

**Summary Minutes of the
U.S. Environmental Protection Agency (EPA)
Science Advisory Board (SAB)
Hypoxia Advisory Panel (HAP) – Subgroup on Causes of Hypoxia,
October 17, 2006**

Panel Members: See subgroup roster – Appendix A

Date and Time: Tuesday, October 17, 2006

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 Alan Blumberg Dr. Virginia Dale, Chair
EPA SAB Staff:	Thomas Armitage, Designated Federal Officer Holly Stallworth David Wangsness
EPA:	Ken Teague, EPA Region 6 Barb Walton, EPA ORD
Others Present:	James Baker, Iowa State University Gloria Donnelly, Hach Homeland Security Technologies Don Parish, American Farm Bureau

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 under the requirements of the Federal Advisory Committee Act (FACA). He reviewed the subgroup's compliance with ethics and conflict of interest requirements and stated that records of subgroup discussions would be maintained. 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, reviewed the purpose of the call, and reviewed the agenda. He stated that the purpose of the call was to discuss progress toward developing assigned responses to parts of the Panel charge. Dr. Sanders then asked the lead discussants (listed on agenda in Appendix B) to review issues they were addressing in their assigned areas.

Discussion of Initial Responses to the Charge Questions

Physical Processes Controlling Hypoxia (Parts 1.A.i, 1.A.ii, and 1.A.iv)

The subgroup discussed the physical processes controlling hypoxia in the Gulf of Mexico. Drs. Wright, Gilbert, Blumberg, and Brown were the lead discussants for this issue (Dr. Brown was not present on the call). Dr. Wright stated that the approach taken by the subgroup was to focus on delivery of oxygen to the area of concern, considering advection and oxygen consumption. Dr. Wright noted that the members were still in the process of reviewing new literature. However, an equation had been developed to represent the important processes to be considered and addressed in the response to the Panel's charge. The group discussed the equation and considered whether it should contain a production term. Several members expressed the opinion that a production term should be added to the equation. Dr. Wright noted that the vertical mixing part of the equation has much to do with buoyancy, fresh water input from the Mississippi River. It was noted that on the Louisiana shelf, stratification is induced by sediment transport. Sediment transport isolates the bottom layer and prevents mixing. Dr. Wright stated that a number of new papers on this topic should be reviewed. Dr. Gilbert stated that the outline of the physical processes section was still a "work in progress." He stated that it would be useful to develop a more complex equation containing some additional terms. Several members agreed and noted that having a "master" equation at the beginning of the section would be very helpful to provide context for text on the causes of hypoxia. Dr. Wright agreed and stated that a more elaborate equation would be developed containing all additional terms that could be addressed.

A member stated that in the future three dimensional models of coastal physics may be used for various analyses. He stated that the master equation should include terms that three dimensional models can address.

Dr. Dale, Panel Chair, agreed that it would be very useful to structure the response by first providing a master equation. She noted that this would provide information needed for sensitivity analyses. A member noted that as the equation is developed it would be helpful to look at the lowest order part first and later develop the higher order part. Dr. Dale suggested that it would be helpful to look at the spatial and temporal aspects of the causes of hypoxia. This would help establish the research agenda.

Dr. Wright stated that it would be useful to have a map of tidal dissipation over the Louisiana Shelf. Dr. Blumberg responded that he is working on obtaining this information. Dr. Wright noted that he planned to spend more time looking at the literature over the next three weeks and hoped to make additional progress developing the response to the charge.

Dr. Paerl discussed an important publication by Rowe et al. He noted that this work links chemistry and biology to a model using three compartments. Dr. Wright responded that this work should be considered by the subgroup because oxygen consumption and in-situ production terms are important and must be addressed in the response to the charge. He noted that it will be important to consider cross-disciplinary synergies.

