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

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[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,

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[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]

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[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

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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]

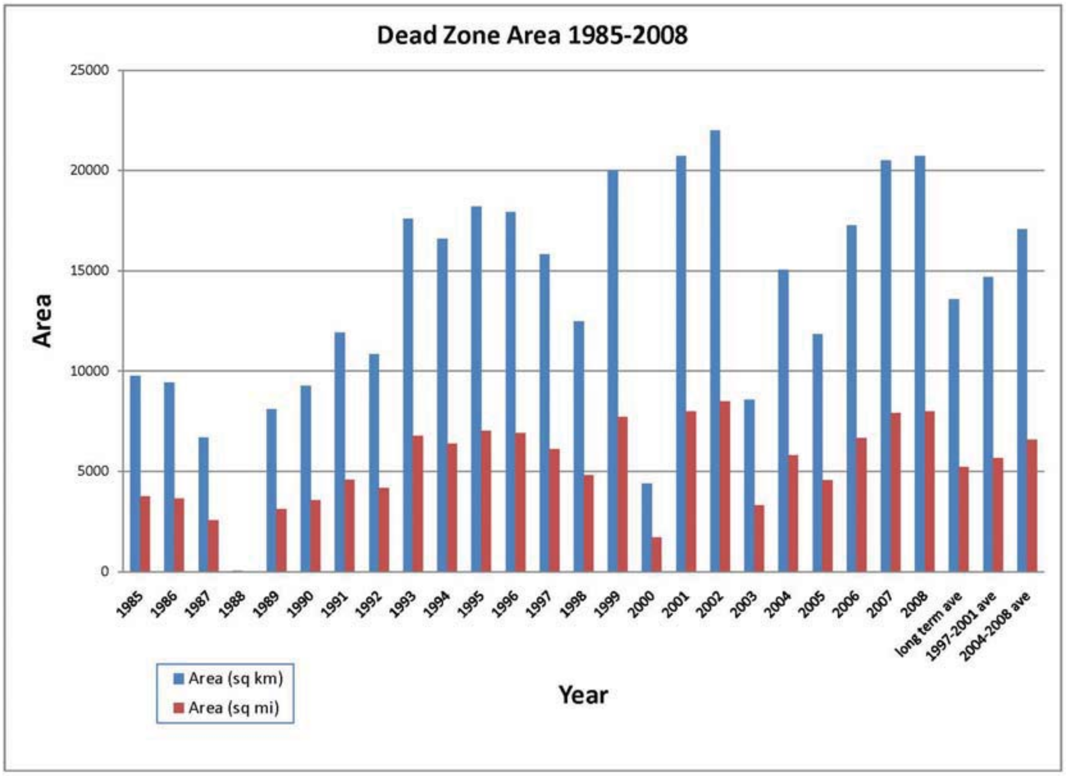

Figure 1. Areal extent of the Northern Gulf of Mexico Dead Zone, 1985-2008.

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

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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]

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[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

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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]

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[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)

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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),

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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]

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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

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[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.

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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;

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[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,

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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]

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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]

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[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

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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.

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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

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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

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[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]

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[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]

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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

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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,

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[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

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[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]

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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

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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

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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.

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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).

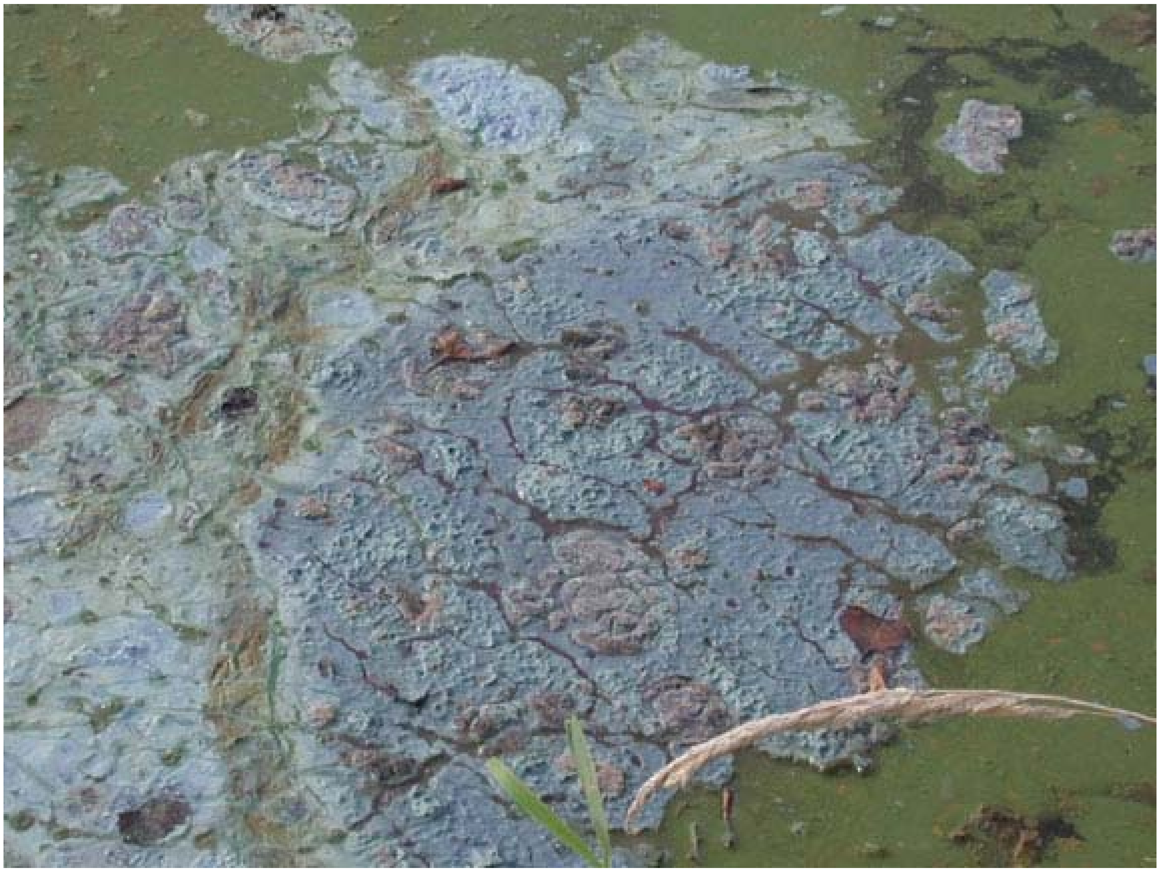

Figure 8. Photo of Lake Crystal, Minnesota.

Figure 9. Algae, Wisconsin Department of Natural Resources.

IV. THE EPA'S HISTORY OF INACTION.

As already noted, although the EPA is aware of the extent and severity of nutrient-caused problems in the Gulf,[109] in United States coastal waters in general,[110] and in the nation's freshwater resources the federal government's response has been slow in coming, slow in moving once it arrived, and largely inefficacious. Despite the many attempts noted below, this summer's Dead Zone is the second largest on record and would likely have been the largest if not for the happenstance of Hurricane Dolly, and EPA is still pondering its response.

A. The Earthjustice Petition And The EPA's Response.

In 1985, LUMCON began the first "concerted, continuous and consistent" study of hypoxia in Louisiana and Texas with funding from National Oceanic and Atmospheric Administration.[111] That year, the large hypoxic Dead Zone in the Gulf of Mexico measured approximately 3800 square miles, larger than the states of Rhode Island and Delaware combined.[112] The size of the Gulf's Dead Zone increased during the early 1990s. In 1993, the year of the Mississippi River's

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109 Since at least 1972, studies have documented hypoxic regions in the Gulf of Mexico. LUMCON, Hypoxia in the Northern Gulf of Mexico, http://www.gulfhypoxia.net/Overview/ (last visited July 15, 2008). As nutrient levels in the Mississippi River have grown since the 1950s, over that same period, the hypoxic zones have grown in size and severity as well.

