MELD Meeting Minutes

2023 NADP Spring Meeting
Hybrid – Virtual and Madison, WI
October 24, 2023

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

Objectives

1. Present Hg updates from the NADP program office
2. Convey status on "8-Point Plan" for Implementation of the passive Hg network
3. Provide updates on the intercomparison study of active and passive monitoring techniques
4. Share latest news on Minamata Convention-related activities
5. Showcase progress and discuss the Integrated Hg monitoring Review
6. Share recent related work on Hg science or findings (Round Robin)

Key Takeaways

1. Good participation, 30 in the room plus 50+ online, including several from Peru
2. **NADP Program Office Updates**: New bag sampling for MDN is looking good. Need better Dry dep estimates to get after Total Hg deposition; working group (measurement and modeling) establishing towards that end
3. **Passive Hg Testing**: NADP passives (MerPas) deployed Apr/Jun/Jul 2023. Generally good agreement between active GEM (Tekran) and ECCC passive GEM (MerPas). Intercomparison at MD99 will continue. Lab intercomparison next.
4. **8-Point Plan for an NADP Passive Hg Monitoring Network**: Will continue to evaluate QA/QC (Phase 1 done) and refine budget (no funds confirmed yet). Optimistic goal is to approve as an official NADP network in 2024.
5. **Minamata Updates from the OESG and EE Air Team:** Contact Terry Keating to provide comments on Draft Analysis Plan, submit "Intent to Provide Data," or join the roster of experts. Sandy encouraged NADP (US) involvement.
6. **Integrated Hg Review**: David Schmeltz provided summary of workgroup progress. Will continue to refine site criteria, add biota, and work towards engaging new partners (like Trent Wickman). SETAC Workshop in Nov 2023.
7. **Litterfall**: time for a trends paper; Mae Gustin offered to write/lead a paper; contact her or David Gay to be involved.
8. Winston Luke conveyed that NOAA funding in support of Hg will be eliminated, jeopardizing AMNet sites and more
9. Mae Gustin provided summary of results of the UNR workshop "Measurement of Atmospheric Mercury: Assessment of new measurement and calibration methods and development of a path forward"
10. Several symposium speakers provided talk teasers for Hg sessions scheduled for both Wed and Thurs

11. Rick will be rolling off as co-chair yet will continue to serve in an advisory capacity for MELD. David Schmeltz will step up in his place as co-chair. We encourage new participation in the MELD Executive team.

Meeting Agenda (October 24, 9am-12pm CT)

9am: Welcome and Introductions
9:15am: Hg Updates: NADP Program Office
9:35am: Status of Hg Passive Intercomparison
9:50am: 8-Point Plan for an NADP Passive Hg Monitoring Network
10:05am: Minamata Updates from the OESG and EE Air Team, in prep for COP-5
10:25am: BREAK
10:40am: Integrated Hg Review
11:25am: Round Robin/Hg Talk Teasers
11:55am: Closing Remarks
12:00pm: ADJOURN

Hg Program Office Report

David Gay, WSLH

MDN

- Currently: 85 active sites. No loss in sites – good!
- Still need funding for Brule River (WI08) now WI92.
- Interested: SC03 (just started!), OH02 (will restart), MN05 (should start this summer), WA03 (talking about 2nd site, might be in Olympic NP), NVxx/Region 9 EPA should be funding an MDN site at Pyramid Lake.
- Closed: KS05 shut down Dec. 2023

AMNet

- Currently: 10 active sites. Newest is with Dr. R. Sosa/UNAM. Request for equipment in Vietnam (Guey-Rong Sheu's student) to establish a new ambient mercury site in southern Vietnam. Lending equipment to Dr. Phu was previously approved by the Executive Committee, provided Phu/Vietnam covers AMNet site fees. OH02 (Kevin Krist) made a major investment in new Tekran instrumentation and shelter.

Litterfall

- Currently: 28 active sites. Newest: MI09, MI52, NM96, WA03. Interest from Bay Mills Community, upper peninsula MI.

Passive Hg Effort

- Things are moving along with 8-point plan. Winston put out first NADP passive Hg Sampler, MerPAS on April 1. There is a 1 month vs. 2 month vs. 3 month QC test ongoing at Eagle Heights.
- Christa working through Canadian SOP
- Overall goal: determine how well NADP can make passive Hg samplers and how much the program would need to charge for network operation

New Bag Sampling for MDN?

