GULF OF MEXICO MERCURY WORKSHOP

December 2-4, 2008

Gulfport, Mississippi

FINAL REPORT OF PROCEEDINGS

DAY ONE: December 2, 2008

Participants

Name	Day 1	Day 2	Day 3
1. Donald Axelrad	X	X	X
2. Joel Blum	X	X	
3. Ruth Chemerys	X	X	X
4. Lynette Cobb	X	X	X
5. Mark Cohen	X	X	X
6. Charles Demas	X	X	
7. Alice Dossett	X	X	X
8. David Evans	X	X	X
9. Henry Folmar	X	X	X
10. Brian Fry	X	X	
11. Gary Gill	X	X	X
12. Cindy Gilmour	X	X	
13. Reed Harris	X	X	X
14. Aixin Hou	X	X	
15. Robert Hughes	X		
16. Allison Jenkins	X	X	X
17. Chris Johnson	X	X	X
18. Adrienne Katner	X		
19. Charles Kovach	X	X	X
20. David Krabbenhoft	X	X	
21. William Landing	X	X	X
22. Fred Leslie	X	X	X
23. Rob Mason	X	X	
24. Ellen McCarron	X	X	X
25. Steve Morey	X	X	
26. Lucie Novoveska	X		
27. Harriet Perry	X	X	
28. Curt Pollman	X	X	X
29. Darren Rumbold	X	X	

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30. David Schanbacher	X	X	
31. Linda Sedlacek	X	X	X
32. Lauren Showalter	X	X	
33. Elsie Sunderland	X		
34. Barbara Viskup	X		
35. Mark Woodrey	X	X	X
36. John Young	X		
37. Kevin Dillon	X	X	X
38. Pruek Pongprueksa	X	X	X
39. Rebecca Comyns	X		
40. Tim Wool	X	X	X
41. Ted Lange	X	X	X
42. Hari Prasad Dasari	X		
43. Spencer Garrett	X		
44. Emelise Cormier	X	X	X

WELCOME/WHY WE ARE HERE

William Landing, Ph.D., Environmental Chemistry and Chemical Oceanography, Department of Oceanography, Florida State University opened the meeting by welcoming everyone and introducing Donald M. Axelrad, Ph.D. Dr. Axelrad, Environmental Administrator, Florida Department of Environmental Protection (FDEP), delivered a short presentation which gave an overview of the issues surrounding mercury contaminants in fish, the focus of this Workshop (Exhibit A).

Following Dr. Axelrad's presentation, participants asked the following questions:

1. Are we speaking to wildlife as well as human impacts?
    a. No, the emphasis is on human impacts, but there will be discussion regarding wildlife (small groups)
2. Why aren't there any representatives from Mexico at this workshop?
    a. The Mexican mercury data we have for the Gulf are crude estimates; we do want to get data from Mexico and would like to have representatives involved. Several scientists from Mexico were invited, but were unable to attend this year's workshop.
    b. Other states should also be considered in addition to those that run along the Gulf of Mexico.
    c. Mexico is working with Canada and U.S. on mercury modeling in the atmosphere.

Facilitator, Janice Fleischer, recognized Ellen McCarron, Assistant Director, FDEP, Division of Coastal and Aquatic Managed Areas, who explained her new role as Water Quality Team Lead with regard to the Gulf of Mexico Alliance (GOMA).
Dr. Axelrad turned the meeting over to Janice Fleischer, the Facilitator.

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AGENDA REVIEW, MEETING GUIDELINES, FACILITATOR AND PARTICIPANT ROLES

Ms. Fleischer reviewed the following documents which were included in each participant's packet:

- Agenda (Exhibit B)
- Facilitator Responsibilities (Exhibit C)
- Participant Responsibilities (Exhibit D)
- Discussion Guidelines (Exhibit E)

Ms. Fleischer described two large flipchart pad sheets displayed on easels outside the meeting room. The "Idea Parking Lot" was to be used for participants to record any suggestions/ideas/items which they felt were not covered at this workshop or which they would like to see covered or detailed at a future meeting. Participants were asked to use the second board to record the names of other individuals who are working on mercury who were not on the list of invitees to this workshop.

The last two items in the participants' packet mentioned by Ms. Fleischer were the Comment Card and the Evaluation Form (Exhibit F). She asked participants to complete the Evaluation Form at the end of the workshop or earlier if they needed to depart before the end of the workshop. All comments written on the Comment Cards are captured at the end of this Report of Proceedings.

Ms. Fleischer reminded participants that all items which they suggest should be included in the GOMA Action Plan need to be able to be accomplished within 5 years. Referring to the GOMA Action Plan, she reiterated the overall goals which should be accomplished in the five years:

- The mechanism by which mercury enters the food chain and accumulates in Gulf of Mexico fish is understood.
- The primary sources of mercury that are responsible for the mercury in Gulf of Mexico fish are identified and ranked.

She then set out the expected results from this Mercury Workshop:

- The beginnings of or the ability to design and prioritize activities to address Action Items.
- Outline of possible research proposals targeted for individual action items.

The meeting was then turned over to Dr. Landing, who moderated for the day.