110 For example, a large hypoxic zone in the Chesapeake Bay attracted significant popular attention during the late 1980s. Philip S. Gutis, *Growing Harm Seen to Key Fish Source*, N.Y. Times, Aug. 14, 1987, at A1.

111 Overview, Hypoxia in the Northern Gulf of Mexico, http://www.gulfhypoxia.net/Overview/ (last visited July 15, 2008).

112 *Id.*

disastrous flooding, it reached a high point of nearly 6800 square miles, larger than the state of Connecticut.[113]

Dr. Nancy Rabalais, one of the LUMCON researchers, brought her research to the attention of the environmental community in 1994. In response, nearly 20 environmental groups approached the Sierra Club Legal Defense Fund, now Earthjustice, and asked the lawyers there to petition the EPA to convene an interstate management conference. Section 319(g)(1) of the Clean Water Act allows a state to petition the EPA to call such a conference when some portion of the navigable waters of that state fail to meet applicable water quality standards because of non-point source pollution from other states. The purpose of such a conference is to "develop an agreement among such States to reduce the level of pollution in [the affected] portion and improve the water quality of such portion"[114] and the Earthjustice petition sought to bring together, under the auspices of the EPA, all of the states contributing to the Dead Zone in the Gulf.

The Earthjustice petition was filed in 1995, and denied later that year. Instead, in December 1995, the EPA, through its Gulf of Mexico Program, held a conference to address some of these same issues. At this conference, the EPA said that it would not take action immediately, but acknowledged that it needed to do something to address the Dead Zone. That "something" turned out to be the development of a "strategy" over the next year or so, involving the states upstream from the Dead Zone. The EPA promised to work through the existing Gulf of Mexico Program to achieve these goals and to educate the upriver contributors to the Dead Zone

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113 *Id.*

114 Clean Water Act § 319(g)(1), 33 U.S.C. § 1329(g)(1).

about the effects of their activities. It promised "on-the-ground" nutrient reduction strategies with set goals by 1997.[115]

Two more meetings were held in 1996 to discuss how the EPA and other federal agencies could involve the upstream states in working to address the Dead Zone. A federal interagency working group asked the White House Office of Science and Technology to study the problem, through its Committee on Environment and Natural Resources.[116] But the promised "nutrient reduction strategies" with "set goals" did not materialize.

B. The Mississippi River/Gulf Of Mexico Watershed Nutrient Task Force.

Two years after the Earthjustice petition, the EPA convened the first meeting of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force ("Nutrient Task Force"). This group consisted of six federal agencies, seven state agencies and two senior tribal representatives.[117] According to Robert Perciasepe, then the Assistant Administrator of the Office of Water at the EPA, the Task Force would meet three to four times a year and would focus on programs already underway. Mr. Perciasepe expressed a desire that the Task Force "not wait until the problem is too large to handle.[118] Environmental advocates attending the meeting

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115 Final Meeting Summary for the First Meeting of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 6 (1997), http://www.epa.gov/msbasin/taskforce/summaries/1stsummary.htm.

116 Mississippi River Basin & Gulf of Mexico Hypoxia Meeting Summaries, http://www.epa.gov/msbasin/taskforce/summaries.htm (last visited July 9, 2008).

117 First Meeting Summary 6 (Dec. 4, 1997), http://www.epa.gov/msbasin/ taskforce/ summaries/1stsummary.htm.

118 *Id.* at 1.

urged the Task Force to "develop action items … rather than merely studying the science," to move "at a much faster pace" than the previous two years, and to set goals "now."[119]

The Task Force continued its meetings, but although commenters continued to urge the Task Force to develop specific numeric goals and criteria,[120] it did not move at a faster pace, immediately develop action items, or set nutrient goals. Instead, it developed a "strategy."[121] It studied the science.[122] It concluded that hypoxia in the Gulf had increased since the 1950s and that this increase was caused primarily by nitrogen loading from the Mississippi River.[123] In 1999, two years after the Task Force was convened it finally began to develop an "Action Plan" – only after receiving a legislative mandate to do so.[124]

Two years later – nearly six years after the Earthjustice Petition, and a year after the legislative deadline – the Task Force unveiled its Action Plan for Reducing, Mitigating and

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119 *Id.* at 6-8.

120 Final Meeting Summary, Sixth Meeting of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 6-7 (Jun, 15-16, 2000), http://www.epa.gov/msbasin/taskforce/summaries/1stsummary.htm.

121 Final Meeting Summary, Third Meeting of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 4-5 (Sep. 24, 1998), http://www.epa.gov/msbasin/taskforce/summaries/3rdsummary.htm (discussing strategy).

122 Final Integrated Assessment, Executive Summary, 2-3 (May 2000), http://oceanservice.noaa.gov /products/hypox_finalexecsumm.pdf.

123 Sixth Meeting Summary 2 (summary of remarks by Don Scavia of NOAA).

124 The Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (HABHRCA), Pub. L. No.105-383, was enacted on November 13, 1998. This statute addressed hypoxia on a national basis, not just in the Gulf. It established a federal hypoxia Task Force, provided for "assessments" of the consequences of hypoxia, and required a plan for controlling hypoxia by March 30, 2000. *See* 16 U.S.C. § 1451. The success of this provision is best demonstrated by the fact that the act was reauthorized in 2004, four years after the "plan" was originally due, this time calling for the development of a "plan" by 2005. P.L. 108-456 at 118 STAT. 3633.

Controlling Hypoxia in the Northern Gulf of Mexico (the "2001 Action Plan"). The 2001 Action Plan called for the reduction of the Dead Zone to less than 5000 square kilometers by 2015, and listed 11 short-term actions to achieve the Action Plan's goals. [125] None of those actions involved any sort of numeric criteria, however, and none of them involved any real *action*. Instead, the "action plan" suggested the establishment of additional committees, the development of additional "strategies" and further study of the problem, as well as the creation of "indicators" that could allegedly determine the progress of any nutrient management action, although it did not explain how these indicators would be used.[126]

By design, the 2001 Action Plan encouraged voluntary action instead of mandates, the use of existing government programs instead of new rules or regulations, and the establishment of lofty goals instead of specific criteria.[127] And it got pretty much what one could expect from such a Plan – a continuation of the status quo. In 2008, the NRC Report found that the results of the Action Plan were "limited." [128] A group of 11 Gulf of Mexico scientists wrote the EPA, similarly lamenting the "lack of progress toward the goal" of reducing the hypoxic zone, and only "modest" implementation of any action.[129] In fact in its 2008 Action Plan, the Task Force

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125 Action Plan for Reducing, Mitigating and Controlling Hypoxia in the Northern Gulf of Mexico, at 9, 13-14 (2001) ("2001 Action Plan").

126 2001 Action Plan at 25-28.

127 2001 Action Plan at 9 (voluntary compliance).

128 NRC Report at 209.

129 *Id*. (summarizing June 2007 letter to the EPA from University of Maryland Center for Environmental Science).

itself observed that the activities inspired by 2001 Action Plan "have not resulted in a reduction of the hypoxic zone."[130]

C. Other Government Initiatives Do Not Solve The Problem.

The Task Force was a federal initiative devoted solely to the Gulf and Mississippi River. In addition to the Task Force, the EPA had in place a number of concurrent water quality initiatives that might have been expected to help reduce the hypoxic zone by encouraging and assisting in the development of numeric nitrogen and phosphorus criteria. Despite these expectations, they did not.

1. Clean Water Action Plan.

The Task Force referred to the Clean Water Action Plan ("CWAP") as a source of funding and as a vehicle through which nitrogen and phosphorus pollution could be ameliorated. The CWAP, issued on February 19, 1998, contained 111 "key actions designed to reinvigorate efforts to restore and protect the nation's waters."[131] Approximately 28 of them related in some way to hypoxia and/or nitrogen and phosphorus pollution in the Gulf and Mississippi River.[132]

The EPA explained that the CWAP was a "blueprint" and that it intended to "identify the major sources of nitrogen and phosphorus in our waters" and to "identify actions to address"

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[130] 2008 Action Plan at 9.