- Looks promising. Will save funds and might even be cleaner and/or easier.
- Currently: about to have a test run of ~100 bags made. Will test cleanliness in lab (blanks), test in field, and work with lab to make necessary improvements.
- D. Gay is going to Mercury Meeting in Minamata, Japan on Nov. 17-20, 2023. They will discuss current status and challenges of Hg monitoring in Asia-Pacific and African regions.

Meeting in Reno – D. Gay takeaways

- General agreement in the room that Tekran GOM and PBM2.5 values are biased low 20 - 50% at least for GOM, depending on location, and ambient atmospheric chemistry. Method for correcting GOM/PBM data was proposed, good progress, but still needs work.
- Good progress made on calibrator, but not ready.
- GOM passives and GOM+PBM2.5 available.
- Do we have a clean definition of dry dep? GOM + PBM2.5 can be important in deposition; however, if Hg entering stomata in plants is considered dry deposition, then GEM dominates, although GOM is more reactive and possibly could have greater impact.

Dry Dep

- One of the main reasons to measure gaseous Hg concentrations is to estimate dry dep. If we have problems with gaseous measurements, then we will have problems with dry dep estimates too. We are concerned with **net** dry dep.
    - Total dep = MDN + (AMNet and Muge's Model)

D. Gay's proposal at Reno:

1. A North American wet dep network (MDN) continues
2. AMNet continues as long as enough people continue to measure
3. We bring online Muge's model of net dry dep of Hg (includes mercury into plants as dry dep)
4. A North American Network of MerPAS
5. Regional sites that make these measurements (Tekran speciation methods, including dual channel, passive measurements of GOM/PBM2.5)
6. Form a modeling group that uses the regional site data to estimate net dry dep for as much of North American as possible

- S. Lyman's input:
    - Passives work, but have ambiguity (MerPAS), and no speciation, need met correction
    - Could get weekly Hg measurements from total Hg
    - For oxidized Hg, could use a pair of cation-exchange membranes in filter pack. Should be inexpensive and could get weekly measurement of GEM/PBM/GOM.
- David Gay noted:
    - AMNet is getting more difficult to run; fewer sites
    - We have bias in GOM for sure, likely PBM
    - But we still want some estimate for dry dep (net) and total dep

Discussion

- E. Felker-Quinn: CLAD may start project for ozone stomatal flux/dry dep. Should we collaborate with Hg dry dep investigation?

- M. Gustin: I think they're different. E. Roy: agree.
- M. Gustin: they're seeing trends with MerPAS, but I don't know if it's sensitive enough to get at monitoring reductions in emissions. D. Gay: others at the Reno meeting agreed.
- S. Steffen: will work with D. Gay to bring up global passive sampling work at Japan meeting. Also, I think you can see emission trends with MerPAS, it will just take longer.
- See more comments in chat.

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

Winston Luke, NOAA

- Current monitoring at Beltsville, Maryland Site (MD 99) – Precip, AMNet, NTN, DMN, & Litterfall
    - Tekran Speciation System (AMNet) – since 2008
    - Reactive Hg by Difference (two Tekrans)
    - ECCC MerPAS passive samplers for GEM – quarterly since Q3, 2022
    - NADP passives – deployed April, June, July 2023
    - Japanese manual gold trap method – uncertain/need additional support
- We see generally good agreement between ECCC passive and Tekran concentrations. But substantial, and so far unexplained, differences in Q3 2021, Q4 2021, and Q1 2023.
    - April 2023: there was an unexplained calibration shift in Tekran D8 (for speciation system), after a prolonged power outage. Will look into that.
    - June 2023: impacted by smoke from wildfires (Canada, North Carolina). D8 calibration differences persist.
    - July 2023: dips typical in late summer/fall, associated with GEM depletion events. D8 calibration differences persist.
    - Average RSD of monthly Tekran Average was 3.9%. Average RPD of Passives was 6.8%.

Conclusion

- GEM measured by two co-located Tekrans was excellent, with RPD of about 2.5%. Average RSD of the three co-located Tekran analyzers (with speciation) was 3.5%.
- NADP MerPas passives showed good precision (average RPD 6.8%), but reported blank-corrected were ~55-60% of average Tekran concentrations.
- Will continue intercomparison at MD99 basically indefinitely, and phase two will involve lab comparison with NADP, ECCC, and Tekran.

