Action Plan

for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico

Mississippi River/Gulf of Mexico Watershed Nutrient Task Force

January 2001

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Action Plan

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This Action Plan describes a national strategy to reduce the frequency, duration, size and degree of oxygen depletion of the hypoxic zone of the northern Gulf of Mexico (the Gulf). The Plan is the result of several years of study and discussion by the members of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force (the Task Force) and many concerned officials and citizens who participated in their deliberations. This Plan is submitted in accordance with The Harmful Algal Bloom and Hypoxia Research and Control Act of 1998, Title VI of Public Law 105-383, section 604(b), enacted on November 13, 1998.

Many bottom-dwelling organisms, such as this crab found off the coast of Louisiana, cannot tolerate low-oxygen conditions.

Purpose

This Action Plan is informed by the findings of the Committee on Environment and Natural Resources (CENR) Integrated Assessment of Hypoxia in the Northern Gulf of Mexico along with many comments submitted about it and the six topic reports on which it is based. In addition, the Task Force considered several other significant reports, including *Gulf of Mexico Hypoxia: Land and Sea Interactions* (Downing et al., 1999), *The Role of the Mississippi River in Gulf of Mexico Hypoxia* (Carey et al., 1999, for the Fertilizer Institute), and *Clean Coastal Waters: Understanding and Reducing the Effects of Nutrient Pollution* (National Research Council, 2000). The Task Force members drew on their many years of experience in agricultural and environmental policy in formulating this Action Plan. The Task Force also listened carefully to dozens of statements by members of the public during its seven public meetings and in written comments.

This plan describes an adaptive approach, based on implementation, monitoring, and research to address known problems, clarify scientific uncertainties, and evaluate the effectiveness of efforts to reduce hypoxia.

Improved coordination and, in most cases, expansion of the excellent private and government-supported efforts to reduce losses of nutrients are central to the success of this strategy. Throughout the Mississippi and Atchafalaya Basin much work is under way to increase the efficiency of farming practices and restore wetlands and riparian buffers. In addition, industry and local governments are beginning to undertake additional efforts to reduce nutrient loadings from point sources and urban runoff. Also, efforts under way in the Mississippi River Basin to identify and implement nonstructural alternatives to flood control and to address coastal land loss in Louisiana will contribute to reducing the impact of nutrient loads in the Mississippi River on the northern Gulf. Implementation, and expansion, of those

Mississippi River Basin

efforts will continue to deliver improvements to water quality throughout the basin and in the Gulf.

The work of the Task Force has provided a basin-wide context for the continued pursuit of both incentive-based, voluntary efforts for nonpoint sources and existing regulatory controls for point sources. Furthermore, research and monitoring that support the proposed remedies and goals in this plan, as well as resolution of uncertainties identified in the CENR Integrated Assessment and elsewhere, are identified as priorities for future action.

The Action Plan proposes an implementation approach to carry out an initial set of 11 priority actions and, subsequently, make adjustments to that initial approach as we evaluate results. This plan describes an adaptive approach, based on implementation, monitoring, and research, to address known problems, clarify scientific uncertainties, and evaluate the effectiveness of efforts to reduce hypoxia. Because of the importance of enhancing these efforts by increasing support for necessary incentives, monitoring, and research, this plan also identifies the need for additional resources.

Scientific investigations document a zone on the Gulf of Mexico's Texas-Louisiana Shelf with seasonally low oxygen levels (<2mg/l). Between 1993 and 1999 the zone of midsummer bottom-water hypoxia in the northern Gulf of Mexico has been estimated to be larger than 10,000 km^2 (4,000 square miles). In 1999, it was 20,000 km^2 (8,000 square miles), about the size of the State of New Jersey, and in 2000, the zone was measured as only 4,400 km^2 (1,700 square miles), resulting in a 5-year running average of 14,128 km^2 (5,454 square miles) for 1996-2000. The hypoxic zone is a result of complicated interactions involving excessive nutrients, primarily nitrogen, carried to the Gulf by the Mississippi and Atchafalaya Rivers; physical changes in the basin, such as channelization and loss of natural wetlands and vegetation along the banks as well as wetland conversions throughout the basin; and the stratification in the waters of the northern Gulf caused by the interaction of fresh river water and the saltwater of the Gulf.

