes, streams, and oceans.

3. CWA Section 303(c)(4)(B) provides that "the Administrator shall promptly prepare and publish proposed regulations setting forth a revised or new water quality standard . . . in any case where [she] determines that a revised or new standard is necessary to meet the requirements of this Act."

4. EPA's denial of the Petition violates the APA for two separate reasons:

(A) The denial violates the APA because it fails to provide reasons for the denial that conform to the relevant statutory factors in Section 303(c)(4)(B) of the CWA. EPA's denial was based on the administrative burden of granting the Petition and EPA's purported policy of working collaboratively with states, but EPA's denial

[1] The Petition was submitted by plaintiffs GRN, MCE, IEC, TCWN, MCEA, Sierra Club, PRN, KWA, ELPC, and NRDC, as well as by Louisiana Environmental Action Network, Public Employees for Environmental Responsibility, and Midwest Environmental Advocates. Plaintiffs also include Waterkeeper Alliance. For ease of reference, we will refer to Plaintiffs collectively throughout, and we will refer to the Petition as "Plaintiffs' Petition."

does not provide a reasoned explanation as to why revised or new water quality standards to address excessive nutrient pollution in Mississippi River Basin and northern Gulf of Mexico waters are not "necessary to meet the requirements of the [CWA]" within the meaning of Section 303(c)(4)(B).

(B) EPA's denial of the Petition alternatively violates the APA because it is contrary to the undisputed evidence in the Petition that numeric nutrient water quality standards are necessary pursuant to Section 303(c)(4)(B) of the CWA to implement the CWA's requirements for Mississippi River Basin and northern Gulf of Mexico waters.

5. Plaintiffs request that the court declare that EPA's denial of the Petition is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law" in violation of the APA, 5 U.S.C. § 706(2)(A), and the CWA, 33 U.S.C. § 1313(c)(4)(B), and order EPA to provide an adequate response within 90 days.

JURISDICTION AND VENUE

6. This Court has jurisdiction over this action pursuant to the APA, 5 U.S.C. §§ 701 – 06, which provides for judicial review of final agency actions for which there is no other adequate remedy in a court; 28 U.S.C. § 1331, because this case presents a federal question; 28 U.S.C. § 1361, because this is an action "to compel an agency officer or employee of the United States to perform a duty owed to the plaintiff[s]"; and 28 U.S.C. §§ 2201 – 2202, which provide for declaratory and further relief.

7. Venue is proper in this judicial district and in this court pursuant to 28 U.S.C. § 1391(e) because no real property is involved in this action and the first-named plaintiff, GRN,

resides or maintains its principal place of business in New Orleans, Louisiana, which is located in the Eastern District of Louisiana.

PARTIES

8. Plaintiff GRN is a not-for-profit membership corporation incorporated under the laws of the State of Louisiana. As stated in its mission, GRN "is committed to uniting and empowering people to protect and restore the natural resources of the Gulf Region for future generations." GRN's vision is that the Gulf of Mexico will continue to be a natural, economic, and recreational resource that is central to the culture and heritage of five states and three nations. The people of the region will be stewards of this vital but imperiled treasure, and they will assume the responsibility of returning the Gulf to its previous splendor. GRN members depend on clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition. GRN maintains offices in New Orleans, LA, and St. Petersburg, FL. GRN currently has more than 4,653 members nationwide.

9. Plaintiff MCE is a not-for-profit membership corporation incorporated under the laws of the State of Missouri. MCE's mission is to work "to protect and restore the environment through education, public engagement, and legal action." MCE currently has more than 1000 members who depend on clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition.

10. Plaintiff IEC is a state-wide non-profit organization focused on protecting Iowa's natural environment. IEC is an alliance of nearly 60 member and cooperator organizations--ranging from agricultural, conservation, and public health organizations, to educational groups, business associations, and churches--along with hundreds of individual members. Its vision is an Iowa where waters run clean, soil stays on the land, the air is clear, flora and fauna are diverse, and people are proud to call it home. Its members enjoy swimming, boating, fishing, hiking, biking and many other activities in and along Iowa's rivers, streams and lakes. IEC members rely on these sources for clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition.

11. Plaintiff TCWN is a not-for-profit corporation organized under the laws of the State of Tennessee. TCWN was organized to advocate for strong policies and programs that result in more effective protection and restoration of Tennessee waters; to educate organizations, decision-makers, and the public about important water resource issues; and to ensure the protection and restoration of Tennessee's waters. TCWN organizes Tennesseans to exercise their right to clean water and healthy communities by fostering civic engagement, building coalitions, and advancing water policy. TCWN is a membership organization whose members depend on clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition.

12. Plaintiff MCEA is a not-for-profit organization based in St. Paul, Minnesota, whose mission is to use law, science and research to preserve and protect Minnesota's wildlife, natural resources and the health of its people. The organization has worked for effective enforcement of the Clean Water Act in the state. MCEA represents 1,000 members across Minnesota who depend on clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition.

13. Plaintiff Sierra Club is a national, not-for-profit organization of approximately 1.3 million members and supporters dedicated to exploring, enjoying, and protecting the wild places of the earth; to practicing and promoting the responsible use of the earth's ecosystems and resources; to educating and enlisting humanity to protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives. Sierra Club advocates for effective enforcement of the Clean Water Act to preserve our nation's waters for recreational, aesthetic, and economic uses. The Club's members depend on clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition.

14. Plaintiff Waterkeeper Alliance is a national not-for-profit corporation organized under the laws of the State of New York representing the interests of more than 49,500 individual members and nearly 200 member Waterkeeper Organizations. Waterkeeper Alliance and Waterkeeper Organizations promote water quality protection and the restoration of waters, through litigation, education, scientific research, and other legal means; advocate for compliance

with environmental laws such as the CWA; respond to citizen complaints; identify threats to water bodies; and generally work to guarantee the public's right to a pollution-free environment. Individual members of Waterkeeper Alliance and Waterkeeper Organizations depend on clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition.

15. Plaintiff PRN, the state affiliate of the National Wildlife Federation, is a not-for-profit organization that strives to protect the rivers, streams and lakes of Illinois and to promote the lasting health and beauty of watershed communities. PRN represents more than 600 members depend on clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition.

16. Plaintiff KWA is a not-for-profit organization that strives to protect and restore the rivers, streams and lakes of Kentucky and to promote the lasting health and beauty of watershed communities. KWA represents more than 700 members depend on clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition.

17. Plaintiff ELPC is a Midwest public interest environmental advocacy organization. ELPC's goals include developing sound environmental management practices that conserve natural resources and improve the quality of life in our communities. ELPC strives to help effectively enforce the Clean Water Act in order to improve the quality of life in our

communities and ensure clean water. ELPC currently has 467 members nationwide who depend on clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition.

18. Plaintiff NRDC is a national, not-for-profit membership corporation with its principal place of business in New York, New York. Founded in 1970, NRDC represents more than 350,000 members nationwide. NRDC's mission is to safeguard the Earth: its people, its plants and animals, and the natural systems on which all life depends. NRDC's board and staff of lawyers, scientists, and other environmental specialists have for decades actively supported and advocated for effective enforcement of the CWA on behalf of NRDC's membership. NRDC members depend on clean water for drinking water, aesthetic and/or recreational use and enjoyment, and/or for their businesses and jobs, including water bodies that are adversely affected by nitrogen and phosphorous pollution and would be improved by the actions requested in the Petition.

19. Plaintiffs bring this action on their own behalf and on behalf of their members. Plaintiffs and their members have been and continue to be injured by EPA's denial of their Petition and failure to promptly promulgate numeric nutrient standards for waters within the Mississippi River Basin and northern Gulf of Mexico. Plaintiffs' members are injured because, *inter alia*, they use and enjoy waters within the Mississippi River Basin that are impaired by nutrient discharges and/or use and enjoy waters of the Gulf of Mexico. EPA's failure to act impairs Plaintiffs' members use and enjoyment of these waters, causing Plaintiffs' members to curtail activities they would otherwise enjoy, derive less enjoyment from other activities, and suffer reasonable concerns and anxiety about the potential for future harm. These injuries are

actual, concrete and irreparable. They cannot be redressed by money damages. The requested relief will redress these injuries.

20. Defendant Lisa P. Jackson, Administrator of the United States Environmental Protection Agency, is charged with the supervision and management of the agency's responsibilities under the CWA, including the statute's requirements under Section 303 that are at issue here. Ms. Jackson is sued in her official capacity only.

21. Defendant United States Environmental Protection Agency is an agency of the federal government, which has the primary responsibility under the CWA to protect the waters of the United States from pollution.

STATUTORY FRAMEWORK

22. The CWA is the principal federal statute enacted to protect the quality of the waters of the United States. Stated goals of the CWA are "to restore and maintain the chemical, physical and biological integrity of the Nation's waters" and "to eliminate[]" "the discharge of pollutants into the navigable waters." 33 U.S.C. § 1251(a).

23. The CWA also seeks to attain "water quality which provides for the protection and propagation of fish, shellfish, and wildlife." 33 U.S.C. § 1251(a)(2).

24. "To achieve these ambitious goals, the Clean Water Act establishes distinct roles for the Federal and State Governments." PUD No. 1 of Jefferson Co. v. Washington Dep't of Ecology, 511 U.S. 700, 704 (1994).

25. Section 303 of the CWA "requires each State, subject to federal approval, to institute comprehensive water quality standards establishing water quality goals for all intrastate waters." P.U.D. No. 1 of Jefferson Co., 511 U.S. at 704 (citing 33 U.S.C. §§ 1311(b)(1)(C), 1313).

26. Under Section 303 of the CWA, water quality standards developed by States "shall consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses. Such standards shall be such as to protect the public health or welfare, enhance the quality of water and serve the purposes of this chapter. Such standards shall be established taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes, and also taking into consideration their use and value for navigation." 33 U.S.C. § 1313(c)(2)(A).

27. Section 303 of the CWA requires States, "at least once each three year period," to "hold public hearings for the purpose of reviewing applicable water quality standards and, as appropriate, modifying and adopting standards." 33 U.S.C. § 1313(c)(1). "Results of such review shall be made available to the [EPA] Administrator." Id. If the State proposes to revise or modify any of its water quality standards, such revisions or modification must be submitted to EPA for the agency to determine whether they are consistent with the CWA's requirements and approve or reject them. Id. § 1313(c)(2)(A), (3).

28. Section 303(c)(4) of the CWA provides that EPA "shall promptly prepare and publish proposed regulations setting forth a revised or new water quality standard" if the agency determines that a revised or new water quality standard submitted by a State is not consistent with the CWA's requirements. 33 U.S.C. § 1313(c)(4)(A).

29. In addition, even when a State has not submitted a revised or new water quality standard to EPA for review and approval, Section 303(c)(4) of the CWA provides that EPA "shall promptly prepare and publish proposed regulations setting forth a revised or new water

quality standard . . . in any case where the Administrator determines that a revised or new standard is necessary to meet the requirements of [the CWA]." 33 U.S.C. § 1313(c)(4)(B).

30. Section 303(d) of the CWA requires each State to "identify those waters within its boundaries" for which existing pollutant discharge limitations "are not stringent enough to implement any water quality standard applicable to those waters." 33 U.S.C. § 1313(d)(1)(A). For any such waters identified, each State is required to establish, in order of priority, a "total maximum daily load" ("TMDL") for those pollutants that are contributing to water quality impairments. Id. § 1313(d)(1)(C). Each State must submit its list of such waters, along with any TMDLs established, to EPA for approval. Id. § 1313(d)(2). If EPA disapproves, the EPA Administrator "shall not later than thirty days after the date of such disapproval identify such waters in such State and establish such loads for such waters as he determines necessary to implement the water quality standards applicable to such waters and upon such identification and establishment the State shall incorporate them . . . ." Id.

