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Mr. John Field
Gulf of Mexico Hypoxia Working Group
National Centers for Coastal Ocean Science
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1305 East-West Highway
Silver Spring, MD 20910

Dear Mr. Field:

Attached are comments of the State of Iowa regarding the six CENR reports regarding the causes and consequences of hypoxia in the Gulf of Mexico. They have been prepared with the assistance of faculty and researches of Iowa State University and staff of Iowa's Department of Natural Resources and Department of Agriculture and Land Stewardship.

The issue of nutrient flux in Iowa's lakes, rivers and streams is very important to Iowans as we utilize these waters as sources of drinking water, recreation, and habitat. We believe it is in our interest to manage sources of nutrients from agriculture, industry and communities in a manner that protects these resources. We also believe that there are opportunities to improve nutrient management. This is consistent with out state non-point source management plan.

While there remains a lot to learn about nutrient flux and hypoxia in the Gulf of Mexico, we hope that efforts we undertake in Iowa to improve nutrient management indirectly have a positive impact on water quality in the Mississippi/Atchafalaya River Basin, and ultimately the Gulf. However, I share the concern of our review team that the six reports do not provide evidence to support nutrient management regulations as a hypoxia reduction strategy.

Sincerely,

Thomas J. Vilsack
Governor

TJV/msf
HYPOXIA

State of Iowa Comments
Committee on Environment and Natural Resources Hypoxia Work Group
Six Committee Reports

The Committee on Environment and Natural Resources (CENR) Hypoxia Work Group for the Mississippi River/Gulf of Mexico Watershed Nutrient (MR/GMWN) Task Force has done a credible job examining the scientific literature and archived data related to the issue of hypoxia in the Gulf of Mexico. The six committee reports describe the hypoxic condition that exists, its ecological and economic consequences, and the flux and source of nutrients within the Mississippi/Atchafalaya River Basin (MARB). They project the in-Gulf effects of reducing nutrient loads to surface waters within the basin, evaluate approaches to reduce nutrient loads, and evaluate the economic costs and benefits of agricultural nutrient reduction measures.

The reports point out limitations in scientific understanding of hypoxia and related issues, data and research needs, and the existence of complex scientific, social, and economic interactions. The reports also are unable to identify direct economic or environmental benefits from reducing nitrogen loads from the Gulf of Mexico. These limitations make it impossible to identify a singular course of action that, applied over the entire MARB, can be expected to result in a predictable consequence of reduced nutrient delivery to the Gulf, reduced hypoxic zone extent and duration, and improved economic and/or environmental conditions within the Gulf, without 'marginal' (in reality, major) economic and social impact on the agricultural industry and the states of the Upper Mississippi River Basin.

In the absence of such a course of action, it is important that the strategy focus on win/win opportunities to reduce nutrient flux and improve environmental conditions without negative economic impact across the MARB. These benefits can be quantified and should form the basis for MARB policy.

The information in the CENR study offers important insight into the need for better nutrient and waste management in agriculture, industry, and urban and municipal wastewater treatment. These needs are well documented in individual state plans and programs to address point and nonpoint-sources of pollution. The strongest argument that can be made from the CENR study is that all states within the MARB, with continued and increased support from federal agencies, must increase their efforts to develop and implement effective point and nonpoint-source pollution prevention programs. There is strong evidence that nutrient and waste management prevention programs can provide measurable improvements locally in water quality, plant and biological communities, and in-stream habitat without adverse economic implications for producers. It follows that these improvements should eventually be felt downstream as far as the Gulf, although the CENR study does not provide evidence of direct correlation.

