The Fertilizer Institute

Nourish, Replenish, Grow

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Re: EPA Draft Science Advisory Board Hypoxia Advisory Panel Public Draft (May 24, 2007)

Dear Mr. Brown and Ms. Stallworth:

The Fertilizer Institute (TFI), on behalf of its member companies, submits these comments in response to the U.S. Environmental Protection Agency's (EPA's) *Draft Science Advisory Board Hypoxia Report*. The document was not announced in the *Federal Register* but released for public review on May 24.

Statement of Interest

TFI represents the nation's fertilizer industry. Producers, manufacturers, retailers, trading firms and equipment manufacturers, which comprise its membership, are served by a full-time Washington, D.C., staff in various legislative, educational and technical areas as well as with information and public relations programs.

As TFI member companies produce and distribute fertilizer nutrients, we have a substantive interest in this report on Gulf of Mexico (GOM) hypoxia.

General Comments

TFI would like to thank the EPA Science Advisory Board (SAB) Hypoxia Advisory Panel for its thoughtful and thorough evaluation of the science regarding hypoxia in the Gulf of Mexico (GOM) and potential nutrient mitigation and control options in the Mississippi-Atchafalaya River Basin. The panel did a commendable job of sorting through the extensive

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scientific literature that has emerged since the 1999 Integrated Assessment Report and compiling the SAB Draft Report.

TFI supports the findings regarding the complex interactions between climate, weather, basin morphology, circulation patterns, water retention times, freshwater inflows, stratification, mixing, and nutrient loadings that determine the nature and extent of hypoxic conditions in the Gulf of Mexico. TFI is encouraged by much of the data presented on nutrient loads, concentrations, speciation, seasonality and biogeochemical recycling processes that are important causal factors in the development and persistence of hypoxia in the Gulf. TFI also supports the concepts of encouraging nutrient management planning through our right rate, right time, right product and right place paradigm. These best management practices are most effective when paired with appropriate conservation practices which may include no-till or low-till, buffer strips, advanced drainage management and enhanced efficiency fertilizers. In addition, we promote a focus on nutrient use efficiency that allows both an environmental and economic goal to be incorporated while increasing crop yields and ensuring that acres farmed are used most efficiently (land use efficiency). U.S. Corn yields have increased on average 1.8 bushels/acre/year over the last 25, years while the nitrogen input has been steady or slightly declining.

Nutrients, though, come from many sources and systematic changes to the GOM through loss of wetlands, alterations and channelization of transit routes, and extreme weather events which strongly impact the health of the overall ecosystem and must also be addressed to positively change the trend and direction of the hypoxic zone. This includes use of improved public and private land management, better and more consistent monitoring throughout the GOM, and a cooperative, incentive-based approach for addressing hypoxia in the Gulf.

However, TFI remains concerned with certain portions of the SAB Draft Report. TFI would encourage the panel to review the document with a primary objective to strengthen the balance and consistency of emphasis on the role that fertilizers play in Gulf hypoxia. In its current form, the report still makes attempts to correlate fertilizer use with hypoxic conditions, de-emphasizes the roles of other point and nonpoint nutrient sources, focuses a disproportionate amount of capital and effort on fertilizer management strategies and gives little credit for U.S. Department of Agriculture (USDA) conservation efforts or to farmers who have made significant efforts to date to control nutrient losses to the Basin's waters.

Response to Comments

On June 29, TFI provided the SAB with extensive, detailed comments on the draft Hypoxia Report. While we understand that the SAB is under no legal obligation to respond to comments, by establishing a public comment period we believe the panel should follow established protocol governing response to comments (including generating a "*Response to Comments*" document). A Response to Comments document would allow the panel to establish some means of allowing commenters to understand which comments were accepted, rejected or countered, and some rationale for how and why each decision was made. TFI is a long-standing participant in the public policy debate associated with the hypoxia issue, and has a vested interest in understanding the current science used in assessing

hypoxic conditions and determining how policy recommendations for the GOM are formulated. Therefore, TFI requests a greater level of transparency in how comments are assessed in these determinations. TFI again includes the full set of comments from our June 29 response, so that these may be evaluated in writing in the Final Report.

Continued Overemphasis on Agriculture

As noted in our earlier comments, TFI remains concerned that the SAB panel places excessive emphasis on agriculture's role in the formation of hypoxic conditions in the GOM. Despite data provided since 1999, the SAB continues to discount the physical, hydrologic and other anthropogenic sources of hypoxic conditions in order to focus recommendations on needed changes to the U.S. agriculture sector. Further, there appears to be a trend towards decreasing nutrient inputs to the Gulf. However, these reductions are discounted or are arbitrarily assigned to sources other than agriculture with little or no supporting data. While some discussion of BMP and other agriculture practices are included in Section 4, no attempt is made to aggregate or estimate the impact that these improvements have made on reducing nutrient inputs to the Gulf. Progress has been made in the agriculture sector, and TFI requests that the final Hypoxia Report provide a more balanced review of the relative source contributions to GOM hypoxia and some meaningful estimate of progress made to date by agriculture.