STATEMENT OF FACTS

A. Plaintiffs' Petition to EPA to Establish Numeric Nutrient Standards and TMDLs for the Mississippi River Basin and Northern Gulf of Mexico

31. On July 30, 2008, Plaintiffs petitioned EPA under 5 U.S.C. § 553(e) to establish numeric nutrient criteria for nitrogen and phosphorous where they were absent from state water quality standards. The petition specifically identified waters of the Mississippi River Basin and the northern Gulf of Mexico as needing such criteria under CWA Section 303(c)(4)(B). Plaintiffs also petitioned EPA to establish TMDLs for nitrogen and phosphorous for those waters.

32. As part of the Petition, Plaintiffs submitted voluminous evidence to EPA that excessive nitrogen and phosphorous pollution from states throughout the Mississippi River Basin

and northern Gulf of Mexico has devastating impacts on water quality and the ability of waters to support their designated uses, both in the states themselves and in downstream waters.

33. Plaintiffs' Petition documents how excessive nitrogen and phosphorous pollution in the Mississippi River Basin and northern Gulf of Mexico has caused a large zone of hypoxia (i.e., a low oxygen "dead zone") to develop in the northern Gulf of Mexico. The Gulf's dead zone is the largest in North America and the second largest in the world.

34. Plaintiffs' Petition further documents how the Gulf's dead zone caused by excessive nitrogen and phosphorous pollution is having significant adverse impacts on the ecology of the Gulf, species diversity within the Gulf, and the Gulf's $2.8 billion commercial and recreational fishing industry, and how an approach that requires reductions in nitrogen and phosphorous pollution throughout the Mississippi River Basin and northern Gulf of Mexico is needed to achieve the level of reductions necessary to protect water quality and designated uses in the northern Gulf of Mexico.

35. Plaintiffs' Petition also documents how, in addition to contributing to the Gulf of Mexico dead zone, excessive nitrogen and phosphorous pollution also cause water quality problems within the Mississippi River Basin itself, and other freshwater ecosystems, due to "the stimulating effect these pollutants have on plant and microbial growth, altering the balance of natural communities, robbing the water column of oxygen, and promoting the growth of pathogenic and toxin-producing microorganisms." Petition at 13. "These problems prevent waters from attaining the basic Clean Water Act 'fishable/swimmable' goals, threaten the health of human and wildlife users of those waters, . . . [and causes] [d]amage to recreational use of waters, . . . [d]amage to drinking water supplies, and [d]amage to the aesthetic quality of waters." Id.

36. Plaintiffs' Petition documents over a decade of EPA statements and actions regarding excessive nitrogen and phosphorous pollution in the Mississippi River Basin and the northern Gulf of Mexico. The Petition documents how neither EPA nor state actions have been effective at reducing excessive nitrogen or phosphorous pollution that contributes to the Gulf dead zone or to water quality impairments throughout the states themselves. Specifically, the Petition documents that existing state water quality standards in the ten Mississippi River mainstem states are largely general and "narrative" (i.e., non-numeric) in nature and have not been effective in reducing excessive nitrogen and phosphorous pollution or protecting designated uses, and that the ten Mississippi River mainstem states have not made significant progress toward adopting numeric nutrient standards on their own. In addition, the Petition documents how "states have largely failed to prepare TMDLs necessary for numerous waters in the Mississippi Basin that are impaired by nitrogen and/or phosphorus pollution and that no TMDL has been established for the mainstem of the Mississippi River or any portion of the Gulf of Mexico." Petition at 70.

37. Plaintiffs' Petition concludes that

> It is clear that action by EPA is needed now – not simply more studies, reports, task forces and conferences. EPA has long known concrete steps that should be taken to begin to control nitrogen and phosphorus pollution . . . .
>
> [N]umeric water quality standards for nitrogen and a TMDL are needed to protect the area of the Gulf of Mexico within the jurisdiction of the Clean Water Act outside of the jurisdiction of any state.
>
> Further, it is clear from the foregoing that numeric water quality standards for nitrogen and phosphorus are necessary to meet the requirements of the Clean Water Act. . . .
>
> At a minimum, the evidence demonstrates that EPA must prepare and publish water quality standards [to control nitrogen and phosphorous pollution] for the Gulf of Mexico and those water bodies in the Mississippi River watershed. Jurisdictional considerations alone dictate that EPA must establish water quality standards to control nitrogen and phosphorus pollution in the mainstem of the

> Mississippi River and the northern Gulf of Mexico, but the evidence of what has happened over the last decade demonstrates the EPA must establish numeric criteria for all water bodies in the Basin.

Petition at 69-71.

B. EPA Denial of Plaintiffs' Petition

38. On July 29, 2011, EPA denied Plaintiffs' Petition in a letter from Michael H. Shapiro, Deputy Assistant Administrator for Water. A copy of EPA's July 29, 2011 denial letter is attached to this complaint as Exhibit B and incorporated herein by reference.

39. EPA's denial letter states that the Agency "is in agreement with many of [Petitioners'] environmental concerns" regarding nitrogen (N) and phosphorus (P) pollution, and it concedes that "nutrient loadings to the Mississippi River and its tributaries are both harming upstream water quality and contributing significantly to hypoxia ... in the Gulf of Mexico." Letter at 1-2. EPA in its denial letter also agrees "that N and P pollution is a significant water quality problem in the MARB [Mississippi-Atchafalaya River Basin] and northern Gulf of Mexico" and states that "reducing N and P pollution is and should be a high priority for EPA's water programs." Letter at 2, 6.

40. EPA's denial letter concludes, however, that EPA "do[es] not believe that the comprehensive use of federal rulemaking authority is the most effective or practical means of addressing these concerns at this time." Letter at 1. Rejecting Plaintiffs' request for EPA to set federal numeric nutrient criteria (NNC) for nitrogen and phosphorus, EPA states "that the most effective and sustainable way to address widespread and pervasive nutrient pollution . . . is to build on" existing technical support efforts "and work cooperatively with states and tribes to strengthen nutrient management programs." Letter at 4.

41. With respect to EPA's authority under CWA Section 303(c)(4)(B) to establish revised or new water quality standards "in any case where [EPA] determines that a revised or

new standard is necessary to meet the requirements of the [CWA]," EPA's denial letter states that "U.S. EPA has used this authority in one recent instance (Florida) to develop federal NNC and retains its discretion to use it elsewhere, as appropriate. . . . While U.S. EPA may at some future time use its authority in response to specific circumstances, U.S. EPA's current approach, consistent with the CWA and Agency policy, is to address N and P pollution and accelerate state adoption of NNC by working in partnership with states and stakeholders to reduce nutrient loadings from both point and non-point sources." Letter at 5.

42. In denying Plaintiffs' Petition, EPA specifically stated that, "[i]n taking this action, U.S. EPA is not determining that NNC are not necessary to meet CWA requirements with respect to the waters . . . identified." Letter at 6. Rather, EPA's denial letter states that it is only "exercising its discretion to allocate its resources in a manner that supports targeted regional and state activities to accomplish our mutual goal of reducing N and P pollution and accelerating the development and adoption of state approaches to controlling N and P." Id.

CLAIMS FOR RELIEF

First Claim for Relief (Petition Denial Not Based on Relevant Statutory Factors)

43. EPA's denial of Plaintiffs' Petition is "final agency action for which there is no other adequate remedy in a court" within the meaning of the APA, 5 U.S.C. § 704.

44. CWA Section 303(c)(4)(B) provides that "the Administrator shall promptly prepare and publish proposed regulations setting forth a revised or new water quality standard . . . in any case where [she] determines that a revised or new standard is necessary to meet the requirements of this Act."

45. EPA's denial of Plaintiffs' Petition fails to provide reasons for the denial that conform to the relevant statutory factors in Section 303(c)(4)(B) of the CWA, in that it does not

provide reasons why revised or new water quality standards to address excessive nutrient pollution in Mississippi River Basin and northern Gulf of Mexico waters are not "necessary to meet the requirements of the [CWA]."

46. EPA's denial of Plaintiffs' Petition constitutes an agency action that is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law," in violation of the APA, 5 U.S.C. § 706(2)(A), and the CWA, 33 U.S.C. § 1313(c)(4)(B).

Second Claim for Relief (Petition Denial Contrary to Undisputed Evidence)

47. EPA's denial of Plaintiffs' Petition is "final agency action for which there is no other adequate remedy in a court" within the meaning of the APA, 5 U.S.C. § 704.

48. Plaintiffs' Petition provides undisputed evidence that numeric nutrient water quality standards for the waters of the Mississippi River Basin and northern Gulf of Mexico are "necessary to meet the requirements of the [CWA]," within the meaning of Section 303(c)(4)(B) of the CWA.

49. EPA's failure in its response to the Petition to determine, within the meaning of CWA Section 303(c)(4)(B), that numeric nutrient water quality standards for the ten Mississippi River mainstem states are necessary to meet the requirements of CWA is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law," in violation of the APA, 5 U.S.C. § 706(2)(A), and the CWA, 33 U.S.C. § 1313(c)(4)(B).

50. EPA's denial of Plaintiffs' Petition constitutes an agency action that is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law," in violation of the APA, 5 U.S.C. § 706(2)(A), and the CWA, 33 U.S.C. § 1313(c)(4)(B).

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs request that this Court enter a judgment:

(1) declaring that EPA's denial of Plaintiffs' Petition is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law," in violation of the APA, 5 U.S.C. § 706(2)(A), and the CWA, 33 U.S.C. § 1313(c)(4)(B);

(2) ordering EPA to provide a response to Plaintiffs' Petition within 90 days that is not "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law";

(3) awarding Plaintiffs their litigation costs and reasonable attorneys' fees in this action, as authorized in 28 U.S.C. § 2412; and

(4) ordering such other relief as the Court may deem just and proper.

Dated: March 13, 2012

Respectfully submitted,

/s/ Machelle Lee Hall
Machelle Lee Hall, Staff Attorney La Bar No. 31498
Adam Babich, La. Bar No. 27177
Tulane Environmental Law Clinic
6329 Freret Street
New Orleans, LA 70118-6321
Phone: (504) 865-5789, direct dial 862-8814 or 862-8800
Fax: (504) 862-8721

Counsel for All Plaintiffs

Thomas Cmar (to be admitted pro hac vice)
Ann Alexander (to be admitted pro hac vice)
Natural Resources Defense Council
2 N. Riverside Plaza, Ste. 2250
Chicago, IL 60606
(312) 663-9900
tcmar@nrdc.org
aalexander@nrdc.org

Counsel for Plaintiffs GRN, MCE, IEC, TCWN, MCEA, Sierra Club, Waterkeeper Alliance, PRN, KWA, and NRDC

Bradley Klein (to be admitted pro hac vice)

Environmental Law & Policy Center
35 East Wacker Drive, Suite 1600
Chicago, IL 60601
312-673-6500
bklein@elpc.org

Counsel for Plaintiff ELPC

Exhibit A

Washington University in St. Louis

SCHOOL OF LAW

Civil Justice Clinic
Interdisciplinary Environmental Clinic

July 30, 2008

Benjamin H. Grumbles
Assistant Administrator for Water
U.S Environmental Protection Agency
Office of Water (4101M)
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Dear Mr. Grumbles:

Please find enclosed a Petition for Rulemaking Under the Clean Water Act for Numeric Water Quality Standards for Nitrogen and Phosphorus and Total Maximum Daily Loads for the Mississippi River and the Gulf of Mexico.

This Petition is submitted on behalf of the Gulf Restoration Network, Louisiana Environmental Action Network, Tennessee Clean Water Network, Public Employees for Environmental Responsibility, Kentucky Waterways Alliance, Missouri Coalition for the Environment, Iowa Environmental Council, Prairie Rivers Network, Environmental Law & Policy Center, Midwest Environmental Advocates, Minnesota Center for Environmental Advocacy, Natural Resources Defense Council, and the Sierra Club.

The Exhibits to the Petition will follow under separate cover.