For this reason, as supported in the following review of the six CENR reports, it is important that MR/GMWN Task Force Action Plan support:

- ***a watershed based approach by states of the MARB to address nutrient management as one element of state water quality protection goals; rather than a hypoxia reduction strategy or regulation imposed over state nonpoint-pollution prevention plans***

- ***increased water quality monitoring to better identify and quantify nutrient sources and flux, and to measure the impact of state nutrient management and discharge reduction programs***

- ***increased research emphasis to better understand (1) the impacts of nutrient management on crop production and nutrient loss in the Midwest, and (2) the effects of nutrient enrichment, Mississippi River management and channelization on coastal environments and hypoxia in the Gulf of Mexico***

Finally, regardless of what sector provides the majority of nutrient input into the Mississippi River, programs to reduce nutrient flux must fairly address all contributing sectors in all states of the MARB. This is the only way that the plan recommendations will gain any level of consensus support basinwide.

The following review comments of the six CENR reports substantively support the above recommendation.

Topic #1. Characterization of Hypoxia

The report provides a comprehensive review of the physical, chemical and biological consequences of hypoxia. It sets the stage for deliberation of the proximate causes of increased phytoplankton production and the role of human-induced factors. However, a significant knowledge gap appears to be a more complete understanding of the role of current or modified fluxes of nitrogen (N), phosphorus (P), and silicon (Si) in controlling hypoxia. The report presents evidence and analyses that identify the nitrate load in the Mississippi River as the likely cause of hypoxia. However, the authors also present data documenting instances where either P or Si limit primary production. It is important that the interactions of these elements also be understood and factored into the design of effective hypoxia reduction strategies.

The authors make a case that there can be no determination of a marine response to any nutrient changes within the Mississippi River system without continued acquisition of basic hydrographic, chemical and biological data related to the development and maintenance of hypoxia over seasonal cycles (Pg. 127, par. 3). In view of what currently is not understood about the scope and mechanisms of the hypoxia problem and the size of the watershed that may ultimately be affected, basin and coastal states should insist on continued research. The language of the report should make it clear to policymakers that Gulf hypoxia is not yet totally understood. While there are positive nutrient management actions that can be taken to reduce nutrient flux, further research is essential. It should be conducted not only by researchers representing Louisiana, but also by universities,

USGS, EPA, NOAA, USDA and other groups having a sufficiently broad constituency to provide a basis for national and regional policy actions.

In the summary section on "Nutrient Intervention," the authors conclude that "success stories" from efforts undertaken on a relatively small scale in Florida and Louisiana are justification for basin-wide nutrient management efforts throughout a major portion of the United States. However, the relevant sections of the complete report seem to paint a more pessimistic picture, noting that a decade of nutrient management effort in the Chesapeake Bay watershed has failed to produce measurable improvement, and that "decades of data may be necessary to statistically demonstrate that remedial actions have helped recovery of oxygen concentrations." It is not appropriate to establish nutrient management policy for the MARB on the basis of two small scale "success stories."

The report mentions incidents of hypoxia around the world (Baltic Sea and Adriatic Sea), some of which apparently have longer periods of record than are available in the Gulf of Mexico, yet relatively little is said about what has been learned from these sites or what governments at these locations are doing about hypoxia. In view of the relatively short period of record in the Gulf, it would be desirable to further evaluate the data, causes of hypoxia, and effect of any remedial programs at other locations in the world.

In the Executive Summary of the report, a section titled "River discharge and flux of materials," makes passing reference to efforts aimed at "managing the birdfoot delta for greater discharge through the Southwest Pass...." Little more is said about this in the main report other than on p. 35 where it is noted that the percentage of Mississippi River water flowing eastward onto the Mississippi-Alabama shelf is unknown. This raises questions as to whether the Gulf hypoxic zone that has been monitored the most (transect "C" in the core of the hypoxic zone, and which is claimed on p.3 to be "representative" of the Louisiana shelf) is not unduly influenced by efforts to channel flow to the west through a particular outlet from the delta. The Corps of Engineers should be asked to clarify current policies on management of flow in the delta. If nutrient concentration and hypoxia off the Terrebonne Bay area is being exacerbated by delta flow control strategies designed to facilitate maintenance of shipping channels, this contribution to the problem should be brought to light. This does not relieve basin states from the responsibility to strive for reduced nutrient losses. However, a comprehensive strategy to reduce nutrient flux should address the Gulf of Mexico impact of channel management on behalf of the shipping industry.