Background on Hypoxia in the Northern Gulf of Mexico

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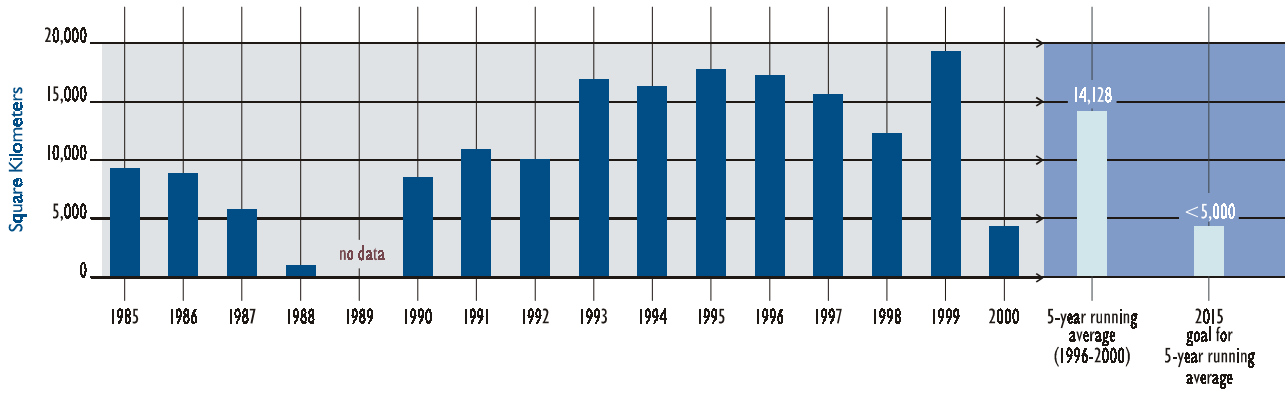
Nutrients, such as nitrogen and phosphorus, are essential for healthy marine and freshwater environments. However, an overabundance can trigger excessive algal growth (or eutrophication), which can result in several possible ecosystem responses. In the nearshore Gulf, excessive algal growth, driven primarily by excess nitrogen, results in a decrease in dissolved oxygen in the bottom water, and a corresponding loss of aquatic (water column and benthic) habitat. Mobile organisms leave the hypoxic zone and those that cannot leave die or are weakened depending on how low the oxygen level becomes and for how long. In the Gulf, fish, shrimp, crabs, zooplankton, and other important fish prey are significantly less abundant in bottom waters in areas that experience hypoxia.

About 90% of the nitrate load to the Gulf comes from nonpoint sources.

Additionally, water quality throughout the Mississippi and Atchafalaya Rivers Basin (the Basin) has been degraded by excess nutrients. Most States in the Basin have significant river miles impaired by high nutrient concentrations, primarily phosphorus, meaning that they are not fully supporting aquatic life uses. In some areas groundwater supplies are threatened by excess nitrate, which can be a human health hazard.

A significant portion of the nutrients entering the Gulf from the Mississippi River come from human activities: discharges from sewage treatment and industrial wastewater treatment plants and stormwater runoff from city streets and farms. Nutrients from automobile exhaust

Comparative Size of Hypoxia Area (1985-2000)



Source: Nancy Rabalais, Louisiana Universities Marine Consortium

and fossil fuel power plants also enter the waterways and the Gulf through air deposition to the vast land area drained by the Mississippi River and its tributaries. About 90% of the nitrate load to the Gulf comes from nonpoint sources. About 56% of the nitrate load enters the Mississippi River above the Ohio River. The Ohio River Basin adds 34%. High nitrogen loads come from basins receiving wastewater discharges and draining agricultural lands in Iowa, Illinois, Indiana, southern Minnesota, and Ohio.

