Summary Minutes of the
U.S. Environmental Protection Agency (EPA)
Science Advisory Board (SAB)
Hypoxia Advisory Panel (HAP) – Subgroup on Causes of Hypoxia
Teleconference, January 26, 2007

Panel Members: See subgroup roster – Appendix A

Date and Time: Friday, January 26, 2007, 9:00 a.m. – 12:00 noon Eastern Standard Time

Location: By telephone only

Purpose: The purpose of this teleconference was for members of the Hypoxia Panel's Subgroup on Causes of Hypoxia to discuss their advisory work related to characterization of the causes of hypoxia in the Gulf of Mexico.

Attendees:

Subgroup Leader:	Dr. James Sanders
Subgroup Members:	Dr. Thomas Bianchi Dr. Daniel Conley Dr. Denis Gilbert Dr. Robert Howarth Dr. Hans Paerl Dr. Donelson Wright
HAP Members:	Dr. Virginia Dale, Chair
EPA SAB Staff:	Thomas Armitage, Designated Federal Officer Holly Stallworth
Other EPA Staff:	Barry Korb, Office of Policy, Economics, and Innovation Donn Viviani, Office of Policy Economics, and Innovation
Others Present:	James Baker, Consultant, Iowa Department of Agriculture and Land Stewardship Laura Beaven, Water Policy Report Dean Lemke, Iowa Department of Agriculture and Land Stewardship Dennis McKenna, Illinois Department of Agriculture Don Parrish, American Farm Bureau Jay Smith, Abt Associates

Meeting Summary

The discussion followed the issues and timing as presented in the meeting agenda (Appendix B).

Convene Teleconference

Dr. Thomas Armitage, Designated Federal Officer (DFO) convened the subgroup teleconference at 9:00 a.m. He stated that teleconference was being held in accordance with Federal Advisory Committee Act (FACA) procedures. He stated that summary minutes of the teleconference meeting would be prepared and certified by the subgroup leader. Dr. Armitage then asked the Hypoxia Advisory Panel (HAP) members and others on the call to identify themselves.

Purpose of the Call and Review of the Agenda

Dr. Jim Sanders, subgroup leader, thanked the members for joining the call and reviewed the purpose of the call and agenda. He stated that the purpose of the call was to continue discussing the HAP subgroup 1 responses to charge questions. He noted that he had pulled together a new draft containing additional material provided by subgroup members. Dr. Sanders stated that he wanted to discuss comments on the new draft and that it was important to discuss Dr. Howarth's proposed revisions. Dr. Sanders noted that subgroup needed to provide draft responses for discussion at the HAP meeting on February 28 – March 2.

Discussion of Draft Responses to the Charge Questions

The subgroup discussed the draft responses. Dr. Howarth summarized his comments. He expressed the opinion that the responses should be organized to stress the following points: 1) hypoxia is recent, 2) it is driven by nutrients, 3) phosphorus is more important than previously believed, 3) physics is more important than recognized in 2000. He noted that if members agreed with these points it would be important to start by describing new knowledge (since 2000). He noted that the physics section should focus on what has changed (e.g., river flow).

Discussion of the physics section of the report:

Dr. Gilbert agreed that the physics section should focus on what has changed (e.g., patterns in river flow, precipitation, snow thaw, etc.). The report should contain more information on changes in river discharge and what has been learned about plume dynamics. Another member noted that it was important to discuss hydrology and in particular, the role of the Atchafalaya. Dr. Bianchi pointed out that a number of important manuscripts were available from a National Oceanic and Atmospheric Administration (NOAA) meeting. Another member expressed support for discussing the

physics in a more integrated way (e.g., integrating hydrology and physics). A member stated that the physics section should emphasize what is known about near and far field differences. He stated that there were big differences east and west of the Atchafalaya. He noted that the 2000 (CENR) report focused on near field linkages to the Mississippi River (Southwest Pass).

Dr. Howarth expressed the opinion that the subgroup draft should start with a discussion of the paleorecord and focus on the time frame of observed hypoxia. This would set the stage for other parts of the report. Several members agreed noting that it was important to bring the phytoplankton and nutrient linkages to the beginning of the draft. Another member stated that this change would require reordering rather than removing material. Dr. Howarth noted that as the physics and other sections of the report were written it would be important to identify changes in physical processes that have occurred and how they may or may not be related to hypoxia. Dr. Gilbert noted that the current draft of the physics section did contain such material, but in his opinion the section needed additional references to Steve DiMarco's recent work. He asked whether this work had been published. A member stated that he was not sure when the DiMarco papers would come out of review. Another member noted that unpublished references could be included in the report.

