

SAES-422 Multistate Research Activity Accomplishments Report

Project No. and Title: NRSP-3, The National Atmospheric Deposition Program – A Long-Term Monitoring Program in Support of Research on the Effects of Atmospheric Chemical Deposition

Period Covered: 5-2013 through 4-2014

Date of Report: June 13, 2014

Meeting Dates: Fall, October 8-11, 2013; Spring, April 14-17, 2014.

Participants

A listing of the attendees is provided, and also available at the meeting summary location at the NADP website (<http://nadp.isws.illinois.edu/nadp2013/>) (attachment).

Meeting Minutes

The NADP is comprised of a technical committee (all participants), an executive committee, several scientific committees, and a series of subcommittees focusing on specific areas of the ongoing project, including operations, quality assurance, ecological response and outreach, and data management. All approved meeting minutes from our 2014 Spring Meeting (and all other meetings) are available on our website (<http://nadp.isws.illinois.edu/committees/minutes.aspx>). Some subcommittee minutes from the Spring Meeting will be delayed for approval, but they will be posted when approved at the same address.

The attachment is the minutes of the Fall 2013 Joint Subcommittee Meeting (a meeting of all participants, with topics of interest to all) (attachment).

Spring 2014 Subcommittee minutes will be available here (<http://nadp.isws.illinois.edu/committees/minutes.aspx>) as they become finalized and available.

Accomplishments

The NRSP-3 provides a framework for cooperation among State Agricultural Experiment Stations (SAES), the U.S. Department of Agriculture-National Institute of Food and Agriculture, and other cooperating governmental and non-governmental

organizations that support the National Atmospheric Deposition Program (NADP). The NADP provides quality-assured data and information on the exposure of managed and natural ecosystems and cultural resources to acidic compounds, nutrients, base cations, and mercury in precipitation and through dry deposition of several of these compounds. NADP data support informed decisions on air quality and ecosystem issues related to precipitation chemistry.

Specifically, researchers use NADP data to investigate the impacts of atmospheric deposition on the productivity of managed and natural ecosystems; the chemistry of estuarine, surface, and ground waters; and the biodiversity in forests, shrubs, grasslands, deserts, and alpine vegetation. These research activities address “environmental stewardship,” one of the Agricultural Experiment Station’s research challenges (Science Road Map #6). Researchers also use NADP Mercury Deposition Network data to examine the role of atmospheric deposition in affecting the mercury content of fish, and to better understand the link between environmental and dietary mercury and human health. This fits with another research priority of “relationship of food to human health.”

The NADP operates three precipitation chemistry networks: the National Trends Network (NTN), the Atmospheric Integrated Research Monitoring Network (AIRMoN), and the Mercury Deposition Network (MDN).

The 256-site NTN provides the only long-term nationwide record of basic ion wet deposition in the United States. Sample analysis includes free acidity (H^+ as pH), specific conductance, and concentration and deposition measurements for calcium, magnesium, sodium, potassium, sulfate, nitrate, chloride, bromide (new), and ammonium. We also measure orthophosphate ions (PO_4^{3-} , the inorganic form), but only for quality assurance as an indicator of sample contamination. At the end of April 2014, 256 NTN stations were collecting one-week precipitation samples in 48 states, Puerto Rico, the Virgin Islands, Canada, and a new site in Argentina. Additionally, there are multiple quality assurance and test sites. Complementing the NTN is the 7-site AIRMoN which are essentially NTN sites operated on a daily basis (i.e., single precipitation events). Samples are collected to support continued research of atmospheric transport and removal of air pollutants and development of computer simulations of these processes.

The 114-site MDN offers the only long-term and routine measurements of mercury in North American precipitation. Measurements of total mercury concentration and deposition (and optional methyl-mercury) are used to quantify mercury deposition to water bodies, some of which have fish and wildlife mercury consumption advisories.

Since 2008, every state and 10 Canadian provinces listed advisories warning people to limit fish consumption due to high mercury levels. Coastal advisories are also in place for Atlantic waters from Maine to Rhode Island, from North Carolina to Florida, for the entire U.S. Gulf Coast, and for coastal Hawaii and Alaska.

The NADP operates two newer gaseous atmospheric chemistry networks: the Atmospheric Mercury Network (AMNet) and the Ammonia Monitoring Network (AMoN, NADP's newest network). In each case, the network goal is to provide atmospheric concentrations of these particular gases, and then to estimate the rate of dry deposition (without precipitation) of the gas. In many cases, dry deposition of the gas could far exceed the wet deposition of the same compound.

At the end of April 2014, 20 AMNet sites were collecting five-minute estimates of gaseous elemental mercury and two-hourly average concentrations of gaseous oxidized mercury and particulate bound mercury. The AMNet provides the only long-term region-wide record of basic atmospheric mercury concentrations in the United States.

The AMoN has 66 sites operating as of April 2014, where two-week averages of atmospheric ammonia gas are being collected with passive devices. This low-cost network is designed to provide long-running estimates of ammonia in the atmosphere. These data are particularly important to agriculture, since many sources of ammonia are agricultural (Roadmap Challenge #6). Data from both gaseous networks support continued research of atmospheric transport and removal of air pollutants and development of computer simulations of these processes.

Short-term Outcomes and Outputs.

Samples Collected. NADP's principal objective and accomplishment/outcome is the collection and analysis of samples for precipitation and atmospheric chemistry. Briefly, the NADP processed a total of 13,608 samples from the NTN, including 106 quality assurance (QA) samples. The analyses included observations of 10 different analyte concentrations and precipitation volume, which allow for calculation of deposition flux for each analyte. These same data were collected daily (i.e., every day with measurable precipitation) from the AIRMoN network. AIRMoN collected and processed 919 precipitation samples, including 64 QA samples. The MDN collected and processed 5,910 weekly mercury-in-precipitation samples, including 1,182 QA samples. Additionally, 420 methyl-mercury samples were also processed, with 84 QA samples. The AMoN collected and quality assured 1,034 ammonia samples, which included 561 QA samples. The AMNet collected, quality assured, and produced approximately

51,200 hourly and two-hourly averages. QA samples are run at the individual sites and not part of the NADP sample counts.

NADP Database. Our second most important accomplishment/outcome is making data available to all for the support of continued research. Scientists, policymakers, educators, students, and others are encouraged to access data at no charge from the NADP website (<http://nadp.isws.illinois.edu>). This website offers online retrieval of individual data points, seasonal and annual averages, trend plots, concentration and deposition maps, reports, manuals, and other data and information about the program. As of today, 2012 calendar year data are complete and online, and the 2013 data is online with final QA to be completed in the next several weeks for development of the final 2013 annual maps and database. Website usage statistics provide evidence that our data are being used. During this reporting period, website usage remained strong. We have recorded 37,582 registered users who accessed our website information and there were 27,806 data downloads from the site (about our typical number). The website received over 1.27 million “hits.” Maps (single or multiple) were downloaded 22,582 different times. We continually divide users into types, and this year was again very typical; about 40% were from federal and state, 36% from universities, 16% from K-to-12 schools, and 8% from other individuals or organizations. The NADP website has registered users from more than 150 countries across the globe. These statistics demonstrate that NADP continues to be relevant to both the scientific and educational communities and continues to attract new users.

Map Summary. The 2012 annual map series and Map Summary Report was developed during June 2013 and available in September 2013. These maps are used widely and constitute one of the major products of the network. Individual maps are filed by network, year, and constituent, and can be downloaded in several formats (<http://nadp.isws.illinois.edu/data/annualmaps.aspx>). Individual maps are compiled into annual Map Summary reports, and the 2012 Map Summary is also available for download (<http://nadp.isws.illinois.edu/lib/dataReports.aspx>). We printed 2,000 copies of the 2012 Annual Summary, and about 80% of these have been distributed thus far. The 2013 data is about to be completed at this writing, and the map development will begin very soon. The 2013 Map Summary report will be available about September 1.

Scientific Meeting (Fall 2013). At the end of each federal year, a combined business and scientific meeting is held to showcase some of the latest deposition research that occurred during the year. During FY13, the meeting focused on “Western U.S. Monitoring and Analysis: Progress and Current Issues” with a goal of focusing more on the observations most important in the Western U.S. (Park City, UT Oct 8-11, 2013). This meeting was a bit unusual due to the federal shutdown and the lack of federal

attendees. We were expecting about 140 attendees, but we only realized about 90 people and participants. The meeting included eight sessions, 44 oral presentations, and 37 posters. Most presentations were given, although a number were given by secondary authors. A significant number of posters were not available at the meeting. Additionally, this meeting was provided as a webcast to benefit those members unable to attend the meeting. Observers could hear the presenters, see the slides, and ask questions. This may become a regular offering of the meetings.

One session was devoted to nitrogen fluxes, a topic of particular interest to agriculture. This shortened session led into an all-day Friday special Nitrogen Flux Workshop. The workshop was hampered by missing federal speakers and chair. Specific topics included U.S. nitrogen flux budgets, the increasing importance of ammonia, and the flux of organic nitrogen. Attendance at the workshop was about 50 people. All presentations, posters, and meeting proceedings (including the workshop) are available on the NADP website (nadp.isws.illinois.edu/conf/2013/session4.html).

Scientific Meeting (FY14, Spring 2014) was held in Ft. Lauderdale, FL on April 14-17, 2014. The Spring meeting is the typical business meeting, and agendas and minutes of all committee meetings are available online (as they become available), including an Executive Committee summary (<http://nadp.isws.illinois.edu/committees/minutes.aspx>).

Scientific Meeting (FY15, Fall 2014). The next fall scientific meeting will be held in Indianapolis, IN (October 19-23, 2014). As of now, a planned "Agriculture and Atmospheric Deposition" session is in the schedule. Ammonia deposition will likely dominate this session. All are welcome, with all presentations, posters, and meeting proceedings to be added to the NADP website.

These basic activities fulfilled the project objectives: (1) coordination of these networks; (2) quality assurance to ensure consistency; and (3) analytical, site support, and data validation services for the sites financed directly through this agreement. Specifically, this report is for the 46 SAES sites, but all of the network results are equivalent for all sites. Over the year, 46 SAES sites operated, none were lost, and LA12 should be restarted within 30 days. Additionally, plans are formulating for starting NADP sites at Florida Agricultural and Mechanical University (FAMU) and North Carolina Agricultural and Technical University (NCA&T), both of which are 1890 Land Grant Universities.

Additional Operation Notes. The NADP continues to convert our precipitation gages to an all-digital network, originating with a Technical Committee decision in 2006 (<http://nadp.isws.illinois.edu/newissues/newgages/newequip.aspx>). An added

advantage to this change is that digital stations will have a very accurate, hourly record of precipitation. As of 5/1/2014, there were 33 sites (of ~300 locations, 89% complete) without digital gages available or installed. Only two of these sites are SAES sites (Cornell/Aurora, UI/Shabbona).

The Central Analytical Laboratory has begun to measure the concentration of bromide ion in all NADP samples as a routine analyte for NTN and AIRMoN sites. Three years of bromide data will be available routinely in the NTN database starting with the 2013 data finalization. Bromide is important to agricultural users, given its fumigant usage in the agriculture industry.

During CY2013, 208 journal articles and reports were generated using the NADP data. Listed in the publications section of this report are the 112 journal articles that were not listed in 2013 SAES-422 report. For CY2014, 72 journal articles have been identified, and will be listed in the 2015 SAES-422 report. This is again evidence that NADP continues to produce data that are both valuable and useful.

In support of our education and outreach responsibilities, two new text books used NADP information during 2013: (1) Millard, S. P., 2013. Probability, Statistics and Information. Also w/ compendium of methods. Springer Science+Business Media NY. ISBN 978-1-4614-8455-4., and (2) Harris, D.C., 2013. Exploring Chemical Analysis, (in Chinese), W. H. Freeman and Co. Additionally 3 dissertations and theses used NADP data: (1) Hale, R. L., 2013. Coupled Hydrology and Biogeochemistry in Social-Ecological Watersheds. Dissertation, Arizona State University; (2) Jones, G. B., 2013. Nutrient Dynamics in Cool-Season Pastures, Master's Thesis, Virginia Polytechnic Institute and State University), and (3) Fleming, C. S., 2013. Nitrogen and Phosphorus Management in the Mid-Atlantic, Doctoral dissertation, Virginia Polytechnic Institute and State University.

