

MELD Meeting Minutes

2024 NADP Spring Meeting
Hybrid – Virtual and Madison, WI
Wednesday, May 1, 2024, at 1-2pm CT

Co-chairs: Colleen Flanagan Pritz & David Schmeltz
Secretary (Interim): Katherine Ko

Objectives

1. Present Hg updates from the NADP program office
2. Provide updates and discuss passive sampling efforts
3. Share latest news on Minamata Convention-related activities
4. Share recent related work on Hg science or findings (Round Robin)

Key Takeaways

1. **NADP Program Office Updates:** Concern about the future of AMNet. AMNet, MDN, and MLN are losing monitoring sites. U.S. Fish & Wildlife Service is closing some MDN and MLN sites.
2. **Passive Hg Testing:** Preliminary data show discrepancies in 2023 data, likely due to instrumentation issue. Working on resolving. Generally good agreement among Tekrans, ~4% bias, data suggests photochemistry plays a role.
3. **MerPAS Assessment:** Reach out to Lucas Hawkins/Tekran if you have MerPAS data to include in sample rate curve.
4. **Passive Network:** the advocates, along with the mercury lab will reach out to continue discussing ideal model, sampling interval, samplers per site, etc. Advocates will continue to refine the 12-point plan. NPS, EPA, NOAA are interested in gathering small group of start-up sites to test and grow the network pilot.

Meeting Notes

Hg Program Office Report

David Gay, WSLH

MDN

- Summary: currently 80 active sites. Two new sites: SC03, OH02. U.S. Fish & Wildlife Service (USFWS) closing four sites: FL05, MI48, ND01, SC05.
- Minor/slow decline, but hopeful that it will level off.
- New site (NVxx) starting with Pyramid Lake Paiute Tribe near Reno, NV.
- Interest: MN05 (Fond du Lac/EPA Region 5) and WA03 (would like a second site, maybe in Olympic NP).

AMNet

- Summary: currently 12 active sites. OH02 up again. HI00 and AK95 likely to close in Sept. 2024. Request for Tekran speciation equipment from Guey-Rong Sheu's former student in southern Vietnam. The Executive Committee approved Dr. Phu's request to borrow equipment, contingent upon payment of coordination fee and participation in the network.

- Concerns about long-term network viability. The Executive Committee should think about other network models for AMNet that might be more sustainable (e.g., GEM only, hybrid passive/GEM)

MLN

- Summary: currently 24 active sites. USFWS closing GA09, MI48, MO46, SC05.
- Interest: Bay Mills Community in upper peninsula MI, and WA03.
- Passive Hg Effort interest
- Bag sampling: still moving forward, slowly. Will be testing Teflon bags for QA/QC review. Basic 12x13 bag is \$10.
 - Look into possibility of cleaning and reusing bags.
 - Will be pre-charging with acid preservative.

General

- Wrapping up QA check on 2023 data. Drawing new maps soon.

Update on Intercomparison of Active and Passive Techniques for GEM Measurement

Winston Luke, NOAA

Background

- Intercomparison at Beltsville, Maryland AMNet Site (MD99).
- From 2020 to Q2, 2022:
 - Passives compared to single Tekran analyzer dedicated to a speciation system.
 - Measurements: GEM (downstream of denuder), GOM, PBM
- Starting in Q3, 2022:
 - Passives compared to Tekrans D8, and X1 and X2 (2-Channel Difference System)
 - Measurements:
 - Speciation System: GEM (downstream of denuder), GOM, PBM
 - Difference System: THg, GEM (Cation Exchange Membrane to remove GOM)

ECCC Passives & Tekran Data (preliminary data)

- Tekran data agree with passives, typically within one standard deviation.
- 2023 discrepancies are likely due to an instrumentation issue; correcting these data should improve agreement.

Agreement Among Tekrans:

- Excellent overall agreement between *identically configured* Tekrans in the Difference system.
- There is a ~4% bias between Speciation system and Difference system data.
 - Better agreement in Winter than in Spring, Summer, and Fall.
 - Subtle Day/Night differences (better agreement at night) also follow the same seasonal variation in agreement.
 - This suggests that photochemistry plays a role (makes sense with KCl denuder and GOM produced photochemically in atmosphere).

