Fields of Opportunities

STATE OF IOWA

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Science Advisory Board Hypoxia Advisory Panel
U.S. EPA Science Advisory Board (1400F)
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Dear Panel Members:

These comments are being submitted in regard to the Hypoxia Advisory Panel's May 24, 2007 draft report. I would like to note that these comments do not necessarily reflect the official position of the Iowa Department of Natural Resources or the Environmental Protection Commission, Iowa's environmental policy body. I have been involved in various aspects of water quality and hydrology throughout my professional career, most recently as member of the Stakeholder Advisory Group of the Upper Mississippi River Subbasin Hypoxia Nutrient Committee and as the lead person for the Department's efforts to adopt state nutrient criteria, and offer my comments in the hope the panel's final report will provide the science needed to formulate an informed, effective policy to deal with Gulf hypoxia.

The refrain of "sound science driving policy" is standard dialogue among government agencies but my observation is this seldom happens; federal water resources policy is often based on poor science, good science that is misinterpreted, or perceptions unsupported by any science at all. The panel's report presents a significant opportunity to actually let sound science guide policy and to this end it is essential the final report provide a clear message that reflects the best available science. The questions the panel must ultimately address and address clearly are:

1. Is enough known about Gulf hypoxia to be able to predict with any reasonable degree of certainty the level of nutrient reductions (N, P, or other nutrients) needed to achieve the stated hypoxia goal and, if so;

2. Can it be determined with any reasonable degree of certainty the management actions in both the upper and lower basins needed to achieve this level of nutrient reductions?

If the panel cannot provide a strong consensus on these basic questions, the report will do little to influence policy. As to formulating an effective policy, a strong, honest "no" to either of these questions would be preferable to a weak "yes" or, worse, a qualified "maybe". I don't know the process the panel will be using to develop a consensus position for the final report but I would hope that all members fully consider the entire report rather than only look at the sections reflecting their own immediate areas of expertise. It would also be of great value to offer the prospect of a minority report for panel members that disagree significantly with any of the final report's conclusions and recommendations.

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Inasmuch as the initial draft is undergoing what may be significant revisions and additions, a number of the shortcomings and problems inherent in the initial draft may be addressed in successive drafts or the final report. Others have already pointed out many of these issues and I understand additional comments are forthcoming. My comments are primarily focused on the "big picture" aspects of the report rather than particular technical elements that others have and are currently addressing.

The separate pieces do not make a whole.

The initial draft is more a collection individual, somewhat disparate pieces than a complete whole. Some of these pieces appear to be very good synopses of the available science and research while others are less so. There are a number of inconsistencies, disconnects, and "loose ends", both on an intra- and intersectional basis, that require attention and hopefully these will be addressed in later drafts or the final report. It is vitally important the final report be regarded as the consensus of the whole panel rather than a collection of individual opinions on the various individual pieces.

Research needs.

Many of the individual sections contain recommendations for research and data collection needs and they are significant. The report also correctly points out that many of the needs identified in the Integrated Assessment have not been met. Therefore, it is unrealistic to expect that all the panel-recommended research and data collection needs will be funded in the near future, if ever. It would seem appropriate for the panel to identify the highest research and data collection needs so scarce funding can be directed to fully meeting those needs versus trying to meet all needs with limited resources. For instance, does the panel feel that development of complex hypoxia models that incorporate P fate and transport (as well as the considerable data to needed calibrate and validate the models) as well as improve the N processes should receive priority over additional research on the efficacy of agricultural best management practices to reduce nutrient loading? Put another way, is it appropriate to use scarce resources to develop more complex Gulf models if the panel feels nutrient reduction will remain the key component of the hypoxia action plan? Wouldn't the research emphasis be better directed to assessing the efficacy of upper basin management strategies? Unless the panel can identify the highest priority research and data collection needs, it is unlikely the science of Gulf hypoxia and nutrient fate and transport will advance significantly within the timeframe established for meeting the hypoxia goal. These research priorities should be a logical extension of panel's comments and recommendations regarding the actions needed to reduce the frequency and size of the hypoxic area.

N reduction recommendations.

The draft report contains ample verbiage documenting the uncertainties of attempting to model the complexities of the northern Gulf. It also provides an overview of the various models that have been used that range from the simple to the complex. Yet, the scientific basis for a 45 percent minimum N reduction target (and perhaps as much as 50 to 60 percent) is explained with a simple "based on the most recent modeled results" with no specific discussion of what models were used and their limitations and uncertainties. Also, is the "consensus from these models" (page 113) simply the result of one or a few researchers looking at the "3 available models" or is it the result of multiple researchers or panel members independently looking at the available models and arriving at the same

conclusion? Such a distinction is critical to the scientific accuracy of the panel's recommendations. Nitrogen reduction has been and apparently will remain a key component of the Action Plan and a more thorough explanation of how this figure was developed is essential to the overall scientific credibility of this report. Also, there is no indication of how such reductions are to be measured and quantified; as TN or NO_3, as a running average, as annual or seasonal loads, etc. Such recommendations are important and wholly within the panel's science charge. Perhaps the strongest science that argues for a 45 to 60 percent N load reduction is that load reductions of this range will essentially "turn back the clock" to pre-1965 conditions. The more important question that must also be answered is what certainty is there that this degree of N reduction, if it can be achieved, will result in a significant reduction in the size and frequency of the hypoxic area?