A new litterfall mercury monitoring initiative is measuring mercury and methyl mercury in forest litterfall (leaves, twigs, etc.). These dry deposition estimates will complement the MDN wet deposition mercury monitoring. Initiation of the trial began in September 2012, and will continue during CY2014. Analysis and field support is provided through the USGS (<http://nadp.isws.illinois.edu/newIssues/litterfall/>).

During the completion of the 2013 data (occurring now), methyl mercury data, which is currently an MDN, will be released on the NADP website for the first time. Release has been delayed for a number of reasons, which have now been cleared.

Continued Quality Assurance Audits. NADP contract laboratories and the Program Office are each reviewed annually in rotation to identify problems, improve performance, and provide external checks to the program. These audits are a mix of external and NADP member scientists. The Program Office of NADP was audited in 2013. The audit results were reporting back to the Executive Committee at the Spring 2014 meeting (the audit team was mostly federal employees, so the normal report back at the Fall 2013 meeting was not given).

Another improvement is to digitize all of the individual field precipitation records (back to 1978) and make them available to researchers via the NADP website, for a more complete site and sample collection record. This is ongoing and should be completed during 2014.

Dry deposition estimates are planned for the gaseous measurements of the AMoN and AMNet networks using modelled estimates of deposition velocity. The Total Deposition Science Ad hoc Committee within NADP is charged with determining methods and protocols for the development of this dataset. These discussions are ongoing, and dry deposition estimates should be available in the near future.

Impacts

As a National Research Support Project, the NADP's most important impact is that our data are used in research, per our research support mission. For 2013, we identified 208 journal articles and reports that used NADP data, maps, and procedures in their own research, for modeling applications, and for comparison to NADP results, etc. These articles are included in our online database of NADP publications.

Here is a short summary of 10 articles (and theses/dissertations) that are of particular interest to the agricultural community, and were not included in our 2013 SAES-422 report.

1. Cady-Pereira et al. evaluated the ammonia emissions estimate of the Tropospheric Emission Spectrometer (TES), a satellite-based atmospheric emissions product from NASA. Using modelling, the 2010 and 2013 TES emissions estimates were compared to the NADP's AMON ammonia network observations. Results showed good agreement during spring and fall, but July TES estimates were clearly biased high as compared to the NADP observations. All available AMON data and stations (66) were used in the analysis.
2. Carson (thesis, Kansas State University) studied the effects of annual burning vs. fire suppression and/or chronic nitrogen additions on soil carbon at the Konza Prairie LTER Station (NTN KS31). Annual burning significantly increased the soil C:N ratio and in situ CO₂ efflux, while decreasing potential ammonification and nitrification rates. Chronic N addition (100 kg N ha⁻¹ year⁻¹) significantly reduced the soil C:N ratio, while increasing total soil N and potential nitrification and ammonification rates. Chronic N addition reduced potential C mineralization, microbial biomass C and N, and altered microbial community composition. These results indicate that different fire regimes and chronic N enrichment over decades affects soil C and N pools and transformations, as well as microbial biomass and composition. The 26 years of observations from KS31 and respective N deposition trends were used to justify the study, and to measure the N wet deposition and other compounds to the plots.
3. Kobe et al. (SAES scientists) were trying to determine how soil characteristics control tree growth performance, and were comparing multiple type of soils in Michigan versus a tropical Costa Rica site. The authors found that the soil characteristics were tremendously heterogeneous, base cations could limit growth in either the tropical or temperate conditions, specific nutrients could limit aspects of tree growth performance, and the trees have the ability to actively manage access to nutrients

with microbial changes. NADP data from multiple sites were used to characterize the base cations and nitrogen flux to the tree stands in the U.S.

4. Mikhailova et al. (SAES scientists) investigated the potential contribution of calcium and magnesium wet deposition to changes in soil inorganic carbon sequestration. The input of Ca and Mg form pedogenic carbonates. The soil orders with the greatest potential inorganic C formation (and therefore C sequestration changes) were Mollisols, followed by Alfisols and Entisols. Normalized per square kilometer, the important soils were Histosols, Alfisols, and Vertisols. The authors used all of the 1994-2003 NADP data for calcium and magnesium wet deposition fluxes.
5. Peckham and Gower simulated the carbon balance of Midwest forest (1800 to 2000) stands to understand the carbon balance under harvesting conditions, and particularly increased biomass removal for biofuel production (leafy mass). The authors used 220,000 km² of temperate Midwest forests. They concluded that the forests were carbon sinks under current management, but the forests became C sources as biofuel production replaced traditional forest products. NADP nitrogen deposition data (~80 sites) were used in the N and C cycling models.
6. Robertson et al. were attempting to define the fate and transport of constituents in an alluvial aquifer in New Mexico. The authors used NADP sodium and chloride data from 7 sites (multiple years) to show that the groundwater Na:Cl ratios were significantly different than the groundwater ratios. Given the geologic, potentiometric, and mineral constraints, the authors were further able to delineated flow using the chemical nature of the groundwater, as compared to atmospheric deposition ratios.
7. Smart et al. (SAES, USDA scientists) studied the interaction of native grasses and introduced cool-season grasses to determine if active management (early season clipping, fire) could allow native species to dominate in the prairie, even under increasing N deposition conditions. Annual clipping and fire were effective, with annual application (vs. biannual or triennial) showed the best results. Low levels of nitrogen deposition (upward trends) should increase the cover of non-native species. South Dakota NADP wet deposition data and trends were used to determine the input fluxes to the crop test plots.
8. Smith et al. (SAES, ARS Authors) measured N losses and cycling in establishing miscanthus, switchgrass, and mixed prairie as compared to typical corn and soybean standing crops. One important finding was the reduction of N losses from some second generation biofuel crops which showed that high-yielding perennial grasses used for biofuel feedstock have the potential to greatly reduce N losses in the

Midwest corn soybean belt. NADP nitrogen deposition fluxes for 4 years were used in the N budget flowing into the test plots.

9. Sprague and Gronberg estimated the input of anthropogenic nitrogen and phosphorus to each county and five water body surfaces in the conterminous United States for 3 separate years. They include many source types: biological fixation by crops, crop and animal production for human consumption, net import of food and net import of feed and atmospheric deposition, fertilizer, and recoverable manure. The authors used nitrate and ammonium deposition fluxes from all NADP NTN sites for several years for their deposition inputs to their database. The data is presented as a database for further study by researchers.
10. Zhang, Wang et al. (Parts 1 & 2) modeled the agricultural air quality over the southeastern United States using two air quality models (CMAQ, CAMx). They were particularly interested in the ability to model the fate and transport of ammonia gas. Both models show large biases in principal gas concentrations (CO, NO, NO₂ and NH₃), particulate matter, and dry and wet deposition. The authors used 19 NADP NTN site observations of sulfate, nitrate and ammonium during 2002 to compare model estimates against.

Publications

Includes 112 publications that used NADP data or resulted from NRSP 3 activities in 2013 (96 publications from 2013 were previously reported last year). Jan-May 2014 publications will be included in next year's report. A publically available online database that lists citations using NADP data is accessible at:

<http://nadp.isws.illinois.edu/lib/bibliography.aspx>.

1. Adeoye, E., Allison, P., Blackburn, C., Blocker, M., Grams, J., Jones, S., ... & Zitricki, B., 2013. The Effects of Simulated Acid Rain on Corn Seed Germination. Frostburg State University Term Paper.
2. Altieri, K. E., Hastings, M. G., Gobel, A. R., Peters, A. J., & Sigman, D. M. , 2013. Isotopic composition of rainwater nitrate at Bermuda: The influence of air mass source and chemistry in the marine boundary layer. *J. Geophys. Res. Atmos.* 118: 11,304–11,316. doi:10.1002/jgrd.50829.
3. Barger, N. N., Castle, S. C., & Dean, G. N., 2013. Denitrification from nitrogen-fixing biologically crusted soils in a cool desert environment, southeast Utah, USA. *Ecological Processes*, 2(1): 16.

4. Barnes, R. T., Williams, M. W., Parman, J. N., Hill, K., & Caine, N. Thawing glacial and permafrost features contribute to nitrogen export from Green Lakes Valley, Colorado Front Range, USA. *Biogeochemistry* 1–18. doi:10.1007/s10533-013-9886-5.
5. Baron, J. S., Hall, E. K., Nolan, B. T., Finlay, J. C., Bernhardt, E. S., Harrison, J. A., Chan, F., & Boyer, E. W., 2013. The interactive effects of excess reactive nitrogen and climate change on aquatic ecosystems and water resources of the United States. *Biogeochemistry* 114: 71–92.
6. Barr, Inc., 2013. Endangered Species Act: Biological Evaluation, Flint Hills Resources Pine Bend, LLC Rosemount, Minnesota, [http://yosemite.epa.gov/r5/r5ard.nsf/48b4cb59f43efe518625745800533fca/d5a343c69158c02886257b970070992b/\\$FILE/Flint%20Hills%20Biological%20Assessment.pdf](http://yosemite.epa.gov/r5/r5ard.nsf/48b4cb59f43efe518625745800533fca/d5a343c69158c02886257b970070992b/$FILE/Flint%20Hills%20Biological%20Assessment.pdf).
7. Barret, M., Dommergue, A., Ferrari, C. P., & Magand, O., 2013. The monitoring of atmospheric mercury species in the Southern Indian Ocean at Amsterdam Island (38° S). In *E3S Web of Conferences* 1: 27001. EDP Sciences.
8. Bash, J. O., Carlton, A. G., Hutzell, W. T., & Bullock Jr., O. R., 2013. Regional air quality model application of the aqueous-phase photo reduction of atmospheric oxidized mercury by dicarboxylic acids. *Atmosphere* 5(1): 1–15.
9. Benedict, K. B., Carrico, C. M., Kreidenweis, S. M., Schichtel, B., Malm, W. C., & Collett Jr., J. L., 2013. A seasonal nitrogen deposition budget for Rocky Mountain National Park. *Ecological Applications* 23(5): 1156–1169.
10. Benedict, K. B., Chen, X., Sullivan, A. P., Li, Y., Day, D., Prenni, A. J., ... & Collett, J. L., 2013. Atmospheric concentrations and deposition of reactive nitrogen in Grand Teton National Park. *Journal of Geophysical Research: Atmospheres* 118(20): 11–875.
11. Benoit, J. M., Cato, D. A., Denison, K. C., & Moreira, A. E., 2013. Seasonal Mercury Dynamics in a New England Vernal Pool. *Wetlands* 33(5): 887–894.
12. Borst, M., & Brown, R. A., 2013. Chloride released from three permeable pavement surfaces after winter salt application. *Journal of the American Water Resources Association*.
13. Boynton, W. R., Hodgkins, C. L. S., O’Leary, C. A., Bailey, E. M., Bayard, A. R., & Wainger, L. A., 2013. Multi-decade responses of a tidal creek system to nutrient load reductions: Mattawoman Creek, Maryland USA. *Estuaries and Coasts* 1–17. doi:10.1007/s12237-013-9690-4
14. Burgy, K., Resline, J., & Smith, P., 2013. Evaluation of lead concentrations in well water from the Piedmont Area of Harford County, Maryland. Maryland Department of Natural Resources, DNR Publication No. 12-10162013-672.
15. Busenberg, E., & Plummer, L. N. A., 2013. 17-Year Record of environmental tracers in spring discharge, Shenandoah National Park, Virginia, USA: Use of climatic data and environmental conditions to interpret discharge, dissolved solutes, and tracer concentrations. *Aquatic Geochemistry* 1–24. doi:10.1007/s10498-013-9202-y.