Topic #2. Ecological and Economic Consequences of Hypoxia

The report evaluating the economic and ecological consequences of hypoxia in the Gulf of Mexico indicates that the shallow continental shelf area affected by hypoxia does show signs of hypoxia-related stress. However, the report also concludes, "Any effect of hypoxia in the northern Gulf of Mexico is intertwined with other environmental stressors. To understand specifically how hypoxia affects populations in the Gulf we first need to determine the contribution of all natural and anthropogenic sources of mortality and growth to population dynamics. We also need to determine what functional aspects of

the ecosystem are specifically affected by hypoxia." The report also concludes, "The economic assessment based on fisheries data, however, failed to detect effects attributable to hypoxia". This report does not make a compelling argument ecologically or economically for a nutrient management strategy based on hypoxia reduction.

Topic #3. Flux and Sources of Nutrients in the Mississippi-Atchafalaya River Basin

The report is a comprehensive examination of the flux and sources of nutrients in the MARB. It makes the connection that nutrients in the lakes and streams of Iowa that are a water quality concern within our borders eventually reach the Mississippi River and flow to the Gulf of Mexico. It emphasizes the importance of state nonpoint-source reduction programs that encourage efficient use of nutrients in agricultural production

In Section 6.1, the authors discuss the importance of nutrient point sources. The estimates indicate that if all N released from point sources reached the Gulf, they would account for 18% of the estimated Mississippi River N-flux. Although less than agricultural nonpoint sources, these contributions also should be addressed in the Task Force Action Plan. For the three Iowa basins, point source inputs appear even less important, accounting for less than 5% of estimated N-flux (Table 4.3). While these estimates describe the maximum possible impact of point sources, they provide a useful perspective. It also is important to note that point source inputs to streams are direct and bypass most of the N-output mechanisms discussed in the report.

In Section 6.1, the authors state that the estimated total N-flux to the Gulf via the Mississippi River accounts for only about 7.5% of agricultural N-inputs (the comparable figure for the Iowa basins is 9%). This relatively small percentage must be kept in mind when practices to control N-loss are considered. Even substantial changes in N-management may have a small impact on the portion of the inputs that reach the Gulf.

Topic #4. Effects of Reducing Nutrient Loads to Surface Waters within the Mississippi River Basin and the Gulf of Mexico

The report portrays agriculture as one of the main sources of nitrogen to the Gulf of Mexico and nitrogen as the main causative agent of hypoxia. The report indicates that the types of agriculture practiced in Iowa are those having the greatest nitrogen loss rates. Many of the management practices recommended in the report have been researched, reviewed, and discussed previously in Iowa and for Iowa conditions. These specific results should be utilized whenever possible to determine potential courses of action for reducing nutrient loading to Iowa surface water systems and to the Mississippi river from Iowa. Although many Iowa farmers have already adopted more nutrient-effective strategies, producer behavior changes slowly, especially when the market causes them to be risk-averse.

The report suggests that Iowa's agricultural producers will need to decrease field losses of nitrogen substantially (e.g., 30% or more) to help protect down-stream aquatic resources. The complexity of this issue makes firm numbers hard to nail down, but the report

implies that the solution to hypoxia and other coastal eutrophication issues relies upon changes in Midwestern agriculture. The report also acknowledges that much uncertainty remains concerning what will happen to hypoxia in the Gulf if changes in N and P use/management or other crop practices take place in Iowa and the rest of the Mississippi River watershed. This uncertainty includes the magnitude of change – what load reduction in Iowa will be necessary to achieve a positive change in the Gulf? The potential impact on Iowa's agriculture depends upon the exact degree of change that is required. Some suggested remedies are relatively benign and follow currently recommended nutrient-use practices in Iowa. These methods could be potentially positive agronomically and environmentally, especially when viewed on a situation-specific and practice-specific basis. Other remedial measures could be seriously detrimental agronomically and economically. Without better cause and effect understanding, nutrient reductions below university recommended, science based agronomic needs should not be recommended or expected.