If you have any questions, please call Kris Sigford at 651.223.5967, Albert Ettinger at 312.795.3707 or Elizabeth Hubertz at 314.935.8760.

Sincerely,

Elizabeth J. Hubertz

cc: Petitioners

BEFORE THE UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF WATER

Petition for Rulemaking Under the Clean Water Act	)
Numeric Water Quality Standards for Nitrogen and Phosphorus and TMDLs for the Mississippi River and the Gulf of Mexico	)

I. SUMMARY

Scientists and the United States Environmental Protection Agency ("EPA") have known for decades that many marine and fresh water bodies of the United States are being harmed by nitrogen and phosphorus pollution. Eight years ago, EPA explained that excess levels of nitrogen and phosphorus are responsible for impairing the Gulf of Mexico and a huge list of waters in nearly every state.[1] Nitrogen and phosphorus pollution causes or contributes to low dissolved oxygen levels and has numerous adverse effects on aquatic life and on the economic, aesthetic, and recreational value of our rivers, lakes, and streams.

Human health effects have also been traced to nitrogen and phosphorus pollution. Excess nitrogen and phosphorus lead to high levels of algae in the water. Before such water is suitable for drinking it must be treated, and cancer-causing trihalomethanes are produced as an unwanted side effect during the treatment process.[2] Further, nitrogen and phosphorus pollution affects

1 Nutrient Criteria, Technical Guidance Manual, Rivers and Streams, EPA -822-B-00-002 (July 2000) ("Nutrient Criteria Guidance").

2 Nutrient Criteria Guidance at 4-5.

human health by stimulating the growth of cyanobacteria. As the National Research Council Committee on the Mississippi River and the Clean Water Act ("NRC")[3] recently explained:

> Excess nutrients in lakes, ponds, slow-moving streams, and brackish areas in the upper ends of estuaries often lead to blooms of cyanobacteria (blue-green algae) that produce toxic substances. Exposure of humans to these toxic substances through contact, inhalation of water spray, or oral ingestion can cause debilitating illness and even death. Recreational activities such as swimming and water skiing can result in exposure to contaminated water, as can being on the water in recreational or commercial fishing. Little is known about the transfer of cyanobacterial toxins into the food web, but recent studies indicate that there may be both environmental effects and human health concerns.[4]

In fact, as demonstrated by the NRC Report and by numerous documents and studies discussed below, nitrogen and phosphorus pollution:

- is causing a huge dead zone in the Gulf of Mexico that threatens numerous human and ecological communities as well as the basic health of the Gulf,
- is impairing fresh water systems in the Mississippi River Basin and in other watersheds across the country, and
- has not been addressed by effective EPA action although EPA has long recognized the massive problems caused by nitrogen and phosphorus pollution.

Moreover, although EPA has offered many plans and methods for addressing the nitrogen and phosphorus pollution problem, those plans have failed, because they have not been backed by direct action by EPA. As discussed below, it is unreasonable to expect states to develop numeric nitrogen and phosphorus standards to protect their own waters, let alone protect downstream waters which they may have little political will to protect. Further, purely voluntary programs to control nitrogen and phosphorus pollution are not getting the job done. Still further,

---

3 National Research Council Committee on the Mississippi River and the Clean Water Act, *Mississippi River Water Quality and the Clean Water Act: Progress, Challenges and Opportunities*, 44-45, 74 (2008), http://nap.edu/catalog/12051.html ("NRC Report").

4 NRC Report at 45.

although EPA has claimed in the past that the states' narrative water quality standards are adequate to allow states to write National Pollutant Discharge Elimination System ("NPDES") permit limits and establish total maximum daily loads ("TMDLs") for nitrogen and phosphorus, as a practical matter, these claims are demonstrably untrue. Most states are doing precious little to control nitrogen and phosphorus pollution and as long as EPA continues its hands-off approach, the situation will not improve.

Currently, the states in the Mississippi River Basin have no numeric water quality standards for phosphorus in rivers or streams or for nitrogen in any waters. Further, most states do not even try to limit nitrogen and phosphorus discharges in NPDES permits. As a result, the impairment of fresh water systems in the Mississippi River Basin and across the country is largely uncontrolled and this year's Gulf of Mexico Dead Zone is the second largest on record. This is true even though EPA long ago recognized that important steps could be taken by the states to address the problem of nitrogen and phosphorus pollution, and that EPA has the clear authority to act if the states fail to do so. In particular, EPA has clear authority to establish numeric water quality standards governing nitrogen and phosphorus pollution under Section 303(c) of the Clean Water Act (CWA), 33 U.S.C. §1313(c), and to establish TMDLs under Section 303(d), 33 U.S.C. §1313(d). As was recently explained in the NRC Report:

> The EPA is authorized to step in and address water quality problems that may exist because of limited state action in setting and enforcing water quality standards related to the Clean Water Act provisions. Indeed, the EPA has the statutory duty to do so. A more aggressive role for EPA in this regard is crucial to maintaining and improving water quality in the Mississippi River and the northern Gulf of Mexico.
>
> There are currently neither federal nor state water quality standards for nutrients for most of the Mississippi River, although standards for nutrients are under development in several states. Both numerical federal quality criteria and state water quality standards for nutrients are essential precursors to reducing nutrient inputs to the river and achieving water quality objectives along the Mississippi River and for the Gulf of Mexico. A TMDL could be set for the Mississippi River and the northern Gulf of Mexico. This would entail the adoption by EPA of a numerical nutrient goal (criteria) for the terminus

of the Mississippi River and the northern Gulf of Mexico. An amount of aggregate nutrient reduction, across the entire watershed, necessary to achieve that goal then could be calculated. Each state in the Mississippi River watershed then could be assigned its equitable share of reduction. The assigned maximum load for each state then could be translated into numerical water quality criteria applicable to each state's waters.

The EPA should develop water quality criteria for nutrients in the Mississippi River and the northern Gulf of Mexico. Further, the EPA should ensure that states establish water quality standards (designated uses and water quality criteria) and TMDLs such that they protect water quality in the Mississippi River and the northern Gulf of Mexico from excessive nutrient pollution. In addition, through a process similar to that applied to the Chesapeake Bay, the EPA should develop a federal TMDL, or its functional equivalent, for the Mississippi River and the northern Gulf of Mexico.[5]

Petitioners Gulf Restoration Network, Louisiana Environmental Action Network, Tennessee Clean Water Network, Public Employees for Environmental Responsibility, Kentucky Waterways Alliance, Missouri Coalition for the Environment, Iowa Environmental Council, Prairie Rivers Network, Environmental Law & Policy Center, Midwest Environmental Advocates, Minnesota Center for Environmental Advocacy, Natural Resources Defense Council, and the Sierra Club request under Section 4 of the Administrative Procedure Act, 5 U.S.C. § 553(e), that EPA use its powers to control nitrogen and phosphorus pollution. Petitioners and/or their members commercially fish, swim, drink water, work with, recreationally fish, canoe, engage in nature study, and otherwise use water bodies that are negatively impacted by nitrogen and phosphorus pollution. For the reasons set forth in greater detail below, EPA should adopt numeric water quality standards for the portion of the ocean protected by the Clean Water Act but outside the jurisdiction of any state and for all water bodies in all states for which numeric water quality standards controlling nitrogen and phosphorus pollution have not yet been established. In the alternative, EPA should do this for the Northern Gulf of Mexico and for all

5 NRC Report at 137.

waters of the United States within the Mississippi River Basin. At a minimum, EPA should establish water quality standards to control nitrogen and phosphorus pollution in the mainstem of the Mississippi River and the Northern Gulf of Mexico.

Further, EPA should establish TMDLs for nitrogen and phosphorus for the Gulf of Mexico, the Mississippi River and each Mississippi River tributary that fails to meet the numeric standards set for nitrogen and phosphorus for which a TMDL has not already been prepared. In any event, EPA should prepare a TMDL for nitrogen and for phosphorus for the mainstem of the Mississippi River and the Northern Gulf of Mexico.

II. NITROGEN AND PHOSPHORUS POLLUTION NEGATIVELY AFFECTS THE GULF OF MEXICO.

Nutrient pollution is devastating the Northern Gulf of Mexico. According to many reports, including those recently drafted by the respected scientists at the NRC and the United States Environmental Protection Agency Science Advisory Board ("USEPA-SAB"), as well as by the Mississippi River/Gulf of Mexico Watershed Nutrients Task Force ("Task Force"), excessive levels of nitrogen and phosphorus — known collectively as "nutrients" — have observable and detrimental effects on saltwater environments, such as the Northern Gulf of Mexico.

The excess nitrogen and phosphorus in these systems have serious consequences, including the creation of harmful algal blooms; the development of areas of lowered dissolved oxygen known as "hypoxic zones" or "dead zones;" the loss of sub-aquatic vegetation, changes in the species composition of benthic organisms, and damage to coral reefs.[6]

---

6 NRC Report at 209; National Research Council, *Clean Coastal Waters: Understanding and Reducing the Effects of Nutrient Pollution* (2000); E. Selman, S. Greenhalgh, R. Diaz, and Z.

A. The Nature and Extent of The Gulf of Mexico Dead Zone.

Due to the excessive nitrogen and phosphorus pollution flowing from the Mississippi and Atchafalaya River Systems, a large zone of hypoxia has developed in the Northern Gulf of Mexico. There are 169 of these hypoxic zones throughout the world. The Gulf's dead zone is the largest in North America and the second largest in the world.[7] In the Gulf of Mexico, hypoxia is deemed to occur when dissolved oxygen levels are less than two milligrams per liter ("mg/L"). At this level, the fish and shrimp that normally live on the bottom can no longer be found.[8] The hypoxic region in the Gulf of Mexico extends up to 125 kilometers ("km") offshore and ranges from the mouth of the Mississippi River in eastern Louisiana west to the coastal waters of Texas.[9] Since 1985, when scientists began regular measurements of the hypoxic zone, its area has fluctuated, although several years it has exceeded 20,000 square kilometers ("km^2") or about the size of Massachusetts (see Figure 1). The Gulf's dead zone has twice the total surface area of

---

Sugg, *Eutrophication and hypoxia in coastal areas: A global assessment of the state of knowledge*, World Resources Institute Policy Note (March 2008); P.M.Vitousek, J.D. Aber, R.W. Howarth, G.E. Likens, P.A. Matson, D.W. Schindler, W.H. Schlesinger & D.G. Tilman, *Human Alterations of the Global Nitrogen Cycle: Sources and Consequences*, 7(3) Ecological Applications, 737-750 (1997).

7 Selman, *supra* note 4; N.N. Rabelais, R.E. Turner, and D. Scavia, *Beyond Science into Policy: Gulf of Mexico Hypoxia and the Mississippi River*, 52 BioScience 129-142 (2002). See also Homepage, Hypoxia in the Northern Gulf of Mexico, at www.gulfhypoxia.net (last visited July 26, 2008).

8 *See Overview,* Mapping the "Dead Zone" *at* www.gulfhypoxia.net (last visited July 26, 2008).