MerPAS Sample Rate Assessment

Lucas Hawkins

Determination of Sampling Rates

- Deployed with active monitor (2537) for normalization of sample rate
- Triplicate sampling (minimum) collected at varying time intervals
- Pooled field blank average
- Capture temperature and windspeed too

Tekran Initial MerPAS Sampling Rate

- Initial published sample rate of 0.111 m³/day. Compares well with CNR Rende study.

Curve with External Contributors

- Plotted Tekran with international intercomparison (Naccarato et al. 2021) and ECCC-NOAA data.
- Combined sample rate of 0.121 m³/day. So, we will keep investigating and likely adjust the sample rate up.

Research in Progress

- Currently setting up year-long urban deployment on Tekran Toronto roof.
- Going for longer deployment: samples to be collected at 3, 6, 9, and 12 months
- Call for data – reach out if you have MerPAS data with collocated active monitoring to include in sample rate curve (especially longer-term studies)

Lab Update on Passive Sampling

Christa Dahman, WSLH

- Fall 2023: Sample length testing (30, 60, 90 days) at Eagle Heights in Madison. Sample performance testing at Beltsville with a collocated Tekran 2537X showed low bias in MerPAS results.
- Since last fall: interlab comparison testing of repacked samplers, precision testing at Eagle Heights, blank evaluations and approach to correction.

Interlab Comparison

- Working together to review data and troubleshoot before including ECCC data.
- Tekran's lab produced the best precision of triplicate samples.
- WSLH performed well, but room for improvement on precision. Overall success.

Repacked Samplers

- Small sample set, but also performed well with similar results and precision.

Precision Testing

- 10 samples deployed at Eagle Heights for 45 days. Samplers were repacked at WSLH. A bit more variation than hoped.
- With 3-sample combinations, about 73% of data were within 1 standard deviation. So realistically, we might be looking towards 3-samples + 1 blank.

Blank Evaluations

- Pretty high standard deviation. Field blanks are well above detection limit. Trip blanks are similar, but may be a better correction to make.
- Using a single collocated field blank to correct results may introduce more error.

- WSLH would plan to provide uncorrected AND corrected sample results.

Next Steps

- Continue testing stability and recovery from repacked samplers at Eagle Heights
- Build stronger dataset of field or trip blanks
- Implement fee-for-service testing at WSLH

Comments/Questions

- S. Steffen, ECCC: would be interested in cross-testing blanks
- E. Prestbo: what is your definition of repacking? C. Dahman: reused both Radiello and mesh screen.

Perspectives on Passive Sampling in a Network Mode

David Gay

- AMNet: it's different now from the original network as built. Fewer researchers involved, missing data and varied data quality. Need a passive network.
- Looking at a bit expensive model, so looking at ways to bring cost down (use own samplers, still buy carbon from Tekran, move to quarterly)

Network model we're looking at now

- 45-day sample (8/year)
- Based on using Tekran samplers
- 2 samples (collocated) and a field blank (so 3 units total)
- \$500 per site and period
- At 8 samples per year, that is \$4,000 per site year

Discussion

- K. Morris: 3 samples + blank quarterly?
- C. Dahman: \$200 per sampler, x3 samplers per set, quarterly = \$2,400. possible to include blank in that cost... but yes also prefer triplicate.
- C. Danielson: 6 per year; 2-month deployments?
- K. Morris: Should we be consistent with what others are doing (i.e., quarterly)?
- D. Gay: good point, there are arguments to be made for different deployment lengths. What is the goal? What are we looking at?
- S. Steffen: agree, ask what answer are you looking for? And then design sampling around that. Current Canada model is about \$70K USD a year for 100 sites (2 samplers + blank). We do reuse samplers.
- M. Gustin: agree, what is the overall objective with the passive network? D. Gay: good step towards a global Minamata evaluation. But you can't estimate dry dep or sources well. But it's also not probable to keep AMNet going.
- W. Luke: so these estimates are based on Tekran samplers. Imagine cost would decrease if we try repacking samplers.
- D. Felton: quarterly is enough for seasonality. Reduced cost allows for more locations.
- D. Gay: maybe solution is some supersites, and then passives everywhere else.