Adaptive Management and Uncertainty

While we agree with the statement on p. 121 that "*(a)daptive management does not postpone actions until "enough" is known about managed ecosystem* (Lee, 1999), *but rather is designed to support action in the face of the limitations of scientific knowledge and the complexities and stochastic behavior of large ecosystems* (Holling, 1978)," TFI disagrees with how this principle is applied in the context of recommendations for GOM hypoxia. TFI remains concerned that the inability to measure BMP efficacy, the reluctance by policy makers to credit farmers and ranchers with progress to date such as acres in conservation reserve or low or no-till systems and corresponding volumes of soil erosion prevented. This continued emphasis on agriculture as the primary cause of hypoxic conditions will only lead to more draconian control measures in the future.

The Panel's dismissal of voluntary programs, recommendations for unauthorized regulatory fixes (including fertilizer taxes, fall application elimination and fertilizer use restrictions), land management use policies that impinge on private property rights (Principles of Landscape Design, pp. 141-143), and scientifically unsupported forecasts of future impairment from agriculture and wholesale changes in crop selection do not indicate a willingness to partner with the U.S. agricultural sector in finding reasonable solutions to GOM hypoxia.

Combined with the findings of EPA that the SAB Panel's recommendations are "*...not likely to be as stringent as would be obtained if states adopted EPA's recommended reference condition values into state water quality standards for all waters*" and past and potential future "regime shifts" in the GOM hypoxia paradigm, **the draft report provides little**

incentive for farmers to participate in any GOM hypoxia-specific programs. TFI and U.S. agriculture will continue to implement BMPs and other landscape changes to increase water quality at the watershed and national scale, but we request that the SAB panel review the Hypoxia Report with an eye towards crediting farmers with progress made to date and limiting recommendations to reasonable actions that can be taken at the farm level commensurate with the level of uncertainty in the current understanding of GOM hypoxia. These concerns are captured in more detail in the specific comments below.

Specific Comments - Executive Summary

p. 2. *While the state of predictive and process models of NGOM hypoxia has continued to develop since 2000, the models similar to those in place at that time are still the best tools for estimating a dose response estimate for nitrogen (N) reductions, with most recent model runs showing a 45 – 55% required reduction for N in order to reduce the size of the hypoxic zone.*

The use of the term "dose response" throughout this document implies a level of precision and accuracy that is not supported by either the empirical data or modeling used throughout the Draft Report. TFI requests that this term not be used in the Final Report.

Recommendations for Monitoring and Research

p 4. TFI requests that a bullet be added to this section recognizing the uncertainty associated with the loss of coastal wetlands and associated barrier islands and its effect on nutrient loading, assimilative capacity and potential impact on "regime changes" in GOM hypoxia.

Management Options

p. 6. *"Conversion to alternative cropping systems (e.g., using perennials or alternative rotation systems) and promotion of environmentally sustainable approaches to biofuel production in targeted areas of the basin"*

The SAB Panel has not provided sufficient data to make this recommendation. Limited data are provided to quantify environmental benefits, no economic data are provided to judge the viability of markets for these goods, and no data is provided to determine the technical or market feasibility of alternative biofuel production. TFI requests that this recommendation be removed from the final Report. Scant mention is made of the USDA Conservation Effects Assessment Program (CEAP), which is dedicated to assessing the efficacy of conservation programs.

p. 6. *Improved management of nutrients by emphasizing infield nutrient management efficiency and effectiveness to reduce losses;*

TFI requests that improved be replaced with "continued" in this recommendation.

p. 7. *Significant reductions in nutrient runoff could also be achieved if nutrients are managed more efficiently on farms, for example moving to spring fertilization rather than*

fall.

This recommendation is not supported by the limited data presented in the draft Report. TFI requests that this statement be removed from the final version.

p. 7. *Subsidies, not regulation, have been the government's primary tool for managing agricultural production and income support in the U.S. as well as conservation in agriculture.*

p. 8. *Although uncertainty remains, there is an abundance of information on how to reduce hypoxia in the Gulf of Mexico and to improve water quality in the MARB, much of it highlighted in the Integrated Assessment. To utilize that information, it may be necessary to confront the conflicts between certain aspects of current agricultural and energy policies on the one hand and the goals of hypoxia reduction and improving water quality on the other.*

These statement are opinions, not facts supported by data in the Draft Report. Further, if a new regulatory regime is to be suggested or implied by the SAB, a thorough discussion of costs, benefits, and obstacles to adoption should be included. TFI requests that biased statements regarding current agriculture and energy policies be rewritten or eliminated throughout the Final Report.