The primary approaches to reduce hypoxia in the Gulf of Mexico appear to be to 1) reduce nitrogen loads from watersheds to streams and rivers in the Basin and 2) restore and enhance denitrification and nitrogen retention within the Basin and on the coastal plain of Louisiana. Annual load estimates based on water-quality measurements and streamflow records indicate that a 40% reduction in total nitrogen flux to the Gulf is necessary to return to average loads comparable to those during 1955-1970. Model simulations suggest that, short of the 40% reduction necessary to return to levels in the mid-century, nutrient load reductions of about 20%-30% would result in a 15%-50% increase in bottom water dissolved oxygen concentrations. Because any oxygen increase above the 2 mg/l threshold will have a significant positive effect on marine life, even small reductions in nitrogen loads are desirable.

While the primary focus of this strategy is on reducing nitrogen loads to the northern Gulf, many of the actions proposed through this plan will also achieve basinwide improvements in surface-water quality by reducing phosphorus as well. Likewise, actions taken to address local water quality problems in the basin will frequently also contribute to reductions in nitrogen loadings to the Gulf.

The goals of this strategy are threefold and based upon five principles:

1. *Encourage actions that are voluntary, practical, and cost-effective;*
2. *Utilize existing programs, including existing State and Federal regulatory mechanisms;*
3. *Follow adaptive management;*
4. *Identify additional funding needs and sources during the annual Agency budget process; and,*
5. *Provide measurable outcomes as outlined below in the three goals and strategies.*

Coastal Goal: By the year 2015, subject to the availability of additional resources, reduce the 5-year running average areal extent of the Gulf of Mexico hypoxic zone to less than 5,000 square kilometers through implementation of specific, practical, and cost-effective voluntary actions by all States, Tribes, and all categories of sources and removals within the Mississippi/Atchafalaya River Basin to reduce the annual discharge of nitrogen into the Gulf.

Within Basin Goal: To restore and protect the waters of the 31 States and Tribal lands within the Mississippi/Atchafalaya River Basin through implementation of nutrient and sediment reduction actions to protect public health and aquatic life as well as reduce negative impacts of water pollution on the Gulf of Mexico.

Quality of Life Goal: To improve the communities and economic conditions across the Mississippi/Atchafalaya River Basin, in particular the agriculture, fisheries, and recreation sectors, through improved public and private land management and a cooperative, incentive based approach.

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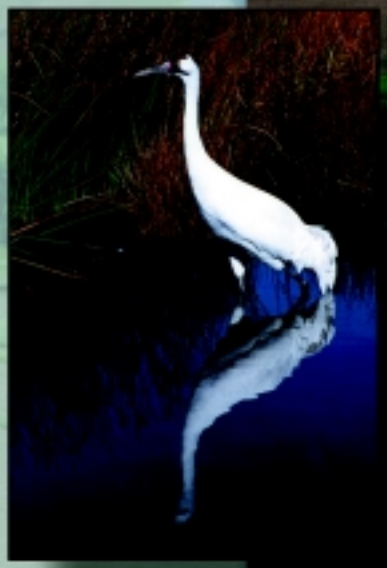
Long-Term Goals

The guiding principle of this plan is that when establishing priorities for watershed restoration, States, Tribes, and Federal agencies within the Mississippi and Atchafalaya River Basin will consider the potential for benefits to the Gulf of Mexico, direct current and increased resources to cost-effective, practical actions that will reduce discharges and runoff of nutrients in the Mississippi and Atchafalaya River Basin, and give priority to watersheds with the highest yields (loads per unit area) of nitrogen to the Gulf as well as being likely to have local benefits.

Using available data, tools, and local partnerships, the Task Force will serve as the national forum to encourage and coordinate implementation, including assessments, research, monitoring, and modeling, and promote adaptive management, including evaluation of progress, updates of goals and strategies, and solicitation of continued financial support, to achieve the goals described on page 9. The Action Plan assumes continuation of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force with invitations for participation by additional States and Tribes in the Basin. The Plan also assumes that Federal, State, and Tribal governments will pursue new legislative authorities needed to implement proposed actions and will identify and propose appropriations needed to accomplish tasks not presently funded.