- A. Piña (USFS): have there been conversations to implement this with states, globally? S. Steffen: yes, Canada is interested, trying to work with their Foreign Affairs department. D. Gay: we've talked with Japan about it as well, thinking about islands in the Pacific. D. Schmeltz: there is also interest among tribal nations.
- E. Prestbo: people end up using the data for a variety of reasons, and that's not necessarily up to us. But NADP is good at providing quality measurements at low costs. So passives might be a good option for people looking to get into mercury monitoring, who don't have capacity (cost, infrastructure, etc.) to do active monitoring.
- K. Morris: NPS has a little seed money to do pilot effort with 2 sites for 1 year. Will help refine lab comparison, QA/QC, costs, lessons learned, etc.
- D. Schmeltz: EPA is also looking at 3 sites to contribute to this pilot effort.
- W. Luke: NOAA program is ending and will have many Tekrans that could be repurposed. Will be discussing in NOS as well.

Minamata Air OESG Update

Sandy Steffen

- Dec 2024: review draft of summary of data collected
- Sept 2025: review drafts of scientific report and recommendations for future EE
- June 2026: final scientific report and recommendations due

Progress Made

- Hired BRI to manage the data influx
- Draft data use agreement (including open access)
- Follow up letter of intent to submit data
- Draft invitation to submit data letter (April 2024, a little behind)

Next Steps

- Sandy's Data team: will work with BRI to transfer data to ECCC and do preliminary analysis. Will send analysis to air team for writing and editing.
- Air Expert Group: will help collect available data. Will interpret results and write and editing text.

Round Robin

- M. Gustin: litterfall data have been compiled. Looking at trend analysis. Preliminary results appear to indicate deposition is a function of litterfall.
- W. Luke: most of NOAA mercury program will be shutting down Sep. 30, 2024. Seeing if there are partners who can assume operations of sites like Mauna Loa; Mercury monitoring will continue at Beltsville. NOAA will have surplus Tekran systems available and would like assistance in identifying potential partners interested in operating the equipment. Tekrans.
- S. Steffen: any forest fire work?
 - K. Morris: there will be an EPA study (John Walker) looking at black carbon/tracing wildfire impacts to precipitation. Could tie in collocated MDN sites? J. Walker: good idea, we looked for sites where CASTNET and IMPROVE are collocated with NTN. Will look at the site list for any collocated MDN sites.
 - D. Felton: Ozone FEM analyzers respond "well" to Hg from wildfire smoke.

- M. Gustin: Determining sources of reactive mercury compounds in Reno, Nevada, United States. DOI 10.3389/fenvc.2023.1202957
- S. Janssen: we will have a mercury session at SETAC this fall! Submit [SETAC](#) abstract by May 15.
- Huiting Mao: new publication: Wu, L., Mao, H., Ye, Z., Dibble, T. S., Saiz-Lopez, A., & Zhang, Y. (2024). Improving simulation of gas-particle partitioning of atmospheric mercury using CMAQ-newHg-Br v2. Journal of Advances in Modeling Earth Systems, 16, e2023MS003823. <https://doi.org/10.1029/2023MS003823> Welcome collaboration from folks interested in using model.
- G. Wetherbee: 2-week sampling?
 - C. Dahman: we are looking for a path forward and welcome collaboration. We've done 1 year of side-by-side sampling at arboretum site. Data looked good, but it's just one site/climate. We are interested in western climates and collocated MDN sites. Are people interested in biweekly sampling? G. Wetherbee: yes, I think we all should be. Will speak more to this in NOS.
 - Noelle (USGS): we have a couple new labs to the program this year (University Nevada Reno and UC Davis). Also, we are interested collocated NTN site at NY20. That's also an MDN site, and if there is funding, we'd be interested in one-week/two-week sampling. More at NOS.
 - K. Morris: Jim Renfro at Great Smoky Mountains is interested in MDN collocated site.

