

**Network Operations Subcommittee (NOS) Meeting Minutes**  
**2019 NADP Spring Meeting**  
**May 13-17, 2019**  
**Madison, WI**

**NOS Chair:** Richard Tanabe (NADP Program Office and Environment & Climate Change Canada)  
**Vice Chair:** Melissa Puchalski (USEPA)  
**Secretary:** Winston Luke (NOAA)

**Tuesday, May 14, 1330**

Welcome and call to order by Richard Tanabe at 1330

1. Approval of minutes from Fall 2018 NOS meeting (Albany, NY) -Richard Tanabe  
**Motion: Greg Wetherbee motion to approve, second by Camille Danielson. Approved.**
2. AMNet Update - Mark Olson (WSLH, NADP Program Office)
  - 18 currently in network (lowest number of sites in AMNet's history (23-24 sites 5 years ago).  
AK03 closed 12/2018; NS01 closed 04/2019
  - ME97 and OK99 need operators - have equipment, but not staff
  - NADP Instrumentation update
    - Equipment moved from Mark Olson's barn to WSLH 5<sup>th</sup> floor - equipment is available, and NADP is sponsoring sites with it:  
Speciation systems at Bondville (IL11) and Clifty Falls (IN21)  
GEM at Leach Lake (MN06), Boston (MA22), and Indiana Dunes (IN34)
    - Data quality from some of these sites is not optimal – due to operator training/commitment?
  - Site visit update
    - Five site visits in 2018, three to date in 2019; in the past the PO averaged 10-12 per year:
    - Site visits are required every two years; this is the first time the PO has fallen behind
    - Overdue sites: MS12 (5 months); IN21 (3 months); NJ30 and NJ54 (2 months); MD08 and MD99 (1 week)
    - Two installations (IN34, MN06)
    - Of the total 18 sites, ten sites are speciation, eight are GEM only
  - Training
    - Two new site liaisons have been trained – Richard Tanabe (ready for solo visits) and Alex Rodriguez
    - Site Liaisons and WDNR operators have been trained on-site (WI07) and at SciOps on the speciation systems and the Tekran 2537X
  - Data Availability
    - All of 2017 data is available on-line
    - 2018 data validation is behind  
< 10% available on-line  
60% needs to be uploaded and needs validation – PO hurt by staffing limitations  
Data requests need to be made of the remaining sites
    - A new business model enlisting student help was tried but failed
    - Needs more effort from the existing site liaison and others to make progress in data backlog
  - AMNet Documents
    - 2017 QA Plan is ready for review
    - 2537X white paper is stagnant -other duties have demanded site liaison's time
    - Operators Manual updated with 2537X, ready for review
  - International Activities (recent and planned):
    - Asia Pacific Mercury Monitoring Network (APMMN)
      - TW01 request site visit and attendance at June 2019 workshop presentation. Training has been requested for wet/dry dep monitoring

- Due to optics of international travel, WSLH is looking for cost sharing and lodging in Taiwan
- APMMN meeting in Manila, September 2018
- Planned APMMN meeting in Jakarta, August 2019
- o International Conference on Mercury as a Global Pollutant (ICMGP) Krakow, September 2019

Discussion:

Greg Wetherbee asked about site support costs associated with AMNet -\$4K per year for GEM only site, \$6K per year for a speciation system

Eric Prestbo offered to help with documentation needs and to review the White Paper intercomparison of the 2537 A/B/X models

### 3. AMoN Update –Camille Danielson (WSLH, CAL QA Manager)

- Preparation and shipping of samplers
  - o 104 AMoN Sites (a high point),
  - o Over 3,000 samples collected to date at WSLH CAL, over 500 Lab QC samples
  - o Considerable effort prepping for network
  - o 3 Weeks before Deployment
    - analytical chemist prepares 30 travel blanks, 90 single samplers, 14 triplicates (42 samplers),
    - 162 samplers plus ~15 for QC and extras
    - 3 day cleaning and assembly process for each batch
  - o 2 weeks before deployment
    - Associate chemists print labels, prep boxes, ship
- Travel Blanks/Triplicates – with every deployment
  - o 25 % Sites get travel blank (TB) per deployment on rotating basis (26 deployments)
    - Of 338 valid TB (June –Dec 2018) = None over criteria (0.2 mg/L)
    - Mean TB = 0.038 mg/L (~4% of mean deployed sampler [NH<sub>4</sub>] of 0.9 mg/L
    - [NH<sub>4</sub>] in valid deployed samples ranged from 0.1-21 mg/L
  - o 12.5% Sites get triplicates per deployment on a rotating basis
    - N = 124 Sets, evaluate RSD
    - Mean RSD = 4.40%
    - # over 10% RSD = 9 (7% of sets)
    - # over 15% RSD = 4 (3% of sets)
    - Results over 15% RSD are rerun to confirm results
- AMoN Flagging
  - o Metadata table available on web site – a few changes to flags since transition to WCAL
  - o For elevated TB > 0.2 mg/L – blank is flagged, but not associated data because TBs may not be rep of all samples; QR code B
  - o QR Code C (invalid) only in the case of:
    - No sampler deployed; No analytical data; major field sampling issue (e.g., hornets' nest on sampler; dropped, broken transport jar, etc.)
- Radiello Body Tracking capability now available through LIMS
  - o After 5 uses all bodies are pulled from circulation but not discarded yet
    - Per manufacturer's recommendation
    - Permeability may be affected (e.g., due to particulate loads at a given site, etc.)
  - o Eventually WSLH hopes to study this and see if more uses are possible due to expense of bodies
- AMoN Preparation QC is a crucial part of the network (over 500 prep QC)
  - o Preparation blanks with every batch of samplers prepared: n= 93 (June 2018-March 2019)
    - Core, body, jar, filter paper blanks, bag per sonicator batch
  - o Core Blank n=72; test core lots
    - If a core lot has been reused, take a core blank each preparation week

- Prep and core blanks meet standard of 0.04 mg/L for mean travel blank
  - Jars are washed in stainless steel dishwasher and tested every wash batch (n = 90 so far)
  - Method Blank n=49; extraction water per extraction
  - Sonicator Blank n=90
    - Water taken from last step in cleaning process from sonicator – a legacy measurement from ICAL, perhaps not the best indicator?
- Room Blanks n=22 (2 x Month)
  - 14 day blanks – samplers hung in room every two weeks; also hung in each of two hoods
  - A sampler is also deployed during extraction
  - Highest room blank (power outage, NH<sub>3</sub> scrubbing) of 2.39 mg/L
  - Target criterion is 0.8 mg/L (4X Travel Blank) – criterion typically met.
- Hood Blanks (2wk and extraction day) n=84 (2 hoods, 2x per month)
  - 3 hoods in same room
    - SAS extraction hood never worked properly; it was turned off and used as clean workspace, but a blank was still deployed there
  - Air Science Sonicator hood worked well ~ 0.08 mg/L with excursion to 0.25 mg/L: 0.28 mg/L in power outage. Target value 0.4 mg/L
  - After December power outage a new Air Science hood was installed
  - New filters installed in original sonicator hood in January - hood blanks < 0.1 mg/L thereafter
  - Extraction Day hood blank (2-6 hour deployment –date of extraction)
    - Target value < 0.2 mg/L –typical blanks 0 to 0.1 mg/L
- AMoN Cleaning Innovation by Chris Worley, working with WCAL
  - Cleaning AMoN racks is labor intensive – rinsing 5 racks 4 times each at last step takes 2 hours\
  - Chris engineered a custom cover to securely hold bodies – now can rinse entire rack and bodies in place in the rack
  - Less handling, less time required (should take only ½ hour)
- Radiello Body Issues
  - Broken samplers, bad lots, shipping issues, handling issues
  - Due to rattling of bodies in Jars? Cleaning too vigorous early on?
- Impermeable bag study
  - Impermeable and other bag type blank study
  - Goal to reduce breakage and maintain or reduce blank NH<sub>4</sub>
  - Impermeable (antistatic) bags showed lowest ammonia results compared to jars and other bags
    - 0.04 mg/L NH<sub>4</sub> -most successful
    - Impermeable Bags (6”x 8”)
    - 4 layers: static dissipative coating, polyester, aluminum shield, static dissipative polyethylene
    - Sampler travels in mini bag LD polyethylene
  - Pilot study –
    - Sites: NH02, NS01, NY96, PA96, UT97, VT99, WY06, AR03, FL19, GA41, OH27, PR20, TX43
    - 4 paired deployments at 13 sites: normal box and antistatic box, plus travel blank
    - October 2018, January 2019, Feb 2019
    - 26 paired samplers, 2 with triplicates
    - 25 paired travel blanks (1 site missing TB)
  - Results :
    - Operator feedback: Overall positive
    - 1 operator found bag difficult to handle in freezing weather
    - No breakage
    - Several ops preferred bag samplers, which consist of a min--ziplock bag inside the impermeable bag. This makes it easier to hold mini bag and deploy into the shelter
    - 25 Sets (50) paired co-located Travel Blanks
      - TB range from 0.01 – 0.125 mg/L NH<sub>4</sub> (All below 0.2 criteria)
      - TB 44% higher jar, 20% higher impermeable, ~36% equal
      - Mean TB 0.04 mg/L NH<sub>4</sub>
      - Mean Absolute difference: 0.01 mg/L NH<sub>4</sub>