Implementation Actions

The following short-term actions and time frames are proposed to achieve the long-term goals outlined above:

1

By December 2000, the Task Force, with input from the States and Tribes within the Mississippi/Atchafalaya River Basin, will develop and submit to the appropriate Federal Agencies an integrated budget proposal for additional funds for voluntary technical and financial assistance, education, environmental enhancement, research, and monitoring programs to support the actions outlined in the Action Plan;

2

By Summer 2001, States and Tribes in the Basin, in consultation with the Task Force, will establish sub-basin committees to coordinate implementation of the Action Plan by major sub-basins, including coordination among smaller watersheds, Tribes, and States in each of those sub-basins;

3

By Fall 2001, the Task Force will develop an integrated Gulf of Mexico Hypoxia Research Strategy to coordinate and promote necessary research and modeling efforts to reduce uncertainties regarding the sources, effects (including economic effects in the Gulf as well as the basin), and geochemical processes for hypoxia in the Gulf;

4

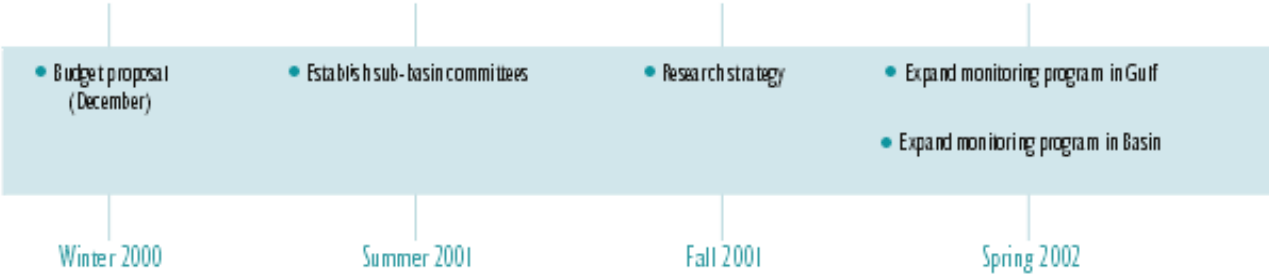
By Spring 2002, Coastal States, Tribes, and relevant Federal agencies will greatly expand the long-term monitoring program for the hypoxic zone, including greater temporal and spatial data collection, measurements of macro-nutrient and micro-nutrient concentrations and hypoxia as well as measures of the biochemical processes that regulate the inputs, fate, and distribution of nutrients and organic material;

5

By Spring 2002, States, Tribes, and Federal agencies within the Mississippi and Atchafalaya River Basin will expand the existing monitoring efforts within the Basin to provide both a coarse resolution assessment of the nutrient contribution of various sub-basins and a high resolution modeling technique in these smaller watersheds to identify additional management actions to help mitigate nitrogen losses to the Gulf, and nutrient loadings to local waters, based on the interim guidance established by the National Water Quality Monitoring Council;

6

By Fall 2002, States, Tribes, and Federal agencies within the Mississippi and Atchafalaya River Basin, using available data and tools, local partnerships, and coordi-



nation through sub-basin committees, described in action #2, will develop strategies for nutrient reduction. These strategies will include setting reduction targets for nitrogen losses to surface waters, establishing a baseline of existing efforts for nutrient management, identifying opportunities to restore floodplain wetlands (including restoration of river inflows) along and adjacent to the Mississippi River, detailing needs for additional assistance to meet their goals, and promoting additional funding;

7

By December 2002, the U.S. Army Corps of Engineers (COE), in cooperation with States, Tribes, and other Federal agencies, will, if authorized by the Congress and funded in the Fall of 2001, complete a reconnaissance-level study of potential nutrient reduction actions that could be achieved by modifying COE projects or project operations. Prior to completion of the reconnaissance study, the COE will incorporate nitrogen reduction considerations, not requiring major modification of significant new costs, into all project implementation actions;

8

By January 2003, or on a time frame established by the sub-basin committees, Clean Water Act permitting authorities within the Mississippi and Atchafalaya River Basin will identify point source dischargers with significant discharges of nutrients and undertake steps to reduce those loadings, consistent with action #6;