Introduction

p. 10 *Nutrients enter ecosystems through off-target migration of fertilizer from agricultural fields, golf courses, and lawns; atmospheric deposition of nitrogen; erosion of soil containing nutrients; sewage treatment plant discharges; and other industrial discharges.*

Please include combined sewer overflow (CSO) and septic tank systems in the list of relative source contributions. Please include some qualitative or quantitative discussion of the relative nutrient contribution of these sources. EPA has estimated (2005) **that greater than one trillion gallons of untreated wastewater flow from CSO sources per year**; yet the panel makes no attempt to quantify or include this important source of untreated nutrients and waste in the model.

Hydraulic Control Options

p . 25. *"It thus appears likely that increases in freshwater discharge from the Atchafalaya River and resulting increased stratification from the early 1900's to the mid-1970's have increased the area of the Louisiana-Texas continental shelf that is prone to bottom layer hypoxia."*

pp. 26-27. *The opportunity exists for EPA and other federal and management agencies to urge flow diversion strategies that also consider the goal of reducing the volume and bottom area of hypoxic waters on the NGOM shelf without endangering other estuarine and coastal waters. The CPRA/USACE proposals also highlight the need for interagency coordination and for an integrated approach to management strategies for jointly addressing multiple*

issues including hypoxia, coastal protection, and coastal inundation.

While TFI agrees with the panel's finding on the importance of changes to the hydraulic regime of the Mississippi and Atchafalaya Rivers to the temporal and spatial extent of Gulf hypoxia, we are concerned that this option is not discussed further in *Section 4: Scientific Basis for Goals and Management Options*. Given the importance of the amount and timing of freshwater inputs to the shelf relative to vertical mixing intensity, stratification and hypoxia, TFI requests that further discussion of hydraulic control options be included in the final SAB Report beyond the one-paragraph summary included on page 22. The amount of freshwater flowing into the GOM system still has the strongest correlation of any of the variables studied to date.

p. 31. *The SAB Panel finds that 20th century changes in the hydrologic regime of the Mississippi and Atchafalaya Rivers and the timing of freshwater inputs to the Louisiana-Texas continental shelf have likely increased the shelf area with potential for hypoxia, although these changes occurred mostly from the 1920s to the 1960s, before the measured onset of hypoxia in the mid-1970s.*

Why are hydraulic changes to the River system dismissed in the Key Findings and Recommendations section? While most of the systemic changes may have occurred prior to 1970, the effects of these changes are still in existence and contributing to current hypoxic conditions. TFI believes that a comprehensive approach is required to effectively reduce the hypoxic zone. TFI requests that this finding be rewritten or eliminated from the Final Report.

2.1.4 Other Limiting Factors and the Role of Silica

p. 39 *One important aspect of differential nutrient loading is the well-documented increase in N and P relative to Si loading (Humborg et al., 200). Agricultural, urban and industrial development and hydrologic alterations in the MARB have led to dramatic increases in N and P relative to Si loading. In addition, human activities through the construction of reservoirs have further exacerbated this situation, by sequestering/trapping Si relative to N and P and reducing the loads of Si to the Gulf of Mexico (Turner and Rabalais, 1991).*

While TFI agrees with this statement, we again raise the issue of why municipal and suburban contributions to loading and other changes in physical/hydrologic parameters are not discussed in Section 4. TFI again requests that these relative source contributions be qualified/quantified and that management options be discussed in the Final Report.

Synthesis Efforts Regarding Organic Matter Sources

p. 44 *Several studies, including those of Rabalais et al. (2002), Turner et al. (2007), Justic et al. (2007) and Rabalais et al. (2007), largely reaffirm the primacy of river nutrients in supporting high rates of in-situ primary production as the dominant source of OM supporting intense ecosystem respiration and development of hypoxic conditions. More recently, Walker and Rabalais (2006) analyzed SeaWiFS algal biomass data in relationship*

to river flow, nitrate loads from rivers and hypoxia. ***Results confirmed strong relationships between nutrient loading and algal biomass distributions; direct relationships to hypoxic waters remained elusive for a variety of reasons.*** *The importance of this work lies in the fact that the whole hypoxic-prone zone was assessed in a synoptic fashion and data were available for both low and high nutrient load periods. Dagg et al. (20076) also reviewed data to determine Mississippi River plume contributions to hypoxia. Results were largely consistent with those noted above, but Dagg et al. (2006) focused on the important role of the plume in both producing and consuming organic matter and dissolved oxygen and in building a case for the importance of coastal wetlands as an important organic matter source. However, there are problems with the magnitude of wetland OM contributions suggested by these calculations, including conversion of wetland sediment losses to OM mass, no consideration for on-marsh respiration of this material, and no consideration of the refractory nature of the particulate a major portion of this OM****. Based on present understanding of the issue, it seems unlikely that wetland loss could be a prime source of OM to the hypoxic zone. {emphasis added}***

pp. 46-47. *DOM and POM delivered to the NGOM by rivers and from coastal wetland losses represent potential OM sources. The weight of evidence currently available suggests that it is unlikely these were triggers for hypoxia development or primary OM sources for hypoxia maintenance. However, the magnitude of river OM sources is large, and hence further characterization of this material is warranted.*