[131] Table of Contents, cleanwater.gov, http://water.usgs.gov/owq/cleanwater/action/toc.html, (last visited July 3, 2008).

[132] First Meeting Summary 2-3.

them.[133] In the section of CWAP entitled "Reduce Nutrient Over-enrichment," the EPA explained its goals:

> EPA will develop nutrient criteria – numerical ranges for acceptable levels of nutrients (i.e., nitrogen and phosphorus) in water. … EPA will develop nutrient criteria for the various water body types and ecoregions of the country by the year 2000. … Within three years of the EPA issuance of applicable criteria, all states and tribes should have adopted water quality standards for nutrients. Where a state or tribe fails to adopt a water quality standard for nutrients within that three-year period, EPA will begin to promulgate water quality standards for nutrients.[134]

The CWAP however, was "not a regulation and [did] not establish a regulatory program."[135] Nor was it designed specifically to address the Gulf hypoxia problem. Although the EPA did develop recommended numeric nutrient criteria, the states did not adopt numeric nutrient standards by 2003, and EPA did not begin to promulgate its own numeric water quality standards for nutrients by July 2004. The CWAP, like the 2001 Action Plan, did not reduce the Gulf's Dead Zone.

2. EPA's National Nutrient Strategy.

On June 25, 1998, the EPA published the National Strategy for the Development of Regional Nutrient Criteria in the Federal Register.[136] In the National Strategy, the EPA explained that it planned to issue "technical guidance" to assist the states in developing numeric nutrient criteria "by the end of the year 2001" and that it expected "all States and Tribes to adopt and

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133 Water Quality Standards Regulation, Part II, 63 Fed Reg. 129, 36778 (July 7, 1998) (describing CWAP).

134 CWAP at 59.

135 65 Fed. Reg. 202, 62567 (Oct 18, 2000).

136 63 Fed. Reg. 34648 (Jun. 25, 1998).

implement numerical nutrient criteria into their water quality standards by December 31, 2003."[137]

Although the EPA did develop recommended numeric nutrient criteria for ecoregions by the end of 2000, the EPA was already backpedaling on enforcing adoption of numeric standards by the states. It explained that the states and tribes now had until "the end of 2004" to adopt nutrient standards, but again promised that the EPA itself would promulgate nutrient water quality standards if it looked like the states or tribes were going to miss the deadline.[138] However, not only did the states and tribes miss the 2004 deadline, as of mid-2007,[139] only two states, Tennessee and Hawaii, had anything that approached numeric nitrogen or phosphorus criteria that covered rivers and streams. No state has any numeric nutrient criteria or standards applicable to the Mississippi River.[140] And, despite its earlier commitment to step in if the states failed to act in a timely manner, the EPA has given no indication that it intends to do so, even though the states and tribes are not even close to the National Strategy's goals.

D. The Environmental Community Tries Again To Convince The Agency To Take Action With No Better Result.

Frustrated with the lack of progress in the Action Plan, the CWAP, and the National Nutrient Strategy, members of the environmental community formally asked the EPA to address the problem. In 2003, the Ozark Chapter of the Sierra Club petitioned the EPA to promulgate

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137 63 Fed. Reg. 34648-49.

138 Nutrient Criteria Development, 66 Fed. Reg. 1671, 1673-4 (Jan. 9, 2001).

139 Current Status: National Nutrient Strategy, Chart, (May 14, 2007) http://www.epa.gov/waterscience/criteria/nutrient/strategy/status.html, visited July 14, 2008.

140 *Id. See also* NRC Report at 126.

water quality standards for the Mississippi and Missouri Rivers located in an eight-state region near the waters' confluence.[141] The Petition asked the EPA to publish standards that were consistent from state to state and that reflected criteria sufficient to achieve and maintain fishable/swimmable waters and satisfy the requirements of the Clean Water Act.[142]

The Sierra Club specifically sought to have the EPA promulgate its own numeric nutrient criteria, both to insure uniformity along the River and to protect the health of the River and the Gulf.[143] Using the Dead Zone as a "graphic demonstration" of the failure of the existing state-oriented system, the Petition pointed out that the Dead Zone owed its size and existence to "excessive nutrients, primarily nitrogen, carried to the Gulf by the Mississippi and Atchafayala Rivers …" and that only the EPA had the authority to ensure that the "cumulative effects" of nutrients from all of the states would not contribute to the Dead Zone.[144] The Sierra Club urged the EPA to use this authority to step in and act.

The year following the Sierra Club's petition, the Natural Resources Defense Council ("NRDC") and the Environmental Law and Policy Center ("ELPC") sent a letter to Benjamin Grumbles, the Acting Assistant Administrator of the EPA for Water, specifically directing the

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141 *See* Petition to the United States Environmental Protection Agency for Rulemaking to Protect Interstate Waters Under the Clean Water Act, (February 25, 2003), attached as Exhibit C. The portion of the Mississippi River involved in the Petition ran from Burlington, Iowa to Memphis, Tennessee. *Id.* at 2.

142 CWA § 303(c)(4), 33 U.S.C. § 1313(c)(4).

143 Petition, Ex. C, at 3.

144 Petition, Ex. C at 16-17 (*quoting* 2001 Action Plan). The Petitioner was not alone in recognizing the failure of the existing scheme. In 2003, the Government Accountability Office (GAO) had similarly recognized that nutrient pollution was one of the largest contributors to the nation's impaired waters and recommended that the EPA take the lead in publishing numeric nutrients criteria. *See* U.S. Gov. Accountability Office, Improved EPA Guidance and Support Can Help States Develop Standards that Better Target Cleanup Efforts, 37-39 (2003).

agency's attention to nitrogen and phosphorus pollution.[145] The letter pointed out that the states were far behind the goals for progress set by the EPA, and noted further that the states were attempting to set numeric nutrient criteria using methods that the EPA had found to be scientifically difficult and had rejected in its own materials.[146] The NRDC/ELPC letter also demonstrated that the states were not including nitrogen and phosphorus limits in NPDES water permits and that the failure to promulgate numeric nutrient criteria was leading to the construction of water treatment plans that could not reasonably treat for phosphorus when those criteria eventually arrived. Like the Sierra Club Petition, the letter sought the EPA's immediate intervention in the problem.[147]

Circumstances seemed auspicious for a positive response from the EPA to the Sierra Club petition. The EPA had agreed to accept the Petition as part of the Settlement of another water-quality standards lawsuit and to grant or deny it within one year of receipt. A 2003 U.S. Government Accountability Office report had highlighted the same inconsistencies and problems with the EPA's existing regulatory framework as the Petitioner. The Environmental Groups' letter reminded the EPA of what it already knew – that the states and tribes were years late in establishing numeric nutrient criteria. The Dead Zone had reached its largest size ever – 22,000 square kilometers – two years before.

However, although the facts of agency inaction had become crystal clear, the Sierra Club's Petition met with no more success than did the Earthjustice Petition filed nearly a decade

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145 Letter from National Resource Defense Council and Environmental Law and Policy Center to EPA, Office of Water, dated March 5, 2004, attached as Exhibit D.

146 Ex. D at 2.

147 Ex. D. at 2, 4.

earlier. The EPA determined that it was "unnecessary for EPA to federally promulgate numeric criteria for the petition area, at this time, to meet the requirements of the CWA under CWA section 303(c)(4)(B)."[148] The EPA claimed it was better that the states focus on developing numeric nutrient standards for Mississippi River tributaries, rather than focusing on the River itself.[149] According to the EPA, all of the states bordering the Mississippi River already had their own narrative standards for tributary streams and most were working to develop numeric nutrient standards for those same tributaries.[150]

EPA promised to "work with" the states to help them develop numeric criteria for the tributaries and "expected" that the states would meet the deadlines set out in its November 2001 policy memo for their development.[151] It also pledged to conduct more monitoring and research on the Mississippi River, to work with the Task Force, and to convene a stakeholders meeting to "discuss the development and adoption of appropriate ambient water quality criteria for nutrients" in the Mississippi River.[152]

E. Current Efforts To Reduce The Hypoxic Zone.

After the EPA's Response to the Sierra Club's 2003 Petition, concerned interests waited to see whether those efforts would bear fruit. The EPA convened the promised stakeholders

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148 Decision on Petition for Rulemaking to Publish Water Quality Standards for the Mississippi and Missouri Rivers Within Arkansas, Illinois, Iowa, Kansas, Kentucky, Missouri, Nebraska, and Tennessee ("Response") at 29 (Jun. 25, 2004), attached as Exhibit E.