9 U.S.EPA, Science Advisory Board, *Hypoxia in the Northern Gulf of Mexico*, (2008), http://yosemite.epa.gov/sab/sabproduct.nsf/C3D2F27094E03F90852573B800601D93/$File/EPA-SAB-08-003complete.unsigned.pdf; N.N. Rabalais, *et al.*, *Characterization and Long-Term Trends of Hypoxia in the Northern Gulf of Mexico: Does the Science Support the Action Plan?,* 30(5) Estuaries and Coasts 753-772 (2007).

the entire Chesapeake Bay, and its volume is several orders of magnitude greater than the hypoxic water volume of Chesapeake Bay.[10]

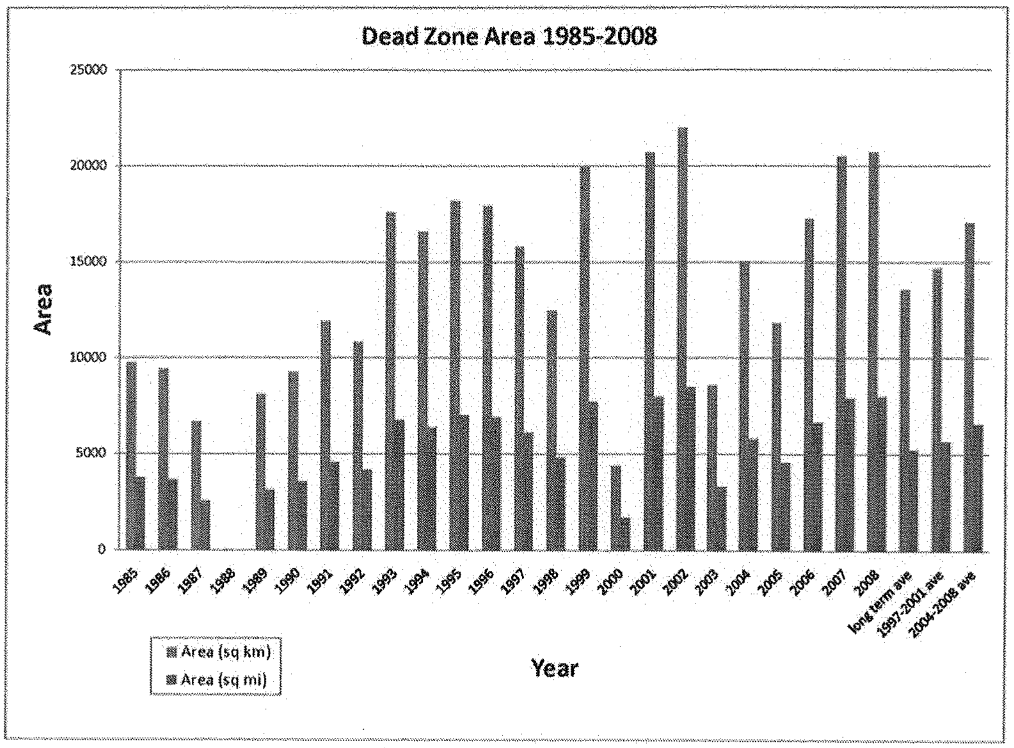

Figure 1. Areal extent of the Northern Gulf of Mexico Dead Zone, 1985-2008.

The hypoxic zone is a giant ecological imbalance triggered far upstream from the Gulf. It begins with the discharge of large amounts of nitrogen and phosphorus from the Mississippi and Atchafalaya Rivers into the Gulf. The nitrogen and phosphorus pollution enriches the water and causes the growth of massive algal (phytoplankton) blooms each summer. Dead phytoplankton

[10] "Overview – What is Hypoxia?" Hypoxia in the Northern Gulf of Mexico at www.gulfhypoxia.net (last visited July 26, 2008).

cells, along with fecal pellets from zooplankton that have eaten the phytoplankton, sink to the lower strata of the Gulf, and provide a large source of available carbon. Bacteria consume this carbon at a high rate, and in the process also consume dissolved oxygen. Because of salinity and temperature differences, the water in the Gulf naturally stratifies. As a result of this stratification, the bacteria and other organisms near the bottom use up the oxygen faster than it can be replenished. When this happens, a hypoxic zone, or sometimes an anoxic zone – an area with *no* dissolved oxygen – forms in the bottom strata of the Northern Gulf. When a hypoxic zone forms, the shrimp and fish that can swim away do so. Those creatures that cannot escape suffocate and die. The ultimate consequence is an environment where little to no sea life exists.[11]

B. The Social and Economic Costs of The Dead Zone.

The lack of oxygen in the Dead Zone poses a serious threat to species diversity in the Gulf and to its $2.8 billion commercial and recreational fishing industry.[12] In the 2008 NRC Report, the authors describe the effects of hypoxia on coastal shrimp and fish:

> Shrimp, as well as the dominant fish, the Atlantic croaker, are absent from the large areas affected by hypoxia (Renaud, 1986; Craig and Crowder, 2005; Craig et al., 2005). There is a negative relationship between the catch of brown shrimp—the largest economic fishery in the northern Gulf of Mexico—and the relative size of the midsummer hypoxic zone (Zimmerman and Nance, 2001). The catch per unit effort of brown shrimp declined during a recent interval in which hypoxia was known to expand (Downing et al., 1999). The presence of a large hypoxic water mass when juvenile brown shrimp are migrating from coastal marshes to offshore waters inhibits their growth to a larger size and thus affects the poundage of captured shrimp (Zimmerman and Nance, 2001). The unavailability of suitable habitat for shrimp and croaker forces them into the warmest

11 "Mapping the 'Dead Zone,'" Hypoxia in the Northern Gulf of Mexico, at www.gulfhypoxia.net (last visited July 26, 2008).

12 National Centers for Coastal Ocean Science, *Gulf of Mexico Ecosystems & Hypoxia Assessment (NGOMEX)* (2007).

waters inshore and also cooler waters offshore of the hypoxic zone with potential effects on growth, trophic interactions, and reproductive capacity (Craig and Crowder, 2005).[13]

C. The Importance of Urgent Federal and State Action.

The USEPA-SAB succinctly demonstrated the importance of timely action to reduce nitrogen and phosphorus pollution in the Mississippi River, observing:

> Biological changes have occurred in the benthic communities of the [Northern Gulf of Mexico], and there is evidence that the living resources are impacted by hypoxia. The Gulf of Mexico ecosystem appears to have gone through a regime shift with hypoxia such that today the system is more sensitive to inputs of nutrients than in the past, with nutrient inputs inducing a larger response in hypoxia as shown for other coastal marine ecosystems (Chesapeake Bay, Danish coastal water). The USEPA-SAB Panel therefore provides the following recommendation: *Nutrients should be reduced as soon as possible before the system reaches a point where even larger reductions are required to reduce the area of hypoxia.*[14]

These observations have been echoed on by Dr. Nancy Rabalais of the Louisiana Universities Marine Consortium (LUMCON) whose website (gulfhypoxia.net) states:

> [W]hile hypoxic environments have existed through geologic time and are common features of the deep ocean or adjacent to areas of upwelling, their occurrence in estuarine and coastal areas is increasing, and the trend is consistent with the increase in human activities that result in nutrient over-enrichment. No other environmental variable of such ecological importance to estuarine and coastal marine ecosystems around the world has changed so drastically, and in such a short period of time, as dissolved oxygen. The severity of hypoxia (either duration, intensity, or size) increased where hypoxia occurred historically or hypoxia exists now when it did not occur previously. The severity of hypoxia has increased in the northern Gulf of Mexico according to indicators identified in sediment samples from the affected area, and the size and frequency of occurrence have increased as the flux of nitrate increased during the last half of the 20th century.[15]

---

13 NRC Report at 61.

14 U.S. EPA, Science Advisory Board, *Hypoxia in the Northern Gulf of Mexico*, *supra* note 9 at 52 (emphasis added).

15 "Overview –What is Hypoxia?" Hypoxia in the Northern Gulf of Mexico at gulfhypoxia.net (last viewed July 26, 2008).

D. Scientific Recommendations.

The scientific community has concluded that direct action must be taken in order to address the Dead Zone. The USEPA-SAB stated that since the 2007 Dead Zone was the third largest since measurements began, "it is even more important to proceed in a directionally correct fashion to manage factors affecting hypoxia." Subsequently, the USEPA-SAB Panel recommends, in order to reduce the hypoxic zone to 5,000 km^2 (the goal accepted in the 2001 and re-affirmed in the 2008 Action Plans):

> a dual nutrient strategy targeting at least a 45% reduction in riverine total nitrogen flux (to approximately 870,000 metric tonne/yr or 960,000 ton/yr) and at least a 45% reduction in total phosphorus flux (to approximately 75,000 metric tonne/yr or 83,000 ton/yr). Both of these reductions refer to changes measured against average flux over the 1980-1996 time period ...with most recent model runs showing a 45-55% required reduction for N in order to reduce the size of the hypoxic zone.[16]

The Panel further states that this reduction is conservative, given that "a number of studies have suggested that climate change will create conditions for which larger nutrient reductions, *e.g.* 50 to 60% for nitrogen, would be required to reduce the size of the hypoxic zone."[17]

The USEPA-SAB study stressed the importance of a dual-nutrient (nitrogen and phosphorus) removal strategy for improving the water quality of both the Mississippi-Atchafalaya River Basin and the Northern Gulf of Mexico. It found that plans that target nitrogen will not address phosphorus impairments throughout the basin, and that phosphorus reductions play an important role in addressing the Dead Zone in the Northern Gulf.[18] The NRC also endorsed an approach targeting both nitrogen and phosphorus pollution, finding that while nitrogen is the primary nutrient of concern in the northern Gulf of Mexico hypoxic zone, excess

---

16 USEPA-SAB, *supra* note 9 at 2.

17 *Id.* at 2.

18 *Id.* at 3.

phosphorus should also be addressed, as it may be a limiting nutrient to phytoplankton growth in the spring, and "in the immediate plume of the Mississippi River as it discharges into the Gulf of Mexico. Given the importance of reducing both nitrogen and phosphorus in various forms, it is necessary to consider management of both of these nutrient inputs."[19] The 2008 Action Plan likewise targets both nitrogen and phosphorus.[20]

In order to reach the goals accepted by the scientific community, a basin-wide approach to reducing nitrogen and phosphorus pollution is necessary. Recent models, including the U.S. Geological Survey SPARROW Model (SPAtially Referenced Regressions on Watershed Attributes), demonstrate the contribution from each mainstem state; these contributions illustrate the importance of nitrogen and phosphorus pollution reductions in all contributing states, as shown in Figure 2 below. The duty to coordinate and implement such a basin-wide approach should be assumed by EPA. In fact the NRC Report states that the Clean Water Act "provides the EPA with multiple authorities that would allow it to assume a stronger leadership role in addressing Mississippi River and northern Gulf of Mexico water quality."[21] As part of this authority, the NRC states that

> A TMDL [Total Maximum Daily Load] could be set for the Mississippi River and the northern Gulf of Mexico. This would entail the adoption by EPA of a numerical nutrient goal (criteria) for the terminus of the Mississippi River and the northern Gulf of Mexico … the EPA should develop [this] federal TMDL, or its functional equivalent, for the Mississippi River and the northern Gulf of Mexico.[22]

---

[19] NRC Report at 63.

[20] *See* Gulf Hypoxia Action Plan (2008), http://www.epa.gov/msbasin/taskforce/pdf/ghap2008.pdf ("2008 Action Plan").

[21] *Id.* at 7.

[22] *Id.* at 12.