The group discussed how changes in discharge from the Atchafalaya could be driving hypoxia. A member noted that discharge from Southwest Pass occurs at a canyon mouth, but the Atchafalaya discharges over a larger area of the shelf. He noted that diverting flow to the Atchafalaya could therefore result in changes in the hypoxic area. A member noted that diversions to the Atchafalaya started in 1929 at 15%, and in the 1970s went to 30%. He stated that this provided a mechanism for much more fresh water staying close to shore on the Louisiana Texas shelf. Another member noted that winds in the summer caused pooling to the east so there were clearly two different sources. A member noted that the complexity of physics is driving hypoxia and that processes have changed over time.

Dr. Wright stated that there has been much progress in understanding the physics since 2000 and that it was important to discuss this progress as well as provide adequate background information on the physical oceanographic processes affecting hypoxia. Dr. Sanders asked that Drs. Wright and Gilbert work on revising this section as discussed.

Discussion of the Historical Patterns Section of the Report

Dr. Conley stated that he had not yet revised the section on historical patterns. He noted that additional material from the recent Rabalais paper should be included in the report. Some material from the Osterman paper should be incorporated, and additional material on diagenesis should also be included. He noted that observed changes were abrupt enough to indicate that diagenesis could be important. A member stated that it was important to use multiple markers when looking at historical changes. Another member stated that the historical patterns section should set the stage for the remainder of the report. Dr. Sanders asked Dr. Conley to revise this section as discussed.

Discussion of the Carbon and Nutrient Fluxes Section of the Report

Several members offered comments on revising the carbon and nutrient fluxes sections of the report. A member stated that he agreed with reordering the topics in the presentation as suggested by Dr. Howarth. However, he noted that there were some areas of disagreement concerning material to be included in the report. He noted that the section on terrestrial organic matter was written with the intent of trimming it later, but the section should address advances in knowledge since 1999. He noted that the large section on $C_3 - C_4$ could be cut back.

Another member stated that he did not want to give readers the impression that there were huge uncertainties with regard to carbon. He stated that it was important to look at inputs and processes in the context of time trends. He noted that when land was cleared for agriculture there was a huge initial increase in carbon flux into the Mississippi river, but the present carbon load is probably less than it was at that time.

A member stated that it was important to look at changes in dissolved organic carbon, which is more labile, and its contribution to oxygen draw down. He agreed that nutrient loading is an important driving force but he expressed the opinion that the dynamics of wetlands should be considered. He stated that it was hard to ignore wetland loss.

A member stated that particulate organic carbon (POC) from phytoplankton should be discussed in the report, but the area receiving such POC is small compared to area of production on the shelf. The subgroup discussed the contribution of carbon from wetlands and the available literature on this topic. Dr. Sanders stated that differences in the published literature needed to be resolved. Another member noted that the material in the carbon section needed balancing. The group discussed the importance of bed load. A member stated that bed load had previously been ignored. Dr. Sanders asked Drs. Howarth and Bianchi to work on revising this section.

Discussion of the role of N and P and the potential for seasonal limitation in controlling primary production

Dr. Paerl stated that he was making some revisions in the nutrients section of the draft report. He noted that some additional references had been added and that Walter Boynton had provided some comments. He stated that he would like to retain information about dual nutrient issues and control. A member stated that it would be important to emphasize aspects that were new or that might have been overlooked in the earlier assessment. Dr. Paerl stated that N and P limitations section needed to address knowledge of how nutrient limitations overlap.

Other issues

Members discussed the need for additional revisions. A member stated that the material on denitrification and nutrient recycling should be brought into one section. A member suggested that the report topics be ordered as follows: 1) paleorecord, 2) role of N and P, 3) physics, 4) carbon, 5) denitrification and nutrient cycling, 6) single versus dual nutrient removal. Dr. Conley offered to rewrite the nutrient cycling and denitrification section. Dr. Conley stated that he would also review and revise the section on the role of Si in phytoplankton species composition. Dr. Sanders stated that some editing of the dual nutrient removal section was needed.