149 *Id.* at 29-30.

150 *Id.* at 27-29.

151 *Id.* at 29.

152 *Id.* at 30 (monitoring and research); 31-32 (convene meeting).

meeting in St. Louis, but the states did not meet the 2004 deadline for the development of numeric standards and EPA did not promulgate numeric nutrient standards for the states in the period that followed.

In 2007, having observed that more than 90% of all states still did not have numeric nutrient criteria, a group of environmental organizations, led by the NRDC, asked the EPA to impose specific technological limits on nitrogen and phosphorus pollution found in one known nutrient source – discharges by publicly owned treatment works ("POTWs").[153] The NRDC Petitioners reminded the EPA that it had just recognized in a memo to state water program directors that nutrient pollution was "pervasive" and that additional measures even beyond the numeric nutrient criteria were necessary to address the problem.[154] Pointing out that significant scientific and technological developments had occurred since the last regulatory update during the 1980s, the NRDC Petition requested that the EPA either adopt the suggested effluent limits for total phosphorus and total nitrogen or develop its own specific effluent criteria.[155] The EPA has not issued a decision on the NRDC Petition.

The Task Force continued to meet to reconsider the science and policy goals of the Action Plan, ultimately releasing its reassessment in 2008. The Task Force initiated this reassessment in 2004, in accordance with the requirements of the renewed Harmful Algal Bloom

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153 Petition for Rulemaking Under the Clean Water Act, Secondary Treatment Standards for Nutrient Removal (Nov. 27, 2007) ("NRDC Petition"), attached as Exhibit F.

154 *Id.* at 51.

155 *Id.* at 7, 51 (citing Memorandum from Benjamin H. Grumbles, EPA Assistant Administrator for Water to State Water Program Directors 1-2 (May 25, 2007)); 54.

and Hypoxia Research and Control Act ("HABHRCA").[156] The reassessment document was due in 2006, but it was not released until 2008. The reassessment – the Gulf Hypoxia Action Plan of 2008 – concluded that "much work remained to be done to implement" the 2001 Action Plan and, as mentioned above, that existing efforts had not resulted in a reduction of the Gulf's hypoxic zone.[157] In fact, if the five-year average size of the Gulf of Mexico Dead Zone prior to the 2001 Action Plan is compared to the current five year average, the Dead Zone's extent has actually increased during the time when the 2001 Action Plan was supposed to be reducing it.

Most recently, the EPA has asked the NRC to study the scientific and technical aspects of implementing a TMDL requirement for nutrients across the Mississippi River Basin in order to "improve local water quality" and "reduce[e] the extent of the Gulf of Mexico hypoxic zone."[158] The scope of the project includes a summary of "existing scientific knowledge" and an identification and evaluation of the "processes and options for allocating nutrient … load reduction responsibilities to the Mississippi River watersheds, major tributaries or basin states."

The NRC characterizes this request as a "follow up" to its 2008 report.[159] In the 2008 NRC Report, the authors reviewed much of the science and history included in this Petition.[160]

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[156] Final Meeting Summary, Sixteenth Meeting of the the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 16 (2008), http://www.epa.gov/msbasin/ taskforce/ summaries/16thsummary.htm.

[157] 2008 Action Plan 4, 10.

[158] Project Information, The Mississippi River and the Clean Water Act: Scientific, Modeling and Technical Aspects of Nutrient Pollutant Load Allocation and Implementation, (2008) http://www8.nationalacademies.org/cp/projectview.aspx?key=48944.

[159] *Id.*

[160] NRC Report 89, 94-95, 113, 126.

They observed the same failures of the Task Force and the Nutrient Strategy to achieve reductions in the size of the Gulf's hypoxic zone and offer this conclusion: "Without [numeric nutrient] standards, whether they are adopted by the states or the EPA, there is little prospect of significantly reducing or eliminating hypoxia in the northern Gulf of Mexico."[161] The authors recommend that individual states or the EPA adopt numeric nutrient standards immediately to protect freshwater tributaries, but caution that this alone would not solve the Gulf's Dead Zone problem. In order to solve the problem, they also recommend that the EPA immediately establish numeric nutrient criteria for the Gulf and the Mississippi River's mouth, then allocate the aggregate amount of nutrient reduction among the states.[162]

In sum, the EPA has long known that nitrogen and phosphorus pollution pose a continuing and growing problem for the nation's saltwater and freshwater resources. Yet despite this knowledge, and despite the efforts chronicled above, nitrogen and phosphorus pollution is still a threat to state and national waters.[163] As discussed below, the time for talk is over. The need is great now and the EPA is the only actor able to make the real changes needed to solve the serious problems in the Mississippi River and the Gulf of Mexico.

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[161] NRC Report 126.

[162] *Id.* at 127, 137.

[163] On July 17, 2008, Earthjustice filed suit against EPA for failure to promulgate nitrogen and phosphorus standards applicable to water bodies in the State of Florida following sending a 60-day notice letter to EPA on April 29, 2008. *See* Complaint, *Florida Wildlife Fed. Inc. v. Johnson*, No. 4:08-cv-00324-RH-WCS (N.D. Fla.).

V. CONTRARY TO THE EXPECTATIONS AND PAST REPRESENTATIONS OF EPA, THE STATES ARE NOT TAKING NECESSARY ACTION TO CONTROL NITROGEN AND PHOSPHORUS POLLUTION.

As discussed above, the Ozark Chapter of the Sierra Club petitioned EPA in 2003 requesting, in part, that EPA publish numeric criteria for nutrients in the petition area. In its June 25, 2004 decision denying the petition, EPA detailed its evaluation of this specific request as follows:

- EPA first looked at whether states in the petition area had adopted numeric nitrogen or phosphorus criteria to protect designated uses;
- EPA next looked to see if petition states had adopted narrative criteria applicable to nutrients and whether there were accompanying procedures to derive numeric criteria; and
- EPA identified the status of petition states' efforts to adopt numeric criteria.[164]

EPA found that the states were poised to adopt numeric nutrient criteria and that these controls on intrastate tributaries would lead to needed near-term reductions in nutrient loadings to the Mississippi River and Gulf of Mexico. EPA further found that, in the interim, petition states' narrative criteria served to establish nitrogen and phosphorus limits in NPDES permits, list waters as nutrient-impaired on section 303(d) lists, and develop TMDLs to restore those waters.[165]

This document has already examined the impacts that nitrogen and phosphorus loadings are having on the Gulf and freshwater tributaries of the Mississippi River. The following section repeats EPA's 2003-2004 examination of petition states' nutrient control activities and demonstrates that, contrary to EPA's conclusions, state general narrative standards are not

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164 Ex. E at 26-32.