9

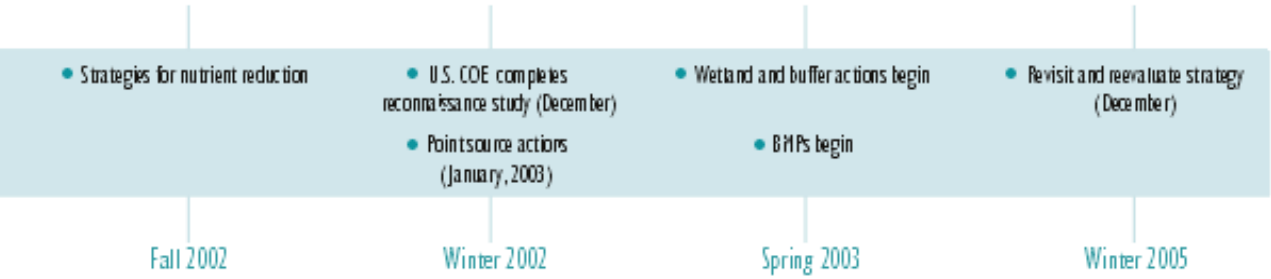
By Spring 2003, or on a time frame established by the sub-basin committees, States and Tribes within the Mississippi and Atchafalaya River Basin, with support from Federal agencies, will increase assistance to landowners for voluntary actions to restore, enhance, or create wetlands and vegetative or forested buffers along rivers and streams within priority watersheds consistent with action #6;

10

By Spring 2003, or on a time frame established by the sub-basin committees, States and Tribes within the Mississippi and Atchafalaya River Basin, with support from Federal agencies, will increase assistance to agricultural producers, other landowners, and businesses for the voluntary implementation of best management practices (BMPs), which are effective in addressing loss of nitrogen to waterbodies, consistent with action #6; and

11

By December 2005, and every five years thereafter, the Task Force will assess the nutrient load reductions achieved and the response of the hypoxic zone, water quality throughout the Basin, and economic and social effects. Based on this assessment, the Task Force will determine appropriate actions to continue to implement this strategy or, if necessary, revise the strategy.



There are no simple solutions that will reduce hypoxia in the Gulf. An optimal approach would take advantage of the full range of possible actions to reduce nutrient loads and increase nitrogen retention and denitrification. This should proceed within a framework that encourages adaptive management and accomplishes this in a cost-effective manner. While reduction of nitrogen is the principal focus of this framework, many of the actions needed to reduce nitrogen loads will complement and enhance existing efforts to restore water quality throughout the basin. With additional assistance, this national effort to reduce Gulf hypoxia will be implemented within the existing array of State and Federal laws, programs, and private initiatives.

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Framework and Approach for Reducing Hypoxia in the Gulf of Mexico

The tools provided by the Clean Water Act, and the programs established under the last several Farm Bills, the Coastal Wetlands Planning, Protection, and Restoration Act, and Water Resources Development Acts, are critical to implementing this plan. Because nutrient overenrichment is a widespread problem, these existing national programs and initiatives incorporate specific elements intended to reduce nutrient loadings to surface waters and to foster restoration of natural habitats capable of removing nutrients from waters. They include the following:

- encouraging nonpoint source pollutant reductions under the Clean Water Act, the Farm Bill, Coastal Zone Amendments and Reauthorization Act, and State cost-sharing programs;
- implementation of the Environmental Quality Incentives Program (EQIP) to assist grain and livestock producers in reducing excessive nutrients' movement to water resources;
- implementation of the Conservation Reserve Program, Wetlands Reserve Program, Corps of Engineers Environmental Restoration Programs, and Agricultural Extension Education Programs to promote restoration and enhancement of natural systems for nitrogen retention and denitrification;
- implementation of nutrient management through State and Tribal efforts to implement watershed-based approaches to water quality management, including monitoring and assessing waters, adoption of water quality standards, which include nutrient criteria, developing total maximum daily

loads (TMDLs), and implementing point source controls for nutrients through the National Pollutant Discharge Elimination System (NPDES);

- promoting public-private partnerships to restore buffers;
- promoting cost-effective flood control alternatives and implementing projects under the Coastal Wetlands Planning, Protection, and Restoration Act that result in nitrogen removal from the Mississippi and Atchafalaya Rivers;
- supporting actions by non-water quality State and Tribal agencies, private landowners, and agricultural and other industries to reduce nitrogen loadings to the basin; and
- providing voluntary incentives for nitrogen reductions from point and nonpoint sources.