- 26 Sets of Samplers (2 with triplicates)
  - Sampler NH<sub>4</sub> ranged from 0.045 to 3.1 mg/L NH<sub>4</sub>
  - Mean RSD 8% (between jar and bag samplers)
  - Of deployed samplers: 27% higher NH<sub>4</sub> in jar, 27% higher in bags, 46% ~equal
- Inherent variability in concentrations/results – supplies, handling in field, etc.
- No definitive proof of detrimental effects of bags
- Future plans
  - Contact sites for 3rd phase pilot
  - July – August deployments (previous test was in cold weather)
  - More data analysis and graphing
  - Share data with QAAG if want to proceed
  - Full cost analysis
  - Consider switch to impermeable bags OR just mini bag inside of jar
- Benefits:
  - Cost savings
    - Reduce # broken samplers
    - Custom boxes required of jars – standard box for bags
    - Potential shipping savings
  - Other potential benefits
    - Cleaner deployment – hold mini bag to deploy (bag within a bag)

#### Discussion:

- Eric Prestbo offered that to reduce blanks in Hg passives, they put a bag of activated carbon outside of the sampler in a jar or in a bag to act as a scrubber. A similar effort might help for AMoN? Camille responded that WCAL does put an acid-impregnated filter scrubber in the shipments.
- Mark Olson noted that it was difficult to get TBs low for years, and congratulated WSLH staff for their efforts. Now we should talk about blank subtraction – this was discussion had been off the table. Camille agrees that blank subtraction is a legitimate approach. TBs are not an issue, as samplers inherently have background NH<sub>4</sub>
- Greg Wetherbee asked about the effect of blank mass (air equivalent concentrations) on derived air concentrations from the samplers. Camille responded that some core lots have non-trivial contamination; at 0.02 mg/L NH<sub>4</sub> which would be equivalent to ~0.06 ug/m<sup>3</sup> (avg) it is fairly negligible, but varies with core lots; some high travel blanks can be 0.1 is equivalent to ~0.2 ug/m<sup>3</sup>.

#### 4. HAL Readiness Verification Plan (RVP) - Martin Shafer (SMPH-WSLH)

- Scope:
  - As for the HAL transition, WSLH drafted a plan to address analytical and field ops for the MDN and the HAL transition. Plan drafted end of 2018, presented to QAGG (Approved)
    - Some aspects of it were not implementable due to the very abbreviated transition timeline, so it has morphed a bit
  - Inter-laboratory System (Field) Comparability (I/C) for Total Mercury (HgT)
    - Field I/C –four sites, dual chimney NCONs deployed at each site: WSLH provides glassware and bottles for one, EFGS for the other
    - WSLH and EFGS analyze samples from their respective “chimney”
    - Full system comparison
  - Analytical Bias – USGS PT program – six participating laboratories
  - Analytical precision (ambient samples) – precipitation sample duplicates, short & long term
  - Analytical accuracy & bias – PT programs, CRMs, spikes
  - Non-standard volumes (10, 15, 20 mL dilutions) for small samples (not yet done yet but will be)
  - Laboratory environment – air concentrations and deposition of HgT (GEM in lab environment)
  - Supply & reagent cleanliness – bottles, glassware, bags, reagents
  - Detection limit metrics (MDLs) – instrument validation in each lab

- Staff demonstration of capability (DOCs)
- On-site laboratory audit (outside review - planned for 2020)
- WSLH has established criteria for all components of plan
- Should be finished by June when UW accepts the MDN
- Inter-laboratory System (Field) Comparability for Total Mercury (HgT)
  - Inter-comparison samples are collected at four sites: Seattle (WA18), Devil's Lake (WI31), Madison (WI06), and Bondville (IL11)
  - Communication and logistics issues at WA18 led to its replacement with Bondville (IL11) approximately 7-weeks into the intercomparison.
  - Approximately 30 collocated samples (10 from each site) will be collected from dual chimney NCON samplers configured with supplies from EFGS in one chimney and supplies from WSLH in the other chimney.
  - Each lab (EFGS and WSLH) provides clean glassware (sample-trains) and 1000 mL PETG bottles and ships supplies to the sites
  - EFGS and WSLH will forward HgT data to Greg Wetherbee for compilation/statistical analysis.
  - Timing: 3/19/2019 – 06/04/2019
  - WSLH has completed analysis through early May.
- No data received to date from EFGS for ambient data samples Inter-Laboratory PT Program
  - For accuracy and bias comparisons, Greg Wetherbee expanded his PT program and prepared 12 synthetic samples and blank for a 6-lab special study
  - Total Hg concentrations in synthetic samples compare well between EFGS and WSLH
  - Median difference in THg concentrations 0.365 ng/L for EFGS, 0.13 ng/L for WSLH
  - Blank analyzed by WSLH at 0.07 ng/L (MDL is 0.2 ng/L, so undetectable)
- Supply QC
  - PETG HgT sample bottle blanks for single use 1L and 2L bottles
  - Bottle blanks Lot means ranged from -0.021 to 0.017 ng per bottle for manual and auto analysis (criteria = 0.04 ng per bottle (mean), and 0.08 ng maximum. Bottles were leached with 1000 mls 0.2% v/v HCl for 24h but were used straight out of the box/uncleaned.
  - \$40K in bottle costs per year
  - Thistle tube and funnel blanks leached with 200 ml 0.2% v/v HCl: means ranged from -0.0075 to 0.0075 ng per item (max criterion 0.08 ng, average criterion 0.04 ng)
    - To clean -soak in hot water detergent, scrubbed with pipe cleaner, rinsed, soaked in 30% HCl for 36 hours, MQ water rinsed and dried
    - Blank values demonstrate effectiveness of cleaning
    - Mean thistle tube & funnel combined blanks with hot water/detergent/30% HCl cleaning procedure 0.013 ng per train
  - Bottle and glassware bags less than 0.04 ng
    - Manual analysis, leached with 250-300 ml of 0.2% v/v HCl for 24h
- Summary: nothing is problematic (WSLH has 25 years' experience in Hg measurements)
  - Traditional MDN protocols align with best practices.
  - Will continue to request field intercomparison data from EFGS
  - More lab exercises needed to demonstrate precision and other metrics
- GEM in air (lab environment) – criterion is < 15 ng m<sup>-3</sup> for 24h average)
  - Analytical lab measured 1.6 ng m<sup>-3</sup>
  - Prep. lab measured 2.1 ng m<sup>-3</sup>

#### 5. Site Liaison Report – Richard Tanabe (ECCC, WSLH)

- Monthly Calls to site support line (800-952-7353) ranged from 40 (December 2018) to almost 90 (January)
  - Lots of shipping issues in January, another deluge of issues (equipment problems, etc.) in March to April. Both related to shut down and its aftermath.
  - By network: 33% NTN, 2% AIRMoN, 19% AMoN, 6% MDN (related to HAL 800# not working), 40% related to precip (data download, gage issues, etc.)
- Trouble Tickets are generated mainly from field form remarks and for missing precipitation data as samples are received. From November 2018 to April 2019 received 204 total: 22 outstanding site issues

- Site power: 4, raingage data: 12, collection efficiency: 2, e-gage: 3, datalogger: 1
- Site login fix – added a button to click to upload any gage data in database from sites
  - If gage data not received, PO will reach out to operators
  - Reporting issues are a challenge (dry weeks, non-uniform time frame of data upload; some operators report quarterly, some report only when asked, etc.)
- Collection efficiency issues
  - Mismatch between bucket weight and precip weight
  - Typically due to load cell issues, met conditions, etc.
- E-gage problems related to cold weather and not putting in antifreeze in a timely fashion. This can crack the ETI shell/leaks
- Data logger – Oklahoma site; program was present in datalogger but was blank
- Data Download Formats:

	10/31/18	4/30/19
PDA	52%	37%
CSI SC115 flash drives	35%	35%
Android/iPhone	5%	20%
Cell and satellite telemetry.	8%	8%

- Android use not as high as hoped (reluctance to open gage in winter). Androids are in stock and ready to install
- WIFI pilot Project
  - Operators currently can use an iPhone with existing loggers but not with existing Bluetooth adapter – requires WiFi serial adapter.
  - WiFly RS-232 serial adapters were purchased and tested in the PO. SOP for implementation was drafted
  - Parts required: Wi-Fi to RS232 adapter, 4” antenna and USB power cable, USB charger (ETI) or 5V to USB adapter (OTT)
  - Cost is ~\$120 for either gage
  - This will provide operators the option of using their iPhones with the LoggerLink app.
  - Pilot sites -2 Otts, 1 ETI gage
- NADP Website
  - Site was updated recently to provide site support tab for all networks
  - Info on egages, collectors, tools to upload precip data, viewing site precip data, summary of networks
  - Support catalogued by equipment (gages, sensors, collectors, troubleshooting equipment ID) Manuals, SOPs, etc.
  - Links to YouTube videos for sample changeout, data download, bag sampling protocols, collector info, sensor and motor box, etc.