165 *Id.*

effectively protecting designated uses, and that as a result, "the response authorities of the Clean Water Act and other laws are not fully engaged."[166]

A. States Are Not Moving Ahead on Numeric Standards.

Petitioners reviewed the July 2008 status of the 10 Mississippi River mainstem states' efforts to adopt numeric nutrient criteria and found that:

- None of the 10 states has adopted numeric phosphorus standards for rivers and streams. Wisconsin alone has draft phosphorus criteria for rivers and streams, but does not have an estimated date for adoption;
- Only two of the 10 states have adopted numeric phosphorus standards for lakes and reservoirs (Minnesota and Illinois). Two more states (Wisconsin and Missouri) have draft phosphorus criteria for lakes, but no firm estimated date for adoption; and
- None of the 10 states has adopted numeric nitrogen criteria for lakes/reservoirs or rivers/streams. Missouri has developed draft numeric nitrogen criteria (for classified, non-oxbow lakes only). No other state has proposed draft criteria for nitrogen for either lakes or rivers. In fact, officials from at least two states (Kentucky and Illinois) have verbally indicated that the state has presently abandoned attempts to develop numeric nutrient standards.

As a result, 10 years after the launch of the National Nutrient Strategy, mainstem states are still wholly dependent on general narrative criteria to protect designated uses for flowing waters in their jurisdiction. Lacking EPA action, this state of affairs is likely to continue for many years, as several mainstem states have either not met deadlines promised in their Nutrient Criteria Development Plans or have explicitly stated that they are waiting for EPA to act.[167].

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166 *Id.*

167 *See* Chart, *Narrative Standards Applicable to Nutrients for Mississippi River Mainstem States*, attached as Exhibit G (listing current narrative standards for each of the mainstem states).

B. States Are Not Using Their Narrative Standards to Derive Nitrogen or Phosphorus Limits Protective of Receiving Waters in Permits.

Petitioners reviewed the status of mainstem states' efforts to derive numeric translator formulas with which to interpret their respective general narrative standards, and found that only one of the 10, Tennessee, had done so. This is the same state of affairs that existed when EPA denied the Sierra Club's Petition in 2004. The failure to either adopt numeric standards or prepare effective methods with which to interpret and implement state narrative standards has crippled the ability of the states to derive effluent limits protective of designated uses in NPDES permits.

None of the 10 mainstem states is deriving water quality based effluent limits for phosphorus or nitrogen in NPDES permits to implement the state's narrative water quality standard. A small proportion of NPDES permits issued by Minnesota, Wisconsin, and Illinois contain one mg/L phosphorus effluent limits due to state rules requiring such a limit for new or expanding dischargers of a specified size.[168]

As discussed below, various state agencies are on record stating that this failure to derive and impose water quality based effluent limits ("WQBELs") for nutrients is due to the fact that, although the state has narrative standards, the state has not adopted numeric water quality standards for nutrients.

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[168] *See* Minn. R. Ch. 7053.0255; Wis. Admin. Code § 217.04; 35 Ill. Admin. Code § 304.123, 302.205.

Minnesota

The Minnesota Pollution Control Agency ("MnPCA") recently conducted a non-degradation review for a proposed new discharge to the Long Prairie River. The Agency declined to derive and impose a WQBEL for phosphorus due to the lack of numeric criteria or standards for flowing waters:

> The mass balance for phosphorus was evaluated at three effluent concentrations to demonstrate the relative increases of each on the river concentrations of TP [total phosphorous]. Each level of effluent phosphorus results in a substantial increase over the background concentration of TP in the river. [Note: the Agency selected the highest of the three evaluated concentrations for the permit.] …Currently, we have no state nutrient standards for nitrogen and phosphorus to address stream eutrophication. When these are developed, lower concentration effluent limits may be considered in the future as needed to protect the Long Prairie River.[169]

The MnPCA has developed a circular argument that insures continued water quality degradation: It will not impose WQBELs unless the receiving water is 303(d) listed; but it does not assess or 303(d) list flowing waters for compliance with the narrative standard; and it does not intend to adopt numeric standards for several years:

> As stated in your comment letter, neither Jewitts Creek nor the North Fork of the Crow River is listed as impaired for phosphorus. MCEA's [Minnesota Center for Environmental Advocacy's] comment letter references an impairment in this stretch, thus requiring water quality based effluent limits as outlined under Section 303 of the Clean Water Act, when in fact, no such impairment has been listed. The nearest downstream waterbody impaired for nutrients is Lake Pepin. This discharge does not have reasonable potential to cause or contribute to the Lake Pepin impairment. If MCEA has issues with whether an impairment needs to be listed, the

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169 Minnesota Pollution Control Agency, *Nondegradation Review, Central Lakes Region Sanitary District*, Environmental Outcomes Division, 5 (undated), attached as Exhibit H.

> comments should be directed via the 303(d) impaired waters listing, not the NPDES permitting process.[170]

> Excess nutrients, TP in particular, are having impacts on rivers and streams throughout the state . . . presently, rivers and streams are not being assessed for nutrient impairment because the Agency does not have nutrient standards (or criteria based on a narrative standard) for rivers and streams.
>
> …The Agency is probably at least three years away from being ready to promulgate river and stream standards.[171]

Wisconsin

The Wisconsin Department of Natural Resources (WDNR) similarly refuses to derive WQBELs in NPDES permits to implement its narrative standard, and has in fact issued guidance directing permit writers not to do so:

> Until there is guidance or a rule that establishes a general or site-specific methodology for determining reasonable potential to attain narrative water quality standards as applied to nutrients, WPDES permits should not be issued with nutrient limits based on narrative water quality standards.[172]

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[170] Lisa M. McCormick, Pollution Control Specialist Senior, Minnesota Pollution Control Agency, *Response to Comments—Litchfield Wastewater Treatment Facility*, (January 31, 2008), attached as Exhibit I.

[171] State of Minnesota, Minnesota Pollution Control Agency, *Staff Post-Hearing Response to Public Comments*, 18 (October 3, 2007) http://www.pca.state.mn.us/water/standards/posthearing-publiccomments.pdf.

[172] Russ Rasmussen, State of Wisconsin, *Correspondence/Memorandum: Determining Reasonable Potential for Narrative Standards*, 3 (December 14, 2006) attached as Exhibit J.

WDNR has recently noted that development of numeric nitrogen water quality criteria are not a priority for the 2008 to 2011 triennial review, meaning WDNR does not expect to begin promulgation of these standards until at least 2012.[173]

Illinois

The Illinois Environmental Protection Agency (IEPA) also declines to include effluent limits derived from its narrative standard:

> There are no existing water quality standards for nutrients that apply to Hickory Creek. A narrative standard exists prohibiting plant and algal growth of other than natural origin. This is a very difficult standard to apply to a permit.[174]

As with Minnesota, the IEPA has also admitted that it is years away from promulgating numeric nutrient standards:

> We estimate that it will probably be another four or five years before we know what phosphorus water quality standards should be in Illinois and to know how different sources of phosphorus would have to be dealt with.[175]

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173 Wisconsin Department of Natural Resources, *2008-2011 Triennial Standards Review Cycle, Topic Descriptions,* 8 (July 2, 2008), http://www.dnr.state.wi.us/org/water/wm/wqs/tsr/documents/Topic_Descriptions.pdf.

174 Responsiveness Summary, *In the Matter of New Lenox, Application for NPDES Permit Renewal*, No. IL0020559, at 6 (IEPA Oct. 31, 2003), attached as Exhibit K.

175 *Id.*

Missouri

In response to comments on a proposed new discharge to the nutrient-impaired Lake of the Ozarks submitted by petitioner Missouri Coalition for the Environment, the Missouri Department of Natural Resources (MoDNR) declined to impose effluent limits for nutrients until numeric water quality standards were adopted by the state or EPA adopted stronger technology-based limits:

> Determining numerical guidelines for nutrients through a reasonable potential analysis or wasteload allocation analysis cannot be done during the brief period of time of this public notice but encompasses a much larger policy change. Developing the nutrient criteria that will protect the waters of the state will require significant analysis of water quality data, some of which is already available and some of which still needs to be collected. It will also require input from citizens concerned with the impact of implementation of nutrient criteria.
>
> Until federal regulations are promulgated which address the need for additional nutrient removal, such as total phosphorus or total nitrogen, the department continues to collect data to determine if nutrient contribution from domestic wastewater causes impairment. Rest assured that when nutrient limitations are promulgated at a federal level or when resolved by the Missouri Clean Water Commission, the department will implement effluent limitations in an expeditious manner for all appropriate facilities as indicated by impairment of watersheds.[176]

Further evidence of the failure of Missouri's narrative standard is provided in the MoDNR's response to comments on another NPDES permit:

> Your first comment appears to express a concern that the final effluent limits contained in the proposed permit will be sufficient to protect water quality, especially with respect to dissolved oxygen, conductivity, phosphate, turbidity, color, odor, and suspended solids. …With respect to phosphate and turbidity, again there are no stream standards

176 Letter to Kim Knowles, Missouri Coalition for the Environment from Kevin Hess, Chief, Water Pollution Section, Missouri Department of Natural Resources (Apr. 16, 2008), attached as Exhibit L.