In a single paragraph, the lack of direct relationships between nutrients and hypoxic waters are downplayed while another potential contributing source is dismissed out-of-hand. Later, there is discussion of research that indicates organic matter was "*equivalent to about 23% of the OM needed to create observed hypoxia on the full shelf.*" However, the Key Findings and Recommendations again dismiss the importance of organic matter. TFI requests that this section be reviewed for some consensus on the role of organic matter and coastal wetlands loss in the formation of hypoxia.

TFI believes that more work is needed on the effects of coastal wetlands and barrier island loss on coastal hypoxia. Between 1990 and 2000, wetland loss was approximately 24 square miles per year. The projected loss over the next 50 years, with current restoration efforts taken into account, is estimated to be approximately 500 square miles (Barras et al. 2003). These coastal wetlands and barrier islands also play a critical role in protecting the region from hurricane strength storms. According to land loss estimates, Hurricanes Katrina and Rita transformed 217 square miles of marsh to open water in coastal Louisiana (USGS 2006).

It is counterintuitive that this large-scale loss of organic material, nutrients, water retention time, as well as denitrification and filtering capacity is not a major confounding variable in coastal hypoxia. Also, the transition from marsh to open water would indicate that the shallow shelf upon which hypoxic conditions arise is increasing with time – a section that is geographically contiguous with hypoxic areas. Clearly, wetlands loss converts to shallow shelf surface water areas that are then more prone to hypoxic conditions. Please enhance the discussion surrounding this topic.

Finally, given the data that Gulf hypoxia worsened following the 1993 flood, there is reason to believe that the cause-and-effect paradigm would again shift following recent 2005 flooding events. TFI encourages the panel to include additional research and discussion on this topic and its potential for causing significant nutrient upwelling and recirculation thus contributing to more severe hypoxic conditions.

2.1.7 Possible Regime Shift in the Gulf of Mexico

p. 50. *It appears that the Gulf of Mexico hypoxia has worsened following the record breaking 1993 spring floods, e.g., smaller river flows now induce a larger response in hypoxia (see Section 2.1.2). The first large (>15,000 km2) hypoxic event occurred after the 1993 flood, with large hypoxia areas over 15,000 km2 observed in most following years.*

Please include discussion of the flooding following the 2005 hurricanes and how these may have further affected the "regime shift." The 2007 hypoxic zone was the third largest recorded, yet the Draft Report does not include any discussion of potential reasons for these measurements.

Current Extent and Patterns of Agricultural Drainage

p. 60. *Based on the USDA surveys, some degree of subsurface drainage is present on 13 million hectares (over 32 million acres) in the Midwest states. However, there is considerable uncertainty with respect to the actual extent and distribution of drainage of cultivated cropland. In the absence of additional survey data, more recent estimates of the extent of drained agricultural land have been developed based on land use and soil class/characteristics (Jaynes and James, 2007; Sugg, 2007). This general approach needs further development and validation but seems to provide the best current estimate of the extent of agricultural drainage.*

p. 73. *Therefore, the river is disproportionately enriched with all nutrients during the spring but particularly with nitrate. This result further substantiates the conclusion drawn earlier that tile-drained fields are a primary source of N, which is released beginning in winter (Ohio into central Illinois) to spring (northern Illinois, Iowa and Minnesota). This influence was very evident in 2002, when 50% of the nitrate-N flux occurred during the 3 spring months. Royer et al. (2006) pointed out how most of the N and P flux from tile drained watersheds occurred during a few months during winter and spring each year, further supporting the trends at this larger scale.*

p. 77. *The greater yields from the upper Mississippi and Ohio-Tennessee River basins no doubt reflect the relative sizes of the basins when compared to the Missouri River but also the importance of point sources in the basins, as well as more intensive agricultural inputs.*

p. 79. *However, the upper Mississippi River subbasin has experienced a decreasing trend in annual flow since the mid 1990s (Figure 26). What appears to be only a slight decrease in nitrate-N yield in the upper Mississippi subbasin in response to what the panel thinks are greatly decreasing net N inputs, demonstrates the difficulty in predicting riverine nutrient*

yields in tile-drained agricultural lands.