Figure 2. Share of the total nitrogen and phosphorus flux delivered to the Gulf of Mexico from sources in states in the Mississippi and Atchafalaya River Basins, taken from U.S. Geological Survey SPARROW Model. Ranks are out of the 31 states that drain into the Mississippi Atchafalaya River Basins.[23]

State	TN Percent (Rank)	TP Percent (Rank)
Illinois	16.8 (1)	12.9 (1)
Iowa	11.3 (2)	9.8 (3)
Indiana	10.1 (3)	8.4 (6)
Missouri	9.6 (4)	12.1 (2)
Arkansas	6.9 (6)	9.6 (4)
Kentucky	6.1 (6)	9.0 (5)
Tennessee	5.5 (7)	5.3 (7)
Ohio	5.4 (8)	4.1 (9)
Mississippi	3.4 (9)	4.4 (8)
Nebraska	3.2 (10)	3.3 (11)
Kansas	3.1 (11)	2.6 (12)
Minnesota	2.9 (12)	2.0 (16)
Wisconsin	2.7 (13)	2.4 (14)
Oklahoma	2.5 (14)	3.3 (10)
Pennsylvania	1.9 (15)	1.9 (17)
West Virginia	1.8 (16)	2.1 (15)
Louisiana	1.7 (17)	2.4 (13)
Alabama	1.1 (18)	0.9 (19)
South Dakota	0.9 (19)	1.6 (18)
North Carolina	0.6 (20)	0.2 (23)
Texas	0.6 (21)	0.7 (20)
Virginia	0.5 (22)	0.4 (21)
Montana	0.4 (23)	0.1 (26)
North Dakota	0.2 (24)	0.1 (25)
New York	0.2 (25)	0.2 (22)
Georgia	0.2 (26)	0.1 (27)
Wyoming	0.1 (27)	<0.1 (30)
Colorado	0.1 (28)	0.2 (24)
Maryland	<0.1 (29)	<0.1 (28)
Michigan	<0.1 (30)	<0.1 (29)
New Mexico	<0. 1 (31)	<0.1 (31)

---

23 Table showing estimated state contributions, in descending order, *in* R.B. Alexander, *et al.*, *Differences in Phosphorus and Nitrogen Delivery to the Gulf of Mexico from the Mississippi Basin* 42:3 Environmental Science Technology 822-30 (2008), available at http://water.usgs.gov/nawqa/sparrow/gulf_findings/

III. NITROGEN AND PHOSPHORUS POLLUTION IMPAIR FRESHWATER SYSTEMS.

Nitrogen and phosphorus pollution lead to myriad problems in freshwater systems throughout the Mississippi River Basin and the nation as a whole. Some problems are caused by high concentrations of the nutrients themselves; for example, direct toxicity of high levels of nitrate in drinking water to humans and to aquatic organisms in natural waters. Most problems caused by nitrogen and phosphorus pollution, however, result from the stimulating effect these pollutants have on plant and microbial growth, altering the balance of natural communities, robbing the water column of oxygen, and promoting the growth of pathogenic and toxin-producing microorganisms. These problems prevent waters from attaining the basic Clean Water Act "fishable/swimmable" goals, threaten the health of human and wildlife users of these waters, and impose significant costs on drinking water suppliers. Nitrogen and phosphorus pollution harm the Mississippi River and its tributaries as follows:

- Damage to recreational use of waters;
- Damage to aquatic plant and wildlife communities;
- Damage to drinking water supplies; and
- Damage to aesthetic quality of waters.

A. Damage To Recreational Use Of Waters.

1. Toxic Cyanobacteria.

Many studies, with both field and laboratory experimental verification, have shown that cyanobacteria thrive in waters polluted by nitrogen as well as phosphorus.[24] For example, in

[24] *See* reviews in *Toxic Cyanobacteria in Water – A Guide to Their Public Health Consequences, Monitoring and Management*. Sponsors for the World Health Organization (I.

many enriched north temperate lakes, total phosphorus concentrations at spring overturn are strongly related to late summer algal biomass that can be dominated by cyanobacteria.[25] Nitrogen is also important in causing cyanobacteria blooms.[26]

The term "toxic cyanobacteria" (or "toxic blue-green algae") refers to species or strains of species that are capable of toxin production.[27] Toxic cyanobacteria produce toxic substances called cyanobacterial toxins or cyanotoxins.[28] These toxins are released into the environment when cyanobacterial cells break open during senescence or natural decay, because of treatment with algicides (herbicides), or in the stomach of an organism that has ingested them. Cyanobacterial toxins can cause respiratory distress and neurological problems in people and pets swimming in or ingesting contaminated water[29] – in fact, as discussed below, dogs have been rapidly killed by exposure to cyanotoxins after swimming in ponds, reservoirs or lakes, and a human death in Wisconsin was related to recreational exposure. Although cyanotoxins commonly accumulate in fish liver and other organs that are not consumed by humans, these toxins also can accumulate in fish muscle (i.e., the fish fillets that are consumed by humans),

---

Chorus & J. Bartram eds.,1999); R.L. Oliver & G.G. Ganf, "Freshwater Blooms," *The Ecology of Cyanobacteria: Their Diversity in Time and Space* 149-94 (B.A.Whitton and M. Potts, eds., 2000); J.M. Burkholder, *Cyanobacteria*, Encyclopedia of Environmental Microbiology, 952-982 (G. Bitton, ed., 2002) (forthcoming); C. Bauer, *The Effects of Increased Nutrient Concentrations in Streams* (2007), attached as Exhibit A.

25 Oliver & Ganf, *supra* note 24; J. Kalff, *Limnology,* (2002); Burkholder, *supra* note 24 and references therein.

26 Oliver & Ganf, *supra* note 24; Burkholder, *supra* note 24 and references therein.

27 Burkholder, *supra* note 24.

28 See reviews in Burkholder, *supra* note 24.

29 Benjamin H. Grumbles, Memorandum, Office of Water Numeric Nutrient Standards Strategy, Attachment 1 at 3 (May 25, 2007), attached as Exhibit B.

sometimes making fish unsuitable for human consumption.[30] Unfortunately, there is little testing for cyanotoxins in fish by the U.S. Food and Drug Administration or other entities.

2. Examples from the Mississippi River Basin.

Severe illnesses associated with the ingestion of cyanobacteria during recreational activities are not merely anecdotal, and are certainly not limited to a few "problem" waterways. Toxins from cyanobacteria have caused severe illnesses in pets and several reported pet deaths, including eight dog deaths reported in several Minnesota counties between 2004 and 2007, and at least one reported dog death in Wisconsin in 2004.[31] [32] A Wisconsin woman experienced physical symptoms, including extreme joint pain, headaches, rash, upset stomach, and fatigue, attributed to ingestion of algae ridden water during a night time swim in a recreational lake in Madison, Wisconsin. This is the fourth report of similar illnesses in the region this year.[33]

---

30 "Report shows algae toxins found in fish and shellfish," The Eureka *Reporter*, Apr. 10, 2008, http://www.eurekareporter.com/article/080410-algae-toxins-found-in-fish-and-shellfish.

31 Minnesota Pollution Control Agency, *What you should know about blue green algae*, Water Quality/Surface # 1.03, (Dec. 2007), http://www.pca.state.mn.us/publications/wq-s1-03.pdf; Minnesota Pollution Control Agency, Bulletin, *Some Minnesota Lakes Seeing Toxic Algae Blooms*, (Sept. 28, 2004) ("The MPCA, Department of Health (MDH), and Department of Natural Resources (DNR) are advising people not to swim or wade in these lakes and to keep pets or farm animals out of the water until the algae clears up.")

32 Wisconsin Dep't of Natural Resources, "Blue-Green Algae in Wisconsin Waters, Frequently Asked Questions," (undated), http://dnr.wi.gov/lakes/bluegreenalgae/; Wisconsin Dep't of Natural Resources, News Release, *Avoid swimming in water with mats of blue-green algae*, (Jun. 11, 2004), http://www.vilaslandandwater.org/water_resources_pages/ blue_green_alga/blue_green_alga_200_dnr_release.pdf.

33 Sandy Cullen, *Mendota swim sickens woman; blue-green algae blamed*, Wisconsin State Journal, (July 22, 2008), http://www.madison.com/wsj/home/local/297407.

Worse yet, the Dane County, Wisconsin coroner ruled that ingestion of cyanobacterial toxins caused the death of a teenage boy in July 2002.[34]

High concentrations of cyanobacteria often deter or prohibit local residents and recreational tourists from utilizing freshwater resources. While the "pea-green soup" or "green paint" appearance, mats, and stench (especially of rotting cyanobacteria blooms, which smell like vomit) are often enough to dissuade many residents from swimming or boating in affected waters, each summer local communities in Minnesota, Wisconsin, Iowa, and Illinois are forced to officially "close" beaches throughout each state to deter public recreation in these potentially toxic waters.[35] In 2006 alone, the Iowa Department of Natural Resources issued advisories at seven different Iowa beaches when samples showed algal toxin levels at these beaches exceeded recommended World Health Organization guidelines.[36] The presence of toxic blue-green algae forced cancellation of the swimming portion of a Wisconsin triathlon expected to draw as many as 2,000 people to the lakefront.[37] Certain jobs necessitate contact with these heavily algae-laden waters, and agencies may issue recommendations to avoid contact and inhalation exposure to agency staff, volunteer lake monitors, and others with required occupational exposure, such as

---

34 Don Behm, *Coroner cites algae in teen's death, Experts are uncertain about toxin's role,* Milwaukee Journal Sentinel, JS Online.com (Sep. 6, 2003), http://www.jsonline.com/story/index.aspx?id=167645>.

35 *James Madison, Olbrich beaches closed*, The Capital Times, (Jul. 10, 2008), http://www.madison.com/tct/mad/topstories/295579.

36 Iowa Department of' Natural Resources, "Highlights 2006," DNR Water Fact Sheet 2007-9, (Jan. 2007).

37 Mike Johnson, *Algae Stops Pewaukee Triathlon's swim*, Milwaukee Journal Sentinel, (July 9, 2008), http://www.jsonline.com/story/index.aspx?id=771125.

water rescue, military, construction, and maintenance personnel.[38] However, despite the health threats, resource management agencies often do not conduct any routine monitoring for blue-green algae or blue-green algal toxins.[39]

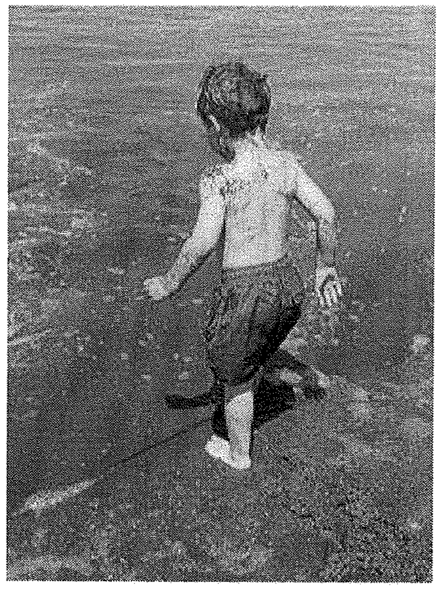

Figure 3. Boy swimming in blue-green algae, Lake Byllesby, Minnesota.

---

38 Wisconsin Dep't of Natural Resources, *Occupational exposure to algal toxins* (April 2008), http://dnr.wi.gov/lakes/CLMN/miscpdfs/Occupational%20exposure %20to%20algal%20toxins.pdf.

39 *See Blue-green Algae in Wisconsin Waters, supra* note 26; M. J. Lindon and S. A. Heiskary, Minnesota Pollution Control Agency, *Environmental Bulletin: Blue-green Algal Toxin (Microcystin) Levels in Minnesota Lakes*, (July 2008)(detailing monitoring results of 62 lakes 2004-2007).

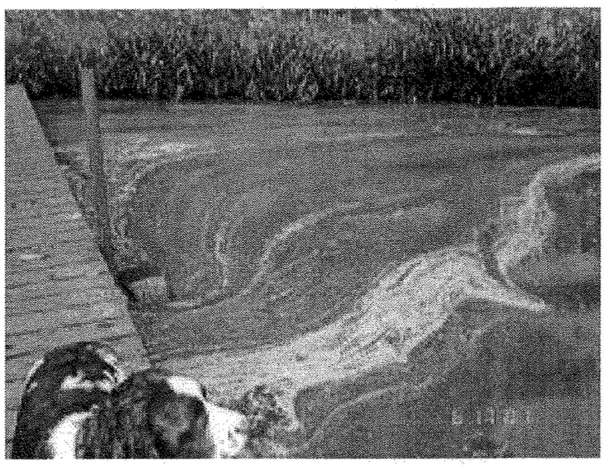

Figure 4. Dog near blue-green algae infested water.