PRESENTATIONS :

HUMAN EXPOSURE TO METHYLMERCURY FROM MARINE AND ESTUARINE FISH, A GULF-WIDE APPROACH

Elsie Sunderland, Ph.D., Research Associate, Harvard University, School of Engineering and Applied Sciences delivered the first presentation. (Exhibit G).

Following Dr. Sunderland's presentation, Ms. Fleischer recorded the following comments from the plenary discussion among the participants and Dr. Sunderland:

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- NY Study and Asian American population: need to note that population subgroups need to be reviewed and averages extrapolated for those groups
- Much of the fish sold in markets are imported, is that taken into account in the research and how does that affect the numbers shown in the analysis?
    - Done nationally, but not for the Gulf particularly
- Was there any follow up on the Asian American study?
    - Yes, now finding that that population is consuming very different species of fish than other populations (we can get contact information on the person who is doing this study)
- How do mercury levels in Gulf of Mexico rate in the world? We know we are high in the U.S.
    - Hard to summarize on a world basis. To what are you comparing it to? Depends on the population studied.

UPDATES ON NOAA'S MERCURY IN GULF FISH & SEAFOOD DATA COLLECTION

The second presentation was delivered by Spencer Garrett, Ph.D., Director of NOAA Fisheries' National Seafood Inspection Laboratory (Exhibit H).

Following Dr. Garrett's presentation, Ms. Fleischer recorded the following comments from the plenary discussion among the participants and Dr. Garrett:

- Is there an assembled database by NOAA?
    - This would be a valuable resource
- Data sets being available are a very valuable resource; we are going to try to get the NOAA data set available and it is one of the items to be discussed at this workshop.
- Can we figure out the concentration of atmospheric mercury in Asian countries (which ones?)
- Selenium mitigation?
    - This is still a subject of research and no full agreement on the effects.

BREAK

At this point in the meeting, participants took a short break. Upon returning from Break, Ms. Fleischer announced that arrangements had been made at a local restaurant so that all participants could meet for dinner.

Presentations then continued.

MONOMETHYL MERCURY CONCENTRATIONS ON THE EASTERN TEXAS-LOUISIANA SHELF DURING THE FORMATION, PEAK AND DISAPPEARANCE OF HYPOXIA

Gary Gill, Ph.D., Technical Group Manager, Marine and Environmental Chemistry Group, Battelle's Marine Sciences Laboratory delivered the third presentation (Exhibit I)

Dr. Gill explained that he has other data sets and would be happy to share them if anyone wants them. Interested individuals are able to contact him at: Gary.Gill@pnl.gov.

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Following Dr. Gill's presentation, Ms. Fleischer recorded the following comments from the plenary discussion among the participants and Dr. Gill:

- Anything over 2% is a very high value for methylmercury (MeHg) and some of the results showed very high MeHg (in excess of 2%).
- They followed a more rigorous analytical method over and above the EPA Standard analytical method.
- Are Mississippi fluxes based on raw water samples?
    - Based on unfiltered samples

MERCURY CYCLING AND FLUXES IN THE NEAR COASTAL ENVIRONMENT

The fourth presentation was given by Dave Krabbenhoft, Ph.D., Research Scientist, U.S. Geological Survey (Exhibit J). Dr. Krabbenhoft's presentation supports the idea of a whole ecosystem approach.

Following Dr. Krabbenhoft's presentation, Ms. Fleischer recorded the following comments from the plenary discussion among the participants and Dr. Krabbenhoft:

- In Mobile Bay the mercury concentrations dropped near the coast whereas in the Everglades the mercury increased near coastal areas.
    - Florida studies were all done in mangroves so the results may have to do with the amount of water flow.
- Why don't you see the same impacts on reactive gaseous mercury (RGM) in the Great Lakes as you do in coastal systems in the southern coastal areas?
    - Don't have the same emitting aerosols, don't get the same halogens.
    - The ocean breeze brings the halogens to the coastal areas.
    - May be related to hydrocarbons (?) Facilitator's Note: I am told this may be referring to volatile hydrocarbons in the atmosphere.

METHYLATION/DEMETHYLATION, ESTUARINE STUDIES, SEDIMENT STUDIES

The fifth presentation was delivered by Cindy Gilmour, Ph.D., Microbial Ecologist, Smithsonian Environmental Research Center (Exhibit K).

Following Dr. Gilmour's presentation, Ms. Fleischer recorded the following comments from the plenary discussion among the participants and Dr. Gilmour:

- Have you ever tried measuring MeHg in aggregates? Marine snow?
- Given the importance of the very sharp redox gradients in sediments, do you think the sediment/water interface was properly sampled?
    - Probably did not capture the sharpness of the interface.
    - Have to try to work on platforms that don't move as much to increase the sharpness of the interface.
- Has anyone looked at methylation in shallow groundwaters?
    - Yes, in the watershed in Chesapeake Bay and other areas.

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BREAK

GULF OF MEXICO MERCURY RESULTS, SAMPLING ISSUES, GULF-WIDE FIELD EFFORTS

Presentation number six was delivered by Rob Mason, Ph.D., Professor of Marine Sciences, University of Connecticut (Exhibit L).