A member reminded the subgroup that they were charged with looking at the 2000 Integrated Assessment and determining whether new research supports or alters any of the findings published in 2000. He stated that the subgroup will have to decide whether they agree with conclusions of the 2000 assessment. Dr. Sanders agreed that this was an important point. He stated that the response to the charge should focus on agreement or disagreement with the findings in the 2000 Integrated Assessment, and should summarize relevant work completed since 2000, information gaps, and research needs.

Dr. Blumberg brought to the subgroup's attention a book that was published in 2005 on modeling the physics of the Gulf of Mexico. Other subgroup members stated that this publication provided relevant and useful information.

Biogeochemical Processes Controlling Hypoxia in the Gulf of Mexico (Part 1.A.iii)

The subgroup discussed the biogeochemical processes controlling hypoxia in the Gulf of Mexico. Dr. Bianchi was the lead discussant for this issue. Dr. Bianchi described the written material he had provided on the topic. He stated that the material focused on sediment-water interactions. He stated that additional relevant papers provide more information that should be summarized the Panel's report. He stated that new work on the importance of fluid muds should be included in the report. Dr. Bianchi stated that he was making progress, and that he would provide a more complete draft before the next subgroup teleconference. Dr. Bianchi referred to the Panel's previous discussion of the effects of hypoxia on fishery resources in the Gulf of Mexico (discussed during Panel

meeting in September, 2006). He expressed the opinion that this issue was not within the scope of the subgroup's charge, which focused on causes of hypoxia not effects.

A member reminded the subgroup that part of the charge was to consider loadings from wetlands and how they contributed to hypoxia. Dr. Bianchi responded that he would include information on this issue. He stated that terrestrial carbon may be a supplement fueling oxygen draw-down. He noted that this material can become suspended and move down-stream.

A member stated that the Rowe and Chapman paper described in the written material provided by Dr. Bianchi was very important. He stated that the paper described changes in the biology and chemistry of the system moving from a region of high turbidity to a more oligotrophic region. Another member stated that the Rowe and Chapman paper provided a good guide for writing about water column nutrients and fluxes. Dr. Conley agreed that the Rowe and Chapman model was very important. He asked whether a figure could be developed to describe this model. Dr. Bianchi stated that an original figure was available and that he would send it to the subgroup.

A member stated that factors affecting the length of time of hypoxic events are not presently well understood. He stated that there are many physical factors that can "bring in" oxygen. He noted that the system does not stay hypoxic continuously and certain kinds of invertebrates can survive in the area where hypoxia occurs. Members continued to discuss the importance of biogeochemical factors in understanding the causes of hypoxia. A member noted that iron and manganese oxides set off microbial chemistry differently. Another member stated that some investigators have not found sulfides in the hypoxic area and others have seen them; this is a point of contention. A member noted that the limit of detection of sulfide is 10 micromolar and stated that this should be considered. Another member stated that it would be very helpful to see how sulfide has have been measured.

Nutrient Dynamics and Linkages to Biogeochemical Processes (Parts IA.iii, I.A.iv, and I.A.v)

The subgroup discussed nutrient dynamics and linkages to biogeochemical processes controlling hypoxia in the Gulf of Mexico. Drs. Howarth and Paerl were the lead discussants. Dr. Paerl discussed a list of questions that he wanted to address in the response to the charge. He noted that an important issue to be addressed is the role of N vs. P. He stated that there had been a number of papers published since 2000 on the nutrient limitation and that he was developing an interpretive set of background paragraphs. He also stated that he had sent emails to a number of people to gather additional information. A member stated that the questions developed by Dr. Paerl captured the important issues to be addressed in this part of the response. Dr. Bianchi stated that it would be important to capture the results of work that had been completed at Texas A&M University on nutrients coming out of rivers. He stated that a number of workers had provided data on P flux. Dr. Paerl stated that he would like to receive available new information.

The subgroup discussed models of productivity and oxygen consumption. Dr. Paerl noted that the available models assume that nitrogen is the limiting nutrient. He stated that it may be useful to consider other limitations such as light. A member stated that Dr. John Morse had developed a diagenetic model that predicts oxygen consumption. A member stated that these models provide important new information to better understand causes of hypoxia. Another member stated that the issue of nutrient cycling, particularly phosphorus recycling and denitrification, was important and should be considered.

