CBP Goal Implementation Team
Water Quality Goal Implementation Team
Toxic Contaminants Workgroup
Meeting Minutes

Date: Wednesday, June 12, 2019
Time: 1:00 - 3:00 PM
Calendar Page: Link

Chesapeake Bay Program
A Watershed Partnership

Agenda Item and Desired Outcome	Time	Background Docs, Notes, and Action Items
1. Introductions and Announcements • FY19 GIT Funding Projects: Overview of water-quality topics submitted this year (IDF curve development, CCC, Choptank service delivery). There will be a partnership-wide GIT project ranking and voting meeting in late July. • There will be no July Toxic Contaminants Workgroup meeting. • Michelle Williams is leaving end of June, new WQGIT staffer for TCW starting in July. • Doug Austin: New entry in Federal Register for review, comments due June 17.	1:00	
2. Recap of STAC Workshop on Toxic Contaminants in Agriculture and Urban Settings – Scott Phillips, USGS	1:10	• Proposed outline for STAC report • Workshop presentations available here.
3. Final Mercury Story Map–Michelle Williams, CRC Michelle will review the updated story map panels following QA by jurisdictional representatives and consultation with field experts.	1:30	• Updated Story Map: Mercury in the Chesapeake Watershed (link) • The Panel 4 title on the Mercury Story Map will be revised to "Mercury Impairments without Existing TMDLs" rather than "Mercury Impairments without Existing or Planned TMDLs".
4. <u>Summarizing Mercury Information</u> –Scott Phillips and Michelle Williams Michelle and Scott will discuss an outline for Summary paper on mercury to capture findings from the April and May TCW calls on		• Summary Paper Outline: State of Monitoring and Management Approaches of Mercury in the Chesapeake Bay Watershed

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mercury. The paper will contain a summary, based on findings presented by each jurisdiction including 1. Monitoring data, 2. Studies being conducted, and 3. Current management approaches, and 4. items need to be considered for the future. The paper would be an "evolving document" so it can include activities what will occur during 2019-2020 concerning mercury. The TCW will provide feedback on the outline.		• Micka Peck will provide examples of TMDL approaches to mercury management outside the Chesapeake Bay Watershed, for inclusion in the mercury summary paper.
5. Mercury Exposure in Freshwater Fish across the Chesapeake Bay Watershed –Collin Eagle-Smith, USGS Collin will discuss an overview of mercury distribution in fish across the Chesapeake Bay Watershed.	2:30	• Presentation
Wrap Up and Adjourn	3:00	

2. **<u>STAC Workshop Outline:</u>**

- Scott presented the draft outline of the report from the STAC workshop on contaminants in agricultural and urban settings. The TCW will be asked to provide comments by the end of June.

3. **<u>Final Mercury Story Map:</u>**

- Michelle Williams introduced the updated mercury story map which incorporates comments received from the TCW. Final actions to complete the story map include including updated MDE data showing delisted segments (panel 3) and addressing the status of impairments without TMDLs (panel 4). Michelle asked for approval to remove the term "planned" from the Panel 4 title.
    - Mark Richards concurred with the decision to remove "planned" from panel 4. It is very uncertain in VA what management approaches will be considered to address continuing Hg contamination.
    - Micka Peck concurred.

Decision: The Panel 4 title on the Mercury Story Map will be revised to "Mercury Impairments without Existing TMDLs" rather than "Mercury Impairments without Existing or Planned TMDLs".

4. **<u>Mercury Paper Outline:</u>**

- Micka Peck suggested adding more content on atmospheric sources of Hg and management and regulations in the air sector. Also, other states have done statewide Hg TMDLs. That might be something to discuss in the paper to talk about other examples of Hg management.

Action: Micka Peck will provide examples of TMDL approaches to mercury management outside the Chesapeake Bay Watershed, for inclusion in the mercury summary paper.

- Don Smith: I think North Carolina has done something similar for Hg—you might consider including that state's management approaches as well.
- Scott Phillips: That could be a section on lessons learned from other state management approaches and implications for management in the Chesapeake Bay Watershed.
- Phillips: We will get these materials to the workgroup at the end of June. We would like the jurisdictions to check to make sure the state-specific information is accurate, and any suggestions you have to improve the document. The updated annotated outline will be distributed to the TCW at the end of June, and you will have time to look at that through July before we solicit formal comments.