> for either parameter although we agree the values you cite seem high. It is our hope that upgrades to the treatment system will lead to significantly improved effluent quality. So we see no reason to change the proposed future effluent limits based on the data you present.[177]

Kentucky

Petitioners are not aware of any NPDES permits in Kentucky containing phosphorus or nitrogen limits derived to protect water quality.

Tennessee

Alone among the mainstem states, Tennessee has prepared a numeric translator of its narrative nutrient standard.[178] Unfortunately, the translator appears to be little used to derive effluent limits in NPDES permits. According to Vojin Janjic, Assistant Manager of Permits Section for the Tennessee Department of Environment and Conservation (TDEC), most permits contain only a requirement to report monitoring results for nitrogen and phosphorus in discharge monitoring reports, and few have explicit numeric limits for nitrogen and even fewer for phosphorus.[179]

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177 Letter to Edward J. Heisel from James A. Rhodes, Stl Ouis Regional Office, Missouri Department of Natural Resources, RE: Permit #MO-0045420 (January 24, 2008), attached as Exhibit M.

178 Gregory M. Denton, Debbie Arnwine and Sherry H. Wang, Development of Regionally-Based Interpretations of Tennessee's Narrative Nutrient Criterion, Tennessee Department of Environment and Conservation (August 2001).

179 Telephone interview by Dana L. Wright, Director of Policy and Legislative Affairs, Tennessee Clean Water Network, with Vojin Janjic, Assistant Manager of Permits Section for the Tennessee Department of Environment and Conservation (July 18, 2008).

Arkansas

Petitioners are aware of just one NPDES permit containing a phosphorus limit imposed by Arkansas Department of Environmental Quality derived to protect water quality in the immediate receiving water (the Ouachita River). A state rule extends (non-WQBEL) phosphorus limits (ranging from one to five mg/L) only to point sources discharging to waters officially listed on Arkansas' 303(d) list if phosphorus is identified as the major cause of impairment.[180]

Mississippi

The Mississippi Department of Environmental Quality has also repeatedly deferred imposition of nutrient effluent limits in NPDES permits until numeric criteria are developed:

> The State is currently in the process of determining nutrient and sedimentation water quality criteria for the receiving stream. We do have a reopener clause in the permit which allows the permit to be modified if the effluent standard, limitation or regulation contains different conditions or is otherwise more stringent than the effluent limitations of the permit; or if pollutants not limited in the permit are deemed necessary; or if the results of a completed TMDL require more stringent limitation or additional monitoring. Should any future data indicate that excessive nutrients associated with this discharge cause or contribute to adverse effects to water quality, appropriate limitations will be determined and incorporated into the permit accordingly.[181]

> Also, the State is currently in the process of determining nutrient water quality criteria. Therefore, phosphorous limitations are not incorporated in the draft permit at this time. We do have a reopener clause in the permit which allows the permit to be modified if the effluent standard, limitation or regulation contains different conditions or is

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[180] Arkansas Pollution Control and Ecology Commission, Reg. 2.509, *Nutrients*, (undated) available at:http://www.adeq.state.ar.us/regs/default.htm.

[181] Letter from Samar I. Patel, Environmental Permit Division, Mississippi Department of Environmental Quality Re: Terra proposed NPDES Permit Renewal, No. MS0000574, at 10, (November 21, 2007), attached as Exhibit N.

> otherwise more stringent than the effluent limitations of the permit; or if pollutants not limited in the permit are deemed necessary; or if the results of a completed TMDL require more stringent limitation or additional monitoring. [182]

Louisiana

Louisiana similarly does not issue NPDES permits with WQBELs for phosphorus or nitrogen derived from the narrative standard. The stated position of the Louisiana Department of Environmental Quality is that when it maintains and protects dissolved oxygen, “nutrients are also controlled and limited."[183]

C. Flowing Waters Are Not Being Assessed and 303(d)-Listed Due to Violations of Narrative Standards, and TMDLs Are Not Being Done for Narrative Violations in Many Impaired Waters.

Petitioners reviewed the practices of mainstem states in assessing intrastate waters for compliance with state narrative standards for nutrients, listing of such waters as impaired by nutrients on 303(d) lists, and preparing TMDLs to restore nutrient-impacted waters to support designated uses. Some limited assessment, 303(d) listing, and TMDL preparation based on interpretation of narrative standards is being done in the Upper Mississippi basin for phosphorus in lakes. Little is being done to assess, list and restore flowing waters related to phosphorus impacts, and none of the mainstem states is addressing impacts from total nitrogen.

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182 Letter from Harry M. Wilson III, Chief, Environmental Permits Division, Mississippi Department of Environmental Quality, Re: Harrison County Utility Authority Permit No.MS0052574, at 1 (January 17, 2007), attached as Exhibit O.

183 Letter to Lisa Jordan from Chuck Carr Brown, Assistant Secretary, Louisiana Department of Environmental Quality, Response to Comments on Village of Morse LPDES permit (October 4, 2007), attached as Exhibit P.

Minnesota

The Minnesota Pollution Control Agency ("MnPCA") has listed lakes as impaired by nutrients under the narrative standard since 2002, when it developed numeric criteria for phosphorus, chlorophyll-*a*, and Secchi depth to interpret the narrative standard. However, the MnPCA has not developed numeric criteria for nutrients for flowing waters. MnPCA itself succinctly summarizes the result of this failure:

> Without a standard (or criterion) there are no assessments, no impaired waterbodies and no TMDLs for that pollutant. The nutrient TMDL for the lower Minnesota River is based on low dissolved oxygen, caused by excess nutrients. The Lake Pepin (Mississippi River) TMDL is based on exceedances of nutrient criteria, applicable because Lake Pepin is a natural lake. Otherwise, there are no pending nutrient-related TMDLs for rivers or streams.[184]

The failure to place nutrient-impacted waters on the 303(d) list does not mean the resources are meeting designated uses. MnPCA monitoring efforts have identified 304 river reaches that exceed "ecoregional norms" (informal, unpromulgated values used by the state in 305(b) reports and as regional benchmarks) for phosphorus and nitrogen. These "ecoregional norms" are uniformly higher than EPA's recommended ecoregional nutrient criteria. Petitioner Minnesota Center for Environmental Advocacy ("MCEA") asked EPA to list these reaches as impaired, as instructed by the MPCA in its response to MCEA's comments on the City of Litchfield permit.[185] EPA declined to do so, but directed the MnPCA to develop and utilize

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184 State of Minnesota, Minnesota Pollution Control Agency, *Staff Post-Hearing Response to Public Comments*, at 18 (October 3, 2007), http://www.pca.state.mn.us/water/standards/posthearing-publiccomments.pdf.