This plan recognizes and builds upon these requirements, programs, and initiatives. A successful strategy to restore water quality in the Gulf of Mexico will almost certainly benefit water quality throughout the Mississippi and Atchafalaya River Basin.

The complex nature of nutrient cycling and transport within the Mississippi and Atchafalaya River basins and Gulf of Mexico makes it difficult to predict specific improvements in water quality that will occur both in the Gulf as well as the entire Mississippi River basin for a given course of action. Further, it is clear that environmental responses to management actions in the basin likely will be slow, possibly requiring decades to demonstrate that remedial actions have helped the recovery of oxygen concentrations in the Gulf and have improved water quality in the Basin. Finally, while the current understanding of the causes and consequences of Gulf of Mexico hypoxia is drawn from a massive amount of direct and indirect evidence collected and reported over many years of scientific inquiry, significant uncertainties remain. Further monitoring, modeling, and research are needed to reduce those uncertainties in future assessments and to aid decision making in an adaptive management framework. A comprehensive program of planning, monitoring, interpretation, modeling, and research to facilitate improvement in scientific knowledge and adjustments in management practices should be coupled to the initial nutrient management strategies developed in Implementation Action #6 of this plan. This adaptive management scheme involves continual feedback between interpretation of new information and improved management actions and is the key to targeting actions within watersheds where they will be most effective.

Adaptive Management: Action, Monitoring, and Research

This adaptive approach should consist of the following components:

Action: implementing the actions identified in this plan, including developing sub-basin strategies based on state strategies, initiating additional monitoring and research, and pursuing a national commitment to supporting actions to reduce and mitigate the impacts of hypoxia in the Gulf. The best current science indicates that sub-basin strategies, in the aggregate, should be aimed at achieving a 30% reduction (from the average discharge in the 1980-1996 time frame) in nitrogen discharges to the Gulf (on a 5-year running average) to be consistent with the Coastal Goal for reducing the areal extent of hypoxia in the Gulf;

The best current science indicates that sub-basin strategies, in the aggregate, should be aimed at achieving a 30% reduction (from the average discharge in the 1980-1996 time frame) in nitrogen discharges to the Gulf (on a 5-year running average) to be consistent with the Coastal Goal for reducing the areal extent of hypoxia in the Gulf.

Education: increasing the stakeholder and national awareness of the causes and effects of hypoxia, the actions under way or planned to reduce those effects, and the role of State, local, and Tribal governments as well as individual landowners, citizens, and businesses to contribute to the solution. Make this information available through electronic media and workshops sharing the latest news on successful approaches and reductions;

Monitoring: increasing the scale and frequency of monitoring of both the extent of the hypoxic zone and the sources of nutrients and conditions of waters throughout the basin;

Research and Modeling: reducing the uncertainties in the effects of the hypoxic zone, the sources, contributing factors and the biochemical processes that underlie the causes and effects of the hypoxic zone, and the social and economic impacts of various control strategies; and

Evaluation and Adaptation: reviewing periodically the results of monitoring and research to assess changing conditions, evaluate performance of specific management actions, and revise this plan, through the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force.

This plan seeks to take maximum advantage of water quality improvement efforts under way or planned nationally and proposes a mechanism to better focus those efforts. Water resources within the Basin ~~ri~~vers, wetlands, lakes, estuaries, and streams ~~an~~d the Gulf of Mexico are expected to benefit from these efforts. Many specific water quality improvement actions can be undertaken by industries, municipalities, farmers, ranchers, and other citizens. These actions can raise property values, conserve soil, increase productivity, reduce input costs, and provide habitat for game and fish and revenue from hunting, fishing, and other recreation. Because of the economic benefits of these measures to the landowners and other stakeholders who undertake them, education and voluntary, incentive-based approaches can be effective in promoting such actions.

Effective implementation of an action plan to reduce the size and effect of the hypoxic zone in the Northern Gulf of Mexico and to improve water quality within the Mississippi and Atchafalaya River Basin will require a monitoring strategy that measures progress toward achieving both long-term and short-term goals. Feedback from such a monitoring strategy will facilitate an adaptive management framework that enables continual improvement of the action plan with increasing knowledge of the factors and processes controlling nutrient losses, their effects on water quality, and the effectiveness of management actions.