5. **<u>Mercury in Freshwater Systems in the Chesapeake Watershed:</u>**
- Background:
  - Mercury (Hg) is known to be a toxic contaminant of global consequence.
  - 1.2-2.4 million people in the world living with a disability due to Hg exposure.
  - Minamata Convention—international treaty to control Hg globally (US is a signatory)
  - Hg cycling is complex, and bioaccumulation is context-dependent. Inorganic Hg interacts differently in different habitats to produce environment-dependent levels of methyl Hg.
- Chesapeake Bay Endocrine Disruptor Study—With Vicki Blazer, in Smallmouth Bass. Comparing methyl-Hg's impacts to endocrine functions compared to other EDCs (primarily estrogenic compounds).
  - 6 sites in MD and PA, plus several sites in national parks in Chesapeake Bay watershed, including Shenandoah National Park.
  - Overlay of fish consumption advisories (FCAs) and 303d listings showed some overlap with monitoring sites, but not standardized.
  - State monitoring data from 1990 – 2017 was added to EDC sites, although there were data challenges due to different approaches and methods in each state (lack of consistent target species, taxonomic overlap across sites, different monitoring standards and methods across states, scaling at HUC and waterbody scale, uneven sampling effort distribution, inconsistent composite collection, and inconsistent length data collected).
  - In general, long-lived top predator taxa had highest Hg concentrations, with the exception of trout—salmonids are consistently lower in Hg. All except striped bass were below the EPA criteria for health concerns.
- Western North America Mercury Synthesis project (Alaska, Canada to Mexican border, western half of continent):
  - Relativized fish total mercury (THg) concentrations at HUC 8 scale, and nearest-neighbors analysis to find hotspots and cold spots in Western N. America. Next steps would be to determine what factors in each hot and cold spot influence observed Hg concentrations. This approach was also applied to the Chesapeake Watershed.
- In the Chesapeake Watershed, found relative differences in THg: THg was higher in northern parts of the watershed and lower in southern regions, with exception of South River in VA. Spatial variation by species also differed slightly (bluegill vs channel catfish vs largemouth bass, smallmouth bass).
  - Consistently high relative THg in northern parts of watershed.

- Streams and rivers have higher Hg than lakes and ponds—suggesting that there could be habitat influences on MeHg availability and uptake.
- Used literature-based values to determine risks to avian health, fish health, human health, and mapped watersheds according to percent exceedance in average THg (only for freshwater fish, not estuarine fish).

- Doug Austin: Methylation tends to occur in anoxic conditions in bottom sediment, but rivers have higher oxidation, yet ponds have lower Hg than rivers.
  - Collin Eagles-Smith: That's correct. The first methylating organisms discovered were sulfate reducing bacteria in wetlands, but since then we have discovered many more organisms that methylate Hg, plus there are many suboxic and anoxic microcosms in rivers and streams—even individual suspended particles have heterogeneous surface DO over their surfaces. Rivers also have larger watersheds, so wetlands where Hg is methylated could drain into a river system. The other factor is that organisms in river environments require more energy to survive, so they may be consuming more Hg-contaminated food which accumulates in tissue. However, a lot of this is still being debated in the literature.
- Scott Phillips asked about the difference between the chart showing average values from fish species across watershed vs. percent exceedance by species by watershed.
  - Eagles-Smith: The first chart is a raw average across the watershed, but the map allows us to look at that at a finer spatial scale, and the actual proportion of individuals rather than a bulk average.
- Takeaways:
  - Bioaccumulation is highly variable across the watershed, with northern sub-watersheds showing more risks of bioaccumulation. Health benchmarks exceeded in 10-90% of fish across HUCs.
  - If there is interest in a broader monitoring program that would better integrate data which could increase utility of modeling, Collin is working on a set of guidelines for such monitoring efforts.
  - Important to know what factors influence bioaccumulation in different watersheds, and understand whether bioaccumulation and risk can be mitigated, or whether bioaccumulation is inherent in the system and risks just have to be communicated.
- Scott Phillips: The roadmap of a monitoring design for evaluating Hg and risk would be really valuable for us as we continue data inventories and summaries.
- Doug Austin: What is going on in the upper Susquehanna in upper PA and NY? Those areas are consistently high in relative Hg.
  - Eagles-Smith: There has been some synthesis done in the NE to look at drivers. In general, the contributing factors are not really the source of Hg, but the environment-dependent factors that control methylation. There is a big Hg synthesis project wrapping up in NY. A lot of those papers are in review and will come out soon, but a lot of it is driven by food web structure in those environments, and the biogeochemistry (sulfate, oxygen, pH, etc).
- Austin: For risk assessment, you are looking at Hg as an endocrine disruptor—I had understood Hg as only a neurological toxin, so that is fascinating to me.
  - Eagles-Smith: The WHO published a report on EDCs, which includes methyl Hg. A lot of people think of EDCs as estrogenic compounds that compete with organism-produced hormones and affects endocrine functioning that way. MeHg targets the endocrine system through its effect on the central nervous system, altering the activity of the pituitary gland. That is an underappreciated aspect of risk from Hg, and a very potent effect of Hg in wildlife. There is a lot of data on water-birds, where methyl Hg is an endocrine disruptor that alters and reduces prolactin production—in water-birds prolactin is related to nesting tenacity, so birds with low-level

