MELD Meeting Minutes

2023 NADP Spring Meeting
Hybrid – Virtual and Madison, WI
May 2, 2023

Co-chairs: Richard Haeuber & Colleen Flanagan Pritz
Secretary (Interim): Katherine Ko

Key Takeaways

1. **New Trends Tool:** The tool builds a statistical model of concentration as a function of precip, season, and year. Based on Hirsh et al. 2010 concept that these weighted functions in the regression can change over time. Mike has run the model for 17 sites so far, will dig into discussion and results soon.
2. **Dry Dep**: WSLH (David and Mark) will run Muge's code. Should we consider a working group for this model? (Link with other modelers, Hg isotope work, etc.)
3. **Passive Hg**: With careful review and QA, there is good agreement between passive and active data.
4. **Minamata Convention**: Mandate: to produce a scientific report, with monitoring data and emissions data, to address guiding questions in monitoring guidance. June 1, 2023: Finalize response to comments and revision of data collection plans. July 2023: Party review of draft data analysis plan.
5. **Integrated Hg Review**: Lots of available data and criteria to consider. Next steps include forming work groups to synthesize and identify siting criteria, survey for candidate sites and existing data, and create a map to overlay paired measurements and ancillary data networks.

Early formation of working groups:

- WG-1: Integrative Hg Review – make progress on priority intensive, multi-media sites
- WG-2: Measurements and Modeling – main tasks include getting the passive network underway, the intercomparisons, and serving to facilitate review of the dry dep model
- WG-3? MLN – and the Hg litterfall data

If you're interested in a workgroup, let the MELD team know.

Meeting Agenda (May 2, 8:30am-12:00pm CT)

8:30am: Welcome and Introductions
8:40am: Status on the Intercomparison of Active and Passive Techniques for GEM and Reactive Mercury Measurements
8:45am: Updates on the Hg Dry Deposition Estimates
8:50am: New Trends Tool to Calculate Trends in Hg Conc. at MDN sites
9:10am: Update: Minamata Convention OESG and the TF HTAP
9:20am: Perspectives from the Minamata EE Air Team
9:30am: Review of National Comprehensive and Integrated Mercury Monitoring Capabilities*
    9:30am: Introduction – What planning has been done?

9:45am: What monitoring is currently in place?

- NADP's Mercury Monitoring Program
- Multimedia Mercury Research Activities at NOAA
- Mercury Monitoring in Biota
- Mercury Monitoring: Priority Ecosystems and National Scale Efforts

10:35am: BREAK

10:50am: Discussion – What are the major gaps? What are the priority sites?

11:50am: Wrap up/Next Steps

12:00pm: ADJOURN

Special Topic* Review of National Comprehensive and Integrated Mercury Monitoring Capabilities
Objectives:

• Share current information on research and monitoring in the U.S. related to the chemical and biological endpoints of mercury contamination;

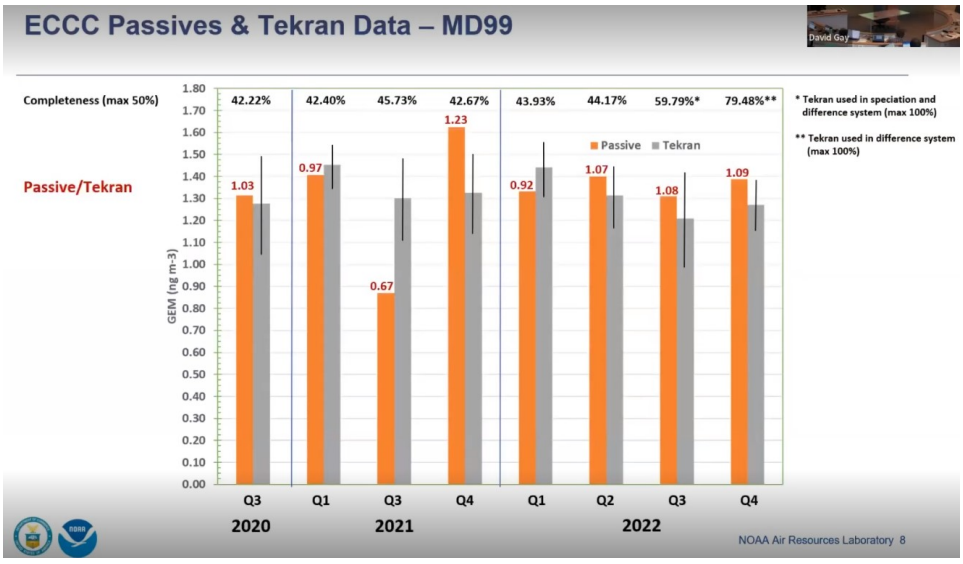
• Characterize and evaluate sites in NADP's mercury monitoring program to identify priority sites to maintain; and