16. Cadwallader, A., Castagna, B., & Dinwoodie, S., 2013. Designing a Stormwater Runoff Control System to Help Prevent Pollution of Flint Pond. Major Qualifying Project Report submitted to the Faculty of Worcester Polytechnic Institute. In partial fulfillment of the requirements for the Degree of Bachelor of Science.
17. Cady-Pereira, K. E., Shephard, M. W., Henze, D. K., Zhu, L., Pinder, R. W., Bash, J. O., ... & Luo, M., 2013. Ammonia Measurements by the NASA Tropospheric Emission Spectrometer (TES). Presented at the 12th Annual CMAS Conference, Chapel Hill, NC, October 28-30, 2013.
18. Carson, M. A., 2013. Responses to Long-term Fertilization and Burning: Impacts on Nutrient Dynamics and Microbial Composition in a Tallgrass Prairie. Master's Thesis, Kansas State University.
19. Castle, S. C., & Neff, J. C., 2013. What controls plant nutrient use in high elevation ecosystems? *Oecologia* 173:1551–1561. doi:10.1007/s00442-013-2695-7.
20. Chapmann, L. Y., McNulty, S. G., Sun, G., & Zhang, Y., 2013. Net nitrogen mineralization in natural ecosystems across the conterminous U.S. *International Journal of Geosciences* 4: 1300–1312.
21. Chen, L., Wang, H. H., Liu, J. F., Zhang, W., Hu, D., Chen, C., & Wang, X. J., 2013. Intercontinental transport and deposition patterns of atmospheric mercury from anthropogenic emissions. *Atmospheric Chemistry and Physics Discussions* 13(9): 25185–25218.
22. Civerolo, K. L., and Roy, K. M., 2013. On the road to recovery: Acid rain and the Adirondacks. *New York State Conservationist* 67:17–19.
23. Clark, C. M., Morefield, P. E., Gilliam, F. S., & Pardo, L. H., 2013. Estimated losses of plant biodiversity in the United States from historical N deposition (1985-2010). *Ecology* 94(7): 1441-1448.
24. Classen, A. T., Chapman, S. K., Whitham, T. G., Hart, S. C., & Koch, G. W., 2013. Long-term insect herbivory slows soil development in an arid ecosystem. *Ecosphere* 4(5): article 52.
25. Coble, A. A., & Hart, S. C., 2013. The significance of atmospheric nutrient inputs and canopy interception of precipitation during ecosystem development in piñon–juniper woodlands of the southwestern USA. *Journal of Arid Environments* 98: 79–87.
26. Cui, S., Shi, Y., Groffman, P. M., Schlesinger, W. H., & Zhu, Y. G., 2013. Centennial-scale analysis of the creation and fate of reactive nitrogen in China (1910–2010). *Proceedings of the National Academy of Sciences* 110(6): 2052–2057.
27. Das, R., Bizimis, M., & Wilson, A. M., 2013. Tracing mercury seawater vs. atmospheric inputs in a pristine SE USA salt marsh system: Mercury isotope evidence. *Chemical Geology* 336: 50-61.
28. DiGirolomo, M. F., Allen, D. C., Stehman, S. V., Stout, S. L., & Wiedenbeck, J., 2013. Insect damage to wind-thrown and standing live black cherry resulting from delayed salvage after a major abiotic disturbance. *Northern Journal of Applied Forestry* 30(3): 101–108.
29. Divers, M. T., Elliott, E. M., & Bain, D. J., 2013. Constraining nitrogen inputs to urban streams from leaking sewers using inverse modeling: Implications for dissolved inorganic nitrogen (DIN) retention in urban environments. *Environmental Science & Technology* 47(4): 1816–1823.

30. Dodson, J., 2013. Final report: Nutrient TMDL for Jackson Blue Spring and Merritt's Mill Pond (WBIDs 180Z and 180A). Nutrients January 2013.
31. Eckley, C. S., Parsons, M. T., Mintz, R., Lapalme, M., Mazur, M., Tordon, R., ... & St Louis, V., 2013. Impact of closing Canada's largest point-source of mercury emissions on local atmospheric mercury concentrations. *Environmental Science & Technology* 47(18): 10339–10348.
32. Epstein, D. M., Neilson, B. T., Goodman, K. J., Stevens, D. K., & Wurtsbaugh, W. A., 2013. A modeling approach for assessing the effect of multiple alpine lakes in sequence on nutrient transport. *Aquatic Sciences* 75:199–212. doi:10.1007/s00027-012-0267-2.
33. Evans, D. M., Schoenholtz, S. H., Wigington Jr., P. J., Griffith, S. M., & Floyd, W. C., 2013. Spatial and temporal patterns of dissolved nitrogen and phosphorus in surface waters of a multi-land use basin. *Environmental Monitoring and Assessment* 1–15.
34. Faustini, J., Thom, T. A., Hunt, K. J., Nilius, R., & Burns, R. E., 2013, November. Water resource inventory and assessment: Cape Romain National Wildlife Refuge, Charleston County, South Carolina. U.S. Fish and Wildlife Service, Southeast Region. Atlanta, Georgia. 84 p.
35. Florida Department of Environmental Protection, 2013. Final Report: Mercury TMDL for the State of Florida, Watershed Evaluation and TMDL Section, October 24, 2013.
36. Franzen, C., 2013. Determination of Atmospheric Mercury and its Deposition in Remote Areas of the Northern and Southern Hemisphere. Dissertation, Ruprecht-Karls-Universität, Heidelberg, Germany.
37. Freedman, Z., Eisenlord, S. D., Zak, D. R., Xue, K., He, Z., & Zhou, J., 2013. Towards a molecular understanding of N cycling in northern hardwood forests under future rates of N deposition. *Soil Biology and Biochemistry* 66: 130–138.
38. Gay, D. A., Schmeltz, D., Prestbo, E., Olson, M., Sharac, T., & Tordon, R., 2013. The Atmospheric Mercury Network: Examination of a long-term atmospheric mercury record across North America. *Atmospheric Chemistry & Physics* 13: 11339–11349. doi:10.5194/acp-13-11339-2013.
39. Geddes, J. A., & Murphy, J. G., 2013. Observations of reactive nitrogen oxide fluxes by eddy covariance above two mid-latitude North American mixed hardwood forests. *Atmospheric Chemistry and Physics Discussions* 13(10): 27891–27936.
40. Goss, N. R., Mladenov, N., Seibold, C. M., Chowanski, K., Seitz, L., Wellemeyer, T. B., & Williams, M. W., 2013. Quantifying particulate matter deposition in Niwot Ridge, Colorado: Collection of dry deposition using marble inserts and particle imaging using the FlowCAM. *Atmospheric Environment* 80: 549–558.
41. Gu, B. & Howard, N., 2013. Annual Permit Compliance Monitoring Report for Mercury in Downstream Receiving Waters of the Everglades Protection Area. Appendix 3-2, Attachment F in 2012 South Florida Environmental Report Vol III. South Florida Water Management District, West Palm Beach, FL.
http://my.sfwmd.gov/portal/page/portal/pg_grp_sfwmd_sfer/portlet_prevreport/2013_sfer/v3/appendices/v3_app3-2.pdf .

42. Guretzky, J. A., Schacht, W. H., Wingeyer, A., Klopfenstein, T. J., & Watson, A., 2013. Litter deposition and nitrogen return in rotationally stocked smooth brome grass pastures. *Agronomy Journal* 105 (4): 915–921.
43. Hale, R. L., 2013. *Coupled Hydrology and Biogeochemistry in Social-Ecological Watersheds*. Dissertation, Arizona State University.
44. Hansen, A. M., & Gay, D.A., 2013. Observations of mercury wet deposition in Mexico. *Environmental Science and Pollution Research* 20: 8316–8325. doi: 10.1007/s11356-013-2012-3 2013.
45. Heard, A. M., 2013. *Global Change and Mountain Lakes: Establishing Nutrient Criteria and Critical Loads for Sierra Nevada Lakes*. Dissertation, Environmental Sciences Department, University of California at Riverside.
46. Heath, T. J., & Baron, J. S., 2013. Climate, not atmospheric deposition, drives the biogeochemical mass-balance of a mountain watershed. *Aquatic Geochemistry*. doi: 10.1007/s10498-013-9199-2
47. Heineman, M., Eichenwald, Z., Gamache, M., Miner, R., & Keohan, P. A., 2013. Comprehensive Water Quality Model of Boston's Drainage Systems. In *World Environmental and Water Resources Congress 2013: Showcasing the Future*, pp. 63-76. ASCE.
48. Herr, J., van Werkhoven, K., Connor, T., Borel, N., Bergstrom, H., & Murakami, T., 2013. *Opportunistic Real-time Management of Saline Drainage Conjoined with San Joaquin River Restoration*. Final Report, University of California at Merced.
49. Herring, G., Eagles-Smith, C. A., Ackerman, J. T., Gawlik, D. E., & Beerens, J. M., 2013. Landscape factors and hydrology influence mercury concentrations in wading birds breeding in the Florida Everglades, USA. *Science of The Total Environment* 458: 637–646.
50. Hinkle, S. R., Bencala, K. E., Wentz, D. A., & Krabbenhoft, D. P., 2013. Mercury and methylmercury dynamics in the hyporheic zone of an Oregon stream. *Water, Air, & Soil Pollution* 225(1): 1694-1710. doi: 10.1007/s11270-013-1694-y1-17.
51. Holland, K. & Hicks, R., 2013. *Final Report: Nutrient TMDL for Rainbow Springs Group and Rainbow Springs Group Run (WBIDs 1320A and 1320B)*. Florida Department of Environmental Protection.
52. Huang, J., Chang, F. C., Wang, S., Han, Y. J., Castro, M., Miller, E., & Holsen, T. M., 2013. Mercury wet deposition in the eastern United States: Characteristics and scavenging ratios. *Environmental Science: Processes & Impacts* 15(12): 2321–2328.
53. Huang, J., Miller, M. B., Weiss-Penzias, P., & Gustin, M. S., 2013. Comparison of gaseous oxidized Hg measured by KCl-coated denuders, and nylon and cation exchange membranes. *Environ. Sci. Technol.* 47: 7307–7316.
54. James, R. T., & McCormick, P., 2012. The sulfate budget of a shallow subtropical lake. *Fundamental and Applied Limnology/Archiv für Hydrobiologie* 181(4): 253–269.