p. 81. *Finally, another factor may be an increase in tile drainage intensity in the region, combined with increasing fall fertilization and warmer winter temperatures. New and replacement tile drainage is added every year to this region, although no data are available to quantify the increase. Fall application of anhydrous ammonia in much of the region has increased greatly since the 1980s (see later discussion in section 4.5.6 for supporting sales and USDA ARMS data). The four states of the upper Mississippi River basin (Minnesota, Wisconsin, Iowa and Illinois) all show an increasing winter (November through March) temperature (for the months following fall application of anhydrous ammonia all show strong increasing trends in winter temperatures during the last 30 years, data not shown). Warmer soils would increase nitrification rates and lead to higher concentrations of soil nitrate that could be lost with late winter and spring precipitation. Therefore, fall applied anhydrous ammonia could be a more important source of spring nitrate-N flux in this subbasin during recent years and, when combined with changing N input and output patterns, may be keeping the flux steady despite the reduction in annual net N inputs.*

p. 86. *Further research is needed to determine why riverine spring nitrate-N fluxes are not declining in response to annual net N input decreases, which will inform management decisions for corn/soybean agriculture.*

While not disagreeing that tile-drained lands contribute nutrients to the River system, TFI disagrees with the conclusion that "tile-drained fields are a primary source of N." Given the "*uncertainty with respect to the actual extent and distribution of drainage cultivated cropland*" and the fact that none of the research cited adequately eliminates municipal, industrial, and nonpoint sources or the effects of CSO (which would also be expected to significantly contribute during the three spring months), TFI requests that all discussions of tile-drained fields as relative sources and source management options accurately reflect the uncertainty associated with this farming practice, as well as a more thorough quantification of the RSC from other sources.

TFI also requests that problems associated with modeling nutrient contributions to the River not immediately be explained in terms of agricultural practices. The data do not support the speculation concerning fall application, there is no discussion of potential problems with the model itself, and other anthropogenic sources are not adequately qualified or quantified. TFI also requests that the recommendation on p. 86 be changed to say "...**management decisions for all anthropogenic sources.**"

3.2 Mass Balance of Nutrients

p. 88. *In fact, this rapid increase in crop production has led to a small decrease in NANI from about 17 kg N/ha/yr (15 lb N/ac/yr) in 2000, to net N inputs of 14 kg N ha/yr (12.5 lb N/ac/yr) in 2004 and 2005 (McIsaac, 2006).*

p. 89. *The subbasins that contribute the greatest N flux to the Gulf are the upper Mississippi*

and Ohio River basins, due largely to the intensity of agriculture with concomitant large inputs of N from fertilizer and fixation combined with the system of tile drains. Therefore, when the nitrogen balance is presented by subbasin (Figure 32) the highest net nitrogen inputs are to those subbasins.

p. 90. *However, a closer look at the inputs to the upper Mississippi River basin shows that, even though N inputs from fertilizer and N2 fixation appear to be fairly level during recent years, the amount of N removed during harvest continues to increase, resulting in a substantial decline in NANI (Figure 33). These changes are not reflected in the other subbasins, which lead to a small decline in NANI to the overall basin.*

p. 92. *Given that there are denitrification losses (that are unmeasured), this result indicates that N must be coming from a depletion of soil N pools, as suggested by Jaynes et al. (2001).*

p. 98. *New methods have been used to calculate N mass balances in this report (net anthropogenic N inputs, NANI). NANI and net P inputs for MARB have increased greatly since the 1950s; but have decreased in the past decade because of steady fertilizer applications and increased crop yields for N, and reduced fertilizer applications and increased crop yields for P. Mass balances in the upper Mississippi river subbasin suggest that under the current tile drained corn and soybean management system depletion of soil organic N pools may be occurring.*

The NANI model uses state-level fertilizer sales as a proxy for fertilizer inputs. As we have tried to explain since 1999, these data may overestimate fertilizer inputs because of the resale of fertilizer to different business entities. It also is unclear how municipal waste is quantified in the NANI model. Further, there is no indication of how population increases in the MARB states are accounted for in the model. For example, the U.S. Census Bureau (http://www.census.gov/compendia/statab/tables/07s0029.xls) estimates that in 1960 8.4 million people lived in coastal counties in the GOM watershed. In 2005, that number had more than doubled to 19.5 million. There is likely a concomitant increase in people living within the MARB watershed. This increase in population also has increased the discharges from wastewater treatment plants, underground septic systems, and CSOs.

There is no discussion of why fertilizer use is the sole possible source for the lack of a decrease in riverine N. The discussion in this section simply assumes that the model is accurate and that any subsequent failings to explain empirical data is the result of additional agriculture inputs not otherwise captured. TFI requests that this entire section be carefully reviewed and rewritten to include potential limits/problems with the model and other potential anthropogenic contributions of nutrients to the MARB.

3.3 Nutrient Transport Processes

p. 102. *Land-disturbing activities (e.g., urban development and mining) can be a significant source of sediment P, particularly when eroded sediments are rich in nutrients because of past agricultural practices. For example, construction of one side channel on the Missouri River floodplain has been calculated to contribute ~ 4,000 metric ton P (4,400 ton P) to the*

river (Kristin Perry, Missouri Clean Water Commission, presentation to SAB Panel, June 2007).