- Updates to MDN Site Support
  - The old HAL toll-free line has been out of service since Feb/2019?
  - MDN Listserv email went out 3/20/2019 notifying operators to call (800) 952-7253 going forward
  - mdn@slh.wisc.edu email created as well –seeing some activity there
  - An online survey was sent as part of the HAL Transition to inquire about operator needs (supplies needed, shipping issues, etc.)
  - Received approximately 60% response so far
  - Mark Olson took paper memos to EFGS to provide hard copy guidance to operators in May, to be included in the outbound shipments to ensure communication
- Changes to Sample Receiving
  - As of June 1st all sample receiving changes to Henry Mall
  - PO is communicating to operators through listserv, monthly reports, and website for AMoN, AIRMoN, NTN, and MDN
  - Also notified agencies that send out prepaid shipping labels to operator (EPA, Wood, USGS, NOAA, etc.) to provide updated labels

#### Discussion

- Mark Olson inquired about egage exchange program? Richard responded that would be addressed in the equipment update report

#### 6. USGS 2018 External QA report – Greg Wetherbee (USGS)

- Study conducted at an old MDN site (CO13) at Ft Collins. Urban site –looking at urban dep at Ft Collins site operator from CSU
- 2018 Summary results:
  - NTN interlaboratory comparison data indicate acceptable performance for both ICAL and WCAL. However the results also indicate a significant positive bias in H-ion measurements (low pH) and nitrate measurements for the new CAL (WCAL). (Consistent with Chris Worley’s WMO sample presentation)
  - MDN interlaboratory comparison data indicate acceptable performance for the HAL, but samples were only shipped to 5 labs quarterly. Results indicated no significant bias with 1 sample out of statistical control that had a RPD of -10%.
  - NTN Field Audit and MDN System Blank programs were curtailed in 2018 for PO/CAL transition. Eight field audit samples were submitted and there were no surprises in contamination levels.
  - Sample shipping was curtailed so as not to overwhelm the WCAL during the transition, also to save costs to fund necessary travel for lab audits, etc – had to put MDN System Blank program on hold, but some carryover samples from 2017 were processed in 2018.
  - Six MDN System Blanks received but no data from EFGS to date. Data for a handful of samples were obtained from the NTN field audit.
  - Co-located program was curtailed until 2020. (there are no co-located samplers anywhere right now)
  - USGS is helping with the HAL Readiness Verification Plan by shipping 12 samples to 6 laboratories, including current HAL and Wisconsin State Lab of Hygiene. Results will be distributed by QAAG as soon as possible.
  - Swedish lab reports instrument problems – no data received to date. Will be included in final report that will be submitted to all participating labs.
  - All labs in the comparison are commercial entities, but they did this work at no cost to the program
  - 2015-16 external QA report is published. Work starting on 2017-18 report in June.
  - Data Release for Bromide Trends paper is published online, but now needs an erratum. (This will be made a priority)
  - Contributed 2 chapters to TDep White Paper: Urban Deposition and Snow Deposition.

- 2018 Transition Year Programs
  - NTN interlaboratory comparison: Continued with 11 labs and 4 samples/month – No change.
  - MDN interlaboratory comparison: Continued with only 5 labs and 4 samples quarterly.
  - NTN field audit and MDN system blank evaluation: Curtailed for transition.
  - Co-located Sampler Program curtailed until ...2020, perhaps 2021.
- NTN Interlaboratory comparison results:
  - Participating labs represent the major labs analyzing precip chemistry in the Northern Hemisphere
  - LABS - ACAP (Japanese lab servicing EANET), CIES (Cary Institute), ECST (ECC Canada), ICAL (Univ. Ill.), MOECC (Ontario Ministry of Env. and CC, Canada), NILU (WMO referee lab, Norway), RTI (IMPROVE lab), NRS (Hubbard Brook), UNAM (Mexico), WCAL (NADP), Wood (CASTNET Lab).
  - NADP Labs (ICAL, WCAL) show low median relative percent difference from most probable values for all cations (good agreement) – a little bias in ICAL results for potassium (5%)
  - Slight Bias in Cl<sup>-</sup> for both ICAL (1.1%) and WCAL (-3.3%)
  - Bias in Br<sup>-</sup> for ICAL and WCAL but not statistically significant
  - WCAL shows great performance for NH<sub>4</sub><sup>+</sup> - all samples were within statistical control
  - For nitrate, there is a slight positive bias at WCAL, with higher variability, bias not statistically significant. Only a few samples out of statistical control for second half of 2018.
  - Sulfate: no significant bias; a few samples out of statistical control (perhaps solution-specific?) in second half of 2018.
  - H<sup>+</sup> Ion shows positive bias at WCAL/lower pH reported by WCAL, which is consistent with Chris Worley's presentation. Variability for pH at WCAL is 3.3X overall variability (of all labs). Control chart for pH shows several samples out of statistical control.
  - As an aside, Camille pointed out that, upon her further analysis, the high bias in H<sup>+</sup> from WCAL results occurred in synthetic rainwater samples – pH of actual precip samples was spot on. Similar results were reported by ECCC lab. Suggests possible matrix effects in some synthetic rain samples?
  - For specific conductance, WCAL results were spot on – some high bias for ICAL (5%)
- NTN 2018 Interlaboratory-comparison program blanks:
  - Only one sample from WCAL shows Mg above MDL. ACAP lab might show contamination – higher number of hits > MDL for all anions/cations
- Field audit results
  - Some contamination from the 8 sites in study (bucket-bottle differences) especially Cl, NO<sub>3</sub>, NH<sub>4</sub>. Generally consistent with past results. Some H<sup>+</sup> loss (bucket-bottle concentration differences)
- MDN interlaboratory results:
  - Control chart for HAL -2018 – with one exception, all samples sent to HAL at EFGS were within statistical control for concentration differences. Only one sample was outside control – by ~ 2 ng per liter, or ~10%, difference (mid-October sample)
  - Box plots for 2018 MDN data: HAL, Taiwan Lab, Swedish Lab, Flett Research, and USGS/Middleton Lab.
  - HAL results were a little more variable than most labs, but there was no significant bias in reported concentrations (from MPV)
- MDN Interlaboratory-Comparison Program/ 1% HCl Blanks (3 per lab): HAL reported no values exceeding analytical detection limit.
- MDN Labs selected for 2019 QA program (labs added in SE Asia to aid APMMN program)\
  - Thailand Environmental Research and Training Center
  - Gwangju Institute of Science and Technology – Korea
  - Kangwon National University – Korea
  - National Institute for Minamata Disease – Japan
  - Dept. Atoms. Sci. National Central Univ. – Taiwan
  - LEEQ – Canada
  - Flett Research – Canada
  - IVL – Sweden
  - NSA – Duluth, MN



- EFGS – WA
- USGS Hg Research Lab – Middleton, WI
- HAL at WSLH
- CAL and HAL Transition
  - Implemented the CAL Readiness Verification Plan with assistance from both laboratories. Results presented in Albany. CAL at UW demonstrated acceptable performance. Report available on NADP web site...soon.
  - Now (2019) implementing the interlaboratory-comparison portion of the HAL RVP.
    - Six Hg labs, including Eurofins FGS (HAL) and Wisconsin State Lab of Hygiene (New HAL).
    - 12 samples, Hg(NO<sub>3</sub>)<sub>2</sub> in 1% HCl
    - Due date for data 5/9/19 & 5 of 6 labs reported data, and Martin Shafer to report on preliminary results.
    - USGS/Middleton Lab provided data from both auto and manual methods to directly compare to WCAL auto/manual methods
- Publications
  - 2015-16 External QA Report is published.
  - Data Release for Bromide Trends paper is published online, but now needs an erratum due to CAL discoveries pertaining to IC method and database. (will pursue ASAP)
  - Contributed 2 chapters to TDep White Paper:
    - Urban Deposition, Snow Deposition
    - Submitted paper on Urban Deposition for STOTEN special issue.

## 7. Wet Incomplete/Wet Dilute Discussion - Camille Danielson

- NTN Sample Types
  - NTN samples < 12 mls designated Wet Incomplete (WI)
    - No filtering, no pH or conductivity measurements.
    - Samples left in 1L shipping bottle.
    - Priority of analysis: 1. FIA for NH<sub>4</sub>, PO<sub>4</sub>. 2. IC for SO<sub>4</sub>, NO<sub>3</sub>, Cl, Br. 3. ICP for Ca, Mg, K, Na (it is rare that all analytes are NOT measured)
  - Samples ~12-30 mls classified as Wet Dilute (WD) samples
    - Samples are poured off and analyzed for pH, conductivity.
    - Remaining sample is filtered and diluted up to 25 mls (ICAL diluted to 50 mls).
    - Full analysis as above (no priority given for analytes)
  - Samples > 30 mls classified as Wet.
    - Poured off for pH and conductivity measurements
    - Filtered, full analysis as above (no priority given for analytes).
    - Archive samples preserved if sufficient volume
- Wet Incomplete concerns
  - WI samples are analyzed unfiltered and left in 1L bottles until able to analyze (2 up to 10 days; avg 5-7 days after receipt)
    - WI are usually contaminated/have higher analytes
    - Since samples are unfiltered, contaminants (pollen, debris) are introduced into analytical stream
    - Most need dilution at the bench for 1 or more high analytes
    - Analytical components change much more over time without filtration  
Example - pH changes with unfiltered samples used for Titrec study
    - Effects on instrumentation?
    - Pipette or pour off carefully to minimize contamination
    - Incomplete analysis!
    - Question: Would data users rather have all NADP analytes reported but risk sample results being <MDL due to the dilution, or would they prefer to keep the status quo?

- Discussion is complicated by some confusion that has been generated by CAL transition, necessitating a discussion.
  - WD was already in place at ICAL as far back as 2004 (only Wet samples analyzed/reported prior to that?)
- ICAL began the WI Protocol in 2015
  - Very low volume samples were set aside, analyzed by priority
- ICAL chose to stop the WD protocol in 2017: Zero WD samples in 2017 and 2018 reported from the ICAL
  - This was apparently without approval - NOS, Joint, QAAG, and Exec minutes were checked as well as the CAL reports and have found no discussion of dropping WD
  - WCAL was told that WD was being used at ICAL visit
- There were no WD samples from the ICAL in 2017 and 2018
- It appears after 2016 WD samples were then coded WI – so all samples <~30mL were treated as WI - not filtered and pH/Cond analyzed last if sample remained
- WCAL followed established ICAL QAP, SOPs and have been doing WD AND WI samples since becoming the CAL; this was not necessarily the case for ICAL in recent years.
- Analysis presented of NTN samples (7/2012 to 7/2018) to determine the number of WI/WD samples
  - Skewed by the fact that in later years WD samples were treated as WI samples, and not diluted or filtered, and no pH or conductivity measurements upon arrival, but at the end of analytical train several days later.
  - At ICAL, WI did not exist from 2012-2014, was instituted in 2015-2016 but dropped from 2017 – June 2018, when WI was reinstated June 2018 (WCAL)
  - Numbers are biased by these changes
  - Likely this decision will affect 1-3% of samples
    - Disproportionately affects analytes at lowest priority: Ca, Mg, K, Na.
    - pH and conductivity are measured last, so lack of sample affects these measurements
  - On the other hand, diluting samples (WD protocols) can dilute analytes < MDL (especially cations), but 96% of data exceeds the MDL, even with dilution to 50 mls as in the past
- Does this warrant an adjustment to protocols?
  - Filter all NTN samples?
  - Possible NEW “WI” samples (volume < 12 mL)
    - No pH/cond, filter and dilute, run all other analytes
    - Syringe filter could be used for very low volumes
  - For WD Volume >12 mL continue as is...
  - Dilute WI and WD to 20 mL or current 25 mL (ICAL was using 50 mL)?
  - Only difference between WI and WD will be pH/Cond measurements on WD
  - -OR- leave WI protocol as is – no pH/Cond, NO filter, Priority order