Following Dr. Mason's presentation, Ms. Fleischer recorded the following comments from the plenary discussion among the participants and Dr. Mason:

- Molar concentrations vs. gram concentrations
    - Are there different uses for these two ways of measuring?
    - It is easier to compare on a molar basis when considering mixtures of chemicals and reactions among them.
    - If only talking about mercury, gram is ok for measuring one metal
- Huge reservoir of mercury in the water, much of it is anthropogenic but it exists even when you don't consider the anthropogenic influences.

WHERE DOES THE MERCURY IN ATMOSPHERIC MERCURY DEPOSITION COME FROM?

Mark Cohen, Ph.D., Physical Scientist, NOAA Air Resources Laboratory, delivered the seventh presentation (Exhibit M).

Following Dr. Cohen's presentation, Ms. Fleischer recorded the following comments from the plenary discussion among the participants and Dr. Cohen:

- Uncertainty will always be a factor, where can resources be best put?
    - Don't have the answer quite yet, no good comparison models yet.
- If you have a target and you want to reduce it by X%, who or what do you target to get the answers?
- Inverse analyses: any potential for them?
    - A little tricky, they seem unsatisfying to me, too many problems.
- Modeling is an iterative process, it must be worked on continually.
- Is there a baseline average deposition?
- Political reality of measuring mercury emission from industrial stacks is why current, reliable information is not available.

SCREENING MODEL FOR GULF OF MEXICO MERCURY CYCLING

Reed Harris, Reed Harris Environmental Ltd. Delivered the eighth and last presentation which was prepared jointly with Curt Pollman, Ph.D., Aqua Lux Lucis, Inc. (Exhibit N).

Following Mr. Harris' presentation, Ms. Fleischer recorded the following comments from the plenary discussion among the participants and Mr. Harris:

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- How important is particle sinking vs. advection in the water column?
- Fish, where they eat and how they move around?
- How much mercury do the fish bring with them?
- Which species should we try and study? Need one that is well understood in its range. Some are far better known than others.
- There are a variety of sources to get information on fish movement.
- Resident vs. migratory fish populations.
- Mercury enters at base of food web, knowing the productivity of the food web is very important and should be included in any modeling being done.
- Hydrodynamic model vs. the water quality model, are you incorporating the two? How are they being reconciled with one another?
    - Running a multi-decade simulation.
- Mercury cycling model probably won't be fully coupled; initial approach is to use the hydrodynamic model to provide mixing and transport information for the mercury cycling model.
- Mercury and nitrogen in coastal and off shore fish seem to be completely decoupled; interesting to talk to folks doing this work.
- What is the optimal spatial resolution for the model?
    - Starting with 20 cells, we are experimenting with how much higher we should go.
    - We are just starting so we can find out what the optimal resolution would be.

ADJOURN

At the conclusion of the Harris/Pollman presentation and discussion, the meeting was adjourned for the day. Ms. Fleischer encouraged all participants to read the document entitled "Gulf Of Mexico Mercury Workshop Breakout Groups With Current Action Items" in preparation for group breakouts the next day.

DAY TWO: December 3, 2008

WELCOME BACK/SMALL GROUP INSTRUCTIONS

Janice Fleischer, Facilitator, welcomed everyone back on the second day of the workshop. She drew everyone's attention to their packets which contained two documents entitled:

1. *Gulf Of Mexico Mercury Workshop Breakout Groups With Current Action Items*
2. *Gulf of Mexico Alliance, Action Plan II Water Quality Priority Issue Team, Mercury Portion*

Ms. Fleischer explained that the second document is a more recent version of the GOMA Action Plan, Mercury Section. It was added to the participant packet subsequent to the design of the workshop and the development of the agenda. The agenda exercises were based on the first document, which, Ms. Fleischer explained, contained the same information as the second document but in a different format. She apologized if participants were confused by the inclusion of the two documents and asked participants to rely on the first document when deliberating during their small group breakouts.

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SMALL GROUP BREAKOUTS: FIRST SESSION

Ms. Fleischer explained that the next 1.25 hours would be spent in small group breakouts. The groups would be divided into six categories and each group would have a small group facilitator who would assist in keeping the group on track and would record all work of the group on a laptop using a projector so everyone in the group could see the work as it was recorded. Additionally, Ms. Fleischer announced that on the Agenda the small group breakouts were referred to as "Tiers"; however, that term had a specific meaning to scientists and may cause confusion; therefore, she would be referring to each small group breakout as a "session".

The small groups were as follows :

1. Atmospheric inputs and atmospheric modeling/ Facilitator: Bill Landing
2. Riverine and groundwater inputs/ Facilitator: Allison Jenkins
3. Net fluxes of dissolved and particulate mercury and methylmercury/ Facilitator: Janice Fleischer
4. Coupled hydrodynamic and mercury cycling models/ Facilitator: Linda Sedlacek
5. Mercury cycling in estuaries and coastal sediments/ Facilitator: Charles Kovach
6. Mercury bioaccumulation and biomagnifications in fish/ Facilitator: Emelise Cornier

Participants were told to remember as they worked through each session that the results must be able to be completed in a five year period. If group members felt a project or item was important to the overall Plan but was unable to be accomplished in the five year period, they should designate it an "emerging issue" and highlight it as it is recorded.