In the Executive Summary (p.xiii), the authors state "Moreover, human responses to changes in agricultural practices tend to be buffered as well. For example, imposition of restraints on application of fertilizer and manure in targeted areas will cause some reduction of agricultural production..." There are many good reasons to reduce nutrient flux from agriculture. There also are many ways to achieve these reductions. The report should put its greatest emphasis on those pathways that are most likely to succeed. Means of nutrient-flux reduction other than "imposition of restraints" should be emphasized. Incentives and voluntary efforts backed by farmer education are more likely to gain acceptance and achieve results.

Many of the N-reduction strategies listed in 3.2.1.5 of the report are costly. Emphasis should be placed on broad use of low-cost methods; especially given the farm crisis we are currently experiencing. The percentages for reduction in nitrate losses listed for each practice should be documented for conditions within individual states. These reductions are extremely site-specific. Also, it is uncertain if implementing these practices will result in decreases in nitrate loss to surface waters large enough to effect necessary N-load changes to the Gulf. Changing rates and the timing of N application cannot stop nitrate movement from soils. Unpredictability in climate also increases the difficulty in implementing these changes.

Education regarding N management should be targeted to specific fields, farms, producers, or watersheds. This is an excellent role for agricultural extension. To improve producer accounting for N and P contained in manure, there also must be increased confidence regarding variability in nutrient analysis, application, and availability. In Iowa, there are recommendations for best nutrient and crop production practices in addition to those outlined in this section. The salient question is, if all crop acres had these practices implemented on them, would the cumulative effects be enough that nitrate loading is reduced to levels needed to effect changes in the Gulf of Mexico?

Discussions in the report concerning the modeling work indicate considerable uncertainty about the potential impacts of source N and P changes on loading reduction and water

quality reactions in the Gulf of Mexico. Adding to the uncertainty is the complexity of interactions, impacts from other elements such as silicon and freshwater load. This raises questions and concerns about recommending major nutrient use changes in the Mississippi watershed, and specifically Iowa, when one cannot predict the quantifiable extent of improvements to the Gulf. Also, if the large-scale landscape modeling used in the report is correct, then, as reported, a 34% reduction of fertilizer N to corn, corn-soybean, and sorghum fields would only reduce the total N load from the Upper Mississippi and Ohio rivers by 2 to 5% (although as mentioned in the report, fully accounting for tile drainage may change these results). It is important to the agricultural industry that significant efforts to change agricultural inputs be repaid by significant improvements in water quality and that any economic costs of these changes be adequately compensated.

Topic #5. Reducing Nutrient Loads, Especially Nitrate-Nitrogen, to Surface Water, Groundwater, and the Gulf of Mexico

The goal of the report was to "identify and evaluate approaches for solving the problem of hypoxia in the Gulf of Mexico" based on the conclusion that the problem is "due to excess nutrients, particularly nitrate-nitrogen." Care must be taken when making recommendations. First it must be proven that they will solve the problem, and second, the potential drawbacks or costs of implementing these recommendations must be carefully evaluated. The authors use the term "slight" to describe the 12 bu/ac yield reduction that would come with a 20% reduction in N application to corn. In some years, this 12 bu/ac may represent most if not all of the farmers net profit.

In the Executive Summary (p. xi) the authors state that they "gave recommendations as to the most reasonable combination of approaches that would be necessary to solve the problem" (hypoxia in the Gulf). Determining what is "most reasonable" may not be appropriate until the questions 'what cost?' and 'who pays?' are answered.

The report states that "Improved manure management, including uniform application of known nutrient amounts...is critical." However, current reality is that economics and technology available do not allow adequate uniformity of manure application or knowledge of manure nutrient content/availability to allow a producer to give precise credit for N. Also, its availability in terms of time and location can be critical to yield and economic viability of production.

In Section 6. Conclusions and Recommendations, the authors state that "Point sources of nitrogen appear to be of little consequence (<5%) in the overall Mississippi River Basin nitrogen load...." This statement confuses what is loaded to the land and what is directly loaded into the Mississippi River. The 0.27 million metric tons of N from municipal and industrial sources are direct inputs into the MARB system. Although they represent less than 5% of the overall input for the basin, they represent 17% of the N output from the river to the Gulf.