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Indicators of Implementation and Results

A multiscale, multidisciplinary, and long-term monitoring strategy is one of the key implementation actions described on pages 13 and 14. The strategy must include measurement of indicators of progress in implementing management or programmatic actions, indicators of environmental response of water quality in the Mississippi and Atchafalaya River Basin and hypoxia in the Gulf of Mexico, and indicators of economic conditions that can be used to gauge the significance and implications of management actions. It must quantify environmental trends and differentiate among trends caused by changes in climate, streamflow, nutrient and landscape management measures, Gulf hydrodynamics, and other concurrent factors. Variables should be measured to quantify the physical, chemical, and biological processes that affect the cause-and-effect relationships between nutrient inputs and resulting environmental quality. The strategy must include periodic data analysis, interpretation, and reporting to all stakeholders that are involved with design and implementation of management, remediation, and restoration actions. Analysis and interpretation must use models that integrate knowledge across scales and hydrologic compartments from the smallest watershed to the Mississippi and Atchafalaya River Basin and the Gulf of Mexico.

The strategy must include periodic data analysis, interpretation, and reporting to all stakeholders that are involved with design and implementation of management, remediation, and restoration actions.

A coordinated and supporting research strategy is integral to maintenance of an effective monitoring strategy and an adaptive management framework for action. Research efforts can be targeted on improving monitoring designs, improving the interpretation of monitoring output, and increasing the predictive power of models and other assessment tools used to design and evaluate management actions.

A baseline condition should be established for all indicators and the monitoring strategy in general to quantify the improvements associated with management action. The expected delay in the response of indicators to management actions indicates that additional improvements in water quality will continue to be realized from actions, that have already been implemented, as well as from future management actions. The CENR science assessment has provided large-scale (Basin and Gulf scale) estimates of baseline conditions in the Mississippi and Atchafalaya River Basin (generally for the period 1980-1996) and the Gulf of Mexico (generally for the period 1985-2000). Additional information available from other sources at more local scales should be included in these definitions of baseline conditions. In addition, more recent information may be available to improve these baseline definitions. The 1997 Hypoxia Response Interagency Activity Report provides an initial listing of Federal programs that could be evaluated for participation through programmatic indicators. Baseline conditions will need to be defined for these indicators.

Indicators that have been considered for the monitoring strategy are listed below. A more detailed and comprehensive evaluation of indicators will be conducted as part of preparing sub-basin strategies under Implementation Action #6.

Environmental Indicators

- Dissolved oxygen concentrations within the current hypoxic zone increase (above 2 mg/l), resulting in a reduction in the duration and spatial extent of the hypoxic zone. Data should provide resolution of the spatial extent and duration of the hypoxic zone.
- Seasonal/annual average nitrogen and phosphorus concentrations and mass loadings are reduced at key river and tributary stations. Measurement stations should represent watershed scales ranging from the local scales at which specific management actions are tested to the scale of the Mississippi and Atchafalaya River Basin as it discharges to the Gulf.
- Bottom-dwelling communities in the current hypoxic zone in the northern Gulf return to a diversity and abundance characteristic of non-hypoxic conditions, and normal migratory patterns of key species are restored.

Economic Indicators

- Population
- Gross Domestic Product
- Industrial Output
- Net Farm Income
- Land Area in Crop Production
- Agricultural Output in numbers of animals and bushels of commodity crop
- Fisheries

Programmatic Indicators

The following indicators will be tracked at various scales. In general, nonpoint sources will be tracked at 8-digit Hydrologic Unit Code (HUC) basins and point sources by discharge location or 8-digit HUC basin:

- Vegetative or forested buffers established along rivers and streams of priority watersheds.
- Producer/acres enrolled in CRP and WRP.
- Acres in conservation tillage.
- Producers implementing nutrient management plans and the number of acres affected.
- States with fully approved Nonpoint Pollution Control Programs.
- Percent population served by secondary treatment.
- Percent population served by Advanced Waste Treatment/Biological Nutrient Removal.
- Reduction in discharges of nitrogen and phosphorus for municipalities.
- Number of municipal stormwater programs approved.
- Estimated/monitored reductions in nitrogen and phosphorus (or surrogate indicators) for industrial point sources.
- Number of 303(d) water segments listed because of nutrient impairment.
- Number and percent of wetland acres restored, enhanced, or created.
- Completion of TMDLs for nutrient-impaired waters.
- Number of States and Tribes within the Mississippi and Atchafalaya River Basin achieving Enhanced Benefits status under the 319 Program.
- Number of projects and amount of dollars directed through EQIP, CRP, WRP, and section 319 in accordance with sub-basin strategies.

Mississippi River/Gulf of Mexico Watershed Nutrient Task Force

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Additional Information

The Mississippi River/Gulf of Mexico Watershed Nutrient Task Force prepared this document following seven public meetings. As part of a process of considering options for responding to Gulf of Mexico hypoxia, a Federal interagency working group asked the White House Office of Science and Technology Policy to conduct a scientific assessment of the causes and consequences of Gulf hypoxia through its Committee on Environment and Natural Resources. The working group then expanded to include States and Tribes and established the Task Force during the fall of 1997. The charge to submit a scientific assessment of hypoxia and a plan for reducing, mitigating, and controlling hypoxia in the Gulf of Mexico was written into law at the end of the 105th Congress (section 604(a) and (b) of Public Law 105-383). The Mississippi River/Gulf of Mexico Watershed Nutrient Task Force held public meetings throughout the Mississippi River Basin to inform the public of the progress toward development of the assessment and action plan.

First Meeting
December 4, 1997
Arlington, Virginia

Second Meeting
April 8-9, 1998
New Orleans, Louisiana

Third Meeting
September 24, 1998
Bloomington, Minnesota

Fourth Meeting
June 30 through July 1, 1999
Memphis, Tennessee

Fifth Meeting
November 18, 1999
Chicago, Illinois

Sixth Meeting
June 15-16, 2000
St. Louis, Missouri

Seventh Meeting
October 11, 2000
Baton Rouge, Louisiana

Resources

EPA's Mississippi River Basin homepage at www.epa.gov/msbasin.

Index of public comments received on the Draft Action Plan. Available on EPA's web site at www.epa.gov/msbasin/hypoxiacomments.

Integrated Assessment of Hypoxia in the Northern Gulf of Mexico, May 2000. National Science and Technology Council Committee on Environment and Natural Resources, Washington, DC. For copies or more information, contact National Ocean Service National Oceanic and Atmospheric Administration, National Centers for Coastal Ocean Science, Coastal Ocean Program, 1315 East-West Highway, Room 9700, Silver Spring, MD 20910. Phone: (301) 713-3338; fax: (301) 713-4044; e-mail: coastalocean@cop.noaa.gov. The report is also available on NOAA's Hypoxia in the Gulf web site at www.nos.noaa.gov/products/pubs_hypox.html.

Analysis of Point Source Nutrient Loadings in the Mississippi River System. Available on EPA's web site at www.epa.gov/msbasin/loadings.html.

References

Carey, Anne E., et al. 1999. *The Role of the Mississippi River in the Gulf of Mexico Hypoxia*, Report No. 70. Environmental Institute, University of Alabama, Tuscaloosa, AL.

Downing, John A., et al. 1999. *Gulf of Mexico Hypoxia: Land and Sea Interactions*. Task Force Report No. 134. Council for Agricultural Science and Technology, Ames, Iowa. For copies, contact Council for Agricultural Science and Technology, 4420 West Lincoln Way, Ames, IA 50014-3447. Phone: (515) 292-2125; fax: (515) 292-4512; e-mail: cast@cast-science.org. The report is also available on the CAST web site at www.cast-science.org.

National Research Council. 2000. *Clean Coastal Waters: Understanding and Reducing the Effects of Nutrient Pollution.* Committee on the Causes and Management of Coastal Eutrophication, Ocean Studies Board and Water Science and Technology Board, Commission on Geosciences, Environment, and Resources. National Academy Press, Washington, DC.

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