Q&A

- M. Gustin: do linear regression between Tekrans?
    - W. Luke: yes, we did, here's the slide. Agreement is pretty good.
    - M. Gustin: ok, Sarah Dunham Cheatham has a paper published in 2022 or 2023, compared a lot of instruments, found Tekrans were off by around 30%.
    - W. Luke: wow, I've never seen disagreement like that. Would like to follow up and discuss.

8-Point Plan for an NADP Passive Hg Monitoring Network

Kristi Morris, National Park Service

- Advocates: Kristi Morris (NPS), David Schmeltz (EPA), Winston Luke (NOAA)
- NADP Contacts: David Gay, Martin Shafer, Christa Dahman, Richard Tanabe
- When they have a draft plan, they will reach out to others to join in the effort

1. Initiative Description
    a. Objectives: provide low-cost monitoring option, fill data gaps, inform EE of Minamata Convention on Hg, and more.
2. Operating Protocols
    a. Field Operations: propose MerPAS with one-month minimum sampling duration, collocated with AMNet sites, MDN, CASTNET, tribes, western USA
    b. Lab Operations: ECCC protocol
    c. Data Management for publicly available data, including Quality Rating Code (A/B/C). Still need to figure out these factors (AMoN for guidance).
        i. Next step: MELD to assemble working group of modelers to work on the dry dep flux
3. Products
    a. Data: preliminary data reports to site operators/sponsors, public NADP website, data added to Hg map summary each year (similar to AMoN)
4. QA/QC
    a. Phase 1: completed. Methods intercomparison at Beltsville MD99.
    b. Phase 2: end 2023/start 2024. Add NADP Hg passive to intercomparison at Beltsville. Lab verification with NADP, Tekran, and ECCC.
5. Budget and Staff Support
    a. Field Operator, Lab, Data Management/Program Office, Cost of Site ($3600/site if using Tekran MerPAS; David Gay estimates $1800/site if building passives in-house; however, this is rough, and costs still need to be refined (Christa))
6. Funding
    a. Nothing confirmed yet, but optimistic (IRA?)
7. Operation within NADP
8. Transition Period
    a. Phase 1 is completed. Phase 2 is end 2023/early 2024. Hopeful to start pilot network in 2024.

Next Steps

- Continue to evaluate NADP MerPAS and NADP in-house Hg passive,
- Continue to develop 8-point plan, refine QA/QC, refine budget.
- Come up with a name!
- Goal is to approve as an official NADP network in 2024.

Feedback

- Are we set on the 1-month deployment? Seems too short. Could consider deploying quarterly samples on a monthly basis, so you have ongoing data.

Minamata Updates from the OESG and EE Air Team, in prep for COP-5

OESG

Terry Keating, EPA

At COP-5

- OESG Effectiveness Evaluation Group will hopefully be created next week at COP-5
- There will be a draft decision on the table for EE. Hopefully will be resolved quickly. Will include adopting an end date for the first EE cycle, accept progress report from OESG, adopt terms of reference for EG (e.g., how many participants from each region?), and adopt list of indicators to be used in the EE.

Ways to Participate

- Will provide Draft Data Analysis Plan for comments by 28 November
- Please fill out the "Intent to Provide Data" form if you have an appropriate data set: https://minamataconvention.org/en/meetings/cop5#sec1516
- Looking to add people from United States to the roster for air component/team of experts
- Contact keating.terry@epa.gov to get involved.

Timeline

- Hopeful that they will move the EE report deadline to COP 7 instead of COP 6. Then, the OESG will be on the hook to do technical work in 2024 and report writing in 2025, with a report produced by the end of 2025.

OESG Air Team

Sandy Steffen, ECCC

- Data Analysis Plan sent out to Parties for comments
- Still resolving database management challenges
- Unknown data sets: South American, Africa, Russia, China
- Contact alexandra.steffen@ec.gc.ca to get involved.

Integrated Mercury Monitoring Review

David Schmeltz, EPA

Background

- Goal: To review the current state of Hg monitoring in the U.S. to help the NADP community make informed decisions about monitoring investments that will maintain/protect/improve national Hg monitoring capabilities.
- What and where are the high priority mercury sites? What sites are missing?
- Preliminary map assessment of high priority sites (with overlapping data sets in various media, long-term, or background intensive monitoring): Great Lakes, Everglades, Niwot Ridge, Hells Canyon, Lake Mendota, Lake Champlain.
- Minamata – where might we be able to discern a signal attributable to Hg emissions reductions affected by the Convention? What criteria would you use to determine where to look? (for air,

watershed, biota?) How/where do these criteria align with available data? What additional data may be needed, and where will it come from?

