Summary Minutes of the
U.S. Environmental Protection Agency (EPA)
Science Advisory Board (SAB)
Hypoxia Advisory Panel (HAP) – Subgroup Conference Call on
Characterization of Nutrient Sources, Fate, and Transport
November 21, 2006

Purpose: The purpose of this teleconference is for members of the Hypoxia Advisory Panel's Subgroup #2 to discuss each panelist's progress toward addressing their assignments related to the current understanding of nutrient sources, fate and transport within the Mississippi River Basin and delivery to the Gulf of Mexico.

Attendees:	Subgroup Leader:	Dr. Judy Meyer
	HAP Members:	Dr. Walter Boynton Dr. William Crumpton Dr. Mark David Dr. Robert Howarth Dr. Richard Lowrance Dr. Kyle Mankin Dr. Kenneth Reckhow Dr. Andrew Sharpley
	HAP Chair:	Dr. Virginia Dale
	SAB Staff:	Dr. Tony Maciorowski Dr. Tom Armitage Dr. Holly Stallworth David Wangsness (USGS)
	Others Present:	James Baker, IA State University Dean Lemke, IA Dept. of Ag. & Land Stewardship Don Perish, American Farm Bureau Dennis McKenna, IL Department of Agriculture

Meeting Summary: The discussion followed the issues and timing as listed in the meeting agenda and is summarized below:

Overview of "Lessons Learned" at Mpls Fate/Transport Symposium:

Those who attended the "Science Symposium: Sources, Transport, and Fate of Nutrients in the Mississippi and Atchafalaya River Basins" in Minneapolis, MN during the period November 7-9, 2006 agreed that there were many updates that will be useful to this review. Much of the discussion revolved around the new nutrient flux estimates

provided by Bill Battaglin (USGS) and, particularly, the need for the panel to fully understand the new procedure being used to estimate nutrient flux, and to fully understand how much of the difference between the values used in the initial assessment and current values are real changes or trends in nutrient flux, and how much is due to the use of a new procedure to estimate flux. The USGS recently posted documentation of the new procedure at: http://toxics.usgs.gov/hypoxia/ and will provide further information during the HAP meeting in December. Bill Battaglin's presentation at the Minneapolis meeting is also available on the Symposium web site at: http://www.tetratech-ffx.com/nutrient_fate_symposium/agenda.htm. There was additional discussion of information presented, such as results of current SPARROW modeling and the current understanding of P as a limiting nutrient, that resulted in the formulation of several of the questions discussed in greater detail later during the call, and are reflected in the attached list of questions to invited speakers at the December meeting.

Discussion of Draft Outline Responses to the Charge:

Temporal Character of Loads/Fluxes (Part 2.A.i):

Prior to the call, there was little or no new information on point sources available to the panel. During the call, Katie Flahive (EPA/OWOW) delivered the MART report "Reassessment of Point Source Nutrient Mass Loadings to the Mississippi River Basin", which was distributed to the panel for their review, and will be discussed further at the December meeting.

A new model for estimations of atmospheric deposition suggests that N deposition in the Ohio River basin is higher than previously estimated, by as much as 50%, but that atmospheric deposition still is not a significant source of N.

There were several questions/comments related to the USGS flux estimates that are reflected in the attached list of questions and will be addressed further at the December meeting.

It was pointed out that seasonal (May/June) NO3 loads are directly related to hypoxia but that P is released over a 1-2 year period on the shelf and, therefore, it is more important to consider annual loads for P.

It also was pointed out that Battaglin presented information on trends that were based on 5-year running averages, largely because the original assessment report set the time period, but the group feels that they should look at trends based on flow-adjusted annual loads.

It was clarified that "total load" to the Gulf of Mexico means the sum of the loads from the Mississippi and Atchafalaya Rivers.

Mass Balance (Part 2.A.ii):

Dr. David is redoing the mass balance assessment from the initial assessment, but will cover the period 1996-2005. He noted that it appears that fertilizer applications have remained fairly constant while crop yields have increased recently, which should result in a decreasing trend in nutrients. At this time, nutrient mass balance (N & P) is not well

understood and requires further research and discussion – see questions for December meeting.

Discharge from tile drains is poorly understood, yet much of the poorly-drained glacial till in the Midwest is underlain by tile drains. Often as much as 50% of an area (lowlands) can be drained by tiles, while much of the runoff from the uplands also enters the drains when the water reaches the lowland areas.

Manure, as a source of nutrients, was not treated effectively in the first assessment but needs to be addressed in this review. However, estimates that compare manure and fertilizer as sources of N & P vary widely, and there appears to be very limited information on application rates and timing of fertilizer at the watershed scale, and similar information on manure is fairly unknown.