#### Discussion:

- Greg Wetherbee and Camille Danielson -dilution and filtration is more laborious but protects the instruments and improves sample validity; significant pH changes seen after setting samples aside (days) for higher priority measurements, and in many cases some analytes in WI samples were so high that dilution was required at the bench anyway. Makes sense to update the protocol.
- Greg Wetherbee pointed out that low-volume samples are likely to increase as NTN moves to bag sampling, as it will be difficult to get all of the sample out of the bags. But, if low-volume samples contribute so little to annual deposition, and NTN was not historically envisioned as acid rain network but as a nitrogen deposition network, does it make sense to amend protocols to accommodate pH/conductivity measurements when the emphasis is on quantifying NH/NO<sub>3</sub>? Camille pointed out that unfiltered samples are fundamentally different from all others. NH<sub>4</sub> could also be changing as pH does.

- Bob Larson asked about the number of WI samples that were still out of range after dilution (at the bench)? Camille responded that there were many, especially for IC (anion) analysis; Bob pointed out that before the WD sample code at the ICAL, there were WA samples –these were diluted with 50 mls DI water, not to 50 mls, and were still filtered.
- Amy Mager pointed out the need to investigate the impacts the change to protocol would have on work flow in the lab – perhaps this is a good starting point for action? Further investigate the logistics of changing the WI/WD protocols (non-traditional filtration, etc.)
- Greg Wetherbee -for certain sites in the desert SW, many samples might be < 30 mls and may in fact dominate the entire record at the site. Greg agrees with the concept of diluting to volume, then filtering
- Camille stated that the current procedure at WCAL is to filter, then dilute. Impacts of this on very low volume samples are uncertain.
- Martin Shafer pointed out that a syringe filter should be suitable for samples of as little as 2-5 mls, but this can be tested. Greg suggests a mechanism for imparting judgment/flexibility.
- Mark Olson asked at what sample volume dilution lowers the analyte concentration to <MDL, thus may be a waste of time. If you can filter as little as a few mls but need 10 mls for analysis, how many analytes may be undetectable?
- Greg Wetherbee suggests that a motion could be crafted to let the WCAL determine the most feasible way to filter low-volume samples and to dilute to a reasonable volume (20 mls? 25 mls?) that would allow for analysis by order of priority.

**Motion proposed by Camille Danielson:**

**The CAL shall evaluate/consider a new protocol for WD samples, including samples formerly designated as sample type WI, such that:**

- 1) Every sample will be considered for filtration,
- 2) Samples will be filtered as feasible with subsequent dilution up to 25 mL, and
- 3) The diluted samples will be analyzed per the current analyte priority protocol.
- 4) Amendment proposed by Eric Hebert – initial results and evaluation to be reported back at the Fall 2019 meeting.

**So moved by Greg Wetherbee, Seconded by Mark Olson. Motion approved**

8. Proposed Strategy for NTN Bag Sampling -Richard Tanabe

- Wisconsin State Laboratory of Hygiene (WSLH) has investigated the change from bucket to bag sampling for NTN. Advantages
  - Increase bag sample collection efficiency. Bag was redesigned to get rid of gussets –less surface
  - Reduce overall network expenses, specifically reducing shipping costs and labor associated with cleaning supplies.
  - Improve the data quality through improved quality control procedures.
- Background:
  - A bag sampling study was carried out by the NADP Program Office from 2012-2014.
  - At the 2014 NADP Spring Meeting results of the bag sampling study were presented to NOS.
  - Motion was approved by NOS to accept Bag sampling as an approved National Trends Network (NTN) and Atmospheric Integrated Research Monitoring Network (AIRMoN) sampling protocol
  - As approved, NTN sites were not required to switch to bag sampling.
  - Bag sampling was permitted for international sites outside of Canada.
  - NTN samples that were collected prior to approval of bag sampling protocol were grandfathered in, specifically samples from Argentina.

- AIRMoN sites switched to bag sampling starting October 1, 2014.
- The AIRMoN network has been bag sampling since October 1, 2014. Currently there are four sites currently in the network (NY67, PA15, WV99, and TN00)
- The Network for Urban Atmospheric Nitrogen Chemistry (NUANC) has been bag sampling since 2016. This is a sub-network of NTN, currently there are six sites (CO06, CO11, CO13, CO85, CO86, and CO87).
- Sample bag design:
  - Previous version was 29"x10.5" gusseted bag. It expanded to 19" to fit over bucket. The sample bag had 2 sections.
  - WSLH bag is a 19"x17.5" straight bag with a double seal at the bottom
  - Both bags designs have a 0.003 mil thickness and made by Degage Corporation based in Terrell, TX
- Bag QC:
  - Ordered and received 10,000 bags. Initial QC done, and results were good.
  - Bags are cleaner than buckets, with mean blanks much less than NTN MDLs for all analytes.
- Changes to the sampler include changes to the bucket strap:
  - The previous version used a webbing strap with a side buckle to secure the sample bag in the bucket while evacuating the air from the bucket.
  - Once the air was evacuated the webbing strap was replaced with a coated wire tie to reduce the possibility of contamination from the fabric webbing strap fraying and breaking down due to UV exposure over extended periods.
- Proposed changes to bucket strap
  - WSLH recommends the use of a ¾" BioThane coated webbing.
  - It has a flexible outer coating that protects the webbing and is durable, easily cleaned, UV resistant and waterproof. The strap would use a double adjust side release buckle.
  - This strap would eliminate the requirement to use both a webbing strap and a coated wire tie.
- Proposed changes to bucket plug
  - The previous version used a piece of heavy duty tape to cover the hole used to evacuate the air.
  - WSLH proposes an ergonomic center pull-tab plug be used –very inexpensive.
- Bag Sampling Implementation Schedule
  - The proposed roll-out of bag sampling to the NTN sites will be a multi-phased approach.
  - Every two weeks the goal is to switch over ~50 sites.
  - This will allow the site support and supply shipping staff to prepare the packages needed to implement the sampling changes (2 buckets with pre-drilled holes, standard 1L bottles, boxes, and bags) and the ability to provide site operators the proper level of support for this significant change in procedures.
  - Initial plan was to inform operators of changes in June 2019 but that will get pushed back due to the HAL transition; the goal is to have all sites switched over before winter.
- Resupply shipping considerations:
  - WSLH needed to re-evaluate the method for sending new/returning used supplies from the sites.
  - Consider dimensional shipping weights. 32" by 16" by 16" box – PO is charged a dimensional weight of 50 lbs.
- Proposed Clean Supply
  - Based on a 20"x12"x12" box, it can fit 9 weeks of supplies for bag sampling (for both rigid and flexible lids).
  - The increase in supplies in the supply box would reduce the number of shipments to the sites from 9 to 6 per year.
  - This would reduce the CAL's overall outgoing shipping costs. As well as reduce subscribers return shipping costs.
  - They will no longer return the large bucket boxes
  - Current shipping box is 32"x16"x16" and contains: 6 lids, 6 1L boxes, 6 FORFs, 6 1L bottles, 6 buckets. Billable weight – 50 lb, Actual weight – 18.55 lb.

- This translates into a cost of \$14.09 per shipment, or \$126.76 per site per year @ 9 shipments per year (outgoing from Henry Mall). Shipping costs from each site is \$60.53/\$544.77 per year
- o Proposed clean supply box is 20"x12"x12" and contains: 18 lids, 9 1L boxes, 9 FORFs, 9 1L bottles, 1 poly mailer. Billable weight – 18lb, Actual weight – 13.1 lb.
  - This translates into a cost of \$6.83 per shipment, or \$40.98 per site per year @ 6 shipments per year (outgoing from Henry Mall). Additional cost of one-time use boxes (6 per year) \$9.43, for a total of \$50.41 per site per year. Shipping costs from each site is \$17.14/\$102.84 per year
- Return shipping proposal
  - o Only supplies returned from sites will be the lids and will fit into coextruded self-sealing polyethylene mailers used by AIRMoN operators for shipping their lids back.
  - o A return shipping polyethylene mailer will be included with each supply box – will try to have operators wait to ship 8 lids back, which will trigger a new clean supply shipment
  - o This would be a benefit to the subscribers, as it would reduce their shipping costs.
- Proposed Lid Use Change
  - o Propose changing the procedure from using 2 lids per week (operator takes a prepared bucket with a clean lid, plus a spare clean lid to put on the in-use sample, changes buckets and comes back with original clean lid that was on the new bucket ) to 1 lid.
  - o Question – do we need to still use two lids for each deployment, or:
    - Have the operator prepare a clean bag/bucket with a clean lid, go to site, take the clean lid to put on the in-use sample and change buckets
    - Use the single lid that covers the new bucket to be deployed to cover the removed bucket.
    - This will reduce the number of lids to be shipped out, but involves a changes to sample deployment/retrieval protocols.
    - CAPMoN uses a similar scheme, and operators would take a spare clean lid.