• Identify data gaps, monitoring needs, and potentially important new areas for monitoring, including in disadvantaged, underserved communities.

Status on the Intercomparison of Active and Passive Techniques for GEM and Reactive Mercury Measurement

Winston Luke, NOAA

- Beltsville, MD - MN99 - is AMNET site, NTN, MDN, Litterfall, & CASTNET site. Should be on the shortlist for keeping, just from sheer number of different measurements going on there.
    - Currently running: Tekrans/AMNet, Difference, and ECCC MerPAS passives.
    - Just added NADP passives, and perhaps Japanese Manual Gold Trap Method
- Passives vs. Tekran data – There was good agreement between the passives and the Tekran for 6 of 8 quarters tested thus far. Quarters 3 and 4 of 2021 were outliers and will be investigated further.



- Difference System: there are factors can degrade the performance of Tekran analyzer (leaks, detector lamp variations, etc.). But careful review and QA of data can identify these issues and support good agreement among analyzers.

Dry Dep Model

David Gay, WSLH

- David Gay has the model, coded in R, does not have the SOP
- Muge has not wrapped up her dissertation, so WSLH (David and Mark) will run the code
- D. Krabbenhoft - ideas for NADP/MELD: early dragonfly Hg work showed interesting trends (e.g., dry dep dominates in rain forests), and encourage linking with Hg isotope work
- S. Steffen - consider linking up with other modelers?
- Leiming Zhang (from chat): this paper describes what constrains I have done, which represents the most up-to date science: The Estimated Six-Year Mercury Dry Deposition Across North America https://pubs.acs.org/doi/abs/10.1021/acs.est.6b04276
- C Flanagan Pritz: is it worth engaging a working group on this model?

New Trends Tool to Calculate Trends in Hg Conc. at MDN sites

Mike McHale, USGS

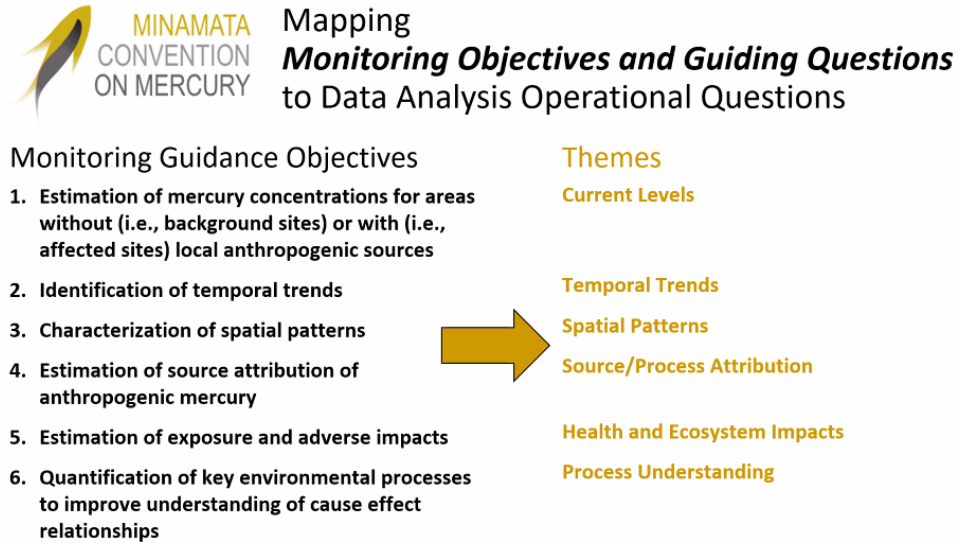
- Based on Hirsh et al. 2010 "Weighted regressions of concentrations based on time, discharge, and season (WRTDS)"
    - Hirsh et al. 2010 streamflow work ("discharge") adapted for "precip" (WRTPS)
    - Not limited to linear/quadratic function - behavior can change over time. In other words, for each date predicted by the model, these weighted functions in the regression can change with time
    - WRTPS: Builds statistical model of concentration as a function of precip, season, and year
    - Mike has run the model for 17 sites so far, will dig into discussion and results soon
- S. Steffen - what is the minimum time span you need to run this model? Could you just increase uncertainty with less data?
    - M. McHale - it's really about the sample size. Wouldn't go less than 10 years. If anyone is interested, feel free to reach out.