Participants were allowed to pick whatever group they felt most qualified or interested in to join. The only criterion was that the small groups be approximately the same size. Participants were encouraged to help their small group facilitator balance the conversation and not allow anyone to dominate the discussions.

Ms. Fleischer went over the first session instructions in detail (Exhibit O). Workshop participants were then dismissed to join their small groups.

SMALL GROUP REPORTS SESSION (TIER) I RESULTS AND PLENARY DISCUSSION

At the end of the first small group session, all participants came together to hear short reports by each small group and react to the work of the group. What follows are the first session results of each group and the comments of all participants after each small group report. Underline indicates new material, ~~strikethrough~~ indicates deleted material.

Breakout Group 1 Session 1. Atmospheric Inputs and Atmospheric modeling

WQ-3.2: Quantify the major input pathways for mercury to the Gulf of Mexico.

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3.2.1 Determine atmospheric inputs of mercury.

3.2.1.a. Compile measurements of wet deposition of mercury and methylmercury from existing studies. Update annually.

- MeHg not usually done. MDN network already exists and is updated annually.
- Distributed monitoring helps ground-truth models; does not provide broad coverage
- Measure other trace elements in rain samples, as source tracers.

3.2.1.b. Estimate nearshore dry deposition fluxes by quantifying dry deposition of reactive gaseous mercury (RGM) using existing and additional measurements.

- Distributed monitoring helps ground-truth models; does not provide broad coverage
- Include supplemental air monitoring equipment (NOx, SO2, O3, etc.) to aid in the interpretation of the RGM data.

3.2.1.c. Deploy samplers on offshore platforms to monitor wet and dry deposition fluxes of mercury over the Gulf of Mexico. Include supplemental air monitoring equipment (NOx, SO2, O3, CO, PM2.5, etc.) to aid in the interpretation of the RGM data.

Measure other trace elements in aerosol samples, as source tracers

3.2.1.d. Model the atmospheric fate and transport of atmospheric mercury in the Gulf of Mexico region resulting from anthropogenic and natural sources in the region and outside of the region (including Mexico, regional, and global).

3.2.1.e. From these models, estimate the wet and dry deposition of mercury to Gulf of Mexico ecosystem(s) to provide inputs for water-ecosystem mercury cycling models. (Previously highlighted as emerging issue. Currently available and do-able.)

3.2.1.f. Also from these atmospheric Hg models, produce source-attribution estimates for the deposition. (Previously emerging issue, Harder, but do-able.)

New Action Items:

- Revise/improve emissions inventories; update periodically to make available for states and modelers, (not as easy as it might seem).
- Make more measurements to improve emission estimates.
- Improve estimates of natural emissions.
- Atmospheric deposition to watersheds (wet plus dry); impacts on rivers and streams fluxes and urban runoff.
- Atmospheric measurements aloft useful for modeling; improve understanding of atmospheric Hg cycling.

New Emerging Issue:

Atmospheric halogen and oxidant measurements to help understand RGM.

PLENARY COMMENTS to Group 1, Session 1 work:

- Go to Mexico for atmospheric studies

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- RE: emerging issues: is there something that can be identified at the end of five years that can be identified
    - Not just "making progress" but actual delivery
- Methylmercury measurements: very few MDN sites are doing this and should be checked into
- Platform measurements of Hg deposition, significant mercury contamination at oil platforms
    - Is this just an aqueous issue or is there also evidence for an atmospheric emission as well?
- May be able to use some inactive platforms
- 80% of all items must be doable with NO EXTERNAL FUNDS, only with current funds, 20% can remain in but will need external funds, everything else must go in to EMERGING ISSUES, they are looking for finished products at the end of five years
    - WML NOTE: This issue was raised by Linda Sedlacek, and is only true for projects to be funded from 2008 funds (already distributed to Gulf states). The goal is to articulate a strong research program and to seek additional external funding for the various components.
- Need things that can be compared to the Governor's Action Plan, these should be completed projects
- Florida Freshwater TMDL study is doing extensive monitoring and it will be available to be plugged into Gulf projects.

Breakout Group 2, Session 1: Riverine and Groundwater Inputs

WQ-3.2: Quantify the major input pathways for mercury to the Gulf of Mexico.

3.2.2. Determine and quantify riverine inputs of mercury.

3.2.2.a. Develop a strategy to monitor mercury concentrations in rivers using ~~determine and quantify riverine inputs into Gulf of Mexico estuaries~~
Use the river drainage areas and flow data to quantify major flow input~~s~~ ~~examine~~ factors that affect mercury and methylmercury concentrations in rivers, and the database from 3.1a (define database here).

3.2.2.b. Using the ~~this~~ monitoring strategy for riverine inputs from 3.2.2.a~~regime~~, monitor dissolved mercury, particulate mercury, and methylmercury fluxes and associated parameters (e.g., dissolved organic carbon, pH, conductivity, and dissolved oxygen, and total suspended solids) from the major ~~approximately eight U.S.~~ Gulf of Mexico tributaries with differing characteristics (e.g., black water, well-buffered systems, land use and cover) for at least three years.

3.2.6. Assess ~~Quantify~~ the potential importance of ~~the impact of~~ submarine groundwater discharge~~son mercury fluxes in the~~ to the Gulf of Mexico.