Given increases in population, residential building, septic systems and loads from nonpoint sources and wastewater, TFI requests that the Panel include discussion of these increasing contributions and potential management options available.

4.2 Setting Targets for Nitrogen and Phosphorous Reduction

TFI cannot provide substantive comments on this section when the model used is currently listed as "*under review*." Please provide the model for public and peer review and allow time for review and comment.

Baseline for Reductions

p. 127. *This suggests that during the important high flow spring period (April, May, June), reductions in nitrate-N flux to the NGOM have not occurred under management systems and programs now in place since the last report. However, the annual nitrate-N reduction indicates that the tile drained corn and soybean systems in the Upper Mississippi and Ohio River subbasins seem responsive on an annual basis to the recent reductions in net N inputs, as discussed in Section 3.2. Whether spring nitrate-N loads will respond to these changes in NANI is uncertain at this time.*

Again, unless other anthropogenic sources are eliminated as contributors, the panel cannot simply assign this as an agricultural problem. A thorough review of the inherent bias in this entire argument is requested by TFI.

Fertilizer Tax is Not Appropriate

p 140. *Table 11: Summary of Policies and Findings from Integrated Economic-Biophysical Models (and related discussions)*

4.4.5 Taxes

pp. 151-152. *The incidence of a tax (and thus determination of who pays the costs) is likely to fall on farmers and consumers of food products made from crops that use fertilizer. In contrast, the incidence of conservation program payments is largely on tax payers. Finally, it is important to note that tax instruments will be more efficient the more broadly they are applied to the various nutrient sources identified as pollutant contributors; so ideally a tax would be applied to all nutrient sources rather than singly to fertilizer.*

TFI disagrees that a nitrogen fertilizer tax is an appropriate policy to address Gulf hypoxia. Most economic studies of fertilizer nutrient demand indicate that fertilizer demand is quite inelastic (Burrell, 1989, Denbaly and Vroomen, 1993; Larson and Vroomen, 1991); that is, an increase in nutrient price brings about a less than (typically significantly less than)

proportional decrease in demand. For example, in their study of nutrient demand in U.S. corn production, USDA economists Denbaly and Vroomen (1993) concluded that "*Elasticities estimated here indicate that a tax on fertilizer would have only limited effectiveness in reducing fertilizer nutrient use in corn production*." Similarly, USDA economists Larson and Vroomen (1991) conclude, "*Thus, while a uniform tax policy on fertilizer may be relatively easy to implement, more location-specific technology-based policies, such as "best management" practices, may be necessary to achieve desired environmental benefits*."

The concept of fertilizer as a "cheap" input that is over applied beyond realistic yield expectations or as insurance is dated and counterproductive. According to USDA data, the cost of nitrogen fertilizers increased 121 percent from 1999 to 2006, while potash and phosphate prices increased 37 percent over the same period. U.S. fertilizer prices paid by farmers have continued to rise since 2006 and hit an all time high in May 2007 as nitrogen prices stood 161 percent above the 1999 level while potash and phosphate prices were up 74 percent compared to 1999.

Furthermore, USDA data indicate that the prices paid by farmers have increased significantly more than the prices received, particularly for inputs like fertilizer. USDA's Index of Prices Paid for Commodities and Services, Interest, Taxes, and Farm Wage Rates (PPITW) for May 2007 stood 58 percent above the 1990-92 average, while the index of fertilizers prices paid by farmers was up 117 percent from 1990-92. Meanwhile, USDA's All Farm Products Index of Prices Received by Farmers in May 2007 **was up only 38 percent from its 1990-92 base**. With fertilizer prices at these levels, assuming farmers over apply fertilizer nutrients does not make economic sense.

Two USDA studies on nutrient demand and implications of taxing regimes are included for the Panel's review and use (Larson and Vroomen, 1993; Denbaly and Vroomen, 1991).

4.4.1 Voluntary Programs

p 146. Given the historical aversion to imposing mandatory requirements in agriculture, the collective weight of these studies suggest that voluntary agreements that do not have incentives associated with them are not likely to be adequate on their own to achieve significant reductions in nutrient runoff. In short, voluntary programs without incentives can have small effects but cannot be relied upon to induce major environmental improvements.

TFI does not believe that a cursory review of four studies, many of which do not include agriculturally related programs, provides the "collective weight of evidence" necessary to suggest that voluntary agreements will not achieve significant reductions in nutrient runoff. TFI requests the panel to include some review of agriculture – related voluntary agreements and their results and to remove this conclusion from the final Report.