Update: Minamata Convention OESG and the TF HTAP

Terry Keating, USEPA

- Co-Chairs: Terry Keating (US EPA) and Dominique Bally Kpokro (Cote d'Ivoire)
- Meeting online monthly since June 2022. Met in person in Geneva
- **Mandate**: produce scientific report with monitoring data and emissions data to address guiding questions in monitoring guidance
- **Timeline**: Response to comments and revision of data collection plans to be finalized by June 1, 2023 (in small teams, i.e., Air, **Biota**, Humans, Other Media, & Emissions/Releases)
- Timeline: Drafting of data analysis plan expected for Party Review by July 2023

- **Guiding questions:**



- Proposed global modelling framework by Dastoor et al. to be submitted

Perspectives from the Minamata EE Air Team

Sandy Steffen, ECCC

Progress for the air component

- Draft Monitoring Data Compilation Plan
- Party responses collated, discussed and sent to team (May 15)
- Revised the Monitoring Guidance Air Addendum to include table summary
- First stab at the Data Analysis Plan – more later
- Started to think realistically about can and cannot
- Met to discuss database management and challenges

Can and cannot

- Very limited time
- Limited people
- Limited data (spatially)

- Only TGM/GEM and wet deposition for Cycle 1?
  - Concentrations
  - Spatial variation
  - Temporal trends
  - Identify gaps
  - Model the gaps

- Use different databases for different data collected?
  - Need to decide quickly on a format for submitting air data

Next steps

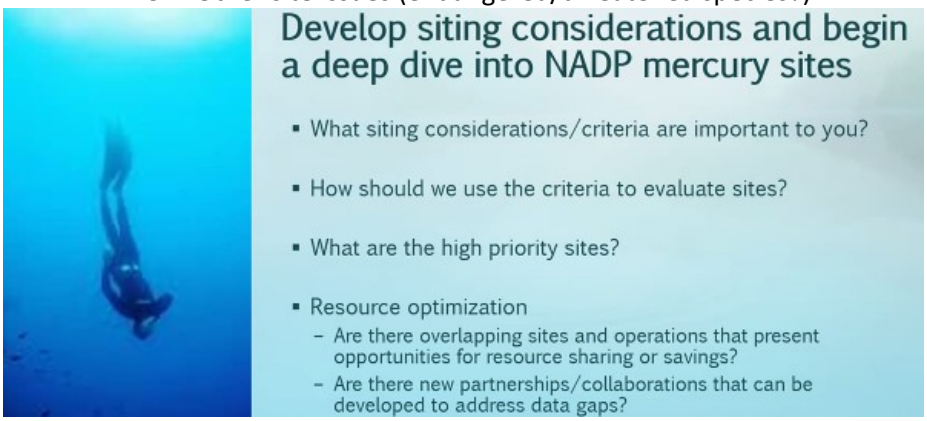
Please Help!

- Sign up to be part of the air group
  - Give advice
  - Support
  - Tools
  - Email sandy (alexandra.steffen@ec.gc.ca)
- Start to gather the data
- Provide data through the US-EPA or state??
- Analysis plan needs input
- Analysis support is needed
- Writing support is needed

Review of National Comprehensive and Integrated Mercury Monitoring Capabilities

Intro - David Schmeltz, US EPA

- **Goal**: To review the current state of mercury monitoring in the U.S. to help the NADP community make informed decisions about monitoring investments that will improve national mercury monitoring capabilities.
- In 2008, used site criteria to identify candidate sites that would contribute to national monitoring network
    1. Baseline data and infrastructure
    2. Will we be able to see and understand change? Sensitivity to Hg inputs
    3. Model evaluation
    4. Want a range of site types
    5. Other site issues (endangered/threatened species?)