185 *See supra* note 164.

numeric criteria interpreting its narrative standard until numeric standards are adopted by the state:

> Currently, M[n]PCA does not have numeric nutrient water quality standards for streams. Minnesota does have a narrative standard that prohibits the degradation of the aquatic habitat of all Class 2 waters due to a material increase in undesirable slime growths or aquatic plants, including algae. Minnesota's guidance manual does not contain a numeric interpretation of the narrative standard as may be utilized to determine impairment in streams due to excess nutrients. Minnesota's Plan for Development of Nutrient Criteria identifies 2009 as a target for completion of research and development of numeric nutrient standards for streams. …EPA understands that M[n]PCA will use the numeric nutrient standards in its assessment program after the standards are adopted by the State and approved by EPA. In the interim, M[n]PCA can use nutrient criteria recommendations published by EPA pursuant to Section 304(a) of the Act or State developed criteria that are protective of designated uses as thresholds for designating nutrient impairments in streams in a future guidance manual.[186]

To date, the MnPCA has not done so. Further, the MnPCA is on record in numerous public forums (see, e.g., EPA N-STEPS presentation by MnPCA's Steve Heiskary, July 9, 2008)[187] estimating that numeric criteria for streams will not be complete until 2011.

Wisconsin

The Wisconsin DNR lists lakes as impaired by eutrophication using a Trophic Status Index that includes phosphorus levels. Wisconsin does not list flowing waters based on narrative violations directly caused by excess nitrogen or phosphorus pollution and does not list lakes or streams due to excess nitrogen. The U. S. Geological Survey conducted significant water quality

186 USEPA, *Decision Document for the Approval of Minnesota's 2008 303(d) List of Impaired Waters,* at 17 (June 10, 2008), attached as Exhibit Q.

187 Steven Heiskary, *Minnesota River Nutrient Criteria Development: Emphasis on Biological Indicators & Relationships,* slide 37 (July 9, 2008), webcast presentation archived at: http://n-steps.tetratech-ffx.com/NTSCHome.cfm.

monitoring for phosphorus and nitrogen in Wisconsin's wadeable streams, showing that of 240 streams sampled, 191 exceed EPA-recommended ecoregional criteria for phosphorus, and 208 exceed EPA recommended nitrogen criteria.[188]

Iowa

The Iowa Department of Natural Resources also lists lakes based on a Trophic Status Index that includes phosphorus. Iowa does not list rivers or streams for excessive phosphorus or nitrogen concentrations. Again, a look at available (2007) data shows that Iowa streams are well in excess of EPA ecoregional criteria, with the 50th percentile of sites at 200 micrograms per liter (ug/L) phosphorus (compared with the EPA Western Corn Belt criterion of 76 ug/L). These streams are averaging 7.4 mg/L nitrate + nitrite as N in 2007 (compared with EPA's total nitrogen criterion of 2.18 mg/L).[189]

Illinois

The Illinois Environmental Protection Agency ("IEPA") assesses and lists lakes as impaired based on the state's numeric standard of 50 ug/L phosphorus.[190] The IEPA removed total nitrogen as a cause of impairment as of 2008, stating:

> We have stopped using total nitrogen, as a cause of impairment for *aquatic life* use. Total nitrogen appeared as nitrogen (total) on previous 303(d) Lists. We do not have a standard for total nitrogen related to aquatic life. In streams, we typically do not have

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188 United States Geological Survey, *Nutrient Concentrations and Their Relations to the Biotic Integrity of Wadeable Streams in Wisconsin*, (2006).

189 Iowa Department of Natural Resources, I*owa's Water, Ambient Monitoring Program, Water Fact Sheet 2008-8* (January 2008), attached as Exhibit R.

190 35 Ill. Admin. Code § 302.205.

> total nitrogen data. The methods, criteria and the manner in which nitrogen was reported as a cause of impairment of *aquatic life* use have changed many times over previous assessment cycles. These criteria had never been shown to be related to *aquatic life* use impairment in any scientific study and had never been used or proposed as water quality standards. Illinois now believes that the criteria by which it placed total nitrogen on previous 303(d) Lists were not scientifically valid. Illinois does not believe that a scientifically valid criterion currently exists for determining when nitrogen is causing an impairment of *aquatic life* use in this state."[191]

Beginning with the 2008 303(d) list, the IEPA also delisted waters impaired by low dissolved oxygen:

> Dissolved oxygen (which is a cause of impairment used to indicate low dissolved oxygen) has been changed from a pollutant to a nonpollutant cause of impairment. Although low dissolved oxygen may be caused by pollutants, the impairment does not result from the discharge of dissolved oxygen into the water. Furthermore, federal regulations in CWA Section 502(6) do not define dissolved oxygen or low dissolved oxygen as a pollutant. Because only pollutant causes of impairment appear on the 303(d) List this means that all entries of dissolved oxygen have been delisted.[192]

Although IEPA uses a phosphorus threshold value of 610 ug/L to assess and list streams as impaired (USEPA's recommended phosphorus criteria for Illinois are 76 ug/L and 35 ug/L), IEPA will not prepare TMDLs for these waters due to its lack of numeric water quality standards for phosphorus:

> Those waters meeting the criteria below may be passed over on the list regardless of priority ranking.
>
> …ii) 303(d) listed waters where the potential causes of impairment are pollutants for which there are no numeric water quality standards in Illinois—e.g., phosphorus in streams, and others. Pending development of appropriate numeric water quality standards

[191] Illinois Environmental Protection Agency, Bureau of Water, Illinois Integrated Water Quality Report and Section 303(d) List—2008, at 10, (June 2008), attached as Exhibit S.

[192] *Id.*

> as may be proposed by the Agency or others and adopted by the Illinois Pollution Control Board, Illinois EPA will continue to work with watershed planning groups and others to identify causes and treat potential sources of impairment.[193]

Finally, despite Illinois' status as the largest state contributor of nitrogen and phosphorus to the Gulf, IEPA also will not prepare TMDLs for nitrogen or phosphorus affected interstate waters, deferring such actions to USEPA:

> i) 303(d) listed waters that are interstate waters—e.g., Mississippi River, Ohio River, Lake Michigan and others. In these waters, the Illinois EPA will continue to work closely with other states and USEPA in addressing issues related to Section 303(d) requirements. USEPA is expected to take a lead role in coordinating the state efforts.[194]

Missouri

The Missouri Department of Natural Resources will not list nutrient-affected waters as impaired based on its narrative standard:

> Missouri is still developing its numeric criteria for nutrients, mainly nitrogen and phosphorous. Until those are developed and put into Missouri's Water Quality Standards, the Listing Methodology developed for Missouri does not recognize any streams as impaired for nutrients.[195]

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193 *Id*. at 110.

194 *Id.*

195 Missouri Department of Natural Resources, *2004/2006 Missouri 303(d) List Frequently Asked Questions*, 6 (October 2006), attached as Exhibit T.

Arkansas

The Arkansas Department of Environmental Quality lists four streams as impaired by total phosphorus on its 2004 303(d) list.[196] The basis for these listings is unknown, as the state's listing methodology for narrative standards is simply given as:

> Narrative Criteria – Waters will be assessed as "non-support" when violation of any narrative water quality standard has been verified by ADEQ.[197]

Mississippi

The Mississippi Department of Environmental Quality ("MsDEQ") does not use its narrative standard to list waters as impaired by excess nutrients:

> Only data for physical/chemical parameters for which Mississippi has adopted numeric water quality criteria in Mississippi's WQS will be used for making a water body 305(b) use support determination and/or a 303(d) listing. Other parameters for which numeric criteria have not been adopted (e.g., nutrients, turbidity/suspended solids, chlorophyll-*a* will be shown as impairment causes if there is an identified association with exceedances of a parameter for which the state has a numeric criterion (e.g. elevated nutrients causing excursions of the dissolved oxygen criterion).[198]

Further, when MDEQ does prepare TMDLs for waterways listed for low dissolved oxygen, the target values derived for nitrogen and phosphorus are often far in excess of EPA

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[196] Arkansas' 2004 List of Impaired Waterbodies at: http://www.adeq.state.ar.us/water/branch_planning/pdfs/303d_list_2004.pdf. This appears to be the most recent 303(d) list available for the state.

[197] *Id.* at 7 (source is unpaginated).