Meeting Agenda (May 1, 1-3pm CT)

1:00 pm: Welcome and Introductions

1:05 pm: NADP Mercury Program Update

1:20 pm: Passive Mercury Monitoring

- **1:20 pm:** Passive Intercomparison Field Study Update (Winston Luke)
- **1:30 pm:** MerPAS Sample Rate Curve (Lucas Hawkins)
- **1:45 pm:** Lab Update on Passive Sampling (Christa Dahman)
- **2:05 pm:** Perspectives on Passive Sampling in a Network Mode (David Gay)
- **2:15 pm:** Discussion and Next Steps (Kristi Morris)

2:30 pm: Minamata Air OESG Update (Sandy Steffen)

2:45 pm: Round Robin (All)

3:00 pm: ADJOURN

Integrated Mercury Review Workgroup: Meeting Minutes

2024 NADP Spring Meeting

Hybrid – Virtual and Madison, WI

Wednesday, May 1, 2024, at 3:15-5:15pm CT

Co-chairs: Colleen Flanagan Pritz & David Schmeltz

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Meeting Notes

Minamata Perspective

Terry Keating, EPA

- Open-Ended Science Group (OESG) is open to one representative from each country. But we also rely on engaging a broad roster of experts – we encourage folks to join. Developing a scientific report for Effectiveness Evaluation Group to use in policy perspective.
- OESG data analysis:

Another Way to Look at the OESG Analysis Questions

Source to Impact Causal Chain

	Emissions & Releases	Air Concentration & Deposition	Other Abiotic Media (soil, sediments, water, ...)	Biota	Human Biomonitoring	Health and Ecosystem Impacts
What trends do we observe?						
Location specific						
Regionally						
Globally						
Are current models consistent with observed trends?						
Location specific						
Regionally						
Globally						
Can we explain the relationship between trends along the causal chain?						
Location specific						
Regionally						
Globally						
Can we attribute trends to sources and other drivers?						
Location specific						
Regionally						
Globally						

Expectations for being able to populate each cell in EE1 decreases

- A U.S. strategy can inform the Minamata Convention/global strategy. U.S. can provide observations and analysis from more data rich environments that will inform the analysis from other parts of the globe that do not have equivalent temporal or spatial records.
 - Would be most useful to have input by March 2025. Draft report from OESG in Oct 2025?
 - Contact eisaku.toda@un.org or keating.terry@epa.gov to contribute to OESG process, join Roster of Experts, etc.
 - J. Healy (EPA/OW/OST): will message Terry about data on Hg in fish fillet tissues.

Considerations for a US-centric Minamata Effectiveness Evaluation Plan

David Krabbenhoft, USGS Emeritus

- Article 22 of the MCM specifically calls for multi-media monitoring (air, biota, human) to quantify environmental response to actions taken by the MCM.

- MCM emphasizes the need to conduct the EE **with attribution!** Attribution means connecting atmospheric declines to other matrices like biota and sediments. That is the challenge.

What makes an appropriately designed MCM EE monitoring plan?

- Include locations and media with anticipated full range of responses
- Use complimentary intensive sites (multiple matrices and mechanistic data available) and extensive networks (larger volumes of temporal and spatial data)
- Align monitoring and data system (s) with anticipated responses (i.e., make sure we are monitoring sites that may have different responses)
- Additional long-term monitoring and new startups may need to be considered
- Models (mechanistic and statistical) will be a critically needed tool to achieve attribution component
- Turnover time of Hg source pool is critically important consideration for monitoring design

Anticipating Atmospheric Response in U.S.:

- Using the 1.1 ng/mg³ from Tate et al., 2023 and modeled predictions (Sunderland et al. 2008, Amos et al. 2015, Song et al. 2015, Pacyna et al. 2016); and assuming the 75% reduction target of the MCM, we derive a post-MCM TGM condition of approximately 0.7-0.9 ng/m³ -> or a 0.2-0.4 ng/m³ decline.

Other Notes

- We need measurements across matrices: air, biota, human, peat, soil, sediment, etc.
- The magnitude of the observed response in water, sediment, and biota will be variable.
- Need to avoid significant legacy contamination sites/regions (Janssen et al. 2019 E&ST).

Comments

- Reach out to MELD group if you are interested in working on the white paper.
- J. Healey (EPA OW): we are coordinating with Sarah; we have data from soil and fish fillet tissue. Reach out if interested.
 - S. Janssen: yes, we are taking into consideration these EPA national assessment datasets.