Discussion

- S. Steffen: what about sites to track particle long-range transport?
    - D. Schmeltz: could be Mt. Bachelor, Mauna Loa… will think about it.
- S. Nelson: consider climate data/characteristics – soil temperature, snow depth, etc. There are existing locations, but not sure if they're also doing mercury work. Maybe LTER sites? Puerto Rico?
    - D. Schmeltz: will look into LTER or NEON in proximity to some of these NADP sites.
- M. Gustin: agree we should look at long-range transport/from Asia for western sites for Minamata. Mt. Bachelors or Nevada. We have several papers published on this topic. One study at Guadalupe Mountains NP (Texas) that saw significant influence on reactive Hg concentrations and deposition associated with Mexico.
    - M.S. Gustin, S.M. Dunham-Cheatham, S. Osterwalder, et al., What is the utility of measuring gaseous HgII dry deposition using Aerohead samplers?: A review, Science of the Total Environment (2023), https://doi.org/10.1016/j.scitotenv.2023.167895
    - Special Section: The Nevada Rural Ozone Initiative: A Framework for Developing an Understanding of Factors Contributing to Elevated Ozone Concentrations in Rural and Remote Environments
    - STOTEN Volumes 530–531 , Pages 1-534, 15 October 2015 Discusses long range transport of ozone, Hg, and other pollutants to the Western United States
- Trent?: include all Class I areas so it's not so NPS-centric, i.e., USFS. Also agree that soil mercury is an important dataset to add, for total dep. Misleading just to look at wet dep maps.
    - D. Schmeltz: yes, like Conor Olson's paper on soil data.
- Trent will join working group

Next Steps

- Continue to develop and refine maps and metadatabase.
- Consider new data product NADP/PO can use for "sites in jeopardy" and opportunities to address data gaps
- Report back in Spring (including on SETAC Hg session)

Round Robin

- **Ryan Lepak**
    - On behalf of **Hannah Miller**: high elevation Hg cycling in Boulder County, CO. Results show that mid elevations are most conducive to MeHg production and wildlife uptake. In addition, high-elevation wetlands store MeHg at levels comparable to arctic wetlands and are sulfate limited.
    - On behalf of **Grace Armstrong**: Hg investigations in Great Lakes (Hg cycling, sources, and stressors). Hg is still pervasive interest in Great Lakes system, resulting in fish consumption advisories.
    - **Own work**: Derived isoscape of Hg across the landscape in National Lake Assessment context.

- **Chris Kotalik**: Hg stable isotopes in dragonflies. Look at differences in Hg sources and whether or not they can be reflected in dragonflies. Also whether we can look at environmental covariates affecting Hg processing and cycling to associate with Hg isotopes.
- **Eric Roy**: GEM fluxes are Harvard Forest and Howland Forest
- **Peter Weiss**: investigating effect of precipitation on airborne reactive Hg washout at Storm Peak Laboratory (Colorado) and at AMNet and MDN sites. Goal is to derive correction factors for GOM/PBM data taken by KCl denuder, which are biased low.
- **Doug Burns**: new paper on Hg temporal and spatial patterns in biota across NY State.
    - Adams, E.M., Gulka, J.E., Yang, Y., Burton, M.E., Burns, D.A., Buxton, V., Cleckner, L., DeSorbo, C.R., Driscoll, C.T., Evers, D.C. and Fisher, N., 2023. Distribution and trends of mercury in aquatic and terrestrial biota of New York, USA: a synthesis of 50 years of research and monitoring. Ecotoxicology, pp.1-18. https://doi.org/10.1007/s10646-023-02704-0
- **Litterfall** (Emmi Felker-Quinn, Mae Gustin, David Gay): may be time to update trend analyses with new data available. Contact M. Gustin or D. Gay if interested or have additional data/info.
    - D. Burns: Charlie Driscoll also mentioned interest in this.
    - R. Lepak: USGS Hg lab is sitting on a fair amount of litterfall isotope data, back from Marty Risch.
- **Mae Gustin:** UNR NSF Atmospheric Hg workshop in October. Will give a talk about dry dep samplers.
- **Winston Luke**: AMNet monitoring support at NOAA will be ending.