  - methyl Hg body burden are more likely to abandon their nests in response to any kind of disturbance. MeHg has these very surprising and subtle effects at low levels.
- Phillips: Given these natural landscape factors that control methyl Hg bioaccumulation, are there other controls that can be used to mitigate this risk?
  - Collin Eagles-Smith: The Onondaga Lake project in upstate NY is a good example of an effort to mitigate methylation by limiting nitrate-reducing bacterial activity. Dissolved sulfate is also a big factor in methylation, so water management is very important to limiting methylation rates—especially in the West in wetting and drying of oxidized mercury and sulfate. We are working to test different methods of water management in the West to control methyl Hg production. Wetlands that allow photodegradation help to limit methyl Hg transport--sunlight can also break the methylmercury bond. There are also food web modifications, for instance removing invasive species causes shifts in methyl Hg concentration up the food chain. There are a number of mechanisms, depending on what scale you are operating at.
- Michelle Williams asked about estuarine hypoxia and algal blooms. Would improvements in water quality and DO potentially reduce the chance for methylation in areas where algal blooms occur?
  - Eagles-Smith: I can only speculate, but yes, I would think that any effort to reduce anoxia in the water column would have benefits to methyl Hg. We are also seeing that the organic matter from algal blooms also fuels methyl Hg production, and that methylation is happening in suboxic as well as anoxic zones. There is the linkage between primary productivity and methyl Hg production. So, reducing nutrient inputs to a water body to reduce hypoxia also limits methylation through limiting the organic matter produced. That would be an interesting thing to monitor in the Chesapeake Bay mainstem.
- Dawn Fulsher asked if methylation can occur on biological slime layers on in-stream rocks.
  - Eagles-Smith: Yes, that can and does happen. People are starting to look at it more and more. There is quite a bit of methylation that occurs in those biofilms. Wetting and drying of the biofilms also triggers fast and efficient methyl Hg production on rewetting.
- Eagles-Smith: The gene for methylation was just discovered, so there are genetic approaches being developed to assess methylating ability, which may be a few years away before we know exactly which micro-organisms in those biofilm assemblages are doing most of the methylation.
- Doug Austin asked about factors controlling methylation rate.
  - Eagles-Smith: Depending on the conditions, it can happen almost instantaneously. You need inorganic mercury that's bioavailable, a carbon source and an electron acceptor (e.g. methyl sulfate). If you have a substrate, and methylating bacteria, the rate can be instantaneous, or can happen slowly over a long period of time—environmental conditions greatly affect the rate and amount of methylation that occurs.

<u>Call Participants:</u>

Scott Phillips, USGS
Michelle Williams, CRC
Doug Austin, EPA CBPO
Emily Majcher, USGS
Micka Peck, EPA

Dawn Fulsher, EPA Superfund
Roger Stewart, VA DEQ
Marel King, CBC
Mark Richards, VA DEQ
Amy Williams, PA DEP
Don Smith, VA DEQ
Collin Eagles-Smith, UMCES