[198] Mississippi Department of Environmental Quality, *Mississippi Consolidated Assessment and Listing Methodology, 2008 Assessment and Listing Cycle*, at 4 (undated), attached as Exhibit U.

recommended criteria. For example, recent TMDLs prepared by MDEQ for the Yazoo Basin recommend a target for total nitrogen of 1.05 mg/l and a phosphorus target of 0.16 mg/l (compared with EPA recommended criteria of .76 mg/l nitrogen and .128 mg/L phosphorus).[199]

Whatever the shortcomings of TMDLs prepared by MDEQ for nutrient-impacted intrastate waters, the agency makes clear that it will not list or prepare TMDLs for the Mississippi River, a job it defers to EPA:

> MDEQ is not listing the Mississippi River on MDEQ's Mississippi 2006 § 303(d) list. In previous lists MDEQ included various segments of the river, but not based on data. Since any TMDL or delisting decision deals with multiple states and multiple EPA Regions, MDEQ considers this a national issue.[200]

VI. PETITIONERS' REQUESTS OF EPA – EPA SHOULD PROMPTLY PREPARE AND PUBLISH NUMERIC STANDARDS FOR NITROGEN AND PHOSPHORUS FOR THE PORTION OF THE OCEAN UNDER THE JURISDICTION OF THE CLEAN WATER ACT AND FOR THE WATERS OF EVERY STATE FOR WHICH STANDARDS HAVE NOT BEEN ESTABLISHED, AND SHOULD ESTABLISH TOTAL MAXIMUM DAILY LOADS FOR THE MISSISSIPPI RIVER AND THE TERRITORIAL WATERS OF THE GULF OF MEXICO.

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 and the NRC Report confirms both that EPA should establish numeric standards to control nitrogen and phosphorus pollution and that EPA should establish TMDLs to protect the Gulf of Mexico and the mainstem of the Mississippi. As stated by the NRC Report:

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199 Mississippi Department of Environmental Quality, Office of Pollution Control, *Total Maximum Daily Load, Total Nitrogen, Total Phosphorus, and Organic Enrichment/Low Dissolved Oxygen for Burrell Bayou, Yazoo River Basin* at 7 (draft, March 2008), attached as Exhibit V.

200 *Id.* at 15.

> The EPA has failed to use its mandatory and discretionary authorities under the Clean Water Act to provide adequate interstate coordination and oversight of state water quality activities along the Mississippi River that could help promote and ensure progress toward the act's fishable and swimmable and related goals.[201]

As shown above, numeric 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.[202]

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. Under Section 303(c)(4) of the Clean Water Act, 33 U.S.C. 1313(c)(4), EPA "shall *promptly* prepare and publish revised water quality standards" where a new or revised standard is necessary to meet the requirements of the Clean Water Act. 33 U.S.C. § 1313(c)(4) (emphasis added). *See also The Raymond Profitt Foundation v. U.S. Environmental Protection Agency*, 930 F. Supp. 1088, 1103-04 (E.D. Pa. 1996).

Still further, it has been shown that the 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. The law is clear: EPA has the authority to establish TMDLs for impaired waters and the duty to do so where the states have failed to do so. *Scott v. City of Hammond*, 741 F.2d 992 (7th Cir. 1984).

Accordingly, the EPA should grant this petition filed pursuant to Section 4(d) of the Administrative Procedure Act, 5 U.S. C § 553(e). EPA should exercise its powers under Sections 303(c)(4) and 303(d) of the Clean Water Act, 33 U.S.C. § 1313(c)(4),(d), to prepare and publish

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201 NRC Report at 7.

202 NRC Report at 74.

numeric water quality standards and establish TMDLs needed to protect the nation's waters, or least the waters in the Mississippi Basin where the need has been most clearly shown above.

In particular, petitioners request that EPA take each of the following steps to meet the requirements and advance the goals of the Clean Water Act:

Regarding numeric water quality standards -

1. EPA should prepare and publish revised numeric water quality standards for nitrogen for every "navigable water," as defined by 33 U.S.C.§ 1362(7), for which a numeric water quality standard for nitrogen has not been submitted to EPA pursuant to 33 U.S.C. §1313(c)(3) and found by EPA to be consistent with the CWA.

2. EPA should prepare and publish revised numeric water quality standards for phosphorus for every "navigable water," as defined by 33 U.S.C.§ 1362(7), for which a numeric water quality standard for phosphorus has not been submitted to EPA pursuant to 33 U.S.C. §1313(c)(3) and found by EPA to be consistent with the CWA.

3. EPA should prepare and publish revised numeric water quality standards for chlorophyll *a* for every "navigable water," as defined by 33 U.S.C.§ 1362(7), for which a numeric water quality standard for chlorophyll *a* has not been submitted to EPA pursuant to 33 U.S.C. §1313(c)(3) and found by EPA to be consistent with the CWA.

4. EPA should prepare and publish revised numeric water quality standards for turbidity for every "navigable water," as defined by 33 U.S.C.§ 1362(7), for which a numeric water quality standard for turbidity depth has not been submitted to EPA pursuant to 33 U.S.C. §1313(c)(3) and found by EPA to be consistent with the CWA.

The request is made separately as to each of the four steps described above and jointly and in the alternative for (i) lakes and reservoirs, (ii) rivers and streams, (iii) the contiguous zone of coastal waters and (iv) the part of the ocean subject to CWA jurisdiction outside of the jurisdiction of any state.[203]

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[203] In establishing criteria, EPA must take full account of its own regulation, at 40 C.F.R. § 131.10(b), which states: "In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters." Accordingly, it is not enough to establish numeric criteria for upstream waters that only account for the problems that nutrients cause locally; EPA must ensure that compliance with those waters' criteria will lead to

At a minimum, the evidence demonstrates that EPA must prepare and publish water quality standards for nitrogen, phosphorous, chlorophyll-*a* and turbidity 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.

As stated in the NRC Report:

> Under Section 303(c)(4)(B), the EPA can establish a water quality standard "in any case where the Administrator determines that a revised or new standard is necessary to meet the requirements" of the Clean Water Act. Accordingly, the EPA can establish a more demanding standard than any of the states included within a significant national watershed as long as, in the EPA's judgment, that standard is necessary "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" or to achieve the fishable and swimmable goal of the Clean Water Act. Given Congress' desire generally "to recognize, preserve, and protect the primary responsibilities and rights of the States to prevent, reduce and eliminate pollution" (CWA Section 101(b)), this supervening authority of EPA is most appropriately exercised only in limited circumstance. The Mississippi River, however, would seem clearly to qualify for special treatment, being the nation's only waterbody with congressional recognition as "*a nationally significant ecosystem and a nationally significant commercial navigation system*," as stated in the Upper Mississippi River Management Act of 1986. Moreover, most of the area in the northern Gulf of Mexico that experiences hypoxic conditions is subject to exclusive federal control and protection under the Clean Water Act.[204]

Petitioners believe firmly that given the facts presented above and the huge problem caused by nitrogen and phosphorus pollution in rivers, lakes, streams and estuaries across the country and in the territorial seas, that this is a case in which water quality standards should be established by EPA on a national basis. Even if EPA disagrees with that assessment, surely the

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the achievement of downstream standards. For example, criteria in the northern areas of the Mississippi River Basin must be consistent with meeting nutrient, dissolved oxygen, and other criteria in the southern parts of the Basin and in the Gulf.

[188] NRC Report at 127.

scope of the problem and the history of the failure to control nutrient pollution in the Mississippi River Basin is irrefutable. Accordingly, EPA must at least establish standards to control nitrogen and phosphorus pollution within the Mississippi Basin.

In addition, petitioners request that EPA establish total maximum daily loads for nitrogen and for phosphorus for the following water bodies:

1. The mainstem of the Mississippi River and every segment thereof;

2. The tributaries of the Mississippi River that do not meet the criteria EPA establishes for nitrogen or phosphorus;

3. The portion of the contiguous zone within the Gulf of Mexico; and

4. The portion of the ocean that is within the coverage of the Clean Water Act in the Gulf of Mexico.

RESPECTFULLY SUBMITTED,

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