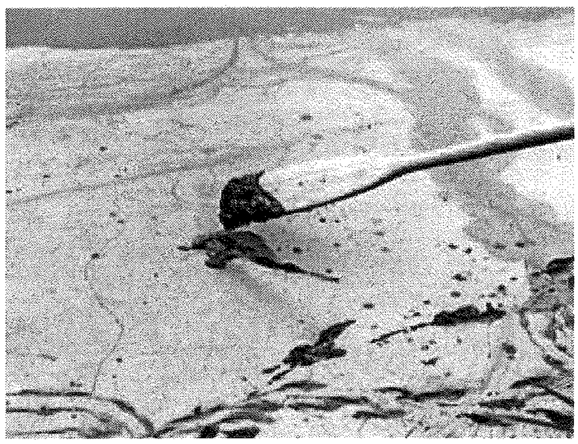

Figure 5. Blue-green algae.

B. Damage to Aquatic Plant and Wildlife Communities.

Various authors have developed conceptual models of important ecological processes that are altered by nitrogen and phosphorus pollution.[40] Nitrogen and phosphorus pollution harms aquatic communities through:

- Stimulating algal and cyanobacterial growth;

---

[40] *See* Bauer, Ex. A at 4-5, 7-10; S.B. Bricker, *et al., Effects of Nutrient Enrichment in the Nation's Estuaries: A Decade of Change*, NOAA Coastal Ocean Program Decision Analysis Series No. 26, National Centers for Coastal Ocean Service (2007).

- Stimulating microbial growth, including growth of some microbial pathogens;
- Direct toxicity to beneficial aquatic life and wildlife that use the aquatic resources; and
- Other undesirable alterations of the aquatic food web.

1. Nitrogen and phosphorus pollution stimulates algal overgrowth in rivers and streams.

As discussed by Bauer, the effects of increased nitrogen and phosphorus concentrations in flowing waters on algae have been studied through (1) correlation between nutrients and algal abundance or biomass, which is generally measured as phytoplankton (floating or sestonic algae) or periphyton (algae attached to the stream bottom) chlorophyll-*a* concentrations, (2) direct measurement of rates of primary production, and (3) nutrient addition studies (bioassays), including the use of nutrient-diffusing substrata.[41] Smith and others reviewed the large body of literature showing that increased nitrogen and phosphorus stimulate algal growth across aquatic ecosystems.[42] Additional reviews of data from experiments with nutrient-diffusing substrata indicate that nutrients often limit algal growth in streams (in 60 to 75% of the experiments reviewed), and co-limitation of algal growth by both nitrogen and phosphorus is more likely to occur than limitation by either nutrient alone.[43] It should be noted, however, that streams in close proximity with similar geomorphology can have different patterns of nutrient limitation,

---

41 *See* Bauer, Ex. A at 4-7.

42 V.H. Smith, G.D. Tilman & J.C. Nekola. *Eutrophication: Impacts of Excess Nutrient Inputs on Freshwater, Marine, and Terrestrial Ecosystems,* 100 Environmental Pollution 179-196 (1999).

43 W.K. Dodds & E. Welch, *Establishing Nutrient Criteria In Streams*, 19 J. North American Benthological Soc., 186-196 (2000); S.N. Francoeur, *Meta-Analysis Of Lotic Nutrient Amendment Experiments: Detecting And Quantifying Subtle Responses*, 20 J. North American Benthological Soc., 358-368 (2001); J. Tank & W. K. Dodds, *Responses Of Heterotrophic And Autotrophic Biofilms To Nutrients In Ten Streams,* 48 Freshwater Biology 1031-1049 (2003).

depending upon their morphometry and the characteristics of their watersheds, and nutrient limitation can change from year to year.[44]

Researchers consistently have reported significant positive relationships between nutrient concentrations and both suspended and benthic algal biomass in streams. Specifically, researchers have found that:

- Nitrogen and phosphorus concentrations influence algal biomass in streams, explaining up to 38% of the variation in benthic algal biomass.[45]
- Increases of dissolved nitrogen and phosphorus led to increased biomass and increased frequency of benthic algal blooms.[46]
- Soluble reactive phosphorus concentrations explained 23% of the variability in monthly chlorophyll-*a* concentrations in New Zealand streams.[47]
- Increased nitrogen and phosphorus concentrations can promote increased benthic algal production in streams.[48]
- In a survey of temperate streams across four continents (most in North America), there was a relationship between increased nutrients and increased levels of suspended algae in stream water, measured as chlorophyll-*a*.[49]

44 A.P. Wold & A.E. Hershey, *Spatial And Temporal Variability Of Nutrient Limitation In Six North Shore Tributaries To Lake Superior*, 18 J. North American Benthological Soc., 2-14 (1999).

45 W.K. Dodds, V. H. Smith & K. Lohman, *Nitrogen And Phosphorus Relationships To Benthic Algal Biomass In Temperate Streams*, 59 Canadian Journal of Fisheries and Aquatic Sciences 865-874 (2002), as corrected, W.K. Dodds, *et al.*, *Erratum: Nitrogen And Phosphorus Relationships To Benthic Algal Biomass In Temperate Streams*, 63 Canadian Journal of Fisheries and Aquatic Sciences 1190-1191 (2006).

46 J.F. Biggs, *Eutrophication Of Streams And Rivers: Dissolved Nutrient - Chlorophyll Relationships For Benthic Algae,* 19 J. North American Benthological Soc, 17-31 (2000).

47 *Id.*

48 W.K. Dodds, V. H. Smith & B. Zander, *Developing Nutrient Targets To Control Benthic Chlorophyll Levels In Streams: A Case Study Of The Clark Fork River*, 31 Water Research 1738-1750 (1997); Dodds and Welch, *supra* note 43.

49 E.E. Van Nieuwenhuyse & J. R. Jones, *Phosphorus-Chlorophyll Relationship In Temperature Streams And Its Variation With Stream Catchment Area*, 53 Canadian Journal of Fisheries and Aquatic Science 99-105 (1996).

- In streams in the Missouri Ozarks, there was a relationship between increased nutrients and increased sestonic chlorophyll-*a* in streams.[50]
- In large rivers, both total phosphorus and total nitrogen were significant predictors of sestonic algal cell counts.[51]
- Total phosphorus concentrations explained 76% of the variability in suspended algal biomass (as chlorophyll-*a*), and total nitrogen was significantly related to algal biomass.[52]
- In rivers across several ecoregions in Minnesota, a significant positive relationship between total phosphorus and sestonic chlorophyll-*a* was found.[53]
- In Illinois streams, a significant amount of the variation in suspended and benthic algal biomass was explained by phosphorus concentrations.[54]
- Concentrations of soluble nutrients in Midwestern streams were all positively correlated with rates of gross primary production, with nutrients explaining 50 to 90% of the variation in production.[55]
- Nutrient concentrations, benthic algae, and gross primary production were significantly higher in agricultural areas, as compared to reforested and forested areas.[56]

---

50 K. Lohman, & J.R. Jones, *Nutrient-sestonic Chlorophyll Relationships in Northern Ozark Streams*, 56 Can. J. Fish. Aquat. Sci. 124-130 (1999).

51 D.M. Soballe & B.L. Kimmel, *A Large-Scale Comparison Of Factors Influencing Phytoplankton Abundance In Rivers, Lakes, And Impoundments*, 68 Ecology 1943–1954 (1987).

52 B.K. Basu & F.R. Pick, *Factors Regulating Phytoplankton And Zooplankton Biomass In Temperate Rivers*, 41 Limnology and Oceanography, 1572-1577 (1996).

53 S. Heiskary & H. Markus, *Establishing Relationships Among In-Stream Nutrient Concentrations, Phytoplankton Abundance And Composition, Fish IBI And Biochemical Oxygen Demand In Minnesota USA Rivers* (2003), available at: http://www.pca.state.mn.us/publications/reports/biomonitoring-mnriverrelationships.pdf.

54 A.M. Morgan et al., Relationships Among Nutrients, Chlorophyll-a, And Dissolved Oxygen In Agricultural Streams In Illinois, 35 J. Environmental Quality 1110-1117 (2006).

55 M.J. Bernot, et al., *Nutrient Uptake In Streams Draining Agricultural Catchments Of The Midwestern United States*, 51 Freshwater Biology 499-509 (2006).

These relationships have been found despite the fact that the flowing water environment of streams often rapidly transports suspended algae through the systems, and despite the fact that in comparison to lakes, streams often are low-light environments, characterized by shading from overhanging terrestrial vegetation or reduced light penetration from suspended sediments.[57] Run-of-river impoundments are intermediate between lakes and streams in many features, but generally are more turbid and flush more rapidly than lakes.[58] In such systems, again, both phosphorus and nitrogen have been reported to be important factors causing algal abundance, including cyanobacteria.[59] Cyanobacterial toxins can be harmful to aquatic life such as zooplankton and fish as well as humans, and high-biomass blooms can result in fish kills.[60]

2. Phosphorus and nitrogen pollution stimulates microbial growth.

Phosphorus and nitrogen stimulate the growth and production of heterotrophic organisms such as bacteria and fungi.[61] Dodds' review of literature related to heterotrophic production supported the generalization that increased nutrient concentrations lead to increased bacterial counts and activity, increased fungal biomass, and, ultimately increased degradation of organic

---

56 M.E. McTammany, E.F. Benfield & J.R. Webster, *Recovery Of Stream Ecosystems Metabolism From Historical Agriculture*, 26 J. North American Benthological Soc. 532-545 (2007).

57 R.G. Wetzel, *Limnology* (3rd ed. 2001).

58 *Id.*

59 M.F. Knowlton & J.R. Jones, *Natural variability in lakes and reservoirs should be recognized in setting nutrient criteria,* 22 Lake and Reservoir Management 161-166 (2006); B.W. Touchette, *et al., Eutrophication And Cyanobacteria Blooms In Run-Of-River Impoundments In North Carolina, U.S.A.*, 23 Lake and Reservoir Management 179-192 (2007).

60 W.K. Dodds, *Freshwater Ecology* 134-35 (2002).

61 W.K. Dodds, *Eutrophication and Trophic State in Rivers and Streams*, 51 Limnology and Oceanography 671-680 (2006).

materials. Often, these effects were associated with both increased concentrations of nitrogen and phosphorus.[62] Increased respiration due to the stimulation of heterotrophic activity can also lead to increased fluctuation in daily dissolved oxygen concentrations and to conditions of hypoxia and anoxia that can cause the death of fish and other beneficial aquatic life.

Increased disease from microbial pathogens, low-oxygen conditions, and other stressors can also be linked to nitrogen and phosphorus pollution.[63] Lemly observed fouling of macroinvertebrate gill structure and reduced survival in eutrophic waters.[64] Similarly, higher incidence of abnormalities on fishes was correlated to increasing nutrient concentrations in Ohio waters.[65] Furthermore, high nitrogen and phosphorus concentrations increased trematode parasite transmission into snails (due to increased algal and snail production) and increased production of parasite life stages (due to improved snail density and health) that may increase the risk of infection for amphibians.[66] Trematode infections induce severe limb malformations and mortality in amphibians. Nitrogen and phosphorus pollution is one factor, among several interactive stressors, that helps to explain the increase in mortality and limb malformations in amphibian populations observed worldwide.

---

62 *Id.*

63 K.D. Lafferty & R.D. Holt, *How Should Environmental Stress Affect The Population Dynamics Of Disease*, 6 Ecology Letters 654-664 (2003).

64 A.D. Lemly, *Using Bacterial Growth On Insects To Assess Nutrient Impacts In Streams*, 63 Environmental Monitoring and Assessment 431-446 (2000).

65 Ohio Environmental Protection Agency, *Association Between Nutrients, Habitat, And The Aquatic Biota In Ohio Rivers And Streams*, Technical Bulletin MAS/1999-1-1, available at: http://www.epa.state.oh.us/dsw/guidance/assoc_load.pdf.

66 P.T.J. Johnson, *et al., Aquatic Eutrophication Promotes Pathogenic Infection in Amphibians,* 104 Proceedings of the National Academy of Sciences 15781-15786 (2007).