Again, a comprehensive strategy to reduce nutrient flux should address all nutrient sources including point sources and non-agricultural nonpoint-sources of nutrient discharge into the Mississippi/Atchafalaya River system.

Topic #6. Evaluation of Economic Costs and Benefits of Methods for Reducing Nutrient Loads to the Gulf of Mexico

In the Topic #6 report, Table 5.1-1 (p. 128, reproduced below) shows that there are no direct estimated benefits from reducing nitrogen loads to the Gulf of Mexico. Therefore, there is not a Gulf of Mexico justification for establishing policies to reduce nitrogen loading.

Table 5.1-1 Summary of Estimated Benefits Associated with Hypoxia Reduction in the Gulf of Mexico as Reported by *Topic Group 2: Ecological and Economic Consequences of Hypoxia*

Potential Benefits of Hypoxia Reduction	Conclusion from Topic Group 2
Restoration of Ecological Communities In the Gulf of Mexico	Data Not Available to Estimate Benefits
Increased Commercial Harvesting of White and Brown Shrimp	Given Available Data, No Estimable Benefits From Hypoxia Reduction
Increased Commercial Harvesting of Gulf Menhaden	Given Available Data, No Estimable Benefits From Hypoxia Reduction
Increased Commercial Harvesting of Red Snapper	Given Available Data, No Estimable Benefits From Hypoxia Reduction
Increased Recreational Harvesting	Data Not Available to Estimate Benefits

The authors correctly point out that environmental benefits would accrue from adopting the policies that they consider, namely soil erosion reductions and the values associated with wetland restoration. But none of these values are derived from a reduction in nitrogen loading. They derive from increased recreational opportunities, improved water clarity, wildlife benefits, etc. Policy should be formulated to meet policy goals, not justified on the basis of benefits only indirectly related. The number of wetlands to restore, a fertilizer tax level or fertilizer restrictions should be based on the impact on N-loading to the Gulf. It is quite likely, for example, that the optimal acreage of wetlands to restore based directly on wetlands values is quite different from 5 millions acres. Likewise, the amount of soil erosion reductions should be determined based on the benefits of reduced erosion, not on N loading reductions.

There is little justification in the report for a policy objective of reducing nitrogen loading by 20%. On page 30 (fourth paragraph) the authors justify a 20% scenario as being a

"win-win" situation in that both the environment and the agricultural sector can both benefit. Yet on the top of page 31, they justify the 20% scenario because it produces "relatively modest impacts" which include a 6% reduction in crop acreage, significant yield reductions, and associated price increases. These estimated impacts of 20% N reduction do not suggest a win-win situation.

However, there can be economic benefits from improved nutrient management for individual farmers. Choosing a policy that maximizes the economic and environmental benefits of nutrient management for individual farmers is justifiable on the basis of the reports.

Summary

The information and findings contained in the six CENR reports are valuable. They make the case for continued and accelerated efforts on the part of states to address point and nonpoint-sources of nutrient contamination. Improved nutrient management will result in improved local water quality and reduced nutrient flux in the Mississippi/Atchafalaya River Basin. Reduced nutrient flux may reduce the extent or duration of hypoxic conditions in the Gulf of Mexico. Unfortunately, the reports discount potential benefits of improved nutrient management for other industrial and municipal sources of nutrients.

The CENR reports demonstrate the need for additional monitoring within the entire Mississippi/Atchafalaya River Basin to better document the sources, nature and extent of the problem. This monitoring will also be important to document changes in nutrient flux as better management and control practices are implemented across the basin. They also support the need for additional research regarding nutrient management in the upper Midwest, and the effects of nutrient enrichment, Mississippi River management, and channelization on coastal environments and hypoxia in the Gulf of Mexico.

The six reports do not do not provide evidence to support nutrient management regulations in the agricultural production areas of the Mississippi/Atchafalaya River Basin as a hypoxia reduction strategy.