P reduction recommendations.

The scientific rationale for a 40 percent P recommendation is very weak and, in fact, the draft report indicates this figure was simply based on "observations of feasible P reductions in other watersheds" rather than any objective analysis of the degree of reduction needed to fully meet the hypoxia goal. Admittedly, there are no Gulf models that incorporate P dynamics nor apparently is there monitoring data to show how, or if, P concentrations and loads changed in the 1955 – 1980 timeframe. The need to reduce P loads in addition to N loads is a major shift from the Integrated Assessment and as such this recommendation deserves a much more critical eye. At the very least the panel should clearly qualify this recommendation as being highly speculative at this point. Also, the discussion of point source P reductions on pages 113 – 115 leaves the impression that effluent total P concentrations in the 0.1 to 0.3 mg/L range are relatively easy to achieve at minimal cost. I question the accuracy of that impression. Over the last decade, a number of the larger wastewater treatment plants have been faced with nutrient removal and this issue deserves a more thorough evaluation of the relative performance and costs for the plants that have incorporated biological and chemical nutrient removal.

Lower basin/Gulf hydrology.

Section 2.1 discusses the significant influence of the hydrology of the distributaries and near-shore Gulf currents on the size and extent of the hypoxic area. Based on a number of statements, it appears that changes such as additional flow down the Atchafalaya have contributed to hypoxia, or at least increased the potential for hypoxic conditions to occur. The lower Mississippi and the Atchafalaya are very much an engineered system but despite a brief mention of potential "engineering modulations", the Summary of Findings and Recommendations essentially dismiss the potential of engineering projects to redistribute the flows as part of the solution. The reader is left with the impression that the sole solution to hypoxia is to reduce upper basin nutrient loads. The question here is whether the panel as a whole agrees that potential engineering works such as diversion of flows to coastal wetlands have little merit in solving the hypoxia problem. Or is it a matter of not having the models that can accurately predict the changes that would result? Given the significant changes to the lower basin that have occurred over the years and their potential contribution to hypoxia, this issue deserves considerably more discussion and justification for the apparent dismissal of the potential of lower basin changes to help control hypoxia.

Cost effective approaches.

Section 4.4 looks at the socio-economic aspects of the various programs and practices that are assumed to be needed to reach the nutrient reduction targets. While such discussions are important to implementing solutions identified by the panel, this discussion appears to be out of place and dilutes the scientific focus of the report. The panel and its report should concentrate on what measures are needed to achieve the hypoxia goal and not speculate on the social, economic and political changes that might be needed to achieve those measures. I suggest this portion be removed from the report along with the recommendations on page 196.

Options to reduce nutrient losses from agricultural sources.

Nutrient load reduction from the upper basin is viewed as a key action and there is general agreement that intensive row crop production in the corn belt is responsible for a major portion of the nutrient loads from the upper basin. However, the draft report leaves a very mixed message as to whether nutrient load reductions on the scale that are being called for are reasonably achievable short of major shifts in land use (e.g., conversion of row crop lands to perennial grasses). This is a significant shortcoming of the draft report. Statements like the one on page 196 that "*Most nutrient reduction practices are well described and well-known in the field of agriculture*" leave the impression that the technology to reduce nutrient loads is well known, it's just a matter of removing "institutional barriers". I strongly disagree with that implied perception. The challenge of significantly reducing nutrient loads from the upper basin is far more complex than represented in the report. Also, N and P have fundamentally different fate and transport mechanisms and best management practices to reduce one may not reduce the other or, in some cases, may actually increase the other. Many of the options addressed in Section 4.5 either have limited applicability in terms of spatial scales or have limited ability to significantly reduce loads. Also, the draft report provides no indication of the scientific framework that will be needed to fully and accurately evaluate the suite of management practices needed to meet the target N and P reductions.

Reduced rate N applications and SOC

The prospect of being able to significantly reduce nitrogen loads by reducing nitrogen application rates on corn without reductions in yields is an appealing one for a number of reasons including two primary ones: 1) a major change in land use and crop rotations is not required and 2) if true, farmers can maintain or even increase profitability, which will negate the need for some type of subsidy payments for low N rate applications. Given the current emphasis on corn-based ethanol production and the unlikelihood of major shifts in the nation's farm policies in the near future, this option is potentially the most realistic one to achieve reductions in N loads within the stated timeframe for meeting the hypoxia goal. Therefore, low-rate N application deserves a closer, more critical look. Two important points that need additional scrutiny are the relative N load reductions compared to N application reductions and the effect of lower rate N applications on soil organic carbon (i.e., organic matter).