3. Direct toxicity of nitrate on aquatic organisms.

Some studies suggest that high levels of nitrate can be toxic to aquatic animals. For example, Camargo and others found that some invertebrate and amphibian species can sustain detrimental health effects or mortality when exposed to nitrate levels around 10 mg/L over a sustained period.[67] Acute toxicity tests showed lethal effects of nitrate to two *Echinogammarus* species (LC_{10} ranged from 8.5 to 22.2 mg NO_3-N/L) and chronic toxicity tests on amphibians, particularly embryos (lowest observed effect concentrations ("LOEC"), and no observed effect concentrations ("NOEC") ranged from 5 to 30.1 mg NO_3-N/L) support the premise that nitrate can be detrimental to survival and reproduction of aquatic animals. Comparison of acute to chronic results for amphibians, the only taxa where such information is available, indicates that chronic effects of nitrate toxicity occur at lower levels than demonstrated using acute tests alone. Salmonid eggs and fry have been shown to be very sensitive to nitrate (NOEC/LOECs ranged from 1.1 to 7.6 mg/L NO_3-N).[68] Environmentally relevant concentrations of nitrate (less than 10 mg NO_3-N/L) depressed tadpole survival in mesocosm experiments.[69]

4. Nitrogen and phosphorus pollution alters the structure of aquatic animal communities.

Chronic nitrogen and phosphorus pollution from anthropogenic nutrient additions, sometimes called cultural eutrophication, shifts aquatic ecosystems out of balance and

---

67 J.A. Camargo, A. Alonso, & A. Salamanca, *Nitrate Toxicity To Aquatic Animals: A Review With New Data For Freshwater Invertebrates*, 58 Chemosphere 1255-1267 (2005).

68 J.W. Kincheloe, G.A. Wedemeyer, & D.L. Koch, *Tolerance Of Developing Salmonid Eggs And Fry To Nitrate Exposure*, 23 Bulletin of Environmental Contamination and Toxicology 575-578 (1979).

69 G.R. Smith, *et al.*, *Effects Of Nitrate On The Interactions Of The Tadpoles Of Two Ranids* (Rana clamitans and R. catesbiana), 40 Aquatic Ecology 125-130 (2006).

dramatically alters food webs with many detrimental effects.[70] Nitrogen and phosphorus over-enrichment detrimentally affects aquatic life, and leads to aquatic life use impairment. These indirect effects are attributed mostly to changes in the dissolved oxygen regime and alteration of food and habitat resources.

a. *Dissolved oxygen regime.*

Changes in algal and bacterial production alter the amount of dissolved oxygen ("DO") present in flowing waters. These changes in DO content of water and sediment can affect macroinvertebrate and fish community structure through a multitude of direct and indirect pathways including direct mortality or physiological stress, altered behavior or habitat preferences, and alteration of metal and ion availability. Through these mechanisms, even the occasional accrual of high levels of filamentous algae may have important biological effects on stream biota. For example, in Illinois streams, a significant relationship was found between presence of high levels of filamentous algae and diel oxygen flux, where filamentous algal abundance explained 62% of the variation in DO flux.[71]

In Minnesota rivers, increased total phosphorus and total Kjeldahl nitrogen were positively correlated with increased biological oxygen demand and DO flux.[72] Data from the Ohio EPA also indicate that low daytime DO and wide DO swings (between day and night) are

---

70 *See* J.M. Burkholder, *Eutrophication and oligotrophication*, in 2 Encyclopedia of Biodiversity, 649-70 (S. Levin, ed., 2001).

71 Morgan, *supra* note 54.

72 Heiskary & Markus, *supra* note 53.

likely in small streams when total phosphorus concentrations exceed 120 micrograms per liter ("µg/L").[73]

b. *Changes in food and habitat resources, and effects on aquatic animals.*

Most indirect effects on aquatic animals from nitrogen and phosphorus pollution are caused by changes in food quantity and quality (such as algae and organic matter) and habitat quantity and quality.[74] Direct studies of the effects of nutrient amendments on streams and the resulting change in algal abundance and composition have shown major changes in the abundance and types of consumers including macroinvertebrates and fishes present in the nutrient-enriched streams.[75]

Correlational evidence, as summarized by Bauer, has shown large changes in macroinvertebrate and fish communities with increasing nutrient concentrations using several state-wide databases:

- In New York wadeable streams, eutrophic macroinvertebrate communities (significantly different in community composition from oligotrophic macroinvertebrate communities) were likely when nitrate exceeded 0.98 mg/L NO3 and total phosphorus exceeded 65 µg/L. There was also a substantial increase in the

73 Bauer, Ex. A at 12 (personal communication with Bob Miltner of the Ohio EPA).

74 *See* Burkholder, *supra* note 70.

75 A.D. Rosemond, *Interactions Among Irradiance, Nutrients, And Herbivores Constrain A Stream Algal Community,* 94 Oecologia 585–594 (1993); J.W. Feminella & C.P. Hawkins, *Interactions Between Stream Herbivores And Periphyton: A Quantitative Analysis Of Past Experiments*, 14 J. North American Benthological Soc. 465-509 (1995); N. Bourassa, N. & A. Cattaneo, *Control Of Periphyton Biomass In Laurentian Streams,* (Quebec), 17 J. North American Benthological Soc. 420-429 (1998); A.M.H. deBruyn, D.J. Marcogliese, & J.B. Rasmussen, *The Role Of Sewage In A Large River Food Web*, 60 Canadian Journal of Fisheries and Aquatic Sciences 1332-1344 (2003); L.A. Deegan, *et al.*, *Effects Of Fish Density And River Fertilization On Algal Standing Stocks, Invertebrate Communities, And Fish Production In An Arctic River*, 54 Canadian Journal of Fisheries and Aquatic Sciences 269-283 (1997).

percentage of "moderately impacted" samples and a decrease in the percentage of "non-impacted" samples at sites determined to be eutrophic.[76]

- An analysis of over 1500 sites in Ohio, with low and high levels of nutrients, shows nutrient concentrations were correlated with significant decreases in fish community health scores in wadeable streams. Significant declines in the number of sensitive fish species and significant increases in tolerant fishes in wadeable streams were found with increasing nutrient concentrations.[77]

- In Wisconsin wadeable and nonwadeable streams, fish and macroinvertebrate community health indices varied significantly in response to phosphorus and nitrogen concentrations. The biological metrics showed "threshold" responses where the mean response (i.e., metric score) above the threshold was determined to be different from the mean response below the threshold.[78]

- In EPA Region 7, comprised of Iowa, Missouri, Kansas, and Nebraska, analysis of nutrient and biological data showed strong relationships between sestonic chlorophyll-*a* and total phosphorus and total nitrogen. Macroinvertebrate species richness was correlated with total phosphorus concentrations, where 11 to 32% of the variance in response is explained by nutrients.[79]

- In Michigan and Kentucky, increased algal abundance, increased Cladophora cover and changes in algal community metrics were related to increased total phosphorus concentrations. Changes in macroinvertebrate and fish measures were also correlated with increasing total phosphorus concentrations. These changes in macroinvertebrates and fishes included declines in sensitive species and declines in measures of biological integrity.[80]

---

[76] A.J. Smith, R.W.Bode & G.S. Kleppel, *A Nutrient Biotic Index (NBI) For Use With Benthic Macroinvertebrate Communities*, 7 Environmental Indicators 371-386 (2007).

[77] R.J. Miltner & E.T. Rankin, *Primary Nutrients And The Biotic Integrity Of Rivers And Streams*, 40 Freshwater Biology 145-158 (1998).

[78] D.M.. Robertson, *et al.*, *Nutrient Concentrations And Their Relations To The Biotic Integrity Of Wadeable Streams In Wisconsin*, Professional Paper No. 1722 (2006); L. Wang, D.M. Robertson, & P.J. Garrison, *Linkages Between Nutrients And Assemblages Of Macroinvertebrates And Fish In Wadeable Streams: Implication To Nutrient Criteria Development*, 99 Environmental Management, 194-212 (2007).

[79] Bauer, Ex. A at 15, 18 and chart (personal communication with Don Huggins).

[80] *Id.* at 18 (personal communication with R.J. Stevenson).

5. Examples from the Basin.

The above studies review damage to aquatic resources and indicate the nitrogen and phosphorus levels at which they occur. Following are additional examples of harms to aquatic life observed in the Mississippi River Basin.

A large fish kill on Lake Benton, in Lincoln County, Minnesota was caused by excessive algal growth.[81]

Figure 6. Photo of Lake Benton (Minnesota) Fish Kill, September 27, 2004.

Overabundant algal growth caused by excess nutrient pollution also affects aquatic wildlife, such as the "serious detrimental effects on duck populations on this historic prime waterfowl resource" at Heron Lake, Minnesota.[82]

81 Minnesota Pollution Control Agency, *supra* note 31.

The Arkansas Game and Fish Commission has been fighting nutrient-fueled aquatic plant growth in the Felsenthal National Wildlife Refuge.

The breadth of nutrient-related damage to aquatic systems is well illustrated in state 305(b) reports from several Mississippi River states.

- The Minnesota Pollution Control Agency recognizes that lake impairments caused by excess nutrient loading has been "one of the leading causes of polluted conditions reported in the 305(b) reports."[83]
- Illinois lists algae as the cause of impairment in approximately 75% of the state's impaired lakes and lists total nitrogen as the cause of impairment in approximately 20% of the states impaired rivers or streams.
- Louisiana lists total phosphorus as the cause of impairment in approximately 20% of its impaired lakes, and 20% of its impaired rivers and streams.
- Iowa and Wisconsin list algae as the cause of impairment in approximately 42% and 38%, respectively, of each state's impaired lakes.
- Kentucky lists nutrients as the cause of impairment in approximately 13% of the state's impaired rivers and streams.
- Tennessee lists nutrients as the cause of impairment for approximately 14% of the state's impaired lakes and reservoirs.

C. Damage to Drinking Water Supplies.

The nitrate form of nitrogen and the excessive algal growth caused by nitrogen and phosphorus pollution in public water supplies pose direct and indirect threats to consumers. In some cases, the pollution and algae can be reduced through the use of water treatment technology, although this imposes substantial costs on ratepayers.[84] Sometimes, however, the

---

82 Minnesota Pollution Control Agency, *Statement of Need and Reasonableness Book II of III*, (July 2007), http://www.pca.state.mn.us/water/standards/sonar-book2.pdf.

83 *Id.* at 30.

84 *See* Nutrient Criteria Guidance, *supra* note 1 at 4-5.

problems may be so severe and the cost of treatment so prohibitive that water supplies must be abandoned.

The primary threats to drinking water from nutrient pollution are:

- Taste-and-odor problems;
- Blue baby syndrome;
- Trihalomethanes; and
- Cyanotoxins from cyanobacteria.

1. Taste and odor problems.

Excessive algal growth with its associated bacterial and fungal assemblages leads to taste-and-odor problems in drinking water supplies. A wide array of freshwater planktonic and benthic algae, including numerous cyanobacteria, produces cucumber-like, fishy, rancid, oily, or "skunk-like" odorous compounds. Many algal volatile organic compounds ("AVOCs") have been identified, some of which are also produced by bacteria or fungi.[85] Relatively few AVOCs – certain terpenoids, sulfur compounds, and polyunsaturated fatty acid ("PUFA") derivatives – cause most algal-associated taste-and-odor problems. Nutrient-poor systems rarely have detectable odors; rather, PUFAs occur frequently and in higher abundance in nutrient over-enriched systems.

Several biosynthetic pathways are involved in synthesis of AVOCs. Some are synthesized during normal growth, whereas others are produced when cellular integrity is compromised, which often occurs during decomposition of cyanobacterial blooms, or changes from oxygenated to anoxic conditions. Addition of copper sulfate or other herbicides that are

---

85 *See* Burkholder, *supra* note 24; Burkholder *et al.*, *supra* note 70.

commonly used in efforts to control cyanobacterial blooms can also promote production of strong odorous compounds.