3.2.6.a. Identify individuals carrying out groundwater monitoring and sample collecting who are willing to collaborate.

3.2.6.b. Measure concentrations of total mercury and methylmercury in groundwater discharges to the Gulf of Mexico.

- Note from Gary Gill: This is not a straight forward task. Simply monitoring mercury in ground water will not provide this information because mercury is not likely to be conservatively

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transported in groundwater. The key interaction is the changes that occur in the last few meters to 10's of centimeters before the water exits. Perhaps the best approach here would be to develop an approach and then conduct a pilot project to demonstrate proof of concept before launching into a major effort.

PLENARY COMMENTS to Group 2, Session 1 work:

- Original language in some has changed, so let's make a start. There are a few places where it could be done quickly.
- Scaling and modeling is really critical in the flux "stuff". Structure should include how much data you need to collect, etc. (get specifics from Cindy)
- Where would point sources fit? Does it fall into this category?
- Currently, mercury monitoring is not part of nutrient plan, but it is our intention to work cooperatively with the GOMA nutrient team.
    - Note from Gary Gill: It is critical to recognize that the sampling approaches used for nutrients will not be appropriate for mercury sampling. Ultra-clean sampling approaches will be needed.

Breakout Group 3, Session 1. Net Fluxes of dissolved and particulate Hg and MeHg

WQ-3.2: Quantify the major input pathways for mercury to the Gulf of Mexico.

3.2.3. Establish the net fluxes of dissolved and particulate mercury and methylmercury to the coastal waters of the Gulf of Mexico.

3.2.3.a Determine the net flux of mercury and methylmercury from rivers and estuaries to coastal waters (other than the Mississippi River) by conducting studies of mercury transport and cycling through estuaries. Choose estuaries that are associated with the above river monitoring program and integrate studies with the GOMA coastal nutrient criteria framework studies. Conduct studies for at least 2 years with emphasis on quantifying the estuarine flushing effects from major storm events.

New sub item: Determine the flux of mercury and methylmercury from the Mississippi River to the GOM.

3.2.4. ~~Map~~ Characterize temporal and spatial ambient mercury and methylmercury concentrations along typical coastal areas to emphasize areas of groundwater input and coastal wetlands.

3.2.4.a. Collect vertical profiles of total mercury and methylmercury in a series of transects from the coastline to offshore to measure mercury-concentration gradients. Overlap coastal transects with the river and estuarine study sites above and integrate with the GOMA coastal nutrient criteria framework studies.

3.2.5. Quantify the net flux of total and methylmercury from the inflow and outflow of water between the Caribbean Sea and the Gulf of Mexico.

3.2.5.a. Water flow through the Yucatan Straits into the GoM is very large and represents a potentially significant flux of mercury into the GoM; much of the inflowing water, however, follows the Loop Current around the central GoM and quickly exits through the Florida Straits. Determine a first order estimate of the net flux to the Gulf and Gulf coastal areas by monitoring mercury

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concentrations in the Yucatan and Florida Straits for at least ~~3 years~~ 2 seasons.
NO LONGER AN EMERGING ISSUE, CHANGED THE LANGUAGE

NEW ITEM: Quantify the sediment water exchange flux of mercury and methylmercury in coastal and marine sediments.

NEW EMERGING ISSUE: Determine the flux of methylmercury from deep GOM waters as a source to pelagic surface waters.
NEW EMERGING ISSUE: Loss of wetlands as it impacts the input pathways for mercury to the GOM.
NEW EMERGING ISSUE: How will the various mercury input pathways be modified by global change.

Other thoughts:

1. Hypoxia area must be investigated as a source of methylmercury.
2. All the oil and gas rigs need to be investigated as a source of methylmercury.
3. Impact of episodic sediment disturbances (hurricanes, tropical storms, shrimping dredging, etc.).

PLENARY COMMENTS to Group 3, Session 1 work:

- We can fingerprint sources of mercury and follow them around, this should help us in the Gulf as well (offered by Joel Blum (Univ. Michigan)
- A new paper on item #3 of other thoughts above on coastal sediments (Turner)
- First cut modeling, Landscape or GIS component to the modeling.
- Is there any kind of fertilization (?) (get from Mark Cohen)

Breakout Group 4, Session 1. Coupled Hydrodynamic and mercury cycling models

WQ-3.2: Quantify the major input pathways for mercury to the Gulf of Mexico.

NOW A NEW ACTION STEP:
3.2.7. ~~Construct~~ Develop a coupled hydrodynamic/mercury water quality modeling framework to quantify how present and future mercury loadings will affect fish mercury concentrations in the Gulf of Mexico region, including both temporal and spatial variability.. ~~to integrate all measurements.~~ Move to Action Step Level Note, previously and emerging issue (PURPOSE STATEMENT?)

New Action Items: (Place before 3.2)

a) Determine questions to answer with the model framework that clearly establishes the model purpose.
    a. Items to consider when creating model framework:
        i. Spatial domain of questions
        ii. Spatial resolution needed to address questions
        iii. Model components

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iv. Data available to parameterize model at optimal spatial and temporal resolution
v. Define appropriate water quality endpoint(s)

b) Determine requirements for hydrodynamic/mercury water quality modeling framework that can be developed within the five years.