## Discussion

- o Greg Wetherbee noted that current protocols protect sample integrity and minimize exposure of the clean sample collector to the atmosphere prior to deployment, because the operator can hold the lid over the in-use sample until the very last seconds before the bucket is covered by the motor arm/cover. The new protocol would expose the sample to the atmosphere during the time it takes to place the bucket in the collector. What about a second skin/bag to put under the lid to seal the bucket prior to deployment?
- o There followed a prolonged discussion about the proposed change from using two lids during sample recovery and deployment (currently) to one lid (proposed) in the bag sampling protocol – it will save cleaning and shipping and supply costs. But concerns were raised about prolonged exposure of deployed sampler to the atmosphere prior to installation, potential damage to bags, etc. Suggestion by Greg Wetherbee to keep track of how the implementation is going and determine if there are effects that show in the data using the new 1-lid protocol. Potential for operators to take spare lids to use depending on conditions.

**Motion: To accept the proposed changes to the previously approved bag sampling procedures as outlined and transition the NTN network from bucket to bag sampling.**

**So moved by Richard Tanabe, Seconded by Eric Hebert**

**Motion approved, but opposed by Tom Butler**

## 9. NADP Site Survey Report – Eric Hebert (ee-ms)

- 78 Site Locations surveyed in 2018.
  - o Total of 86 Collectors (63 NTN Collectors, 23 MDN Collectors) and 77 Primary Rain Gages.

- Fewer sites visited than normal (~120 per year) – this is the first year of eems’ new contract with EPA, to visit sites once every 4 years.
- Engage accuracy of 70 gages was near perfect, as expected. Belfort accuracy not reported. Eric supports the replacement of the 17 Belforts still in use
- Tests of sensor temperature – sensors are maintained at a temp just above freezing to melt accumulated snow.
  - Once the grid is activated the sensor heats up to evaporate the precip so that collector can close quickly when precip stops.
  - The sensor temp should be close to ambient temps (slightly higher) but warmer than ambient at temps below freezing. Sensors largely passed, with one discrepancy probably due to failure of an operator to follow test protocols
  - Manufacturer’s spec calls for sensor heating ~60 °C within 10 minutes –only one sensor (NC25) failed this test and was replaced
- Visual examination of sites/site infrastructure revealed some problems
  - Cows very close (< 3m) to collector at one site, but kept out of enclosure by fence
  - Damaged collectors, needs to be cross-referenced
  - One issue noted with several rain gage shells (ETI) not aligned - perhaps a source of apparent sensor failure - should be investigated and cross referenced
  - Some issues with motor boxes, collector arms (missing pivot bolts) and pivot point uncovered by a boot – can affect lid closing.
  - Uncovered and disintegrating backup battery box
  - Mounting deck boards loose at older sites. Might present a safety hazard if used as a step.
  - Substandard wiring modifications in the field
  - Wooden mounting pole was used for the ETI rain gage (MT site), and no wind shield, so mounting mast may shake in high winds
- Eric presented a short video of drone footage used to perform an aerial survey of the sites, and including this type of survey to augment the fixed-ordinate surface photos.
  - Aerial surveys can provide information on terrain and fetch surrounding a site, vegetation type and height/rate of growth.
  - Can edit the videos to provide photos corresponding to the fixed-ordinate site photos, and to take still pictures
  - Perform 360° aerial surveys if desired
- eems has added a third van to their survey/audit fleet
  - Vans are equipped with GPS trackers, website is being updated to display van location
  - This can be useful for operators needing special/emergency attention if a van is in close proximity
- Site survey data summary by collector type to evaluate number and percentage of collectors meeting all assessments to evaluate network operations and overall data quality
  - Siting criteria, sample handling issues, etc. could account for much of the failure to meet all site assessments.
  - Some issues with collector arms of NCONs - need to add Loctite to prevent loosening of bolts

<u>Collector type</u>	<u># Surveyed</u>	<u># Meeting all Assessments</u>	<u>Percentage Meeting all Assessments</u>
NTN ACM	39	34	87%
MDN ACM	13	8	62%
MDN N-CON	10	8	80%
NTN N-CON	24	24	100%

- Eems Internal QA
  - 13,744 fields entered by surveyor, 13,744 duplicate entries
  - 97 total errors (0.71%), 88 duplicate entries (0.64%)

- Maria Jones asked about the number of ETI gages with problems associated with optical precip sensors/connectors. Eric responded that he sees lots of corrosion on those, need to add dielectric grease to the base plate.
- Greg Wetherbee supported the use of drones but pointed out the advantage of consistent ground photos to assess vegetation growth and incursion into the 30 degree siting cone around the collectors. This is more difficult with a drone, esp on takeoff. Eric responded that better quality drones will help, as will labelling directional information in the videos.
- Rich Grant stated that if eems uses drones as part of their business plans/practices (i.e., commercial use) it would require a certified pilot to operate the drones – more stringent flight rules apply versus using drones as a hobby, particularly at urban sites, perhaps limiting the utility of drones.
- David Gay pointed out that there are two main uses for ground-based site photos: 1. To determine if a given site still meets siting criteria or needs improvement and 2. is appropriate for various types of research. Eric responded that assessing upwind fetch is really possible only from a drone (vertical perspective).
- John Walker echoed the importance of using a drone to provide standardized information (how to standardize?) about upwind fetch, coupled with existing ground-based site photos.
- Greg Wetherbee asked about the existence of a process to engage sites that may need attention with respect to vegetation and other siting criteria. USGS has this problem with some of their sites, and is aware of issues, but correcting them often takes quite some time. Eric suggested that site maintenance issues be incorporated into operator training.
- Bob Larson raised the issue that if a site needs repair beyond the site operator's skills, how do we effect repairs? Richard Tanabe has faced this issue and suggested eems make site upgrades when in the vicinity, and provide a mechanism to address issues. Rotating/secondary operators may not have appropriate skills.
- Greg pointed out the issue of site locations/remoteness means that skilled operators are sometimes hard to find, and we as a network may be lowering our standards to accommodate them. Operator turnover is also an ongoing problem (Richard Tanabe). Greg Wetherbee suggests a network-wide tabulation and documentation of the # of sites (and as a percentage) with chronic problems –is this widespread? Eric responded out that the eems annual reports contain much of this information.

#### 10. A proposal for a low-power collector modification –Bob Larson (WSLH)

- Need a solution to address problems at solar-power sites (typically high elevation). Long-duration snowstorms etc., result in low solar charging and draining of the batteries by the sensor heater on the collector
- 44 NTN sites are solar.
  - 15 are high elevation, snowy sites
  - In 2018, 22 sites had 1+ weeks with data impacts because of gaps due to insufficient power.
  - At 2 or 3 sites: 10 weeks or more impacted.
- Power demands
  - Typically low for the datalogger and rain gage, but high for the sensor and motorbox
  - When precip starts, the collector opens, the grid sensor is heated until precipitation stops, or the battery dies.
  - The collector is designed/operated to open and close ASAP after precipitation starts or ends; not ideal for limited power situations

- At solar sites the collector drains the battery until there is insufficient voltage to operate the collector or the datalogger
- This results in gaps in the data, and the collector state is in an unknown state during gaps.
- A worst-case scenario could unfold with multiple days of snow, cold temperatures, and little solar charging.
- Collector uses up all of its power to heat the sensor grid so it can close the instant the snow stops
- Using the datalogger to control the collector through relays
  - Relays can power the collector, control power to the sensor, and control the collector openings
  - Can use datalogger inputs for decision making, from the sensor, gage load cell (rate of accumulation of precip), system voltages, and ambient temperature
  - Prioritize datalogger operation if there is insufficient power to operate the collector
  - Relays could be installed in a small enclosure under the collector.
  - Connections to/from the enclosure include power in/power out to collector, sensor input/output, and datalogger signals and outputs.
  - Estimated cost ~\$300-\$400
- Suggested approach
  - Continue with the 15-minute reporting period.
  - Gage and datalogger always stay powered, but use the sensor judiciously
  - Check for sufficient power before opening or closing the collector, and power the collector only when it needs to open or close.
  - This protocol could be implemented seasonally or triggered when system voltage is low.
- Collector open protocol
  - Once the collector has been opened, only close it at the quarter hour
  - At 12 minutes into quarter hour, check rain gage to see if measurable precip has occurred
  - If yes, collector to stay open and re-check in 15 minutes.
  - If no, power sensor for up to 10 (?) minutes and recheck for activity
  - When precip has stopped, check voltage and close collector
- Collector closed protocol
  - At 5 and 10 minutes into the quarter hour, check gage for precipitation and system voltage
  - Open collector if precip has occurred and power is available
  - At 12-15 minutes, power sensor
  - At 15 minutes, check gage and sensor for precipitation, and check system voltage
  - Open collector if precipitation occurred and power is available

## Discussion

- Greg Wetherbee pointed out that checking for precip at 15 minute intervals will result in an increase in missed exposures, as collector will not open immediately. Bob agreed but this approach would be used at only a handful of sites (e.g., Loch Vale). This is preferable to draining the battery and not knowing the state of the collector.
- Greg suggested a co-located study (standard vs low-power protocols) to observe effects on data quality, ideally at Wisconsin (subject to staffing and resources)
- Eric Hebert suggests using a CAPMoN sensor, not a conventional grid sensor.
- Mark Olson suggested using the optical sensor in the ETIs to determine precip rates, but questions about the optical sensor reliability remain. An antler-style optical sensor may be preferable.
- David Gay suggested that under a low power threshold it may be advantageous to use the rain gage (rather than the grid sensor) to open and close the collector. But, sensitivity of gage under light precip rates may limit the utility of this approach, although under light precip the effects on chemistry and deposition are minimal.