4.5.4 Cropping Systems

p. 168. *Clearly, including perennial crops in a rotation, as well as conversion to perennial*

systems, can reduce NO3 leaching, partly due to the fact that perennials are generally more efficient users of N than annuals. As a result, Randall and Vetsch (2005) raises a key question of whether significant reductions in nutrient (especially NO3) loadings to surface waters are possible without changing from the predominant annual cropping system of corn-soybean rotation to a mixed system that includes perennials. While annual grain crop production is an essential component of agricultural systems in several areas of the MARB, the development of economically viable continuous cropping systems will help improve in-field nutrient use efficiency and decrease off-site loads.

This assumes a viable market for these goods. Some qualification of this recommendation is needed.

Fertilizer Use and Application Technology

p. 179. *Although it is not possible to correlate fall N application directly with fall fertilizer N sales, it is likely that a large fraction of the fall N sales represents N applied in the fall Czapar et al., 2007).*

p. 182. *The effects of fall N application versus spring N application on nitrate transport in tile drainage depend on many factors, including soil temperatures, soil texture, precipitation, and drainage intensity.*

p. 182. *If these various estimates of N use and nitrate-N loss are combined, changing from fall to spring application may affect at least 25% of the corn acreage and reduce nitrate-N losses to streams by perhaps 15 to 30%. This represents an estimated 4 to 8% reduction in nitrate-N load from all corn acreage in the upper MARB. Depending on losses of nitrate-N in tile drainage (estimated at 20 to 40 kg N ha/yr or 18 to 36 lb N/ac/yr), this change in practice would amount to a nitrate-N load reduction ranging from about 15,000 metric tonne N/yr (16,500 ton N/yr) to about 61,000 metric tonne N/yr (67,000 ton N/yr). This load reduction is 5 to 19% of the spring nitrate-N load reduction goal (320,000 metric tonne N/yr or 353,000 ton N/yr) and 2 to 7% of the annual N load reduction goal (820,000 metric tonne N/yr or 904,000 ton N/yr).*

The discussion of fall fertilizer use remains speculative, at best. The data do support a quantified estimate of loading reduction. TFI requests that this section quantify the uncertainty associated with any quantified loading reductions. Also, TFI requests that a similar level-of-effort be placed into qualifying and quantifying relative source contributions and reduction potential from other anthropogenic sources, such as nonpoint runoff from residential and urban sources (p. 198) and CSO contributions.

Include Data on Urban/Suburban Nonpoint Source Improvements

p. 198. *Although controlling urban non-point sources can provide significant benefits from improvements to local water quality, these non-point sources are not significant determinants of hypoxia in the Gulf of Mexico, both because concentrations tend to be lower than those from agricultural sources, and because the urban land comprises less than 1% of the*

Mississippi River Basin (e.g., Mitsch et al, 1999). Thus, although actions to reduce urban non-point sources may be justified, these control actions will not likely contribute significantly to reductions in the size of the Gulf of Mexico hypoxic zone. Since control of urban non-point sources will not have an important role in reducing hypoxia, we do not focus on actions to reduce urban non-point sources of nutrients in this report.

TFI disagrees with the absence of discussion on urban/suburban nonpoint sources and the conclusion that "*these control actions will not likely contribute significantly to reductions in the size of the Gulf of Mexico hypoxic zone."* TFI requests that the panel include some data on urban/suburban nonpoint source improvements, especially given population changes and increases in residential construction since 1999. In addition, nutrients are used on suburban lands, golf courses, and publicly owned lands which comprise far more than 1 percent of the MARB. Finally, many lawn and garden fertilizer companies have developed advanced efficiency or slow release products that are tailored to limit nutrient losses and protect watersheds. Phosphate free products (or low P) are now widely available and the N formulations for lawns typically include significant percentages of a variety of slow release compounds. These formulary changes have the potential to significantly reduce environmental losses and thus need to be considered in management strategies.

Rewrite Ethanol and Water Quality Section

pp. 201-210. As currently written, this section does not pass muster in terms of appearing to be scientifically balanced. At a minimum, land conversion, nutrient use and loss, cattle increase, and ethanol concentration scenarios in this section should be labeled as "worst-case" projections. A preferred alternative is that the panel rewrite this section incorporating more of the available credible literature on biofuel projections. The table below indicates possible efficiencies of corn to ethanol production given varying energy sources and techniques; and energy input estimates are accurately characterized therein (McElroy, 2007, *Capturing Carbon Opportunities*):

Corn-Ethanol System	Emission Reduction	Carbon Offset (Mt)*	Carbon Credit ($)**
Industry aggregrate estimate (Farrell 2006)	13%	76,370	305,481
Natural gas-fired dry-mill plant w/ drying DG	40%	234,986	939,943
Natural Gas-fired dry-mill plant w/ wet DG	70%	411,225	1,644,900
Closed-loop plant w/ feedlot & an. digestion	80%	469,971	1,879,885

*Based on a 100 million gallon ethanol plant; fermentation CO_2 not included (nuetral)
**$4 per metric ton CO_2, Dec. 2006, http://www.chicagoclimateexchange.com/

SOURCE: Adam J. Liska, University of Nebraska Department of Agronomy and Horticulture, Nebraska Center for Energy Sciences Research.