55. Janke, B. D., Finlay, J. C., Hobbie, S. E., Baker, L. A., Sterner, R. W., Nidzgorski, D., & Wilson, B. N., 2013. Contrasting influences of stormflow and baseflow pathways on nitrogen and phosphorus export from an urban watershed. *Biogeochemistry* 1–20. doi: 10.1007/s10533-013-9926-1
56. Kaushal, S. S., Likens, G. E., Utz, R. M., Pace, M. L., Grese, M., & Yepsen, M., 2013. Increased river alkalization in the Eastern U.S. *Environmental Science & Technology* 47(18): 10302–10311.
57. Kobe, R. K., Baribault, T. W. & Holste, E. K., 2013. Tree performance across gradients of soil resource availability. *Forests and Global Change*, Chapter 11:309.
58. Kolker, A., Engle, M. A., Peucker-Ehrenbrink, B., Geboy, N. J., Krabbenhoft, D. P., Bothner, M. H., & Tate, M. T., 2013. Atmospheric mercury and fine particulate matter in coastal New England: Implications for mercury and trace element sources in the northeastern United States. *Atmospheric Environment* 79: 760–768.
59. Laacouri, A., 2013. The Distribution and Uptake Dynamics of Mercury in Leaves of Common Deciduous Tree Species in Minnesota, USA. Master's Thesis, University of Minnesota.
60. Lawrence, G. B., J. E. Dukett, N. Houck, P. Snyder, and S. B. Capone. 2013a. Increases in dissolved organic carbon accelerate loss of toxic Al in Adirondack lakes recovering from acidification. *Environmental Science & Technology* 47:7095–7100.
61. Lee, J., 2013. Techniques for submodular maximization. *Discrete geometry and optimization*. Fields Institute Communications 69: 163–177.
62. Lee, M. K., Natter, M., Keevan, J., Guerra, K., Saunders, J., Uddin, A., Munir Humayun, Yang Wang, & Keimowitz, A. R., 2013. Assessing effects of climate change on biogeochemical cycling of trace metals in alluvial and coastal watersheds. *British Journal of Environment & Climate Change* 3(1): 44–66.
63. Lei, H., Wuebbles, D. J., Liang, X. Z., Tao, Z., Olsen, S., Artz, R., ... & Cohen, M., 2013. Projections of atmospheric mercury levels and their effect on air quality in the United States. *Atmospheric Chemistry and Physics Discussions* 13(8): 20165–20194.
64. Li, X., Bao, H., Gan, Y., Zhou, A., & Liu, Y., 2013. Multiple oxygen and sulfur isotope compositions of secondary atmospheric sulfate in a mega-city in central China. *Atmospheric Environment* 81: 591–599.
65. Linder, G., Brumbaugh, W., Neitlich, P., & Little, E., 2013. Atmospheric deposition and critical loads for nitrogen and metals in arctic Alaska: Review and current status. *Open Journal of Air Pollution* 2 (4): 76-99, doi: 10.4236/ojap.2013.24010.
66. Linker, L. C., Dennis, R., Shenk, G. W., Batiuk, R. A., Grimm, J., & Wang, P., 2013. Computing atmospheric nutrient loads to the Chesapeake Bay watershed and tidal waters. *JAWRA Journal of the American Water Resources Association* 49(5): 1025–1041.
67. Lloyd, P., 2013. Reassessment of the environmental impacts of sulphur oxide emissions from power stations. *Journal of Energy in Southern Africa* 24(2): 28–36.

68. Lovett, G. M., Arthur, M. A., Weathers, K. C., Fitzhugh, R. D., & Templer, P. H., 2013. Nitrogen addition increases carbon storage in soils, but not in trees, in an eastern U.S. deciduous forest. *Ecosystems* 16: 980–1001. doi: 10.1007/s10021-013-9662-3.
69. Lu, X., Jiang, H., Zhang, X., Liu, J., Zhang, Z., Jin, J., ... & Cheng, M., 2013. Estimated global nitrogen deposition using NO₂ column density. *International Journal of Remote Sensing* 34(24): 8893–8906.
70. Mamun, S., & Villegas, C. O. E., 2013. Nutrient Runoff and TDML in Lower Santa Ana Watershed. Thesis: California State University, Los Angeles, California.
71. Maxwell, J. A., Holsen, T. M., & Mondal, S., 2013. Gaseous elemental mercury (GEM) emissions from snow surfaces in northern New York. *PLoS ONE* 8(7): e69342. doi:10.1371/journal.pone.0069342.
72. Medalie, L., 2013. Concentration, flux, and the analysis of trends of total and dissolved phosphorus, total nitrogen, and chloride in 18 tributaries to Lake Champlain, Vermont and New York, 1990–2011. U.S. Geological Survey Scientific Investigations Report 2013–5021, 29 p., <http://pubs.usgs.gov/sir/2013/5021/>.
73. Mellor, N. J., Hellerich, J., Drijber, R., Morris, S. J., Stromberger, M. E., & Paul, E. A., 2013. Changes in ecosystem carbon following afforestation of native sand prairie. *Soil Science Society of America Journal* 77(5): 1613–1624. doi:10.2136/sssaj2012.032.
74. Mikhailova, E. A., Goddard, M. A., Post, C. J., Schlautman, M. A., & Galbraith, J. M., 2013. Potential contribution of combined atmospheric Ca²⁺ and Mg²⁺ wet deposition within the continental US to soil inorganic carbon sequestration. *Pedosphere* 23(6): 808–814.
75. Millard, S. P., 2013. Probability, statistics and information. Springer Science+Business Media: New York, NY. ISBN 978-1-4614-8455-4.
76. Murray, G. L., Kimball, K. D., Hill, L. B., Hislop, J. E., & Weathers, K. C., 2013. Long-term trends in cloud and rain chemistry on Mount Washington, New Hampshire. *Water, Air, & Soil Pollution* 224(9): 1–14.
77. Nakagaki, N., Hitt, K. J., Price, C. V., and Falcone, J. A., 2013. Methods to characterize environmental settings of stream and groundwater sampling sites for national water-quality assessment: U.S. Geological Survey Scientific Investigations Report 2012–5194, 56 p.
78. National Park Service, Air Resources Division. 2013. Air quality in national parks: Trends (2000–2009) and conditions (2005–2009). Natural Resource Report NPS/NRSS/ARD/NRR—2013/683. National Park Service, Denver, Colorado.
79. Nelson, S. J., Webster, K. E., Loftin, C. S., & Weathers, K. C., 2013. Shifts in controls on the temporal coherence of throughfall chemical flux in Acadia National Park, Maine, USA. *Biogeochemistry* 116(1-3): 147–160. doi: 10.1007/s10533-013-9884-7.
80. Peckham, S. D., & Gower, S. T., 2013. Simulating the effects of harvest and biofuel production on the forest system carbon balance of the Midwest, USA. *GCB Bioenergy* 5: 431–444. doi:10.1111/gcbb.12033.

81. Qian, Q., Parajuli, B., Fu, Q., Yan, K., Gossage, J. L., & Ho, T., 2013. Assessment of Acid Deposition Effects on Water Quality of the Upper Rio Grande River Section in Texas. *Journal of Water Resource & Protection* 5(8): 792–800.
82. Ray, J. D., 2013. Annual data summary 2011: Gaseous pollutant monitoring program. Natural Resource Data Series NPS/NRSS/ARD/NRDS—2013/443. National Park Service, Denver, Colorado.
83. Rice, K. C., & Price, J. R., 2013. Comparison of mineral weathering and biomass macronutrient uptake in two small forested watersheds underlain by Quartzite Bedrock, Catoctin Mountain, Maryland, USA. *Aquatic Geochemistry* 1–18.
84. Riscassi, A. L., & Scanlon, T. M., 2013. Particulate and dissolved mercury export in streamwater within three mid-Appalachian forested watersheds in the US. *Journal of Hydrology* 501: 92–100.
85. Robertson, A. J., Henry, D. W., and Langman, J. B., 2013, Geochemical evidence of groundwater flow paths and the fate and transport of constituents of concern in the alluvial aquifer at Fort Wingate Depot Activity, New Mexico, 2009. U.S. Geological Survey Scientific Investigations Report 2013–5098, 89 p., <http://pubs.usgs.gov/sir/2013/5098/>.
86. Robison, A. L., Scanlon, T. M., Cosby, B. J., Webb, J. R., & Galloway, J. N., 2013. Roles of sulfate adsorption and base cation supply in controlling the chemical response of streams of western Virginia to reduced acid deposition. *Biogeochemistry* 116(1-3): 119–130.
87. Rojas, A. L. P. Transferencia Al Rio De La Plata De Compuestos Nitrogenados Atmosfericos Procedentes Del Area Metropolitana de Buenos Aires (Transfer to the Rio De La Plata From the Metropolitan Area From Atmospheric Nitrogen Compounds in Buenos Aires). Dissertation, Universidad de Buenos Aires, www.digital.bl.fcen.uba.ar
88. Sandhu, N. K., Axe, L. B., Jahan, K., Ramanujachary, K. V., & Magdaleno, T. F., 2013. Leaching of As, Pb, and Sb from highway marking glass beads. *Journal of Environmental Engineering* 139(9): 1168–1177.
89. Scott J. T., and Grantz, E. M., 2013. N₂ fixation exceeds internal nitrogen loading as a phytoplankton nutrient source in perpetually nitrogen-limited reservoirs. *Freshwater Science* 32 (3): 849–861.
90. Sickles II, J. E., & Shadwick, D. S., 2012. “Transference Ratios” to predict total oxidized sulfur and nitrogen deposition—Part I, monitoring results. *Atmospheric Environment* 77 (October): 1060–1069.
91. Sickles II, J. E., Shadwick, D. S., Kilaru, J. V., & Appel, K. W., 2013. “Transference Ratios” to predict total oxidized sulfur and nitrogen deposition—Part II, modeling results. *Atmospheric Environment* 77: 1070–1082.
92. Smart, A. J., Scott, T. K., Clay, S. A., Clay, D. E., Ohrtman, M., & Mousel, E. M., 2013. Spring Clipping, Fire, and Simulated Increased Atmospheric Nitrogen Deposition Effects on Tallgrass Prairie Vegetation. *Rangeland Ecology and Management* 66(6): 680–687.
93. Smith, C. M., David, M. B., Mitchell, C. A., Masters, M. D., Anderson-Teixeira, K. J., Bernacchi, C. J., & DeLucia, E. H., 2013. Reduced nitrogen losses after conversion of row crop agriculture to perennial biofuel crops. *Journal of Environmental Quality* 42(1): 219–228.

94. Smith, K. P., 2013. Water-quality conditions, and constituent loads and yields in the Cambridge drinking-water source area, Massachusetts, water years 2005–07. U.S. Geological Survey Scientific Investigations Report 2013-5039, 73 p., <http://pubs.usgs.gov/sir/2013/5039/>.
95. Sprague, L. A., and Gronberg, J. M., 2013. Estimated anthropogenic nitrogen and phosphorus inputs to the land surface of the conterminous United States—1992, 1997, and 2002: U.S. Geological Survey Scientific Investigations Report 2012–5241, 14 p.
96. Sullivan, T. J., Lawrence, G. B., Bailey, S. W., McDonnell, T. C., Beier, C. M., Weathers, K. C., ... & Bishop, D. A., 2013. Effects of acidic deposition and soil acidification on sugar maple trees in the Adirondack Mountains, New York. *Environmental Science & Technology* 47(22): 12687–12694.
97. Thomas, R. B., Spal, S. E., Smith, K. R., & Nippert, J. B., 2013. Evidence of recovery of *Juniperus virginiana* trees from sulfur pollution after the Clean Air Act. *Proceedings of the National Academy of Sciences* 110(38): 15319–15324.
98. Timm, B. C., & McGarigal, K., 2013. A preliminary assessment of the ground-dwelling arthropod community composition in six common dune cover types at Cape Cod National Seashore. *Northeastern Naturalist* 20(3): 529–539.
99. Torres, A., Bond, T. C., Lehmann, C. M., Subramanian, R., & Hadley, O. L., 2013. Measuring organic carbon and black carbon in rainwater: Evaluation of methods. *Aerosol Science and Technology*. doi: 10.1080/02786826.2013.868596.
100. Tremaine, D. M., & Froelich, P. N., 2013. Speleothem trace element signatures: A hydrologic geochemical study of modern cave dripwaters and farmed calcite. *Geochimica et Cosmochimica Acta* 121: 522–545.
101. United States Environmental Protection Agency, 2013. Progress Report 2011 Clean Air Interstate Rule, Acid Rain Program, and Former NO_x Budget Trading Program. http://www.epa.gov/airmarkets/progress/ARPCAIR11_downloads/ARPCAIR11_environmental_health.pdf.
102. Vidon, P. G., Mitchell, C. P., Jacinthe, P. A., Baker, M. E., Liu, X., & Fisher, K. R., 2013. Mercury dynamics in groundwater across three distinct riparian zone types of the US Midwest. *Environmental Science: Processes & Impacts* 15(11): 2131–2141.
103. Wang, X., Wu, Z., Shao, M., Fang, Y., Zhang, L., Chen, F., ... & Bao, R., 2013. Atmospheric nitrogen deposition to forest and estuary environments in the Pearl River Delta region, southern China. *Tellus B*, 65:, 20480, <http://dx.doi.org/10.3402/tellusb.v65i0.20480>
104. Weigelt, A., Temme, C., Bieber, E., Schwerin, A., Schuetze, M., Ebinghaus, R., & Kock, H. H., 2013. Measurements of atmospheric mercury species at a German rural background site from 2009 to 2011 – methods and results *Environ. Chem.* 10: 102–110. <http://dx.doi.org/10.1071/EN12107>
105. Weigold, M. and Pillsbury, E., 2013. Long Island Sound: A socioeconomic perspective, Chapter 1 in Latimer, J. S., Tedesco, M. A., Swanson, R. L., Yarish, C., Stacey, P. E., & Garza, C. Long Island Sound. Springer Inc.: New York NY, ISBN 978-1-4614-6125-8, doi: 10.1007/978-1-4614-6126-5.