- There was overall support for investigating a possible solution, but not in the form of a motion and not to burden PO staff.
- Bob will try to develop a prototype for the Fall meeting. First cut may be to observe effects only on collector operations, without sample collection/analysis, to reduce costs and effort
- Rich Grant asked about collector capture efficiency in light or blowing snow. Would the proposed low-power option be a large effort for a low catch? Greg Wetherbee responded that catch efficiency is poor but the network would still collect relevant information even at low catch efficiency. He sees this as preferable to having a collector die and unable to close (undefined sample).
- Bob suggested low catch efficiency in snow conditions is due to scouring of snow out of the bucket. By keeping the collector operating, the bucket will be sealed and minimize scouring.
- Greg Wetherbee suggested another improvement. Under heavy snow a “snow cone” can develop in an open collector. When collector tries to close the lid it can burn out the motor if the cover does not fully close. A mechanism to close the collector as soon as the bucket is full (of snow) would be a useful modification.
- Melissa Puchalski suggested using students to conduct the relevant tests. General concurrence.

#### 11. Precipitation e-gage Update and Issues – Bob Larson

- Data processing changes
  - Integrating CAL, HAL, and PO processing into 1 software system will provide better information for data reviewers (e.g, precip data from co-located NTN/MDN sites can be readily compared)
  - Provide better feedback to operators (past sample receipt reports have never included information about working/nonworking gages – now will be added in).
  - When CAL and HAL worked independently of each other, there were many differences in data protocols that required final reconciliation by PO.
  - The new system will allow easier determination of consistent total precipitation using harmonized protocols and without previous DST differences between CAL and HAL .
  - Will allow easier reconciliation of sample volumes when gage data are missing.
  - Will allow reconciliation of daily precip. This was not done under the old system –the NTN daily amounts were published, but not corrected when total precip was edited, and MDN daily amounts were never published.
  - Now, data reviewers will have access to screened precipitation data, sample volumes for co-located networks, collector performance data for co-located networks, and additional data sources.
- Additional data sources
  - Daily Prism data,
    - A gridded data source at 4 km resolution across the CONUS, sometimes updated with late data.
    - Prism starts with a map of monthly mean precip, bias corrected with daily gage data
    - This updated map surface is interpolates to extrapolate to other areas .
  - Quantitative Precipitation Estimates
    - NWS product
    - Interpolate NEXRAD data east of the Rockies, bias corrected with gages
    - Satellite values are used where NEXRAD not available
    - Gages and Prism data are used in the mountainous west (precise definition is unknown)
    - Provides 4 km resolution over CONUS, AK, PR

- To support these data sources, Python programs were written to download and unarchive the maps; import to ArcGIS; re-project the maps; extract precipitation at NADP site locations; and update SQL daily table.
- When reviewing data from a given site, these products will be available to assess quality of precip data.
- At this time, PO proposes using this data as supplemental info, not as a substitute source. The data can be used to evaluate and confirm primary sources, and efficacy can be evaluated on a site by site basis.
- A poster will be presented at the Fall meeting assessing the potential for this method to be used as a substitute source.
  - In order to be feasible the definition of days must be aligned
  - NADP defines a day in precip data as midnight-to-midnight local time
  - Prism/QPE products define a day from noon to noon GMT).
- Precipitation substitution
  - Order of preference: Primary gage, onsite backup gage, sample volume, other network sample volume, or estimated from other sources (sample invalidated in this case).
  - Problem with this order is that, according to ICAL software rules, if precip for one day is missing, entire week of precip data is thrown out.
  - This causes a problem if the sample volume is the only alternate; often the sample volume is worse than the partial gage data.
  - Motion passed in DMAG to allow use of incomplete rain gage data if it is the best source (i.e., if no on-site backup gage is present).
    - Compare the sample volume to partial gage data to see which is larger, if false precip data are not suspected
    - If partial gage data are better than sample volume, the gage data are used, but the PO records subppt source as “gage – incomplete”.
  - Other substitution problems are poor collection of frozen precipitation and data gaps due to power issues - possible unknown state of collector.
    - When this occurs, PO approximates the precipitation by difference in bucket depth
    - Adds that to daily precipitation (not to 15 minute records)
    - Flags daily precip source as “egage – supplemented”
- Temperature compensation
  - Load cell outputs in mVolts.
  - In ETI this voltage is temperature corrected (e.g., -0.0001 in/mv), and the corrected voltage is converted to bucket depth (a linear relationship).
  - Similar procedure is applied in the Ott-Pluvio, but specifics are unknown.
  - Under severe changes to temp compensation parameters, the derived raw bucket depth can be compromised and invalidated and can fluctuate with ambient temperature
    - This can be due to damage/dropping of the bucket and damage to load cell, incorrect assembly, shell rubbing on the bucket, fauna nesting under the load cell, etc.
    - This can also happen in the Ott Pluvio (to a lesser extent), but is easier to detect.
    - This may be affecting the gage data at Bondville currently.
  - A faulty gage can be swapped out and tested, but a temp compensation check can be done on site (gage will be out of service for a few days).
    - The collection chamber is removed and dried and replaced, and the gage is checked for foreign material under the load cell.
    - The gage is covered with an NADP bucket and allowed to run for 48 hours to one week so see if the bucket depth is flat/constant, or continues to vary with time.
    - Bob would like to try the on-site procedure at a few sites to see if this is a viable test to identify and correct temperature compensation problems.

- It may also be possible to use this method to recalibrate the gage by performing the test under a variety of temperature regimes.

**Wednesday, May 15 0830**

12. Special Studies Request Proposal -Mike Olson and Amy Mager (WSLH)

- The PO/CAL receives 6 to 10 request per year for NADP samples.
  - Desire to formulate a plan for equity when dealing with special requests.
  - Requests for splits, active archive, filtered material, and other (e.g., AMoN extracts).
  - Primarily researchers at Universities, but also agency labs.
  - The requests have been supported in the past, in general facilitated out of the ICAL,
  - But there was not always full communication to Exec – WCAL will attempt to remedy this.
- Historical document dealing with special requests
  - Dates to 2008
  - Objective to leverage NADP networks to assist requests.
  - Ensure there is sufficient sample volume to properly process samples and accommodate requests.
  - Ensure that the NADP retains sole authority to decide on archival sample disposition (allowing no third-party dissemination.
  - Thus there is precedent to allow NADP to “own” archive samples and determine their use.
  - It was envisioned to directly involve the Program Coordinator and NADP Chair.:
  - Procedure: Requests will be sent by NADP PC or his/her designee to the Chair of the NADP Executive Committee, the Chair of EROS, and the CAL director. These four people comprise an ad-hoc committee charged with evaluating the requests. The NADP PC or his/her designee chairs this committee.
- However, as of 2019
  - These procedures were not being fully implemented.
  - Potential for inequity in sample distribution.
  - Exec is supportive of the allowing the PO and CAL to represent the Executive Committee in assessing requests, to ensure timely response to requestors.
  - Exec still should hold the ultimate authority on making the decision for sample distribution.
- Proposed new policy – guide for sample archive request evaluation and approval
  - Formal evaluation plan to be approved by executive committee
  - The sample request must support the NADP Mission.
    - Supports the production of quality-assured data and information resources for NADP stakeholders
    - Assures NADP remains a premier cooperative research support program through aiding scientists, policy makers, and educators to advance the understanding of deposition impacts on natural and built ecosystems and human health.
    - Creates a mechanism to respond to emerging issues of deposition monitoring and supports the advancement in measurement system methods.
  - Evaluation objectives:
    - Does the request meet the expectation of the cooperative agencies and subscribers? Does the request meet NADP mission as outlined in the NADP Governance Document? The key items evaluated during the review are:
      - Agreement with NADP mission
      - Application of technically sound methods and scientific approaches
      - Feasible for NADP to accommodate the request
    - The review is not meant to dictate or judge the science (including methods) as being relevant or appropriate on its own. It is not the role of the review process to be an authority on the state of the science, but rather, to assess does the requested use justify NADP support.

- The NADP PO/CAL role is to give guidance to requestors on how the proposed approaches, application, and methods could be improved or altered to strengthen the justification for NADP support
- Ultimately the review procedure is meant to represent the opinions of the NADP Executive Committee and its constituents. The Executive Committee, or its designee, has the final authority on how NADPs effort and resources are allocated to support the greater research community and other stakeholders.
- Procedure
  - Initiated through the Program Coordinator
  - Ensure all paper work submitted
  - Reviewed by PO to ensure meets NADP mission and is feasible; if so, then
  - Reviewed by NADP Program QA/Special Studies manager for technical robustness, scientific merit, and feasibility (not limited to internal NADP input only)
  - Reviewed by CAL to assess effort, cost, implementation feasibility
  - Establish a consensus between reviewers and make a final decision
  - The process is iterative with feedback from requester & external experts on the topic
  - The Executive Committee has final authority on sample release and PO/CAL effort
  - Sample requestor can appeal directly to the Executive Committee
  - Difficult and unique requests (including the long-term archive) will be referred to the Executive Committee.
  - Inform executive and require acknowledgments
- Request process for NADP samples
  - PC sends requestor a formal request form and accompanying memo (WCAL is in the process of revising this form) (Note: The memo is complete as of October 2019)
    - Contact info, shipping info, sample handling requests, and billing info
    - Network & sample type
    - Filtered, unfiltered,
    - Aliquot of current sample, archived NTN sample (0-5 years post collection), expired archive sample (NTN: 6<sup>th</sup> year post collection), AIRMoN archive sample (0-2 years post collection), AMoN extracts (0-2 years post collection)
    - Each sample type will require a separate submitted request
    - Purpose and objectives of the study (subject to alignment with NADP goals)
- Fees, documentation, tracking
  - Setup fee \$75 (one time: project review, documentation & tracking, LIMS set-up and updating, billing set-up, invoicing)
    - Per sample fee \$5 (routine samples)
    - For non-standard requests, evaluate fee adjustment accordingly
    - Collect billing info up front
  - Documentation/tracking/billing issues
    - Details and status of all project requests
    - Can be accessed by PO, CAL Management, Billing
    - On-going shipping and billing tracked
    - How many samples shipped/when
    - WSLH Billing Dept. has info needed to create invoice
    - Date billed, date payed is tracked
  - Request status, approvals, billing information, invoicing, etc. are tracked in database/spreadsheet
  - Laboratory Information Management System (LIMS) is used for configuration/setup for sample processing, sample hold requests, label printouts for additional sample processing, etc.
  - Processing for archive samples
    - Sites and Dates obtained from the study request
    - Use LIMS to identify appropriate sample ID numbers for the request