New 3.2.7 Apply the modeling framework to:

~~3.2.7a. Calculate~~ Quantify the geochemical cycling of ~~fluxes of mercury into and within~~ relevant ~~to the Gulf by using a model to incorporate~~ing the mercury concentration and concentration gradient data into high resolution hydrodynamic circulation models for the Gulf of Mexico ~~(e.g., NCOM or HyCOM).~~

3.2.7.b. Use the resulting model to simulate mercury cycling and bioaccumulation in the GoM. Use the model to help identify data gaps and any additional information or research needs.

3.2.7.c. Where appropriate, integrate the mercury model with hydrodynamic and water quality models developed for the GOMA nutrient criteria framework studies.

WQ-3.3: Determine where mercury methylation occurs and what processes govern its occurrence.

3.3.4. Integrate methylation information into the coupled hydrodynamic/mercury water quality model to help identify data gaps and any additional information or research needs.

WQ-3.4: Determine how and where methylmercury enters into the food webs and bioaccumulates in fish (in collaboration with Nutrients PIT).

3.4.5. Incorporate trophic information into the coupled hydrodynamic/mercury water quality model to help identify data gaps and any additional information or research needs.

PLENARY COMMENTS to Group 4, Session 1 work

- What is the spatial domain of what we are measuring?
- Moving into watersheds is a separate issue, can be done independently of anything done in the Gulf of Mexico. It will get done with TMDL work.
- Rather say "just need net number" out of river, separate this out otherwise project could be so big it is undoable.
- Do we need to have a full watershed model or not?
- This is not a TMDL effort, although they are related.
- Coupling of hydrodynamic models and mercury models and how they interact with each other.
- Fish Species-specific level work needs to be done, generic species are not adequate
- Need recommendation for target species
- Subgroup to discuss the domains, what is spatial extent of this effort, you cannot possibly ignore the freshwater component. If we don't know where it is coming from we cannot solve the problem.

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- Some watershed work is already being done, get our work done first, go to watersheds then to rivers.
- Approach all of this in an iterative fashion. We need to look at stages and not eliminate anything until it is determined it is not really needed at all.
- I think that a GIS component will be necessary to this effort (as well as other efforts) so that different habitat types and their aerial extent can be identified relative to their source/sink signature for mercury and methylmercury.

Breakout Group 5, Session 1: Mercury ~~Cycling~~ Methylation/Demethylation ~~in Estuaries and Coastal~~

WQ-3.3: Determine where mercury methylation occurs and what processes govern its occurrence.

3.3.1. Use the information collected in WQ-3.1.1 to identify what we know about methylmercury distribution ~~methylation~~ and net methylmercury production in estuarine, coastal and pelagic systems.

3.3.2. Develop a strategy to understand where mercury methylation occurs in the Gulf of Mexico ecosystem and the processes that govern it, beginning with using the information from WQ-3.3.1. The strategy may include in situ sampling in estuarine, nearshore and pelagic environments as well as laboratory studies.

3.3.3. Implement mercury methylation-demethylation studies based on strategy created in Action Item 2.

3.3.4. Integrate methylation information into the coupled hydrodynamic/mercury water quality model to help identify data gaps and mercury sources for methylation, any additional information or research needs.

NEW ITEM: Develop a strategy to determine what are the sources and relative age of mercury that are driving methylation.

Group comment: Should include how ecosystem process changes (e.g., climate change, changing nutrient fluxes, ocean acidification) may affect net methylation.

PLENARY COMMENTS Group 5, Session 1 work:

- Affects of climate change, include changing hurricane intensity.
- On the new item, aging the mercury that is moving through the system, the response time in modeling does speak to the aging.
- Add in coastal restoration, you are adding a lot of new marsh.

Breakout Group 6, Session 1: Mercury Bioaccumulation and Biomagnification

WQ-3.4: Determine how and where methylmercury enters into the food webs and bioaccumulates in fish (in collaboration with Nutrients PIT).

3.4.1. Use the information collected in WQ-3.1.1 and 3.1.2 to identify where methylmercury enters into food webs and bioaccumulates in fish. Focus on differences

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between estuarine food webs and offshore food webs. As needed, implement studies needed for action items below.

3.4.2. Develop and implement a strategy to identify priority species for human consumption to be used in the trophic transfer studies below by looking at the concentration of mercury in different fish species, the catch for each species, and the intake of each species by at-risk groups.

3.4.3. Conduct trophic transfer studies of fishery species identified in step 2.

3.4.4. ~~Conduct water column transect studies in the GoM to measure~~ Assess methylmercury entry into the lower food web (bacteria, phytoplankton, zooplankton, and benthos). Integrate with the sampling in 3 above and the GOMA coastal nutrient criteria framework studies.

3.4.5. ~~Incorporate~~ Communicate and consider trophic information in the coupled hydrodynamic/mercury water quality model to help identify data gaps and any additional information or research needs. (PREVIOUSLY EMERGING ISSUE).

NEW ITEM: Assess biological transport of Hg through space , eg. from sediments, vertical transport of plankton, estuary to nearshore to offshore.

WQ-3.5. Better our understanding of mercury effects on key non-fishery species (e.g., whales and dolphins, seabirds).