Water suppliers can address these problems to some extent, but at a cost that is eventually passed along to consumers. Notably, two common taste-and-odor compounds produced by cyanobacteria are geosmin and 2-methylisoborneol ("G-MIB"). These compounds are not effectively removed by conventional treatment processes (coagulation-sedimentation-chlorination), and variably removed by activated carbon.

2. Blue baby syndrome.

Excessive levels of nitrogen in the form of nitrate in drinking waters can cause blue baby syndrome (methemoglobinemia) in infants. Infants less than six months old are particularly susceptible to this potentially-fatal illness where a disruption in hemoglobin levels in blood impairs the supply of oxygen throughout the body. EPA's drinking water standard for nitrate was adopted specifically to protect against this illness. It is possible to reduce levels of nitrate during drinking water treatment, which comes at an increased cost to water suppliers and consumers.[86]

3. Trihalomethanes.

As EPA has described, the formation of trihalomethanes during drinking water treatment processes is a problem caused by nutrient pollution.[87] Stimulation of algal growth by nutrient pollution leads to high levels of organic matter in drinking water supplies, which in turn lead to the production of trihalomethanes during disinfection. Trihalomethanes are carcinogens,

---

[86] National Primary Drinking Water Regulations, Final Rule, EPA, 56 Fed. Reg. 3526, 3537-38, (Jan. 30, 1991); National Research Council, *Nitrate and Nitrite in Drinking Water*, (1995).

[87] Nutrient Criteria Guidance, *supra* note 1, at 4-5.

regulated by EPA through a human health-based water quality standard of 80 mg/L for total trihalomethanes.[88] It is possible but expensive to address the problem by modifying the water treatment process or by switching to alternative disinfection processes.

4. Cyanotoxins.

As discussed previously, the growth and abundance of potentially-toxic cyanobacteria are directly stimulated by nutrient pollution in freshwater systems. Some cyanobacteria strains produce toxic substances called cyanobacterial toxins or cyanotoxins.[89] Ingesting cyanobacterial toxins can cause neurotoxicity, hepatotoxicity, various cytotoxicity effects, and gastrointestinal effects in humans, as well as skin irritation and rashes. Some common cyanotoxins are malignant tumor promotors, based upon studies with small mammals. The available evidence supports the premise that extended exposure to low levels of cyanobacterial toxins can have chronic effects on humans. At present there are no drinking water standards specifically for cyanobacteria and their toxins, but since 1998 the Contaminant Candidate List has included cyanobacteria (blue-green algae) and their toxins as contaminants.[90]

In 2001 the EPA identified several cyanobacterial toxins as high priorities for potential health risks in source and finished waters of drinking water utilities in the U.S. The World Health Organization has set 1 μg microcystin-LR L^{-1} in drinking water as a guideline for human health protection.[91] The guideline is based on one common cyanotoxin, a type of microcystin (among more than 80 types of microcystins), despite the fact that multiple toxins often are

---

88 *See* 40 C.F.R. §.141.64(b).

89 Burkholder, *supra* note 24.

90 U.S. EPA, Consumer Confidence Reports, (undated) available at http://www.epa.gov/safewater/ccr/.

91 World Health Organization, *Algae And Cyanobacteria In Fresh Water*, Guidelines for Safe Recreational Waters, Volume 1 – Coastal and Fresh Waters (2003).

present in affected waters, because supporting animal and human toxicity data are incomplete for most other cyanotoxins.[92]

Many studies, with both field and laboratory experimental verification, have shown that cyanobacteria thrive in waters polluted by nitrogen as well as phosphorus.[93] In turbid waters, light generally is the resource that is most important in limiting algal production, including cyanobacteria, but when light limitation is relieved – for example, if there is enough time between rainstorms and episodic sediment loading events – cyanobacteria respond strongly to both phosphorus and nitrogen enrichment.[94] The effects of nutrient over-enrichment on cyanotoxin production are more complex, and depend upon the species, strain, the group of toxins, and other environmental conditions.[95] Microcystin production tends to be directly proportional to growth rate which, in turn, generally increases with increasing phosphorus and nitrogen concentrations.[96]

---

92 Burkholder, *supra* note 24.

93 *See* Chorus & Bartrum, *supra* note 24; Oliver & Ganf, *supra* note 24; Burkholder, *supra* note 24; Bauer, Ex. A at 9.

94 Touchette *et al.*, *supra* note 59.

95 Chorus & Bartram, *supra* note 24.

96 P.T. Orr & G.J. Jones, *Relationship between Microcystin Production and Cell Division Rates in Nitrogen-Limited* Microcystis aeruginosa *Cultures*, 43(7) Limnol.Oceanogr. 1604-14 (1998); Chorus & Bartram, supra note 24; J.L. Graham, *et al.. Environmental Factors Influencing Microcystin Distribution And Concentration In The Midwestern United State*s, 38 Water Research 4395-4404 (2004) *but see* G.L. Boyer, *The Occurrence of Cyanobacterial Toxins in New York lakes: Lessons from the MERHAB-Lower Great Lakes Program*, 23 Lake and Reservoir Management 153-60 (2007).

If blooms of cyanobacteria are detected, drinking water can be treated to remove toxins, but at more expense for water treatment plant operators.[97] Carbon filters, for example, can remove cyanotoxins effectively, but they are expensive and, therefore, not routinely used in many systems. Moreover, screening of treated public water systems is imperfect – for many cyanotoxins, routine analytical methods are still being developed, toxicity thresholds do not exist and water is usually only screened after other evidence of a potential problem is detected.

5. Examples from the Basin.

This summer Minneapolis residents complained to city officials that the water from their taps is simply too "stinky" to drink— the smell being caused by too much algae present in the city's drinking water supply, the Mississippi River. St. Paul residents, after many years of similar problems invested $10 million to install a granular activated carbon system that "improved the aesthetic quality of the water."[98]

Iowa has several surface waters listed as impaired for drinking water use because of high nitrate concentrations in source water.[99] These include the Des Moines and Raccoon Rivers upstream of Des Moines (population 193,189); the Cedar River which is the drinking water source for the City of Cedar Rapids (population 108,772); the South Skunk River upstream of

---

97 J.A. Westrick, *Cyanobacterial Toxin Removal In Drinking Water Treatment Processes And Recreational Waterways,* Proceedings of the Interagency, International Symposium on Cyanobacterial Harmful Algal Blooms (ISOC-HAB): State of the Science and Research Needs, 261-76 (H.K. Hudnell, ed., 2007).

98 Rodrigo Smith and Paul Walsh, *Water In Minneapolis And Nearby Suburbs May Smell And Taste Funky For Two More Weeks,* Minneapolis Star Tribune (July 11, 2008), http://www.startribune.com/local/24310144.html.

99 Iowa Department of Natural Resources, *Category 5 of Iowa's 2005 Integrated Report, The List of Impaired Waters*, (May 1, 2007) (draft), http://wqm.igsb.uiowa.edu/WQA/303d/2006/draft_2006_Category-5_303d-list.pdf.

Oskaloosa (population 10,600); and the Middle Raccoon River upstream of Panora (population 1,100).

In Illinois, Lake Georgetown, in Vermilion County, had to be abandoned as a drinking water source for the City of Georgetown in 2003 because of high nitrate levels. The City now uses a groundwater source in Indiana for its water supply.[100] Also, because of nitrate levels in excess of the drinking water standard, three Central Illinois reservoirs (the Streator reservoir,[101] Lake Decatur,[102] and Lake Vermilion[103]) water suppliers have had to install ion exchange systems to remove nitrate at their water treatment plants. The cost for the system at the Streator Reservoir was $1.6 million.[104] Costs for the Lake Decatur system were $7.5 million, plus Operation and Maintenance costs of $40-50,000 per year and media replacement every 10 years at a cost of $3 million.[105]

Several states along the mainstem of the Mississippi River report trihalomethane problems with public drinking water supplies. Iowa, for example, reports 14 violations at eight public water suppliers serving nearly 45,000 people in 2007.[106] Missouri reports 18 communities

---

[100] Personal communication from Rick Cobb, Illinois EPA.

[101] Illinois EPA and USGS, Source Water Assessment Program Fact Sheet, IAWC - Streator, LaSalle County (May 2, 2002).

[102] Illinois EPA and USGS, Source Water Assessment Program Fact Sheet, Decatur, Macon County (March 1, 2002).

[103] Illinois EPA and USGS, Source Water Assessment Program Fact Sheet, Consumers Illinois Water Co. Vermilion Division, Vermilion County (May 2, 2002).

[104] Personal communication from Rick Cobb, Illinois EPA.

[105] *Id.*

[106] Iowa Department of Natural Resources, *Public Drinking Water Program 2007, Annual Compliance Report*, 17 (June 2008).

with trihalomethane violations in 2006.[107] Tennessee reports 48 water treatment facilities with major violations during 2004.[108]

C. Damage To Aesthetic Quality Of Waters.

Nutrient pollution impairs the aesthetic quality of freshwater systems mainly by:

- Significantly reducing water clarity,
- Causing floating mats of live and decomposing algae, and
- Producing hypo- and anoxic conditions resulting in unpleasant odors and fish kills.

The stimulation of freshwater algae and cyanobacteria by nutrient pollution described herein results in excessive quantities of planktonic and sestonic algae in lakes, rivers, and streams. Water clarity is decreased significantly by the algae as they overgrow the system and form blooms. During the day, these microscopic plant-like creatures make oxygen from photosynthesis, but at night, the many tiny cells consume much or all of the oxygen that was in the water so that fish suffocate to death. As the algal blooms die, bacteria use oxygen to decompose them, exacerbating the low-oxygen situation. When waters have little or no oxygen (conditions known as hypoxia and anoxia, respectively), anaerobic bacteria growing on the bottom sediments produce hydrogen sulfide, methane, and other offensive-smelling gases that are byproducts of anaerobic respiration. Anoxic conditions can kill fish and other aquatic organisms, leading to further visual and odor impacts on the aesthetic quality of waters.

---

107 Missouri Department of Natural Resources, 2006 *Annual Compliance Report of Missouri Public Drinking Water Systems*, 28 (undated), http://www.dnr.mo.gov/env/wpp/fyreports/index.html

108 Tennessee Dep't of Environment and Conservation, *Annual Report of the Violations of the Federal Safe Drinking Water Act, January 1, 2004 through December 31, 2004*, 28-70 (July 2005).

The following photos illustrate the aesthetic impact on waters within the Mississippi River Basin states:

Figure 7. Algae Bloom (Minnesota Pollution Control Agency).

Figure 8. Photo of Lake Crystal, Minnesota.

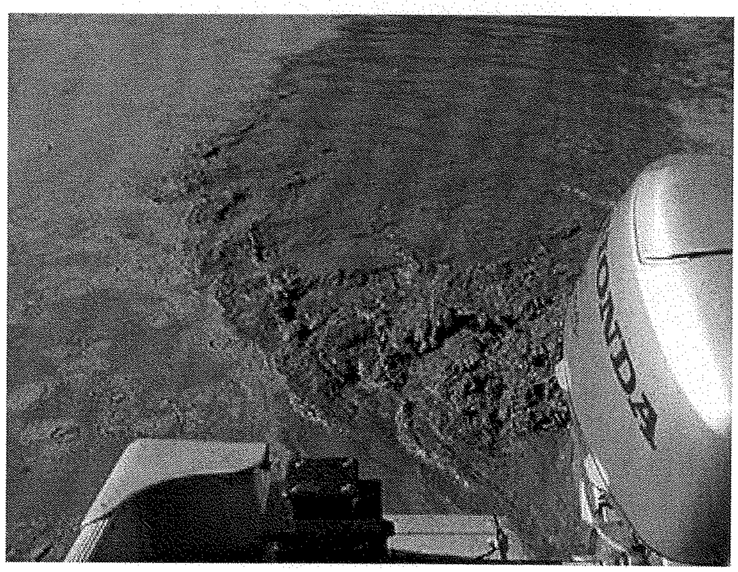

Figure 9. Algae, Wisconsin Department of Natural Resources.