- Using FreezerPro® software, WCAL is in process of cataloging ALL archive samples (60,000+ samples from ICAL) (Note: This process is 90% complete as of 10/17/2019)
  - Map of freezer/shelf/tray
  - Scan sample into software, location is marked
  - Enter sample number to retrieve location
- Special Studies Status Summary (as of May 1)
  - Since the transition of the CAL in June, 2018 WSLH has had 13 special studies
  - 7 of these are on-going, 6 are completed, 7 of the 13 were inherited from ICAL
  - 5 requests currently in the review process
  - Studies have been a mix of incoming sample/filter saves, retrieval of archived samples, or both.
  - Unfiltered sample requests (3)
  - Filtered sample requests (7)
  - Filter saves (2)
  - Archive sample requests (2)
- Summary
  - The goal of the special studies request proposal is to implement a policy that:
    - Ensure fairness for sample request
    - Represents the mission of NADP and the will of the Executive Committee
    - Ensures sample requests are consistently evaluated for merit, cost, effort, and feasibility
  - Support of these studies strengthens NADP by establishing external interest and awareness and fostering future applications of network resources
    - Requests for archive samples are being accepted, but will not be processed and samples sent until samples are organized/mapped as above, to minimize effort required to comply with requests
    - Envision archive samples to be organized by end of August

## Discussion

- Tamara Blett asked about differences in fee structure for external vs. program agency requests. Amy Mager responded that differentiation has not been made, but can be considered. She added that the set-up fee is a one-time fee and would not be assessed again unless the scope of the request project changes significantly or completely, and maybe not even then. Much of the set-up fee is administrative (billing, tracking, etc.). Mike Olson added that the concept of equity dictated the assessment of fees NADP subscribers should have the same cost burden as external requestors. Exec can make the ultimate decision. Perhaps the cost of special studies can be incorporated into the NIFA or other funding arrangements used by subscriber agencies?

**Motion: To approve Special Studies Plan and Cost Structure and send draft plan to Exec. So moved by Greg Wetherbee, Seconded by Tom Butler  
Motion approved**

## 13. Equipment Update – Richard Tanabe

- NED equipment summary
  - During the government shutdown there were a number of ACM collectors that were so loaded with snow and ice that the motor boxes failed in trying to close the collector lids.
  - In the NTN and AIRMoN, total motorbox and sensor failures for the ACMs from January-March 2019 were 32 and 15, respectively, but only 1 and 1 for the NCON collectors.
  - For MDN, there were 9 motorbox and 4 sensor failures for the ACMs (Jan.-Mar. 2019), and 0 and 0 for the NCONs
- ETI repair loaner program
  - Program was instituted for ETI gages which are experiencing load cell issues (e.g., temperature compensation problems) and optical sensor failures (wiring issues)

- Purchased 3 ETI NOAH IV's
  - Purchased 5 outer shells
- FL23 and NC06 required replacement ETI gages (impacts from Hurricane Florence)
  - eems dropped off the gages at Wood, then were sent to NC06. Data comm issue.
  - eems has not visited NC06 yet –site w/o power now
- CO10 required ETI shell a week ago (broken wiring)
- Belfort rain gage upgrades
  - 15 Belfort 5780's remain in the NTN/MDN networks.
  - WSLH has purchased 15 Ott Pluvio 2-L this FY. Should arrive in a few weeks
  - Remote Monitoring Module (RMM) no longer available from Ott
  - Bob and Richard have redesigned RMM.
- Remote monitoring module redesign
  - CSI CR300-Wifi datalogger
  - CSI PS150 12V power supply w/charging regulator built in
  - Enclosure w/connectors, parts, mounting hardware
  - Total cost \$1205 (~\$1,075 for CR300 and power supply, ~ \$130 for connectors, parts, etc.)
  - Cost of CR800 only \$1135.
  - Will allow iPhone/Android connectivity
  - Limitation is number of channels.
  - Enough for 2 collectors and OTT Pluvio
- Ott Pluvio 2-S
  - One in network at OH17 or 52 (Cleveland)
  - This gage has not yet been approved
  - Approval process initially discussed in Spring meeting in Louisville
  - No action so far –gage never approved
  - Differences between Ott Pluvio 2 and 2-S may be related to temperature compensation?
    - Co-located gages (2 and 2-S) deployed at Bondville
    - Mark Rhodes presented cumulative precip graph of the data in 2017
    - Ott Pluvio 2 is reporting higher than CRN gage at site
    - Ott Pluvio 2-S agrees well with CRN gage
  - Is it time to approve the Ott Pluvio 2-S?
    - Same load cell and electronics as 2-L (approved gage)
    - Differences in capacity (smaller orifice in 2-S)

Discussion:

- Greg Wetherbee commented that we already have one 2-S in the network and approved the OP2 with less scrutiny
- Richard Tanabe: OP 2-L is still available and is less expensive than the 2-S. With higher cost and lower capacity, wider deployment of 2-S not likely
- Mark Olson commented that he deployed the OH sampler in Cleveland, working with closely with Mark Rhodes, who was ready to approve the gage in 2017. However, the issue was dropped during the CAL transition

**Motion: To Approve the Ott Pluvio 2-S rain gage as an official gage in NADP networks  
So moved by Greg Wetherbee, seconded by Mark Olson  
Motion approved**

- 12V battery issues
  - Used in ETI NOAHIV and OTT Pluvio RMM.
  - As the gages age, the batteries are starting to fail (8), can cause data download issue:
    - Due to corrosion of terminal
    - Requires replacement of battery and in some cases the terminal leads

- NED maintains a stock of batteries
- PO will purchase and ship as required
- Some are sent to eems so that Eric Hebert & Co. can replace as needed
- Lithium 3V batteries
  - Used in CR1000 and CR800 dataloggers.
  - 3.6 VDC, 1.2 Ahr, 1/2 AA size cell battery.
  - Powers the clock and SRAM when not connected to 12V.
  - Campbell Scientific recommends replacing when  $<2.7$  V.
  - Challenge is to identify which sites have these loggers
  - USGS has purchased 80 gages at one time and has seen failure already
  - Will other sites start to fail?
    - PDA sites – provide weekly data to evaluate battery voltage
    - SC115 (Flash drive) sites – battery data not available.
    - LoggerLink sites – battery diagnostics in app/status file.
    - LoggerNet sites – via diagnostics/status file.
  - Strategy
    - Since 3/1/2019, of 88 PDA sites
      - one is below 2.7V
      - one 1 is below 3.0V
      - rest are above 3.0V
    - Issue is the other ~270 dataloggers.
    - What is the best plan? Provide batteries to eems for replacement?

Discussion:

- Eric Hebert asked what is required to change the battery
- Richard Tanabe stated that it is typically beyond the skills of an operator. Must remove the logger from the ETI gage or Ott RMM box, use specific nut driver to remove 6 screws, get inside that to replace battery, program must be off, then reinstalled. A tedious and time consuming process especially in winter.
- Greg Wetherbee commented that a proactive plan of replacing batteries in the summer months will ensure several years of reliable operation
- Bob Larson asked do we replace batteries as needed or on a fixed schedule? Discussion:
  - Wires in the logger are delicate and subject to damage
  - Greg Wetherbee would like eems to replace batteries but would need to be compensated for this effort
  - Rather than proactively replace battery, replace only those  $< 3.0V$ ?
  - Greg would like an estimate of the number to be replaced, eems schedule and associated costs to formulate a plan and report back at the Fall meeting. For example, 80 USGS gages put in at same time and will likely fail at same time
  - Bob Larson stated that the life of the internal battery will be affected by power outages at a site; sites under continuous power will have longer battery life than those at which battery voltage is drained periodically
  - Greg responded that according to CSI specs, max battery life is 10 years, and many of the USGS gages are approaching that point. Life may be as short as 3-4 or 7 years at some sites.
  - David Gay suggested that eems makes a reasonable decision while on site, but any battery approaching its 10-year life is automatically replaced
- The PO will work with eems to formulate a battery replacement plan
- ETI 12V battery chargers
  - Like the batteries, they are starting to fail. 2 different models of charger
  - Often cause of data download issues
  - NED maintains stock and supplies and ships as necessary

- NED equipment repair
  - Alex Rodriguez (Student, now LTE)
    - He worked with Chemistry Department electronics shop
    - Wrote Aerochem motorbox and sensor repair SOPs
    - Built jigs to test/troubleshoot components from collectors and sensors
- NADP Precipitation sampling station (“Precipistation”)
  - Student-led effort
  - Through the UW Mechanical Engineering Capstone Design Project
  - Goal: Develop a robust event-based precipitation sampler
  - Initial progress made, the PO can work with students in the incoming class to continue development
- Wet-only deposition collectors
  - Need to find a second alternative to the NCON collector
  - Continuing to investigate other options for wet-only deposition collectors.
  - Currently a modified Xancom Inc. Canadian Air and Precipitation Monitoring Network (CAPMoN) D400 collector is being considered.
  - At the 2017 Spring meeting in Louisville, NOS approved \$6K purchase of NTN prototype based on ECCC design.