Transport, Transformations, Sources, & Sinks (Part 2.A.iii):

There was much discussion of denitrification and how it can be significant at lower flows, but that the majority of the nutrient mass is transported during high flows when in-stream processes can't keep up with the supply. Extending the retention times in reservoirs, backwater areas, floodplains, wetlands, etc. will increase denitrification but, at the same time, the production of N2O or N2 may be an important contribution to greenhouse gases and, therefore, needs to be better understood as measures are introduced to increase denitrification. Wetlands can control nitrogen losses if managed in a way to allow for wet/dry cycles.

There appears to be little information on denitrification in large river systems. What is available is mostly model derived, and ranges of values are quite large. For this review, it is important to be able to set some upper and lower limits for nitrification and denitrification to be able to evaluate the effects on the total mass balance.

Mark David will attend a workshop on denitrification during the week of November 27.

There does not appear to be much net exchange (sorption/desorption) of P in the river system, but desorption occurs as the plume becomes more salty (approximately 10% of the load on the time scale of hours to days) and the remainder can desorb from the sediments on the time scale of years.

There was further discussion of fertilizer and manure application rates, timing, and form; the relation between the reduction of nutrients and the potential loss of soil organic matter (will it result in a negative N balance); the effect of modifying cropping systems; and the need to better understand the range of inputs at the watershed scale rather than State averages – all of which helped to formulate questions to the technical presenters at the December meeting (see below).

Predicting Nutrient Delivery to the Gulf (aPrt 2.B.i), and
Routing & Transport Processes from Source to Gulf (Part 2.B.ii):

Information provided at the Minneapolis Symposium and presentations scheduled for the December SAB meeting will contribute to the understanding of the ability of current models to address these issues.

Discussion of Questions for Invited Experts at December 6-8 Meeting:

Discussion throughout the conference call, and additional input following the call, evolved into the following questions to several of the technical experts scheduled to make presentations related to their areas of expertise, and to participate in roundtable discussions with the panel.

Questions/Comments to USGS Concerning New Load/Flux Estimates:

1. Given that the large river nutrient concentrations change slowly, has consideration been given to interpolating concentrations rather than model fitting? Would interpolated values be a better representation of flux in a given year compared to model fitting?

2. The number of monitoring sites has decreased since the initial assessment. Please provide a list and/or map of the changes.

3. We understand that the Action Plan called for the estimation of 5-year moving averages, but have you looked at decadal trends and/or annual trends, which may provide a different picture than the 5-year moving average?

4. What nutrient trends do the current analyses indicate, and what is the current explanation?

Questions/Comments to USDA on CEAP:

1. What are the most relevant and up-to-date reports on conservation activities that would contribute to an understanding of nutrient sources, fate, and transport within the Mississippi River system?

2. We understand that summary reports are being prepared by each of the benchmark watersheds within the MRB for review in early 2007. Are there early drafts available that could provide some background on current conservation practices, their numbers and locations, their effectiveness at reducing nutrient loads to surface and ground water, and any preliminary mass balance calculations?

Questions/Comments to Modelers:

1. Please comment on the model's strengths and weaknesses for addressing HAP charge-related questions at the MSB and Gulf of Mexico scale. At what scale is the model most applicable? And what is your level of confidence if it is scaled up or down?

2. What are the error estimates and uncertainties associated with the model?

3. Some of the current models appear to have questionable accuracy in predicting, at small and intermediate-scales, the potential nutrient (total N, total P, inorganic N, inorganic P) transport/delivery to flowing streams and major tributaries. Dr. David Mulla - at the recent Nutrient Source, Fate and Transport Symposium in Minneapolis, MN - illustrated strengths and weaknesses and the possible benefits of identifying critical source areas using appropriate small and intermediate-scale models. Dr. Mulla also showed a slide which indicated that a 40 percent increase in precipitation had contributed to a 245% increase in water discharge over a 50-year period. With these observations in mind:

a. Could/should the approach(es) illustrated by Dr. Mulla in his presentation in Minneapolis, MN be used throughout the Mississippi River Basin to more accurately identify critical "source" areas, to guide management changes to reduce specific nutrient (N and/or P) loss, especially during critical discharge periods (early spring: April-May) .....in targeted areas within the Basin?

b. Considering the costs already associated with educational efforts, and costs associated with some local and state nutrient regulation implementation, what would the costs/benefits be of conducting such modeling before any further national policy development or implementation?

4. Comment on plans and/or opportunities for improvements in the model – and, is the timing such that the outcomes will contribute to this review?

5. We understand that SPARROW is being updated from 1992 to 2002 agricultural and land cover data for the calibration year. What are the limitations of fewer monitoring data during 2002 for calibration? And, are denitrification estimates being updated?

6. Any information on the ability of SWAT to simulate conservation practice effects on N and P transport would be helpful. More specifically, to what extent is SWAT being used to address/simulate the effects of tile-drain management alternatives, drain spacing, manure application as a nutrient source, and stream buffers?