What monitoring is currently in place?

NADP, David Gay

- MDN: 85 active sites
    - WI08 now is WI92 - site is in potential jeopardy due to funding
    - NE98
    - AK02 restarted
    - Last site to close was OH02 in Apr 2022
    - Interested: SC03, MN05, WA03, NVxx
    - KS05 will close at the end of 2023
- AMNet: 10 active sites
    - Newest: Mexico City with Dr. R. Sosa/UNAM
    - Request for equipment in Vietnam (Nguyen Ly Sy Puh, Guey-Rong Sheu's former PhD student) - are we interested?
- MLN: 24 active sites
    - New: KY10, TX22, TX97
    - Sampling for 2023 will begin in August
    - Interested: Bay Mills Community, upper peninsula
    - WA03
- Passive Hg Effort
    - Winston put out the first NADP passive Hg sampler, MerPAS in April 1st
    - Martin has QA test at Eagle Heights
    - Christa is working through Canadian SOP

    - Overall goal: determine how well we can make passive Hg samplers and how much we would need to charge for network operation
- New Bag Sampling for MDN?
    - David Gay will present idea in Joint: bag model could save money on funnels, thistle tubes, shipping and breaking glass, etc.
- Hattori Tatsuya/Japan Method
    - Says that the Japan manual method will run, now/as is, for a 7 day sample

NOAA, Winston Luke

- Oceanic and Atmospheric Research (OAR)
- National Ocean Service (NOS) - Mussel Watch Program
    - Oysters, Blue Mussels, and Zebra Mussels
    - Database available to 2013
    - Dennis Apeti, Program Manager: very interested in bioavailability of deposited Hg
- Marine Ecotoxicology Branch, Charleston, SC (Wd Wirth and Marie Delorenzo)
    - Focus almost exclusively on THg in marine sediments, surface waters, plant tissues, animal tissues (marine and freshwater fish, shellfish, marine mammals)
- National Marine Fisheries Service (NMFS)
    - National Seafood Inspection Laboratory (NSIL)
        - Multi-year effort started at NSIL in Pascagoula, MS (hence AMNet site nearby)
    - Alaska Fisheries Science Center, Seattle WA: Marine Mammal Laboratory (Brain Fadely and Tom Gelatt)
        - Studies conducted and data stored at UAF

Biota, Collin Eagles-Smith, USGS

- Fish
    - No long-term national freshwater fish monitoring effort…
    - … because it's assumed that states have their own intensive fisheries monitoring efforts…
    - … but Collin and Colleen assessed these efforts, and there's small sample size, high variability, inconsistent sampling times (i.e., not annually) and species (i.e., not sampling same species or comparing same species across sites)
- Birds
- Invertebrates
    - Dragonfly Mercury Project is biggest national-scale effort: many sites with 5+ years of data

Priority Ecosystems and National Scale Efforts, Sarah Janssen, USGS

- Isotopes show that biota can reflect wet or dry dep, which can vary regionally
- Long term multi-matrix monitoring
    - VOYA
        - Brigham et al. 2021 https://doi.org/10.3390/app11041879
        - NADP sites, long-term collaboration between USGS and NPS
    - Florida Everglades
        - 30+ years of data in Janssen et al. 2022 http://dx.doi.org/10.1016/j.scitotenv.2022.156031, and 10+ years of multi-matrix monitoring by USGS, NPS, and EPA

- Great Lake
    - Large-scale Hg monitoring in Lake Trout going back to 1970s by EPA GLNPO
    - Hg isotope archive
    - Great Lakes regional trends, lake specific, and local
    - Incredibly responsive to changes in atmospheric Hg dep
- Hells Canyon Complex
    - Poulin et al. 2023 *Biogeochem. Cycles*
    - Baldwin et al. 2020 https://doi.org/10.1021/acs.est.9b07103
    - First comprehensive examination of Hg in reservoirs systems
    - 10+ years of monitoring and process-level data
    - Process work across matrices by post-docs and PhD candidates
    - Critical gaps: arid zones in the West and freshwater regions of Southeast

Discussion

Questions to address:

1. What are the priority sites? What are the major data gaps?
2. What siting criteria are important to you? What criteria should we consider to determine priority sites and gaps?
3. How or where do the mercury biological/biogeochemical monitoring and process-related research align with NADP sites?
4. Are there sampling locations that would benefit from the addition of an atmospheric mercury site (MDN, AMNet, MLN, Passive)
5. What are the big data gaps in relation to Tribal nations and disadvantaged communities (i.e., underserved and overburdened by pollution).