106. Yelenik, S., Perakis, S., & Hibbs, D., 2013. Regional constraints to biological nitrogen fixation in post-fire forest communities. *Ecology* 94(3): 739–750.
107. Zhang, Y., & Wu, S. Y., 2013. Fine scale modeling of agricultural air quality over the southeastern United States using two air quality models. Part II. Sensitivity studies and policy implications. *Aerosol and Air Quality Research* 13(5): 1475–1491.
108. Zhang, Y., 2013. Biogeochemical Cycling of Mercury in the Atmosphere-ocean-land System: Global and Regional Modeling. Master's Thesis, University of Washington.
109. Zhang, Y., Olsen, K. M., & Wang, K., 2013. Fine scale modeling of agricultural air quality over the southeastern United States using two air quality models. Part I. Application and Evaluation. *Aerosol and Air Quality Research* 13(4): 1231–1252.
110. Zhao, S., Liu, S., Sohl, T., Young, C., & Werner, J., 2013. Land use and carbon dynamics in the southeastern United States from 1992 to 2050. *Environmental Research Letters*, 8(4), 044022.
111. Zhou, J., Feng, X., Liu, H., Zhang, H., Fu, X., Bao, Z., ... & Zhang, Y., 2013. Examination of total mercury inputs by precipitation and litterfall in a remote upland forest of Southwestern China. *Atmospheric Environment* 81: 364–372.
112. Zhu, J., Wang, T., Talbot, R., Mao, H., Yang, X., Fu, C., ... & Xie, M., 2013. Characteristics of atmospheric mercury deposition and size-fractionated particulate mercury in urban Nanjing, China. *Atmospheric Chemistry and Physics Discussions* 13(11): 28309–28341.

Appendices

National Atmospheric Deposition Program 2013

Annual Meeting and Scientific Symposium

(underlined names were unable to attend due to federal budget restrictions)

Participant List

Adlhoch, Joseph	Joseph Adlhoch 1901 Sharp Point Drive Suite E Fort Collins, CO 80525 USA	Phone: 970-484-7941 Fax: Email: jadlhoch@air-resource.cc
Almand, Berkeley	Berkeley Almand 427 UCB 1111 Engineering Dr. Boulder, CO 80309 USA	Phone: 303-807-7668 Fax: Email: berkeleyalmand@gmail.c
Aneja, Viney	Viney Aneja Dept of Marine, Earth and Atmospheric Sciences North Carolina State University 5136 Jordan Hall, Box 8208 Raleigh, NC 27695	Phone: 919-515-7808 Fax: 919-515-7802 Email: viney_aneja@ncsu.edu
Archuleta, Cassie	Cassie Archuleta 1901 Sharp Point Drive Suite E Fort Collins, CO 80525 USA	Phone: 970-484-7941 Fax: Email: carchuleta@air-resource.
Arens, Seth	Seth Arens 195 N 1950 W Salt Lake City, UT 84116 USA	Phone: 801-536-4146 Fax: Email: sarens@utah.gov
<u>Artz, Richard</u>	Richard S. Artz NOAA - Air Resources Lab NCWCP-R/ARL-Room 4265 5830 University Research Court College Park, MD 20740-3818	Phone: 301-683-1367 Fax: 301-713-0119 Email: richard.artz@noaa.gov
<u>Aumann, Ethan</u>	Ethan Aumann BLM NOC, Denver Federal Center Bldg. 50, OC-520 Denver, CO 80225 USA	Phone: 303-236-0589 Fax: Email: eaumann@blm.gov

<u>Barna, Michael</u>	Michael Barna National Park Service CIRA/CSU 1375 Campus Delivery Fort Collins, CO 80523	Phone: 970-491-8692 Fax: 970-491-8598 Email: barna@cira.colostate.edu
<u>Bash, Jesse</u>	Jesse Bash EPA/ORD/NERL/AMD 109 T.W. Alexander Dr USEPA MD-243-04 Research Triangle Park, NC 27711	Phone: 919-541-0862 Fax: 919-641-1379 Email: jesse.bash@noaa.gov
<u>Beachley, Gregory</u>	Gregory Beachley 1200 Pennsylvania Ave NW MC 6204 J Washington, DC 20460 USA	Phone: 202-343-9621 Fax: Email: beachley.gregory@epa.g
Bell, Michael	Michael Bell 2539 Rambling Ct Riverside, CA 92507	Phone: 9098153388 Fax: Email: michael.bell@email.ucr.e
Bergerhouse, Thomas	Thomas R. Bergerhouse Illinois State Water Survey NADP 2204 Griffith Drive Champaign, IL 61820	Phone: 217-244-3712 Fax: 217-244-3054 Email: bergerho@illinois.edu
Bravo, Humberto	Dr. Humberto Bravo Circuito Exterior CD Universitaria C.P 04510 Mexico City, D.F. MEXICO	Phone: 011-52-55-5622-4370 Fax: 011-52-55-5622-4052 Email: hbravo@unam.mx
Brunette, Bob	Bob Brunette Eurofins Flobal Sciences - HAL 11720 North Creek Parkway N Building 7, Suite 400 Bothell, WA 98011	Phone: 425-686-3560 Fax: 425-686-3096 Email: robertbrunette@eurofins
<u>Burns, Douglas</u>	Douglas Burns U.S. Geological Survey 425 Jordan Road Troy, NY 12180-8349	Phone: 518-285-5662 Fax: 518-285-5601 Email: daburns@usgs.gov
Butler, Thomas	Thomas J. Butler Cornell University Ecology & Systematics 211B Rice Hall Ithaca, NY 14853	Phone: 607-255-3580 Fax: 607-255-0238 Email: tjb2@cornell.edu
<u>Bytnerowicz, Andrzej</u>	Andrzej Bytnerowicz USDA Forest Service PSW Research Station 4955 Canyon Crest Drive Riverside, CA 92507	Phone: 909-680-1562 Fax: 909-680-1501 Email: abytnerowicz@fs.fed.us

Call, Bowen	Bowen Call IV Utah Division of Air Quality P.O. Box 144820 Salt Lake City, UT 84114 - 4820	Phone: 801-536-4215 Fax: 801-536-4099 Email: bocall@utah.gov
Campbell, Rick	Rick Campbell Sac & Fox Nation Environmental Department 305 N. Main Reserve, KS 66434	Phone: 785-742-4707 Fax: 785-742-2180 Email: rick.campbell@sacfoxenv
Carou, Silvina	Silvina Carou Environment Canada 4905 Dufferin Street Downsview, Ontario Canada, M3H 5T4	Phone: 416-739-4879 Fax: 416-739-4882 Email: silvina.carou@ec.gc.ca
Cismoski, Scott	Scott Cismoski 1901 Sharp Point Drive Suite E Fort Collins, CO 80525 USA	Phone: 970-484-7941 Fax: Email: scismoski@air-resource.c
Clair, Tom	Dr. Tom Clair Wood Buffalo Environmental Assoc Fort McMurray, AB Canada	Phone: 780-972-9516 Fax: Email: tclair@wbea.org
Claybrooke, Roger	Roger Claybrooke Illinois State Water Survey NADP 2204 Griffith Drive Champaign, IL 61820	Phone: 217-244-2838 Fax: 217-333-6540 Email: rclay@illinois.edu
Cohen, Ronald	Ronald Cohen Department of Chemistry UC Berkeley Berkeley, CA 94720-1460 United States	Phone: 510 642-2735 Fax: Email: rccohen@berkeley.edu
Collett, Jeffrey L.	Jeffrey L. Collett Colorado State University Atmospheric Science - 1371 Campus Fort Collins, CO 80523-1371	Phone: 970-491-8697 Fax: 970-491-8483 Email: collett@atmos.colostate.c
Cook, Elizabeth		Phone: Fax: Email: elizabeth.m.cook@asu.ec

<u>Cooter, Ellen</u>	Ellen Cooter md E243-02 RTP, NC 27711	Phone: 919-541-1334 Fax: Email: cooter.ellen@epa.gov
Copeland, Scott		Phone: 307-332-9737 Fax: Email: scopeland@fs.fed.us
Creswell, Joel	Joel Creswell Brooks Rand Labs 4415 6th Avenue. NW Seattle, WA 98107	Phone: 206-735-6192 Fax: 2066326017 Email: joel@brooksrands.com
<u>Cummings, Tonnie</u>		Phone: Fax: Email: tonnie_Cummings@nps.gov
Dastrup, Dylan	Dylan Dastrup 750 s 650 w #345 Provo, Ut 84601 US	Phone: 801.592.9369 Fax: Email: DylanDastrup@comcast.net
<u>Dennis, Robin</u>	Robin Dennis EPA/ORD/NERL/AMD MD E243-02 109 T.W. Alexander Drive Research Triangle Park, NC 27711	Phone: 919-541-2870 Fax: 919-541-1379 Email: dennis.robin@epamail.epa.gov
Dillner, Ann	Ann Dillner 1 Shields Ave. Crocker Nuclear Lab Davis, CA 95616 United States	Phone: 530-754-0509 Fax: Email: amdillner@ucdavis.edu
Dombek, Tracy		Phone: 919-541-5934 Fax: Email: tdombek@rti.org
Doskey, Paul	Paul Doskey Michigan Technological University Dept of Civil & Environmental Engineering 1400 Townsend Drive Houghton, MI 49931	Phone: 906-487-2745 Fax: 906-487-2943 Email: pvdoskey@mtu.edu

Echeverria, Rodolfo Sosa	Dr. Rodolfo Sosa Echeveria Circuito Exterior CD Universitaria C.P 04510 Mexico City, D.F. MEXICO	Phone: 011-52-55-5622-4370 Fax: 011-52-55-5622-4052 Email: rodsosa@unam.mx
Edgerton, Eric	Eric Edgerton Atmospheric Research & Analysis, Inc 410 Midenhall Way Cary, NC 27513-5538	Phone: 919-522-8565 Fax: 919-678-1159 Email: eedgerton@atmospheric-
Evans, Jordan		Phone: Fax: Email: evansjord@gmail.com
<u>Fenn, Mark</u>	Mark Fenn USDA FS Riverside, CA	Phone: Fax: Email: mfenn@fs.fed.us
Fowler, David		Phone: Fax: Email: dfo@ceh.ac.uk
<u>Frank, Neil</u>	Neil Frank USEPA MD-14 Research Triangle Park, NC 27711	Phone: 919-541-5560 Fax: Email: frank.neil@epa.gov
Furiness, Cari	Cari Furiness NC State University College of Natural Resources 3113 Jordan Hall Campus Box 8008 Raleigh, NC 27695-8008	Phone: 919-515-4653 Fax: 919 515-6193 Email: cari_furiness@ncsu.edu
Gaddis, Aimee	Aimee Gaddis P.O. Box 15 Sapelo Island, GA 31327	Phone: 912-485-2251 Fax: 912-485-2141 Email: Aimee.Gaddis@dnr.state
Gartman, Nina	Nina Gartman Illinois State Water Survey Central Analytical Laboratory 2204 Griffith Drive Champaign, IL 61820	Phone: 217-244-0869 Fax: 217-244-3054 Email: ngartman@illinois.edu
<u>Gebhart, Kristi</u>	National Park Service	Phone: Fax: Email:

Glick, Nicholas	Nicholas Glick 101 College Place Syracuse, NY 13210 USA	Phone: 845-492-1448 Fax: Email: nbglick@syr.edu
Goldberg, Dan	Dan Goldberg University of Maryland Department of Atmospheric and Oceanic Sciences 3417 Computer & Space Sciences Bldg. College Park, MD 20742	Phone: 860-424-6851 (cell) Fax: 301-314-9482 Email: dgolddb@atmos.umd.edu
Goodman, Keli		Phone: Fax: Email: kgoodman@neoninc.org
Grant, Richard	Rich Grant Purdue University 915 W. State Street West Lafayette, IN 47907-2054	Phone: 765-494-8048 Fax: 765-496-2926 Email: rgrant@purdue.edu
Green, Lee	Lee Green 2204 Griffith Drive Champaign, IL 61820	Phone: 217-244-5437 Fax: 217-333-0249 Email: leegreen@illinois.edu
<u>Haeuber, Richard</u>	Richard Haeuber U.S. Environmental Protection Agency 1712 Johnson Ave, NW Washington, DC 20460	Phone: 202-343-9250 Fax: 202-565-2140 Email: haeuber.richard@epa.gov
Hand, Jenny	Jenny Hand 1375 Campus Delivery Fort Collins , CO 80521 USA	Phone: 970-491-8292 Fax: Email: rosemary.borger@colostate.edu
Hardison, David	David Hardison 3040 Cornwallis Rd PO Box 12194 Research Triangle Park, NC 27709 USA	Phone: 919-541-5922 Fax: Email: davidh@rti.org
Hardison, Eva	Eva Hardison 3040 Cornwallis Rd PO Box 12194 Research Triangle Park, NC 27709 USA	Phone: 919-541-5926 Fax: Email: eva@rti.org

Harrison, Phil		Phone: Fax: Email:
Haugaard, Erik	Erik Haugaard 4415 6th Ave NW Seattle, WA 98107 US	Phone: 206 596 8481 Fax: Email: erik@brooksrandinc.com
Hebert, Eric	Eric Hebert EEMS PO Box 357593 Gainesville, FL 32635	Phone: 352-262-0802 Fax: 352-331-5893 Email: eric.hebert@ee-ms.com
Henze, Daven	Department of Mechanical Engineering University of Colorado	Phone: Fax: Email: daven.henze@colorado.edu
Houdeshel, Dasch	Dasch Houdeshel 110 S Central Campus Dr Urban Water Group, Suite 2000 Salt Lake City, Utah 84112 United States	Phone: 8014403395 Fax: Email: daschh@hotmail.com
Huber, Cindy	Cindy Huber 8246 Hunters Trail Roanoke, VA 24019	Phone: 540-563-5815 (home) Fax: Email: chuber579@gmail.com
Huber, David	David Huber 429 S 12th Ave Pocatello, ID 83201 United States	Phone: 970 420-7708 Fax: Email: hubedavi@isu.edu
Hyslop, Nicole	Nicole Hyslop Crocker Nuclear Laboratory One Shields Ave Davis, CA 95616 USA	Phone: 530-754-8979 Fax: Email: nmhyslop@ucdavis.edu
Isil, Selma	Selma Isil AMEC E & I CASTNet 404 SW 140th Terrace Newberry, FL 32669-3000	Phone: 352-333-6607 Fax: 352-333-6622 Email: ssisil@mactec.com

Jansen, John J.	John J. Jansen Southern Company P.O. Box 2641 Birmingham, AL 35291-8195	Phone: 205-257-7698 Fax: 205-257-7294 Email: jjjansen@southernco.com
Johnson, Andy	Andy Johnson Maine DEP 17 State House Station Augusta, ME 04333-0017	Phone: 207-287-7047 Fax: 207-287-7641 Email: Andy.Johnson@maine.gov
Jones, Keith	Keith Jones 201-401 Burrard Street Vancouver, BC V6C3S5 Canada	Phone: 604-664-9123 Fax: Email: keith.jones@ec.gc.ca
Karlstrom, Jason	Jason Karlstrom Eurofins Frontier Global Sciences 11720 North Creek Parkway N Building 7, Suite 400 Bothell, WA 98011	Phone: 425-686-3573 Fax: 425-686-3096 Email: jasonKarlstrom@eurofins
Kenski, Donna	Donna Kenski Lake Michigan Air Directors Consortium 9501 W. Devon Ave Suite 701 Rosemont, IL 60018	Phone: 847-720-7883 Fax: 847-720-7891 Email: kenski@ladco.org
<u>Kerchner, Maggie</u>	Maggie Kerchner NOAA Office of Oceanic & Atmospheric Research Air Resources Laboratory NOAA Chesapeake Bay Office 410 Severn Avenue, Suite 107A Annapolis, MD 21403	Phone: 301-367-6801 Fax: 410-267-5666 Email: margaret.kerchner@noaa.gov
Kerschner, Brian	Brian Kerschner Illinois State Water Survey Central Analytical Laboratory 2204 Griffith Drive Champaign, IL 61820	Phone: 217-244-6417 Fax: 217-333-0249 Email: bmkersch@illinois.edu
Knipping, Eladio	Eladio Knipping EPRI 3420 Hillview Ave Palo Alto, CA 94304-1395	Phone: 650-855-2592 Fax: 650-855-1069 Email: eknippin@epri.com
Kreykes, Kimberly	Kimberly Kreykes Air Monitoring Center 2861 West Parkway Blvd. West Valley City, UT 84119	Phone: 801-536-4042 Fax: Email: kkreykes@utah.gov

Krupa, Sagar	Dr. Sagar V. Krupa University of Minnesota Twin Cities Dept of Plant Pathology 495 Borlang Hall 1991 Upper Buford Circle St. Paul, MN 55108	Phone: 612-625-7227 Fax: 612-625-9728 Email: krupa001@umn.edu
Larson, Robert	Robert Larson Illinois State Water Survey NADP 2204 Griffith Drive Champaign, IL 61820	Phone: 217-333-9008 Fax: 217-333-6540 Email: blarson@illinois.edu
<u>Lear, Gary</u>	Gary Lear U.S. Environmental Protection Agency Clean Air Markets Division 1200 Pennsylvania Avenue, Mail Code 6204J Washington, D.C. 20460	Phone: 202-343-9159 Fax: 202-343-2360 Email: lear.gary@epamail.epa.g
Lebens, Bob	Bob Lebens 715 SW Morrison St. Suite 503 Portland, OR 97205 US	Phone: 503.478.4956 Fax: Email: blebens@westar.org
Lehmann, Christopher	Christopher Lehmann Illinois State Water Survey NADP 2204 Griffith Drive Champaign, IL 61820	Phone: 217-265-8512 Fax: 217-333-1708 Email: clehmann@illinois.edu
Liptzin, Daniel		Phone: Fax: Email: daniel.liptzin@unh.edu
Liu, Xuejun	Xuejun Liu Yuanmingyuan Xilu 2 Beijing, Beijing 100193 China	Phone: +8613811559176 Fax: Email: liu310@cau.edu.cn
<u>Ludtke, Amy</u>	Amy Ludtke U.S. Geological Survey Box 25046, MS-401 Denver, CO 80225	Phone: 303-236-1876 Fax: 303-908-0791 cell Email: asludtke@usgs.gov
Lyman, Seth	Seth Lyman 320 N. Aggie Blvd Vernal, UT 84078 United States	Phone: 4357221740 Fax: Email: seth.lyman@usu.edu

<u>Lynch, Jason</u>	Jason Lynch EPA/CAMD 1200 Pennsylvania Ave, NW Washington, DC 20460	Phone: 202-343-9257 Fax: 202-343-2360 Email: lynch.jason@epa.gov
Maestre, Alexander	Alexander Maestre 11000 University Pkwy. Bldg. 58, Rm. 70 Pensacola, FL 32514 USA	Phone: 850-474-2060 Fax: Email: aam30@students.uwf.edu
Malm, William	William Malm CIRA/CSU 1375 Campus Delivery 200 West Lake Street/CSU Fort Collins, CO 80523	Phone: 970-491-8292 Fax: 970-491-8598 Email: malm@cira.colostate.edu
Martin, Randy	Randy Martin Utah State University Utah Climate Center 4825 Old Main Hill Logan, Utah 84322	Phone: 435-797-1585 Fax: Email: Randy.martin@usu.edu
Massad, R.S.		Phone: Fax: Email:
<u>Mast, M. Alisa</u>	M. Alisa Mast U.S. Geological Survey Denver Federal Center Box 25046 Denver, CO 80225-0046	Phone: 303-236-4882 Fax: 303-236-4912 Email: mamast@usgs.gov
McDade, Charles	Charles McDade Crocker Nuclear Laboratory University of California Davis, CA 95616 USA	Phone: 530-902-3208 Fax: Email: cemcdade@ucdavis.edu
McDonnell, Todd	Todd McDonnell 2161 NW Fillmore Ave Corvallis, OR 97330 USA	Phone: 541-758-1330 Fax: Email: todd.mcdonnell@esenvir
<u>McMurray, Jill</u>	Jill McMurray 646 meadowlark Ave. Bozeman, MT 59718	Phone: 406-223-8735 Fax: Email: jamcmurray@fs.fed.us

<u>Mebane, Ann</u>	Ann Mebane	Phone: 307-367-4326 Fax: 307-739-5750 Email: amebane@fs.fed.us
Molenaar, John	John Molenaar 1901 Sharp Point Drive Suite E Fort Collins, CO 80525 USA	Phone: 970-484-7941 Fax: Email: jmolenaar@air-resource.ca
Murphy, Jennifer	Jennifer Murphy 80 St George St Toronto, ON M5S 2M8 Canada	Phone: 416-946-0260 Fax: Email: jmurphy@chem.utoronto.
Murray, Keenan	Keenan Murray 918 College Ave Houghton, Michigan 49931 United States	Phone: 4083910110 Fax: Email: kmurray@mtu.edu
<u>Nilles, Mark</u>	Mark Nilles U.S. Geological Survey Denver Federal Center Box 25046, MS 401 Denver, CO 80225	Phone: 303-236-1878 Fax: 303-236-1880 Email: manilles@usgs.gov
Olson, Mark	Mark Olson 1876 Lewis Road Mount Horeb, Wi 53572	Phone: 608-335-4232 Fax: Email: mlolson@illinois.edu
<u>Padgett, Pamela</u>	Dr. Pamela Padgett USDA Forest Service Riverside Fire Laboratory 4955 Canyon Crest Drive Riverside, CA 92507	Phone: 951-680-1584 Fax: 951-680-1501 Email: ppadgett@fs.fed.us
Percy, Kevin	Kevin Percy 100-330 Thickwood Blvd Fort McMurray, Alberta T9K 1Y1 Canada	Phone: 780-747-8216 Fax: Email: kpercy@wbea.org
Perry, Kevin	Kevin Perry University of Utah Meteorology Department, Rm 819 135 S 1460 E Salt Lake City, UT 84112-0110	Phone: Fax: Email: kevin.perry@utah.edu