7. How would you recommend we resolve any scale issues regarding basin-wide assessments, which are based on using your model at an inappropriate scale for which it was developed?

8. Is there any way of using SWAT to spatially link processes / losses occurring in different parts of the Basin, but which influence Gulf inputs?

9. The new load estimates for the Mississippi River basin differ from earlier estimates, primarily because of a new procedure being used to calculate the loads. What are the implications of this for the hypoxia models that have been run to data?

Questions on N & P Management Approaches:

1. Please be prepared to discuss the effectiveness, applicability, and potential impact of current and emerging management practices including drainage management, cropping systems (cover crops, perennials, living mulches, relay crops, etc.), and infield nutrient management (timing, application rate, etc.).

2. Please provide your perspective on the watershed study published in JEQ in 2004 where the authors showed that changing from fall NH3 application to use of the late spring nitrate test (LSNT) led to changes in nitrate loads from the treated watershed compared to the control watersheds. What is the magnitude of the potential changes if this approach is widely used?

3. Across the cornbelt, it appears that fertilizer application rates have been relatively constant and crop yields have dramatically increased in recent years, leading to small N balances. River nitrate concentrations should be declining now or soon, depending on system lags. Can you comment on these recent changes and the potential for stream nitrate concentrations in the upper Midwest to decline in response?

4. Fertilizer use is based on averages of state sales data, and manure application rates are fairly unknown. At the watershed scale, most information is from surveys, and these data are generally very limited spatially. What would you suggest as sources of information on fertilizer and manure application rates, timing, and locations at a watershed scale? Given that surveys can't be done everywhere, what is the best way to make reasonable estimates of both?

5. How well do we understand the source distribution, timing and, therefore, the nutrient mass balance associated with manure?

6. What is new in manure management over the past several years, and are there any data suggesting that manure management has resulted in any related improvements in water quality?

7. What is the current understanding of the effects of modifying cropping systems to reduce nutrient loss as opposed to further reducing fertilizer/manure application rates?

8. What is known about the consequences of potential reductions in fertilizer application rates to soil resource sustainability? Given the high yields of the past five years and steady fertilization rates, is it likely we are reducing soil organic N pools in the cornbelt? If so, what are the biophysical mechanisms that would cause this?

9. Please comment on drainage management in general, the use of denitrification reactors around and at the end of tile drain lines, and other options being considered that would alter drainage management to improve water quality while maintaining drainage.

10. What is known about the potential for drainage management in the Des Moines lobe?

11. If P mainly drives Nutrient Management Planning (NMP) in the upper basin where there is a concentration of livestock operations and local water quality issues are freshwater driven, while N drives NMP as one gets closer to the Gulf, are there any efforts to coordinate management of N & P within the Basin as a whole? This may be an issue as P-driven management could have little or no effect on N loss reduction (may even increase N loss) and vise-versa. In other words, is there a plan to marry short-term NMP strategies with long-term goals and impacts?

12. As market forces impact the construction of ethanol and biodiesel production facilities, and as farmers change their cropping systems to take advantage of these energy-based crop markets, what is the potential impact of these market forces on nitrogen and phosphorus use in the Mississippi River Basin? Is nutrient (N and/or P) discharge to the Mississippi River (and to the Gulf of Mexico) likely to change as a result of these market forces, and if so how much for each nutrient?

13. In some states, farmers are required to prepare and submit nutrient management plans before the application of manure nutrient resources to individual farm fields (e.g Regulation 5 in Arkansas for liquid manures). In other states, before nutrients from fertilizer, manure, and/or biosolids can be applied to farm fields, approved nutrient management plans are required (e.g. Neuse River and Tar-Pamlico River Basins in North Carolina).

a. Would mandatory nutrient management plans for all farm fields in the Mississippi River basin be a cost-effective means to significantly reduce nutrient (N and/or P) discharge to local water resources, the Mississippi River and, ultimately, the Gulf of Mexico?

b. Are agricultural policies in place, or could/should practical and straightforward policies be developed, to provide economic incentives to farmers to prepare AND implement nutrient management plans in the entire Mississippi River basin?

All questions have been forwarded to the respective speakers with a request that they consider them while preparing their presentations, but also be aware that additional questions will likely develop during the roundtable discussions.

Review of Action Items & Assignments:

Dr Meyer and Dave Wangsness agreed to draft a list of questions for the December meeting and circulate it to the subgroup for additions and comments. That process resulted in the above list.

Dr. Meyer requested that each subgroup member provide her with a few bullets describing their work to date by December 1 so that she can incorporate them into a brief overview of Subgroup 2's progress report for the December meeting.

Respectfully Submitted:

/Signed/

David J. Wangsness
Designated Federal Officer

Certified as True:

/Signed/

Dr. Judith Meyer, Leader
Hypoxia Advisory Panel -- Subgroup on Nutrient Sources, Fate, and Transport