Discussion of charge question 1(a), forecast modeling

The subgroup discussed changes in the draft response to charge question 1B. Members stated that the Scavia model and opportunities for application of other models should be mentioned. A member stated that it might be useful to refer to the near versus far field physics issues. A member noted that the Scavia model brought in empirical evidence and it performed well in the near field. Dr. Conley offered to add some additional material on the strengths and weaknesses of empirical relationships. A member noted that an important paper by Hetland was currently in review. He observed that this paper describes a physical model dealing with oxygen and resuspension. A member noted that the subgroup might want to recommend that future work focus on using more sophisticated models of physical processes coupled with biogeochemical models. Dr. Sanders asked Drs. Gilbert and Wright to revise this section. Another member stated that the subgroup should not encourage the development of one large watershed model. He noted that it would be better to use multiple models varying from simple to complex.

Discussion of response to charge question 3(a)(i)

A draft response to charge question 3(a)(i) had been prepared by Dr. Bianchi. Dr. Sanders stated that he was not prepared to discuss this draft response on the teleconference, but he asked subgroup members to review the response and send him comments.

Public Comments

The Designated Federal Officer stated that there had been no requests to make comments.

Next Steps

Dr. Sanders summarized the discussion and subgroup assignments as follows:

- Dr. Conley will revise the section on historical patterns and evidence for hypoxia on the shelf (section 2 of the most recent draft) to address comments and incorporate new information from the recent Rabalais publication and from the Osterman publications. He will also address the diagenesis question. The report will be restructured and this will become the first section.

- Dr. Paerl will develop the new second part of the report. This part will focus on the role of nitrogen and phosphorus in driving and fueling hypoxia and will include the following sections of the current draft: parts of 3b (nitrogen and phosphorus fluxes to the NGOM: relative importance of basin, offshore sources, and atmospheric deposition), 5 (role of N and P and potential for seasonal limitation in controlling primary production), 5a (N and P limitation in different shelf zones), 5b (relative importance of each of the Rowe and Chapman (2002) zones to the onset and continuation of hypoxia), 5c (The linkages between high primary production inshore and the hypoxic regions further offshore), 6 (other limiting factors), 7 (role of Si in phytoplankton species composition and subsequent alterations of C transport and utilization). Dr. Paerl will emphasize new knowledge concerning phosphorus.

- Dr. Conley will review the discussion of Si and provide edits and references for incorporation into this part of the report.

- Drs. Wright and Gilbert will revise the section on physics. This will become the third section of the report. This section will retain much of the background material but will emphasize changes that have occurred (i.e., changes in the flow of fresh water and the role of the Atchafalaya in hypoxia). It will contain discussion integrating the hydrology and physics and also will address new knowledge of differences in processes to the east and west of the Atchafalaya (material presented by DiMarco at last HAP meeting).

- Drs. Bianchi and Howarth will develop a new fourth part of the report. This part will focus on carbon, and will include material from the following sections of the most recent draft: 3a (terrestrial – including wetlands – vs. autochthonously produced carbon), 3b (nitrogen and phosphorus fluxes to the NGOM: relative importance of the basin, offshore sources, and atmospheric deposition) and any material that would have been provided in section 4 of the most recent draft (transport, loss, and transformation of terrestrial and autochthonously-produced carbon in different shelf zones).

- Dr. Conley will combine the section on nutrient recycling and removal and their impacts on primary production with the section on denitrification and P burial as loss mechanism. This piece will become the fifth part of the report.

- All subgroup members will review section 9 of the most recent draft (single vs. dual nutrient removal strategies. Edits will be incorporated into this section and it will become the sixth part of the report.

- Drs.Wright and Gilbert will review the section addressing charge question IB and provide revisions addressing the following: 1) Additional discussion of how modeling provides useful information (this should refer to the physics discussion of near vs. far field processes), where modeling starts to “break down,” and the usefulness of the Scavia model in the near field. 2) Recommendation that the next steps should focus on using more sophisticated models coupled with biogeochemical models. 3)

Additional general philosophical statements concerning the value of empirical models and the recommendation that there should not be one large watershed model developed for the Gulf of Mexico (as was done for Chesapeake Bay). It would be preferable to have multiple models varying from simple to complex.

- Dr. Conley will provide additional material on the strengths and weaknesses of empirical relationships for the modeling piece.

- All subgroup members should provide comments on the draft material addressing charge question #3.

Dr. Sanders asked members to send revisions to the Designated Federal Officer by Friday, February 16.

Dr. Sanders than thanked the members for participating and adjourned the call.