3.5.1. Use information from WQ-1.1.1 to summarize what we know about mercury concentrations and effects in non-fishery species.

3.5.2. Combine information from item 1 above with food-web information and trophic bioaccumulation models to understand ultimate linkages to mercury sources throughout the Gulf.

3.5.3. Develop mercury risk assessment on several key non-fishery species.

Add Action Step to address human health:
Assess exposure rates to humans (consumption patterns, sample human hair, identify high-risk groups - recreational and subsistence anglers, ethnic groups, etc.).

PLENARY COMMENTS Group 6, Session 1 work:

- Human health context drives this entire problem, that is what will fund this entire project.
- Action items need to be included to make this so.
- Priority species need to be reviewed, other areas of the country are using different priority species. (silversides and grass shrimp as examples)
- Organisms that are widely distributed throughout the Gulf should be considered, they may indicate where you should be looking.

SMALL GROUP INSTRUCTIONS FOR TIER II BREAKOUTS

At the conclusion of the small group reports and discussion for Session 1, Ms. Fleischer explained that the group would be taking a short lunch break during which time they could continue their work or relax

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before beginning to work on the Session (Tier) 2 tasks. Session 2 would build on the work begun in Session 1; the small groups would remain the same with the exception of Groups 3 and 5 which would be combined since they shared many issues in common. Ms. Fleischer would become the small group facilitator for Group 6, thereby giving Ms. Cormier the opportunity to become part of the group and Mr. Kovach would facilitate for the combined Groups 3 and 5.

Ms. Fleischer reviewed the Instructions for Sessions 2 and 3, anticipating that some groups may finish their Session 2 work and want to move into the next stage of work (Exhibit P). The group then broke for lunch.

PRESENTATION AND PLENARY DISCUSSION: INFORMATION GATHERING AND DISSEMINATION

Upon returning from lunch, a change was made in the Agenda. The presentation and discussion regarding Information Gathering and Dissemination which was originally scheduled for the end of the day, was moved to directly after lunch to give participants the benefit of this information and plenary discussion prior to their continuing their deliberations. The Conveners felt that much of this information could have an impact on the small groups' development of Action Steps, Items and Activities so it would be better to have the discussion before any further detail work was done.

Ellen McCarron began by giving a short presentation (Exhibit Q). She discussed the makeup of the Gulf of the Mexico Alliance and an Action Step that was not included in the breakouts.

During Ms. McCarron's presentation, she emphasized that all projects need to be able to be accomplished within a five year term. One participant asked when the clock started ticking on the 5 year term, to which Ms. McCarron replied that it had not started yet. March, 2009, is when the 5 years would begin.

Dr. Landing made a couple of announcements and the group engaged in a short open discussion:

- This afternoon's primary goal is activity development; cost is NOT an issue at this time, we want you to develop the activities.
    - Look at the ones that are doable now, get all activities down
    - Then look at the ones which may take longer
    - The drafters will look at all the results and may make some changes
- One of the big challenges is integrating all the items, is there a plan to do that?
    - Yes, the implementing agencies will be doing that
- The Periodic Mercury Forum is primarily for keeping everyone up to date and sharing information on what is already being done and the results to date.
- Need coordination or a technical committee.
    - That will be formed.
- Where will the RFP's come from?
    - GOMA or NOAA?

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- Federal agencies will provide funding for GOMA activities. We need to also look out for other sources like Seagrant, etc. This is above and beyond their usual funding.
- There is a new South Atlantic Alliance forming as well.

The group was asked to respond to the following questions concerning Water Quality 1.1 of the GOMA Action Plan:

1. **Should a steering committee exist to seek and compile existing data on mercury studies in the Gulf of Mexico region, to be posted on a GOMA website?**
    a. Yes, will be formed.
    b. It will do more than what is outlined above, to coordinate mercury research in the Gulf; keep everyone informed, get more RFP's, etc.
    c. Reality check: you may be compiling metadata, not data.

2. **Who in the GOMA would be responsible for posting information on a GOMA website?**
    a. Chris David
        i. Does this for all teams, he controls the website (NOAA sponsored)

3. **Is it important to maintain a list of researchers working on Hg in the Gulf of Mexico region, and who would be responsible?**
    a. Yes, it is important, also piece in hydrodynamic modelers, not only mercury.
    b. Could be a steering committee
    c. Who maintains this Gulf based list now?
        i. Check out Gulfbase.org
    d. Suggestions should be sent to Linda Sedlacek, FDEP:
        i. Linda.Sedlacek@dep.state.fl.us
    e. What is the role of industry? Are they being brought in somehow?
        i. ICOSRMI (Interagency Committee on Ocean Science and Resource Management Integration)
        ii. There is a strong desire from GOMA to get business and private industry to be involved and participate.
    f. Please include researchers area of expertise and interest.

4. **Is it necessary to hold annual workshops on Hg in the GOM (assumes that research on many of the Action Items and Emerging Issues would be ongoing)?**
    a. How frequently should this be done (annual???)?
    b. For the purpose of talking about progress, to adjust items as necessary.
    c. Frequency is an issue, but at least every 18 months.
    d. Can we coincide with meetings of other teams?
        i. We have several places that want to coordinate meetings so we will be doing that.