Personne, Erwan	Erwan Personne UMR Environnement et Grandes Cultures Thiverval Grignon, Thiverval Grignon 78 850 France	Phone: +33 1 30 81 55 70 Fax: Email: erwan.personne@agropar
Phelan, Jennifer	Jennifer Phelan 3040 Cornwallis Rd. P.O. Box 12194 RTP, NC 27709-2194	Phone: 919-541-7079 Fax: Email: jenphelan@rti.org
Poirot, Richard	Richard Poirot Vermont Dept. of Env. Cons. Davis Building - 2nd Floor 1 National Life Drive Montpelier, VT 05620-3802	Phone: 802-272-3664 Fax: 803-828-1250 Email: rich.poirot@state.vt.us
Prestbo, Eric	Eric M. Prestbo Tekran Research and Development 2707 NE 125th ST Seattle, WA 98125	Phone: 416-449-3084 Fax: 416-449-9298 Email: eprestbo@tekran.com
<u>Puchalski, Melissa</u>	Melissa Puchalski US EPA 1200 Pennsylvania Ave, NW MC 6204J Washington, D.C. 20460	Phone: 202-343-9882 Fax: 202-343-2356 Email: puchalski.melissa@epa.gov
Ray, Alison	Alison Ray EEMS 264 Montego Key Novato, CA 94949	Phone: 478-451-9427 Fax: Email: alison.ray@eems.com
<u>Ren, Xinrong</u>	Xinrong Ren, PhD. NOAA Air Resources Laboratory & University of Maryland Dept. of Atmospheric & Oceanic Sciences R/ARL - NCWCP - Room 4259 5830 University Research Court College Park, MD 20740	Phone: 301-683-1391 Fax: 301-683-1370 Email: xinrong.ren@noaa.gov
Rhodes, Mark	Mark Rhodes Illinois State Water Survey 2204 Griffith Drive Champaign, IL 61820	Phone: 217-244-6413 Fax: 217-333-0249 Email: rhodes1@illinois.edu
Ring, Allison	Allison Ring University of Maryland Department of Atmospheric and Oceanic Sciences 3417 Computer & Space Sciences Bldg. College Park, MD 20742	Phone: 908-875-1304 (cell) Fax: 301-314-9482 Email: aring@atmos.umd.edu

<u>Risch, Martin</u>	Martin Risch U.S. Geological Survey 5957 Lakeside Boulevard Indianapolis, IN 46278-1996	Phone: 317-290-3333 ext. 163 Fax: 317-290-3313 Email: mrrisch@usgs.gov
Rogers, Christopher	Christopher M. Rogers AMEC E & I 3901 Carmichael Avenue Jacksonville, FL 32207	Phone: 904-391-3744 Fax: 904-399-3176 Email: Christopher.Rogers@amec.com
<u>Rumsey, Ian</u>	Ian Rumsey U.S. EPA, NRMRL, APB Mail Drop E305-02, 109 TW Alexander Dr. Research Triangle Park, NC 27711 U.S.A	Phone: (919) 541-4746 Fax: Email: rumsey.ian@epa.gov
Samuelson, Tiffany	Tiffany Samuelson 1601 Prospect Parkway Fort Collins, CO 80525 United States	Phone: 970-530-3500 Fax: Email: tiffany.samuelson@aecom.com
Saylor, Rick	Rick Saylor Atmospheric Research & Analysis, Inc. 2422 Meadowglen Trail Snellville, GA 30078	Phone: 770-736-4631 Fax: Email: rsaylor@atmospheric-res.com
Schichtel, Bret	Bret Schichtel National Park Service CSU/CIRA 1375 Campus Delivery Fort Collins, CO 80523	Phone: 970-491-8292 Fax: 970-491-8598 Email: schichtel@cira.colostate.edu
Schimelfenig, Todd	Todd Schimelfenig 3310 Holdrege Street 813 Hardin Hall Lincoln, NE 68583-0968	Phone: 402-472-8764 Fax: 402-472-2956 Email: tschimelfenig1@unl.edu
<u>Schmeltz, David</u>	David Schmeltz USEPA Headquarters Ariel Rios Building 1200 Pennsylvania Avenue, N. W. Mail Code: 6204J Washington, DC 20460	Phone: 202-343-9255 Fax: 202-343-2360 Email: schmeltz.david@epa.gov
<u>Schwede, Donna</u>	Donna Schwede EPA US EPA, Mail Drop E243-04 Research Triangle Park, NC 27711	Phone: 919-541-3255 Fax: 919-541-1379 Email: schwede.donna@epa.gov

<u>Sheibley, Rich</u>	Rich Sheibley U.S. Geological Survey Washington Water Science Center 934 Broadway, Suite 300 Tacoma, WA 98402	Phone: 253-552-1611 Fax: (253) 552-1581 Email: sheibley@usgs.gov
<u>Silva, Sandra</u>	Sandra Silva Chief - FWS Air Quality Branch c/o NPS (AIR) P.O. Box 25287 Denver, CO 80225	Phone: 303-914-3801 Fax: 303-969-2822 Email: sandra_v_silva@fws.gov
<u>Smiley, Jewell</u>	Jewell Smiley Physical Scientist, US EPA National Analytical Radiation Environmental Laboratory 540 South Morris Avenue 1	Phone: 334-270-7073 Fax: Email: smiley.jewell@epa.gov
Sullivan, Timothy	Timothy Sullivan E&S Environmental PO Box 609 Corvallis, OR 97339	Phone: 541-758-5777 Fax: 541-758-4413 Email: tim.sullivan@esenvironm
Tanabe, Richard	Richard Tanabe Environment Canada Air Quality Research Branch 4905 Dufferin Street Toronto, Ontario, Canada M3H 5T4	Phone: 416-739-4320 Fax: 416-739-4281 Email: richard.tanabe@ec.gc.ca
Taylor, Jeff		Phone: Fax: Email: jht@ksu.edu
ter Schure, Arnout	Arnout ter Schure EPRI 3420 Hillview Ave Palo Alto, CA 94304	Phone: 650-855-2753 Fax: 650-855-1069 Email: aterschu@epri.com
Tevlin, Alex	Alex Tevlin 80 St George Street Toronto, Ontario m5s3h6 Canada	Phone: 4169463011 Fax: Email: atevlin@chem.utoronto.c
Thompson, Tammy	Tammy Thompson 1375 Campus Delivery Fort Collins , CO 80523 USA	Phone: 970-491-8292 Fax: Email: rosemary.borger@colost

Tigges, Mark	Mark Tigges Air Resource Specialists, Inc. 1901 Sharp Point Drive, Suite E Fort Collins, CO 80525	Phone: 970-484-7941 Fax: 970-484-3423 Email: mtigges@air-resource.co
Tordon, Robert	Robert Tordon Environment Canada 16th Floor, Queen Square 45 Alderney Drive Dartmouth, Nova Scotia CANADA B2Y 2N6	Phone: 902-426-4780 Fax: 902-426-9158 Email: rob.tordon@ec.gc.ca
Turner, Charles	Charles Turner 4949 c Cox Road Glen Allen, VA 23060 United States	Phone: 804 527-5178 Fax: Email: charles.turner@deq.virginia.gov
Volk, Lisa	Lisa Volk Illinois State Water Survey 2204 Griffith Drive Champaign, IL 61820	Phone: 217-333-0887 Fax: Email: lisavolk@illinois.edu
<u>Walker, John</u>	John Walker U.S. Environmental Protection Agency National Risk Management Research Mail Drop E305-02 Research Triangle Park, NC 27711	Phone: 919-541-2288 Fax: 919-541-7885 Email: walker.johnt@epa.gov
Watson, John	John Watson 2215 Raggio Pkwy Reno, NV 89512 United States	Phone: 7756747946 Fax: Email: john.watson@dri.edu
<u>Webster, Jill</u>	Jill Webster US Fish and Wildlife Service National Wildlife Refuge System Branch of Air Quality 7333 W. Jefferson Ave., Sute 375 Lakewood, CO 80235-2017	Phone: 303-914-3804 Fax: 303-969-5444 Email: jill_webster@fws.gov
Wentworth, Greg	Greg Wentworth 80 St. George Street Toronto, ON M5S3H6 Canada	Phone: 416-946-3011 Fax: Email: greg.wentworth@utoronto.ca
<u>Wetherbee, Greg</u>	Greg Wetherbee USGS/BQS PO Box 25046 DFC, B95, MS 401 Denver, CO 80225	Phone: 303-236-1837 Fax: 303-236-1880 Email: wetherbe@usgs.gov

Weymiller, Penny	Penny Weymiller Air Quality Program Manager Shoshone-Bannock Tribes P.O. Box 306 Fort Hall, Idaho 83203	Phone: 208-478-3853 Fax: 208-478-4083 Email: pweymiller@sbtribes.cor
White, Warren	Warren White 2400 pole line 47 davis, ca 95618 usa	Phone: 530@7521-1213 Fax: Email: whwhite@ucdavis.edu
Williams, Jason	Jason Williams Dept of Civil Engineering, 101 Sloan Hall Washington State University Pullman, WA 99164	Phone: 315-415-1249 Fax: Email: jason.williams2@email.w
Williams, Scott	Scott Williams Environmental Protection Department Northern Cheyenne Tribe PO Box 128 Lame Deer, MT 59043	Phone: 406 477-6506 ext. 105 Fax: Email: scott.williams@cheyenne
Wolff, Veronika	Veronika Wolff Reckenholzstrasse 191 Zurich, ZH 8046 Switzerland	Phone: +41 44 377 7513 Fax: Email: veronika.wolff@agroscoop
Wunderlich, Dave	Dave Wunderlich Eurofins Frontier Global Sciences 11720 North Creek Parkway N., Suite 400 Bothell, WA 98011	Phone: Fax: Email: davidwunderlich@eurofin
Young, Eric	Eric Young Administration-Research Service Executive Director, Southern Association of Agriculture Experiment Station Directors Venture Center IV 100, Box 7561 NCSU Campus Raleigh, NC 27695	Phone: 919-513-1746 Fax: 919-513-1114 Email: eric_young@ncsu.edu
Zhu, Liye	CU Mechanical Engineering Dept. 1111 Engineering Drive ECME 114	Phone: 303-492-7077 Fax: Email: liye.zhu@colorado.edu

Joint Subcommittee Meeting

Park City, Utah

October 8, 2013

- Welcome – Mark Olson
 - broadcast and recording of Joint/NOS through anymeeting.com
 - Richard Tanabe will be taking minutes due to NOS Vice-chair and Secretary unavailable to attend due to Shutdown
- ***Motion to approve minutes from Spring Meeting – Madison, WI moved by Chris Lehmann, seconded by Pam Padgett. Minutes approved.***
- Introductions around the room.
- State of the NADP (David Gay)
 - Joint/NOS/Symposium/N Flux Workshop will be on-line

Financial Highlights - Income and Expenses

FY14 6.2% increase over FY13

- majority of dollars are spent @ labs
- CAL 45%, HAL 24% accounts for ~70%
- Personnel 25%
- Line items 5%
 - o Acid Rain 2015 13% - Combined with Fall Meeting, expected 600-900 attendees for conference

Network & Site News

NTN

- o PA – Integrated the PA State Network 15-18 sites in the state
- o NY – Integrated NY State Network
- o Canada – BC22, SK20, SK21
- o Argentina – still running, some shipping issues

- o Since Oct 2012
- o 1 lost, 11 added, 265 sites total

- o New map for NTN/AIRMoN – Bromide is the map on the Annual Report Cover

AIRMoN

- o VT99 closed on May 31, 2013
- o Down to 6 sites and holding

AMoN

Since Oct 2012

- o 1 lost (Kansas), 6 added, there will be 64 sites

- Substantial QA database

MDN

Since Oct 2012

- 4 lost, 2 added, 109 sites and some coming
- 16 methyl, 54 co-located, 7 urban, 4 daily
- Great Lakes Atmospheric Mercury Network
 - 9 new MDN sites (2 with continuous funding)
 - Fill in the gap for Michigan, Ohio, Indiana

AMNet

Since April 2012

- 3 lost, 7 added, 22 currently

Mercury Litterfall Initiative

- successful year 2012
- 14 sites
- 2013 sampling occurring now
 - 13 sites
 - Puerto Rico coming – will be year round sampling

Current Electronic Rain Gauge Network

- 260 out of 312
- 10-12 have e-gauges but not operating
- 85% of network is digital

Webinar Training

- started 2013
- alternating between the CAL and HAL
- 30-35 people
- a few technical issues early on, resolving issues with new equipment
- saving money
- how effective is yet to be seen
- training more, may not be as good/effective compared to in-person training