Dr. Gilbert stated that the role of upwelling was also very important and should be included in the master equation. He stated that a diagenetic model had been developed by workers at McGill University, and that he would send the paper to Dr. Bianchi. Dr. Paerl stated that over the next four weeks he expected to make progress on drafting his section of the response.

Dr. Howarth stated that he had not yet prepared written material on the assigned topic but that he would provide this before the next subgroup teleconference. Dr. Howarth stated that his section would address the linkages between biogeochemical processes and nutrient dynamics. He would address cycling and recycling focusing on sediment exchange processes. He noted that there was not much site-specific information for the Gulf of Mexico available on this topic so he would have to draw upon what has been done elsewhere. He stated that he would be able to make progress on this by November 15. Dr. Sanders stated that it would be helpful to share information with the subgroup as it is developed. Dr. Paerl asked members to send him any new references or papers on nutrient cycling.

Historical Changes in Productivity and Hypoxia

The subgroup discussed historical changes in productivity and hypoxia. Dr. Conley was the lead discussant. Dr. Conley reviewed the written material he had provided to the group on this topic. He stated that he had gathered much of the relevant literature on this topic published since the 2000 Integrated Assessment. He stated that the available information shows that there have been increases in hypoxia since the 1960s and 1970s. He mentioned some of the problems associated with the available studies. He stated that some studies show that the spatial extent has increased, but more work must be done on this. He stated that there were some problems associated with the dating of sediment cores and determining accurate sedimentation rates. Members discussed other papers that had been published or were in press. A paper published by workers at the University of South Florida was mentioned. A subgroup member stated that, based on available data, hypoxic events in the Gulf can be linked to the Mississippi River. Some data are available to link hypoxic events with historical land clearing activities.

The subgroup discussed modeling and the linkages between hypoxic events and fertilizer use. A member noted that there are two or three different models that have been used to look at nitrogen and one or two for phosphorus. Landscape models have been used. A

member mentioned that the inability of some models to deal with tile drainage was a problem. The group discussed use of the SPARROW model.

A member asked the subgroup to comment on the available literature on algal pigment concentration in sediment. He asked how much of this algal pigment was a result of diagenesis breakdown vs. accumulation over time. Papers by Rabalais and Chen et al. were discussed. These papers showed an increase in production and an increase in preservation of algal pigment. A member mentioned that studies of bacterial pigments have also been completed. Some studies show the presence of hydrogen sulfide. Dr. Conley stated that he would review the papers to find strong and weak points, but in general the consensus seems to be that changes have occurred. A member stated that the available evidence is suggestive of enhanced loading.

Implications of Reducing P and N (Part

The subgroup discussed implications of reducing P and N. Dr. Sanders was the lead discussant. Dr. Sanders stated that he is looking at the available literature and the white paper that was published on the importance of phosphorus. He stated that he would be looking at the literature that has addressed nutrient limitation from a both a stoichiometric and experimental perspective. He stated that he will be looking at the 2000 Integrated Assessment to evaluate the validity of nitrogen removal strategies and the implications of phosphorus removal, and noted that it is probably important to remove both. He stated that he will be identifying additional work that still needs to be completed in this area.

A subgroup member noted that the previous assessment had focused on nitrogen but called for reductions of both N and P. The subgroup discussed the white paper on phosphorus. A member stated that a final report on this never issued, and he expressed the opinion that the group should not review a draft report that was not released. Dr. Sanders agreed that the paper should not be reviewed, but he noted that concepts in the paper provide a good starting point for consideration of the issue of N vs. P. He stated that it will be important to identify problems and whether there is a lack of science to address them.