Respectfully Submitted:

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Dr. Thomas Armitage
Designated Federal Officer

Certified as True:

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Dr. James Sanders, Leader
Hypoxia Advisory Panel – Subgroup
Causes of Hypoxia

APPENDICES

Appendix A: Roster of Subgroup 1

Appendix B: Meeting Agenda

U.S. Environmental Protection Agency
Science Advisory Board Hypoxia Advisory Panel
Subgroup on Causes of Hypoxia

LEADER

Dr. James Sanders, Director, Skidaway Institute of Oceanography, Savannah, GA

MEMBERS

Dr. Thomas Bianchi, Professor, Oceanography, Geosciences, Texas A&M University, College Station, TX, USA

Dr. Alan Blumberg, Director, Department of Civil, Environmental, and Ocean Engineering, Stevens Institute of Technology, Hoboken, NJ

Dr. Walter Boynton, Professor, Chesapeake Biological Laboratory, Center for Environmental Science, University of Maryland, Solomons, MD

Dr. Otis Brown, Dean, Rosenstiel School of Marine and Atmospheric Science, Miami, FL

Dr. Daniel Joseph Conley, Professor, National Environmental Research Institute, Department of Marine Ecology, Roskilde, Denmark

Dr. Denis Gilbert, Research scientist, Ocean and Environment Science Branch, Maurice-Lamontagne Institute, Dept. of Fisheries and Oceans Canada, Mont-Joli, Quebec, Canada

Dr. Robert W. Howarth, David R. Atkinson Professor , Dept. of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY

Dr. Hans Paerl, Professor of Marine and Environmental Sciences, Institute of Marine Sciences, Univ. of North Carolina, Chapel Hill, Morhead City, NC, USA

Dr. Donelson Wright, Chancellor Professor, School of Marine Science, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA

SCIENCE ADVISORY BOARD STAFF

Dr. Thomas Armitage, Designated Federal Officer, U.S. Environmental Protection Agency, Washington, D.C

Appendix B – Teleconference Agenda

SCIENCE ADVISORY BOARD
Hypoxia Advisory Panel – Subgroup on Causes of Hypoxia
Public Teleconference
January 26, 2007, 9:00 a.m. – 12:00 noon (Eastern Standard Time)

Agenda

Purpose: The purpose of this teleconference is for Subgroup #1 of the Hypoxia Advisory Panel to continue drafting the report.

9:00 a.m.	**Convene meeting**	Dr. Thomas Armitage Designated Federal Officer
9:10 a.m.	**Purpose of the call**	Dr. James Sanders, Subgroup Leader

9:15 - 11:30 a.m. **Discussion Topics**

1. Address the state of the science and importance of various processes in the formation of hypoxia in the Gulf of Mexico

The physical context: zonation, plume dynamics and stratification, and circulation influences on O_2 transport and utilization

Lead Discussants: Drs. Denis Gilbert, Don Wright, and Alan Blumberg

Historical patterns and evidence for hypoxia on the shelf

Lead Discussant: Dr. Daniel Conley

Carbon and nutrient fluxes from the Mississippi River Basin: sources, sinks, and changes through time

Lead Discussants: Drs. Thomas Bianchi and Robert Howarth

Transport, loss and transformation of terrestrial and autochthonously-produced carbon in different shelf zones

Lead Discussant: Dr. Thomas Bianchi

Role of N and P and potential for seasonal limitation in controlling primary production

Lead Discussants: Drs. Hans Paerl and Robert Howarth

Other limiting factors

Lead Discussant: Dr. Hans Paerl

Role of Si in phytoplankton species composition and subsequent alterations of C transport and utilization: can increased N:Si, P:Si fuel an increased microbial loop and exacerbate hypoxia?

Lead Discussants: Drs. Hans Paerl and Daniel Conley

Nutrient (especially N and P) recycling and removal and their impacts on primary production

Lead Discussants: Drs. Robert Howarth, Hans Paerl, Thomas Bianchi, and Daniel Conley

Single vs. dual nutrient removal strategies

Lead Discussants: Dr. James Sanders

2. Comment on the state of the science for characterizing the onset, volume, extent, and duration of the hypoxic zone

Current state of forecast models

Lead Discussants: Drs. Robert Howarth, Alan Blumberg, Denis Gilbert, and Don Wright

Advantages and disadvantages, and reconciling different model types

Lead Discussants: Drs. Robert Howarth, Alan Blumberg, Denis Gilbert, and Don Wright

11:30 - 11:45 a.m.	**Public comments**	
11:45 a.m. - 12:00 p.m.	**Review next steps**	Dr. Sanders and Subgroup
12:00 noon	**Adjourn**	