In addition, this work estimates significant overall emission reductions in GHG pollutants depending on the corn-ethanol system utilized. For example, the USDA projects production capacity in the industry to exceed 12 billion gallons within a few years, with further expansion in ethanol output during the next decade is expected to be more moderate. Even with less than full capacity utilization in the industry, USDA expects ethanol production grows to more than 12 billion gallons by 2015. USDA's 2007 long-term projections indicate that more than 30 percent of the corn crop will be used to produce ethanol by 2009/10, remaining near that share in subsequent years. A roughly 33 percent increase in biodiesel use by 2017 will increase soybean demand and prices. USDA projects that increased corn prices will have a dampening effect on the number of cattle and chickens raised in the United States. Increased commodity prices projected over the next 10 years translate into smaller government payments under current farm commodity programs. (Wescott, P. *Ethanol Expansion in the United States: How Will the Agricultural Sector Adjust*? USDA. May, 2007).

This would result in an increase of 55 million kg N (120 million lb) annually to the MARB if fertilization and other management practices remain the same.

Assumptions such as "other management practices remain the same" are both vague and misleading. Again, U.S. farmers have greatly decreased nutrient use per bushel of corn produced over the last two decades. This trend is expected to increase as more precise best management practices are implemented across the landscape. Biotechnology advances paired with more sophisticated management techniques are currently increasing genetic yield potential by an estimated 3 percent per year. Targeted conservation practices should further minimize nutrient losses to the MARB, as suggested by current flux trends.

Farrell et al. (*Science*, Jan. 27, 2006) note that the two studies (Patzek, Pimental, references 11, 12 in article) *stand apart from others by incorrectly assuming that ethanol coproducts should not be credited with any of the input energy and by including some input data that are old and unrepresentative of current processes*… As an example, Patzek uses the assumption that all corn grown in the Midwest is fertilized with ammonium nitrate (AN); whereas in reality anhydrous ammonia is typically the preferred N source. This assumption compounds the error in net energy calculations not only by the conversion of anhydrous to AN but also the efficiency of N uptake within the cropping system.

Longer-term advances in commercial cellulosic ethanol production and further increases in efficiency in the corn-ethanol system will also change nutrient use and loss projections in the MARB. TFI strongly encourages the panel to rewrite this entire section with an eye towards a more robust data set, more realistic assumptions and some discussion of the uncertainty of the projections provided.

The Corps is dumping large quantities of Missouri Soil into the Missouri River

There are other projects initiated by the federal government that contribute significant quantities of nutrients to the watershed yet are omitted from referenced models and nutrient budgets. For example, at the request of the Fish and Wildlife Service, the U.S. Army Corps of Engineers is digging 22.9 miles of chutes through river-bottom ground along the Missouri River. These chutes are intended to create habitat for the endangered pallid sturgeon. The 2007 and 2008 budget for these projects in Missouri is estimated at 50 million dollars. These 22.9 miles of chutes are planned to be over 200 feet wide. The Corps is digging these chutes about 18 to 25 feet deep. They are located at 10 different sites within the state of Missouri. The surface area of the chutes total about 606 acres.

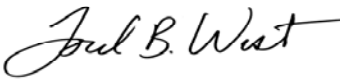
As the Corps dig through Missouri's richest alluvial soil to make these chutes, the Corps is dumping the excavated soil into the Missouri River. The soil will be lost from Missouri forever. **The projects are dumping 24 MILLION TONS of soil directly into the river**. A million semi-trucks with 24 tons each, would stretch bumper-to-bumper from New York to Los Angeles and back. This rich alluvial soil is loaded with naturally occurring nutrients, silica, and carbon. These nutrients make this river bottom ground grow lush grass and CO_2 removing trees. Dumped into the water, these millions of pounds of nitrogen and phosphorus may be contributing to the hypoxic dead zone in the Gulf of Mexico.

The amount of phosphorus to be dumped into the Missouri River by the Corps of Engineers is 31.3 million pounds. That is equivalent to 47 percent of the entire annual load of phosphorus of the entire Missouri River basin. EPA's Science Advisory Board on Hypoxia recommends that wastewater treatment plants limit their phosphorus discharge to 0.3 ppm and nitrogen to 3 ppm. **The soil discharged by the Corps measures 653 ppm phosphorus and 154 ppm nitrogen.** The cost of phosphorus removal from water runs $75 to $293 per pound.

Conclusion

TFI is pleased to have the opportunity to comment on this important issue. If you have further questions regarding these comments, please do not hesitate to contact me at (202) 515-2700 or via e-mail at fwest@tfi.org.

Sincerely,



Ford B. West
President