Trend Analysis and Watershed Mass Balance for a Northern Hardwood Forest

Connor Olson

- Preparing manuscript on mass balance work at Huntington Wildlife Forest (HWF; NY20). Mass balance for watershed and for lake separately.
- Components
 - Wet dep – MDN
 - Dry dep (non-litter) – AMNet and GEOS-Chem
 - Dry dep (litter) – MLN
 - Evasion – Empirical model: Choi et al. 2008
 - Runoff (Inlet) – Measured: Exploration and Graphics for RivEr Trends (EGRET)
 - Runoff (Outlet) – Measured: EGRET

Watershed Mass Balance

- 2004-2020 data

- Overall inputs to system in this time period are decreasing; largest input is dry dep (non-litter). See decreases in wet dep and litterfall too, and see significant decreases in litterfall.
- Evasion is biggest loss pathway. Having better long-term evasion estimates would be useful.
- Estimate 1.8 kg Hg introduced from 2004-2021, with ~20% evaded back to atmosphere and ~74% retained in soils. This is that legacy reservoir – about a 1.7% increase in total soil reservoir per year.

Lake Mass Balance

- More variable. Lake is net sink for Hg, about 3.4g/yr, most of which is ending up in sediment.
- Overall, there is a very minor decrease. Largely driven by a sharp decrease early in record, followed by increase in Hg loading to lake. Possibly caused by qualitative changes in DOC to more humified fractions (lake browning).
- Methylmercury: a lot more variability.

Brook Trout Trends

- Five lakes with 15 years of data
- Unsurprisingly, we find no significant trends. Would need either more fish per year (replicates), or more years (time), to detect small changes.

Linking patterns of atmospheric mercury deposition with bioaccumulation in aquatic ecosystems *Collin Eagles-Smith, USGS*

- Dragonfly THg is decoupled from Hg wet dep at the site scale
- Temporal trends in dragonfly mercury concentration vary across regions (increase, decrease, no trend; 2010-2020).
- Averaging across whole dataset (1,500 site-years) shows ~11% decline in dragonfly mercury from 2010-2020. Wet dep THg concentrations declined 13% over the same time period.
- D. Krabbenhoft: it's also great to have this robust data set (dragonfly mercury) and apply new tools, like S. Janssen's isotope work (<https://pubs.acs.org/doi/10.1021/acs.est.4c02436>).

NADP Perspective

David Gay, NADP

- Big question: will we be able to accomplish an effectiveness evaluation? Yes, but a hamstrung one. We need to think about where we're monitoring. Wet dep in Eastern and Southern US, but not in West. Dry dep... not so much.
 - What can we (NADP) do to help? Make wet dep cheaper (i.e., bag method). Run passive network, if that's what we decide.
- Trends: increasing in the West and Plains (C. Olson 2020, <https://pubs.acs.org/doi/full/10.1021/acs.estlett.0c00185>). 2005-2015 range, but most of these sites are no longer running.
- Brainstorm idea: Look at high-elevation lake (atmospheric dominated)... national parks out west... Crater Lake? Where we could add AMNet and MDN.
 - D. Krabbenhoft: agree
 - G. Wetherbee: Loch Vale, Rocky Mountain NP

- D. Felton: in canopy and above tree line
- D. Felton: at the last CASAC meeting for NOx/SOx, it was suggested to use dep instead of air concentrations. So there are folks interested in seeing Hg.

Next Steps

- D. Krabbenhoft and small group is working on white paper. Reach out if interested in commenting. Will share with Terry for OESG.

Meeting Agenda (May 1, 3:15-5:15pm CT)

3:15 pm: Overview and Introductions (Sarah Janssen and David Schmeltz)

3:35 pm: Minamata Perspective (Terry Keating)

3:35 pm: Considerations for a US-centric Minamata Effectiveness Evaluation Plan (David Krabbenhoft)

4:05 pm: Site-Specific Studies

- Integrated map presentation, with a focus on air and other media (Sarah Janssen and David Schmeltz)
- "Trend Analysis and Watershed Mass Balance for a Northern Hardwood Forest: Insights from 15 years of Monitoring" (Connor Olson)
- "Linking patterns of atmospheric mercury deposition with bioaccumulation in aquatic ecosystems at a national scale" (Collin Eagles-Smith)

4:45 pm: NADP Perspective - Site gaps and priorities (David Gay)

5:00 pm: Next Steps and Proposed Outcomes (Sarah Janssen and David Schmeltz)

5:15 pm: ADJOURN