Part B of the Charge to the Subgroup

Dr. Sanders reminded the subgroup that at the meeting in September they had decided to defer answering part B of the charge (comment on the science for characterizing the onset, volume, extent and duration of the hypoxic zone). Dr. Howarth suggested that the response to this question might focus on the empirically derived models. Another member noted that there has been considerable disagreement on this issue and that it would be useful to have an inventory of the models. It was noted that a separate teleconference on models was held by several members of the Panel and they were identifying experts who should come to the next Panel meeting in December.

Discussion of Experts to be Invited to the Next Panel Meeting

The group discussed inviting a number of experts to the next Panel meeting in December. Subgroup members stated that it would be helpful to hear from the following people: Dr. James Ammerman – nutrient limitation and (N, P, and Si), Dr. Steve DiMarco – physical factors affecting hypoxia, Drs. Don Scavia and Victor Bierman – large scale models, Dr. Robert Dean – Corps of Engineers – ecosystem restoration efforts proposed by the U.S. Army Corps of Engineers.

A member stated that modeling is an overarching issue. He stated that it would be useful to hear from a number of modelers offering different perspectives. Dr. Dale suggested that it would be useful to have a panel of modelers speak to the Panel at the meeting in December. Members agreed that this would be helpful.

Public Comments

Dr. Sanders asked the DFO if there were any persons on the call who had asked to make comments. The DFO responded that there had been no requests to provide comments.

Review Action Items and Assignments

Dr. Sanders reviewed the action items and assignments. Dr. Sanders stated that the next subgroup 1 teleconference would be held on November 15 from 9:00 a.m. – 12:00 p.m. He stated that all subgroup members should continue developing more detailed written material for their parts of the response to the charge. He asked members develop this material before the next teleconference on November 15. Dr. Sanders stated that he would look at the material received and send an email to the members concerning the next teleconference.

At the conclusion of the discussion, Dr. Sanders thanked the members for their contributions and asked them to provide more specific written material. There were no additional comments so Dr. Sanders adjourned the teleconference.

Respectfully Submitted:

Certified as True:

/Signed/

/Signed/

Dr. Thomas Armitage
Designated Federal Officer

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

APPENDICES

Appendix A: Roster of Subgroup 1

Appendix B: Meeting Agenda

Appendix A – Subgroup Roster

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. 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

AGENDA
SCIENCE ADVISORY BOARD
Hypoxia Advisory Panel – Subgroup on Causes of Hypoxia
Public Teleconference
October 17, 2006, 9:00 a.m. – 12:00 p.m. (Eastern Time)

Purpose: The purpose of this teleconference is for members of the Hypoxia Advisory Panel's Subgroup #1 to discuss their advisory work related to characterization of the causes of hypoxia in the Gulf of Mexico.

9:00 a.m.	Convene meeting	Dr. Thomas Armitage Designated Federal Officer
9:10 a.m.	Purpose of the call and review of the agenda	Dr. James Sanders, Subgroup Leader
9:15 – 11:00 a.m.	Discussion of draft outline responses to the charge	
	Physical processes controlling and hypoxia (parts 1.A.i, 1.A.ii, and 1.A.iv of the charge)	Lead Discussants: Drs. Denis Gilbert, Don Wright, and Otis Brown
	Biogeochemical processes controlling hypoxia (part 1.A iii of the charge)	Lead Discussant: Dr. Thomas Bianchi
	Nutrient dynamics (parts 1.A.iii, 1.A.iv, and 1.A.v of the charge)	Lead Discussants: Drs. Robert Howarth and Hans Paerl
	Role of redox reactions	Lead Discussants: Drs. Daniel Conley and Robert Howarth
	Historical changes in productivity and hypoxia	Lead Discussant: Dr. Daniel Conley
	Implication of reducing P and and N (part 1.A.vi of the charge)	Lead Discussant: Dr. James Sanders
11:00 – 11:30 a.m.	Technical briefings needed and questions to be answered	Dr. Sanders and Subgroup

11:30 - 11:45 a.m.	Public comments	
11:45 a.m. – 12:00 p.m.	Review action items and assignments	Dr. Sanders and Subgroup
12:00 p.m.	Adjourn	