Bold = key criteria (as identified by the NADP community) (D. Krabbenhoft: Differing interests between the Minamata EE-centric focus and the more general focus of NADP will give rise to differing priorities, and thus criteria)

- Eric: Mount Bachelor is an important site for Air
    - **High elevation**
    - **Geographic location**: west coast
    - Western forest fires influence
- Sandy: Whistler is going to be shut down this year - so down to Little Fox Lake in Canada (no **forest fire influences**, so agree with Eric about a high elevation site in northwestern US. May not be best for biological input, but more so long-range transport)
- S. Janssen (in chat: Hey Sandy, we have 15-20 years of Yukon River data for waters (total and MeHg), I need to check the exact site in AK. It would be good to merge that with air monitoring data. As if you need more to think about
- Doug Burns: "maximizing the wet dep map" aka losing a site that shrinks that map would be bad. Also **maximize sites that pair MDN and MLN**. For example, invest in Bad River.
- Collin and Rick: could consider overlay map of DMP sites and MDN, MLN sites. **Ecoregion diversity**
    - D. Krabbenhoft: This was done at the Annapolis 2006 meeting but would/should be done again since so much has changed.
- Colleen: how were MercNET cluster sites identified?
    - D. Krabbenhoft: the meeting we had in Annapolis MD to discuss exactly this question was more of a deep dive.

- S. Janssen: consider approach by checking with other groups (i.e., academia) and where their intensive sites are. Where are there data we can tap into? Also where is there ancillary data?
    - D. Krabbenhoft: Generally hard to find data sets with a record of QA/QC from our academic colleagues. They will usually point their published papers, which rarely actually have that information that is needed to use the data in an effort like this.
- Trent (MN18): agree with looking at it more regionally/big picture rather than site by site.
- D. Schmeltz: what are the policy drivers of our work?
    - D. Krabbenhoft: agree that this is a very important point. Straying away or not considering policy drivers generally leads to a quick cessation of monitoring efforts – which we don't want!
- Collin and Sarah: science questions driving it: what biological systems are susceptible to atmospheric dep? Also, effectiveness of emissions.
    - D. Krabbenhoft: This is where the MELD rubber hits the road, and I believe more the discussion needs to focus on this.
- G. Wetherbee: pair MDN sites with NTN sites, consider operating costs (i.e., one operator for two sites vs. two operators for two sites)
- C. Flanagan Pritz: how does passive effort fall into this?
    - D. Krabbenhoft: Good question, and that depends on what the ultimate motivation for testing these devices is. If it is for reducing costs to sustain and/or grow the network, then I agree. If it is for the purposes of use in Minamata EE in North America, I have sincere doubts. Recall the EE requires detection, trend quantification, and with attribution specific to the actions of the EE Treaty. Simple calculations I have done says that we will need to be able to "detect, conduct temporal trend analysis and with attribution" for a signal that will likely be 0.2-0.3 ng/m3. To accomplish that, we will need sites with LONG TERM EXISTING data that was collected with strict protocols throught out the data record. Throwing a new method at the start of trend detection effort likely will not work given the +/- ~10% accuracy that I see in the MD site record for the past couple years. That is not to say that the MerPAS and NADP devices for passive air Hg sampling do not have a role or place in mercury monitoring, I am just concerned that it is likely too late to apply them for Minamata EE purposes in the USA/North America.

Next Steps

- Synthesize and identify siting criteria
- Survey for candidate sites and existing data
    - S. Janssen's idea of a survey to get a better sense of the data out there (academia) and co-located sites, NEON, LTER
- Map with paired measurements, consider ancillary data networks
    - D. Schmeltz will overlay map (S. Steffen would like to be looped in, to bring to Canada)