Iowa research data shows the “net return to N” curve is relatively flat through a range of N application rates, suggesting that producers may be able to lower their N application rates for both a corn-soybean rotation as well as continuous corn without sacrificing net profitability if they are currently applying at rates above the economic optimum range. However, N load reductions of the magnitude being called for may not be possible without significant reductions in net economic return for a number of reasons. The data suggest that N load losses from tile drainage do not decrease on a 1:1 linear basis. For instance, a 40 to 50 percent reduction in N rate application might be required to achieve a 30 percent reduction in nitrate loss through tile drainage, depending upon current application rates. Statewide N sales data for Iowa suggests that N rate applications, excluding manure N, average around 135 to 140 lb N per acre. This suggests that the N rate reductions needed to achieve 30 percent N loss reduction could result in significant reduction in net profitability.

The matter of SOC loss is also an issue of long-term environmental concern. Simple N mass balance calculations strongly suggest that at current economically optimum rates on corn-soybean rotations the organic matter in the soil is being “mined” to provide the additional N needed to balance N inputs and outputs. Lower-rate N application rates on corn-soybean rotations will only increase the SOC depletion rate if it is assumed current yields can be maintained. Over the long term, loss of SOC will result in poorer soil tilth and potentially greater environmental consequences than hypoxia per se. The draft report concludes, however, that “There is no direct evidence for an effect of lower non-zero fertilizer rates, near the economic optimum, leading to decreases in SOC.” If the same standard is applied to hypoxia as a whole, it would also be correct to say there is no direct evidence for an effect of lower nitrogen loads leading to a decrease in the size and frequency of the hypoxic area. The potential loss of SOC associated with lower-rate N applications is a topic that deserves much more discussion than a simple dismissal of “no direct evidence”.

Adaptive management

Based on a review of the draft report, I believe the honest answers to the two questions posed in the second paragraph of my comments are “no” and “no”. The complexities of N and P fate and transport in the upper and lower basins as well as the northern Gulf make it extremely difficult to predict N or P load responses to agricultural management practice changes or to predict hypoxic area responses to N and P load changes. The concept of adaptive management is mentioned several places in the draft report (although not in the Summary and Findings) and given the complexities and uncertainties, an adaptive management framework seems appropriate. However attractive and appropriate it may be, there are several concerns that need to be recognized.

- The timeframe for adaptive management is necessarily long. Even if significant changes in land use, wastewater treatment (e.g., nutrient removal) and other sources of nutrients could be achieved in the short term, which is highly unlikely, the response to such changes may take many years, perhaps decades to detect. This requires a long term approach and the question is whether the institutional framework exists to make this approach work. If the panel recommends an adaptive management model, it would be appropriate to also caution that such an approach would likely take a commitment of decades.

- An adaptive management approach requires accurate data to be able to empirically establish accurate cause and effect relationships. The question is whether the data needed to accurately measure the assumed causal and response factors exist. For instance, can it be determined if producers in the corn belt significantly reduce N rates or shift from fall anhydrous to late spring UAN applications? Our work in Iowa suggests it is very difficult to accurately determine N application practices on anything but a gross, statewide basis. Wholesale land use changes such as conversion of crop ground to perennial grasses can generally be documented through remote sensing but smaller scale changes such as the land area under no till or conservation till versus conventional till is very difficult to determine accurately. Also, the water quality monitoring data (present, past and future) needed to detect trends may be missing or inadequate. If the panel recommends an adaptive management approach, it should highlight the data that will be needed to feed back into this systems approach and make recommendations accordingly.

- Will N (and/or P) reductions short of the target recommendations result in improvement? A key issue in the adaptive management approach is whether a reduction in the size and frequency of the hypoxic area would be expected with load reductions smaller than the target 45 to 60 percent N load reduction. Or is 45 percent N reduction a threshold below which improvements (i.e., a decrease short of the 5000 km^2 goal but a decrease nonetheless) would not be expected? Some nutrient research in the upper basin suggests that water quality improvement may not be achieved by nutrient reductions unless nutrient concentrations can be reduced below a certain threshold, thresholds that are often considerably below existing levels. Is this the case with the Gulf or would smaller nutrient load reductions be expected to result in proportional improvements? The draft report does not address this important issue. The challenge of achieving a 45 percent N load reduction is so great that many might simply dismiss this target as not being feasible short of major land use changes. If lesser reductions, say 15 percent, would be expected to pay dividends, there may be better overall acceptance of the need to continue to reduce nutrient loads on the part of producers.

In general, the draft report does a relatively good job of identifying the challenges in bringing good science to the hypoxia problem, with some sections doing a better job than others. However, the draft report fails to address several key issues with the clarity that will be needed to formulate an effective Gulf hypoxia action plan. The two most glaring deficiencies in my mind are the relatively weak scientific justifications for the recommended N and P load reductions and the lack of a clear message as to the agricultural management practice changes that will be needed achieve those levels of load reductions. Hopefully the final report will address these shortcomings in a manner that will lead to an effective, science-based hypoxia action plan.

Thank you for the opportunity to comment.

Sincerely,

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