SMALL GROUP BREAKOUTS, SESSION 2 AND SMALL GROUP REPORTS WITH PLENARY DISCUSSION

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Following the discussion regarding information accumulation and dissemination, participants broke into small groups once again to continue detailing the work begun in Session 1. Several groups were able to complete their Session 2 work, and continued into Session 3. The small group reports were begun on Day Two but, due to the late hour, it was decided to adjourn for the day and continue the remaining small group reports on Day 3 of the Workshop.

Prior to adjourning on Day 2, the following observations and comments were made by participants:

- There is a need for standardized data.
- We may want to identify one lab to gather information.
- We want to be cost effective but not exclusive.
- A QA program is important.
- It is critical to have metadata.
- Need to consider impact of groundwater on hydrodynamic modeling.
- NCOM is an example of a complex hydrodynamic model.
- Other than Florida, there is not much research on groundwater in marine environments.

ADJOURN

DAY THREE: December 4, 2008

Day 3 began by having small groups 3-6 give their reports. Group 6 and Group 1 felt they needed further work and met again. The remaining participants met with Ellen McCarron to rework Action Steps so that they incorporate all changes that had been proposed at the workshop. The purpose of this was to provide a logical crosswalk to the Governors' Action Plan II as well as toward the next working draft of the Action Plan.

The work of each small group is reflected in the following attachments to this Report (note: not all groups created answers to the specific Breakout Questions):

Exhibit R: Group 1, Session 2 Table
Exhibit S: Group 1, Session 3 Breakout Questions
Exhibit T: Group 2, Session 2 Table
Exhibit U: Group 2, Session 3 Breakout Questions
Exhibit V: Group 3, Session 2 Table
Exhibit W: Group 3, Session 3 Breakout Questions
Exhibit X: Group 4, Session 2 Table
Exhibit Y: Group 5, Session 2 Table
Exhibit Z: Group 5, Session 3 Breakout Questions
Exhibit AA: Group 6, Session 2 Table

WRAP UP, NEXT STEPS

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Ellen Mc Carron reported on the work her group had done on the Governors' Action Plan, changes in the order to Action Steps and insertion of a new Step. **(**Exhibit BB **).** Ms. McCarron stated that the Governors from the five Gulf States want to get their version of the Action Plan out as quickly as possible for the writing team to begin work on and to adhere to the overall GOMA schedule as much as possible. Participants asked:

- What will be the vetting and finalizing of the product produced from the workshop (i.e., the Action Plan)?
- The Water Quality Team Leads must approve the Governors' Action Plan first, then it will be submitted to the AMT (Alliance Management Team). This must all be done by the beginning of April, 2009.
- Governors' Action Plan is going out to the public now.
- Will this group get to see everything from this workshop again?
    - Yes, probably by next week. See website for information: http://www2.nos.noaa.gov/gomex/waterquality/welcome.html

Timeline for completed work from this workshop:

- Cleaned up version of small group work by each facilitator of the small groups due by Friday, Dec 12 to Ellen McCarron.
- All work will be posted on the FDEP website by Dec 15 and participants of this workshop will also be notified of the posting so they can comment.
- Participants get comments to the small group facilitators by December 19.
- Facilitators reconcile the comments and send back to Ellen McCarron by December 29.
- Ms. McCarron sends all work to GOMA's Water Quality Team or if timing is an issue, at a minimum the core group that represents the Alliance Coordinating Team (i.e., state leads, coordinators, team lead, and federal liaisons).

ADJOURN

Ms. Fleischer thanked everyone for their hard work and assistance in keeping the workshop focused. She asked everyone to fill out their Evaluations. The meeting was adjourned.

COMMENT CARDS RECEIVED

"It would have been extremely helpful for us to have gone around the room and introduced ourselves at the beginning of the meeting…and at different points during the meeting, e.g. at the start of each small group"
Anonymous

"Improve observational network and to give more importance for mercury modeling."
Hari Prasad Dasari

"Very nice meeting, good presentations and discussions. Fun, too."
Anonymous

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"I enjoyed this workshop very a lot. The part I enjoyed most was hearing the peers thoughts on mercury research and talking to people about my own research on mercury. Putting the pieces together should be valuable to every participant."

Anonymous

"Goals were a little ambitious but the groups stayed focused. Meeting was run efficiently."

Anonymous

"Great meeting, to be continued."

Don Axelrad

IDEA PARKING LOT (CHANGED TO: MARINA AND BOAT BASIN)

Ideas for Testing from Brian Fry:

1. *Many marine Hg problems are not anthropogenic in origin, but natural, especially Hg problems in deep-water offshore ecosystems that support e.g. King Mackerel.*
2. *Most marine fish Hg problems are not rooted in sediments but stem from active methylation in the water column where reduced microniches form for sulfate-reducing bacteria (esp. in offshore marine snow or inshore in epiphyte communities on marsh grass or seagrass).*
3. *Solving Gulf Hg problems is better done by focusing on reducing nutrients inputs from watersheds rather than focusing on reducing Hg inputs.*

OTHER RESEARCHERS

Richard Fulford-GCRL/USM: trophic transfer-estuarine and marine fish

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