Recent Travel

- April in Montreal : Tri-national Workshop on Assessment of Monitoring Results from Mexico's PRONAME Program
- May in Chicago: Precipitation Chemistry Science Advisory Group
- May in Phoenix: National Tribal Forum
- Rochester : Acid Rain 2015 scouting trip

- CAL Status Report (Chris Lehmann)

Detailed report available at <http://go.illinois.edu/NADPCALREPORT>

New CAL Staff

- Tracey Dombek has left
- Annette Wells (FIA)
- Dr. Sybil Anderson (Special Projects)
- Katie Blaydes (ICP)
- Gustava Hoskins (Technician)
- Will add one more for shipping/receiving
- NADP Graduate Intern: Marcelo Vieira Silva

Other Staff changes

- Nina Gartman – CAL QA & Method Analyst
- Lee Green – CAL Lab Supervisor
- Brian Kerschner – Assistant Data Manager

Update analytical methods

- sulfite by IC
- Nitrite by Colorimetry
- Using passive samplers for ambient NO₂ and SO₂
- Total Nitrogen

New reports and data products
handling of low volume samples
See NOS for discussion

Site Operations and Site Support

- NTN – 11 new, 1 closed, 55 sites with significant issues
- AIRMoN – 1 closed, 1 with significant issue
- AMoN – 6 new, 1 closed, 1 with significant issues

CAL site support – Jeff Pribble

- Webinars on-line <http://go.illinois.edu/NADPTraining>

Lab Operations

- 2004 266 sites
- 2013 back to 265 sites
- CAL still has the capacity to absorb growth ~ 40-50 sites
- CAL detection limits
 - o Excellent performance
 - o By network and by instrument
 - o Bromide still a concern – don't see it getting any lower

AMoN Sampler Issues

- updated cleaning procedures – consulted with manufacturer

- reduced the number of travel blanks
 - o 1 in 4 sets

NTN/AIRMoN Archive Sample Distribution

- AIRMoN 3040 (1 research group)
- NTN 6020 (8 research groups)
- 2007 NTN currently being distributed
- 2009 AIRMoN currently being distributed

Data Deliverables - Average data lag

- NTN 67 days
- AIRMoN 49 days
- AMoN 79 days

Data Receipt Reports

- field forms scanned upon receipt and emailed back to NTN sites
- AIRMoN/AMoN – developing by end of year

Other Activities

- Total Nitrogen Deposition Study
- Total/Elemental Carbon Deposition Study
- Metro East St Louis Study completed
- Passive sampling of SO₂/NO₂
- Pursue as an expansion of AMoN Network
- Intern Ammonia Flux Study

Posters

- Sample Dilution Study
- AMoN 5 year Trends
- Training Webinars

- HAL Report (Bob Brunette)

- review of Mercury Regulations

MDN Site Startup/Shutdowns in 2013

- LADCO support of ~ 20 MDN sites (~8-10 new)
- Approximately half can get up and running quickly with existing sites/operators
- High altitude locations – higher precipitation and higher Hg wet deposition
- Makah MDN (WA03)
 - o On life support from the HAL
 - o Important site due to offshore flow
 - o North American input, mostly non-US source influenced
- proposal to monitor high altitude sites
- high Hg deposition region not monitored

- corresponds to high inland lake and fish monitoring data (high fish Hg)

MDN Network Operations

Equipment Modernization

- ACM 56 (-5)
- NCON 52 (+5)
- Belfort 11 (-1)
- E-gage 97 (+1)

Site Liaison Activity

- 307 technical support calls
- 186 e-mails

Equipment Failures

N-CON

- 12 Thies sensors, 1 motor, 3 relays, 1 power cord/ 1 event recorder cable

ACM

- 14 motor boxes, 4 sensors, 4 heater, 1 thermostat

Ott Pluvio

- 1 gauge sent to Hach

ETI

- none

New staff - Dave Wunderlich – QA Manager since Oct 2012

HAL 2012 Lab Review

- specific recognition 11
- Findings 9

HAL database conversion

- Access to SQL conversion
- Submitted Nov 2012, original and new and compared
- Submitted to Program Office QA – 1st/2nd round
- HAL to submit response to 2nd round of comments

Data Deliverable Schedule

- submitted annual 2012 QA Report
- need to respond on comments

Commission new instrument

- automated Total Mercury Instrument
- comparison looks good, not final values
- close to green light to move forward

HAL proposal for NOS for collocated MDN/NTN site precip depth data

- when the gauge fails and no backup data, currently use bottle catch/bucket catch, may produce 2 different values
- there is a concern if challenged in court

HAL Sample Evaporation Study

- follow up from PO report Spring/Fall 2012 – PO data showed ACM evaporation with fan on
- HAL ran an 8 month study using 2 MDN ACM
- Not seeing losses so far

Trace Metal Initiatives

- 12 point plan – further discussion 2014
- 7 new Trace Metal Sites in 2013

Total Mercury Deposition at MDN sites

- estimate Dry Deposition of RGM (reactive gaseous mercury)Hg monitor
- passive system to supplement wet deposition
- HAL selected to support Natural Rivers and Streams Assessment 2013-14
- Measuring fish tissues

- QA Report (Mark Rhodes)

2012 QA Reports

- Field Survey – in progress
- HAL – comments from external reviewers received
- CAL – in progress
- AMNet – in progress

2013 QA Reports

- start working on reports

External Reviews

2013 Program Office – Aug 2013

- Gary Lear – USEPA (Team Leader)
- Kristi Morris – NPS
- Amy Ludke – USGS
- No report at this meeting as all reviewers are federal employees

2014 CAL

- Greg Wetherbee – USGS (Team Leader)
- Eric Hebert – EEMS
- Richard Tanabe – Environment Canada
- Chemistry person - ?

Site Survey – June 2013 (# completed)

- AIRMoN – 0, MDN – 18, NTN – 38, Collocated – 9
- AMNet – 2, AMoN – 5

Training Webinars

- CAL/HAL on alternate months
- AMNet pending USGS Field Audit Program recorded and posted in August

Updates in NOS

- SOP approval
- Revision to Site Selection and Installation Manual
- NTN Bag Sampling
- Sensor Study
- AMoN Travel Blanks
- Belfort Rain Gauge
- Methyl Mercury
- MDN Evaporation

SOP usage citation and disclaimer – other agencies/networks are using but not crediting NADP

Breakout to sub committees and meet back after lunch for continuation of Joint Sub-committee Meeting.

Call to Order – Mark Olson @ 13:39

- Sub-Committee Reports
 - See each sub-committee's minutes for details and highlights from the individual meetings
- Webinar Training (Jason Karlstrom)
 - NADP Site operations On-Line Training Sessions
 - using anymeeting.com
 - Since the Spring meeting there have been 8 sessions
 - MDN 18-22 attendees
 - NTN 21-34 attendees

Technical issues

- YouTube is often blocked on attendees computers
- YouTube videos are not viewable in recordings
- Live demos not best due to lack of multiple viewing angles
- Significant audio issues – USGS webinar in August and MDN sample change webinar
- Upcoming webinars 2013-10-30 AMON and 2013-11-13 NTN FORF
- After the audio is resolved, need to redo the sample change
- Other topics monthly data review, MDN overview
- Sample video was played

Discussion

- Are other technologies available [Cari Furness]
- Possible to have operators watch every few years, customize a DVD eventually [Jason Karlstrom]
- host on NADP server [Chris Lehmann]
- consider production options [Cindy Huber]
- may be training the same people every time [Jason Karlstrom]
- are operators/supervisors notified [Mark Rhodes]
- for MDN note goes in coolers, e-mails also go out for both NTN and MDN [Jason Karlstrom]

- Mercury Litterfall Report (David Gay)

- second year – 13 sites, in 2012 there were 14 sites
- data in on time
- data is not released on web
- some numbers are quite large
- moving along quite nicely
- advertised this year and got some more sites

- AMNet Report (Mark Olson)

2013 Progress Report

- 18 to 22 sites up 20%
- OH02 back on line
- OH52, Toledo, Lake Erie
- Soon to add AK03, first GEM only site
- Presque Isle, Maine on-line in November 2013

Site Visits

- 13 in 2013
- 4 for the first time
- 9 repeat
- next up is NS01, MD08
- NYSDEC site visits – shuffling of equipment at sites
- NYSERDA supports 3 NY sites

AMNet Data Availability

Data Posting Lag Times

- Reduce lag between collection and submission
- Work toward real time data submission
- Collocate 2537X and speciation at WI07 (Aug 2013)

What's next?

- expected data transfer
- site visits
- expansion to Asia

- NY State relocation of 3 sites
- Continue collocation in WI

Questions

- Is Tekran providing new instrument for approval [Mark Rhodes]
- 2537X – NADP is in possession at WI07, rest of Speciation system from Florida DEC [Mark Olson]

- Shutdown Samples (Chris Lehmann)

- there were 47 NTN site changes on September 30
- 194 hours? Once sample exceeds, what to do with the data? Invalidate?
- Pam Padgett – NPS asked for furlough exemption for CA94
- Will have to look at on a case by case basis

- AMoN Status Report (Chris Lehmann)

- 64 AMoN sites
- 3 new Canadian sites

Average Concentrations 2012

- time weighted mean
- quarterly relative concentration

Independent Audit Program

- 8 sites participated in independent audit program

Passive Sampler Precision

- 2007-2010 triplicates on all deployments
- 2011-present triplicates on 5%
- Precision data quality 20%

Travel Blanks

- remains an interesting problem
- the lab continues to test, including staff lunches

QA – DQO – Spring Meeting

- Sigma-Aldrich coupler – drilled & tapped for 5/16" – #18 bolt
- Why Radiello PDS (passive diffusion sampler)?
 - o Comparison with Alpha, Ogawa
 - o Collocated at Bondville
 - o Not sure if Alpha is still available
 - o Ogawa – not sure if still a US distributor

Current AMoN Research

- MARGA comparison

Planned Activities

- collocate IL11 Pranalytica NH3
 - NH3 Chamber Exposure Study
 - AWMA – 5 year trend test
 - Significant trends ($p < 0.1$) at 8 sites, no trend at 6 sites
- Nitrogen Flux Workshop Update (Chris Rogers for John Walker)
 - update on the block agenda on web
 - Wednesday Symposium Start time at 9:15 am
 - “1st Deposition Dash” will start at 7:00am, meet in the lobby for a walk/run
 - 3 miles or 1 hour
 - Spring 2014 Meeting – Ft Lauderdale, FL
April 14-17, 2014
Sheraton Ft. Lauderdale Beach Hotel
Reservation Deadline: March 14, 2014
 - Fall 2014 Meeting – Indianapolis, IN
Date: TBD (maybe in September)
 - NADP Secretary Nominations – Andy Johnson for Kathleen Weathers
-recommended nominee: Emily Elliott from University of Pittsburgh
 - Other Business
Chris Rogers
 - what to do with MeHg database
 - very close – have something for spring
 - move forward

MOTION: Pending HAL and Program Office resolving questions arising from Mark Rhodes’ study, that the recalculated Program Office Methyl Mercury data be made available on the website as soon as practical.

Moved by Chris Rogers, seconded by David Gay

Discussion:

- HAL reports already available [Mark Olson]
 - o If the published values are different, is it a problem
 - o Reports are stamped preliminary
- If significant differences at site, what is the correct value, look to see why there is a difference and if significant, which is correct? [Bob Larson]

- Rounding issues when blank correcting [Jason Karlstrom]
 - o thresholds for differences
- posting subset not all the data, why not accept HAL values as is the case with total Hg [Mark Rhodes]
- Moving forward is PO doing calculation [Mark Olson]
 - o historical calculated by PO
 - o accept HAL values moving forward

Friendly Amendment's

- 1. 2002-2012 use Program Office data***
- 2. Going forward the HAL's values will be used***
- 3. Provide data advisory***

Abstain: Mark Rhodes

Motion passed with friendly amendments

- ***Motion to adjourn moved by Pam Padgett, seconded by Tom Butler. Motion Passed.***