## Discussion

- Greg Wetherbee noted that the collector cost is 2X that of NCON. Richard explained that the collector is a prototype, so costs will be higher for one unit. Mark Olson reiterated the need to find a second collector. Greg asked about other options? No viable options identified. Richard also stated that the D400 sampler exceeds NADP needs, so ultimate price of a collector to be used in NADP networks should be lower. Manufacture of numerous collectors will reduce unit costs as well. David Gay noted that the cost of a collector used in Taiwan is ~\$6,000, but Mark Olson responded that the collector in question is patterned after the MIC-B sampler, which is not approved by NADP (due to splash considerations). Richard Tanabe contacted Xancom about price.
- Greg asked about Xancom. Richard described it as a small company filling a niche market. Owner is ~ 50 years old and will likely manufacture the collectors into the future. Mark Olson noted that NCON is not necessarily a stable company, and an alternative vendor is needed. Mark recommends purchasing the prototype, replacing its sensor with one used on NCONs to remove that component of variability, and compare the performance of the Xancom and NCON collectors. Greg concurs that the sensor on the Xancom unit is acceptable, but that using a common sensor for the comparison makes sense. Greg asked about the mechanical performance of the D400 units. Response: Some issues have been observed with collector wiring, but the motor is fine. It is operated by a sealed linear actuator.
- David Schmeltz inquired about approaching NCON to acquire the manufacturing rights to their technology to bring the samplers into the network. Richard said that this has not been done. David Gay suggested that NCON could sell the manufacturing rights to the collector to Xancom. David Schmeltz asked about other users of NCON collectors. Response: Eric Hebert says that they are used for water quality, Greg said that NEON uses NCONs. Greg supports testing the prototype collector but urged the PO to retrieve collectors from inactive sites to maximize their utility. Mark Olson said that Richard has pursued this and will continue to do so. Greg suggested a renewed effort. Mark Olson agreed but this is a separate issue, and the PO needs to test a new collector.



**Motion: To authorize the Program Office to purchase an ECCC modified D400 model collector for testing. Cost ~ \$9.5K**

**So moved by Richard Tanabe, seconded by Mark Olson**

**Motion approved**

14. CASTNET Update – Melissa Puchalski (EPA CAMD)

- Introduction:
  - Some reorganization within EPA/CAMD
    - Melissa, Greg Beachley David Schmeltz, Tim Sharac, Taylor Macy working on CASTNET
    - Also integrated the surface water monitoring program into the group, with Jason Lynch, (Melissa –others? I couldn't hear all the names)
    - Together constitutes the Monitoring Group in OAP
    - Work closely with John Walker (scientific collaboration)
    - Wood operates the network
- Funding
  - EPA monitoring budgets are not increasing
  - CASTNET funds are allocated for air monitoring network, NADP (NTN, AMoN, PO QA) and independent audits for CASTNET and NADP including regulatory audits
  - CASTNET's R&D budget has been reduced to \$0 to keep sites operating
  - Aging equipment and infrastructure strain the already tight budget
  - In 2019 \$1 million rescission to program office in the science and technology funding
  - Budgetary constraints are being felt in the network now
- Extreme weather/political events
  - Beaufort, NC (BFT142/NC06) hurricane Florence caused \$30,000 damage & 6-months lost data
    - Tower and shelter were lifted off the base. Shelter was elevated to prevent further flood damage during repair trip
    - Rain gage is being shipped to ETI for repair
  - Sumatra, FL (SUM156/FL23) hurricane Michael caused \$4,000 in damage & 1-month lost data
    - Repaired damaged NADP rain gage
    - Restored power
  - Government shutdown (12/22/18 – 1/25/19) impacts affected sites:
    - ACA416, BAS601, BBE401, BUF603, CHA467, DUK008, EVE419, FOR605, GLR468, GRB411, GRC474, JOT403, LAV410, MAC426, MEV405, NEC602, PAR107, PET427, PIN414, ROM406, SEK430, SHE604, THR422, VOY413, WNC429, YEL408, YOS404 – lost ~5 weeks of data
    - 25 sites lost 6-weeks data. GRC474 and YEL408 only 4 weeks. There were impacts to trends especially in the Western US for Q1. Most sites kept ozone running.
    - EPA sites were okay because it kept contract running, and Wood had funding to keep operating and stretched the funding by moving calibration trips, repair trips, charging to other studies and reaching out to operators directly to keep things running.
    - Approximately 158 site-weeks of data lost
- Network overview
  - Currently 96 monitoring sites
    - Eighty two sites measure regulatory O<sub>3</sub> to support NAAQS
    - Six tribal monitoring sites
    - NPS operates 27 sites; BLM-WSO operates 5 sites
  - Jan. 2018 NPS added ZIO433, Utah (ozone only)
  - May 2019 closing HOW191, ME special studies site at Ameriflux site tower and relocating O<sub>3</sub> equipment to DUK008, NC
  - NPS adding Death Valley, CA; Craters of the Moon National Monument, ID; Carlsbad Caverns National Park, NM; and Grand Teton National Park, WY in 2019 (ozone only)
  - Network is supported by Wood (EPA) and ARS (NPS/BLM-WSO)
- Trends in ambient concentrations

- CASTNET has tracked changes in ambient concentrations and dry & total deposition since 1990
  - Provides accountability for EPA emission reduction programs (acid rain, transport rules, NAAQS, etc.)
  - Became a regulatory O<sub>3</sub> network in 2011
  - Most CASTNET sites are co-located with NTN and AMoN to provide estimate of total N budget
  - Document concentration reductions for O<sub>3</sub>, total nitrate, SO<sub>2</sub>, etc.
- What value does CASTNET provide?
- CASTNET total deposition estimates
  - To estimate dry deposition, combine concentration measurements from the network
  - Interpolate concentrations
  - Apply modeled deposition velocity data
  - Combine with AIRMoN and NTN Prism surface
  - Add unmeasured species to derive total deposition
- Nylon filter testing continues
  - Pall discontinued manufacturing Nylasorb filters used to measure HNO<sub>3</sub> and SO<sub>2</sub> by CASTNET, CAPMoN and EPA's Chemical Speciation Network (CSN) in 2017
  - Wood and Environment & Climate Change Canada have been evaluating and testing MTL nylon filters
  - Washing of filters has been done in-house
  - MTL SOPs and DI systems have been updated
  - Newest batch of filters have passed acceptance testing for CASTNET and CAPMoN but labs will continue to test batches
- Ozone design values
  - CASTNET measures ozone at regionally representative sites characteristic of rural areas
  - Differentiates the CASTNET O<sub>3</sub> measurements from state-operated monitors in urban areas
  - Calculated as the 3-year average of the 4<sup>th</sup> highest 8-hour daily maximum concentration
  - CASTNET measures year round regardless of the O<sub>3</sub> season
  - CASTNET follows 40 CFR requirements for regulatory monitors
- Trends in ozone concentrations
  - Evaluated by Eastern and Western regions in the U.S.
  - NO<sub>x</sub> reduction programs in Eastern US have resulted in lower O<sub>3</sub> concentrations at the highest end of the concentration distribution
  - Trends not as pronounced in the Western U.S.
  - Increase in background ozone due to international transport, climate change issues (faster photochemistry at higher temperatures)?
- Drivers of O<sub>3</sub> formation in rural areas
  - NO<sub>x</sub>, NO<sub>y</sub> measurements at several CASTNET sites
  - Correlation between diurnal increases in O<sub>3</sub> and in NO<sub>x</sub> oxidation products (NO<sub>z</sub>)
  - NO<sub>z</sub> made up of alkyl nitrates, HNO<sub>3</sub>, NO<sub>2</sub>, etc. Alkyl nitrates have been shown to correlate well with ozone production during average summer periods
  - During exceedances oxidized nitrogen increases with ozone
  - NO<sub>y</sub> – NO (NO<sub>z</sub>) contributes more during high ozone periods
  - Studies have shown during elevated O<sub>3</sub> levels, NO<sub>y</sub> increases but NO<sub>x</sub> remains fairly constant – what non-speciated precursors are driving the O<sub>3</sub> increase?
  - EPA urges researchers to use EPA data to investigate air quality issues because staffing, funding, and workload challenges limits CAMD's ability to do this.
- AMoN site characterization flux study
  - Develop a methodology for using 2-week average AMoN concentrations in a bi-directional NH<sub>3</sub> flux model
  - Provide NADP with a model for calculating net and component fluxes
  - Inform the use of AMoN measurements in TDEP maps
  - ⊖ Field sampling complete (Phase I) – 2017/2018: measured met, chemistry of soil & vegetation samples (~~Melissa correct??~~)
    - Bondville (agricultural site)
    - Chiricahua National Mon. (range land)

- Duke Forest (natural hardwood forest)
- Met measurements: 3D wind components, Solar radiation, temperature (2 and 9m), wetness, wind speed and direction (hourly average)
- Soil conditions: moisture and temperature (hourly average)
- Soil chemistry: moisture, NH<sub>4</sub><sup>+</sup>, NO<sub>3</sub><sup>-</sup>, pH at 15 locations per site; 5 soil cores within 1x1 m plot, separated by O and A horizons (seasonally)
- Vegetation structure: LAI at 15 locations (seasonally)
- Vegetation chemistry: bulk leaf and litter: moisture, total N, NH<sub>4</sub><sup>+</sup>, pH at 15 locations per site; 50 g leaf litter collected (upper & lower canopy); green leaves from 3-5 trees (seasonally)
- o Currently processing sonic anemometer and LAI data; QA'ing laboratory data
- o Model development (Phase II) – 2019/2020
  - Parameterize flux model using vegetation and soil chemistry data from field campaign and literature
  - Assess model sensitivities to biogeochemical & meteorological inputs
  - Develop method for use of 2-week AMoN concentrations
  - Standardize model for implementation across AMoN
- Total reactive nitrogen (TRN) system deployed at Duke Forest, NC
  - o Moved TRN system to the tall tower at Duke Forest in 2017
  - o Heated inlets/converters at sampling height of 30 m
  - o Measures NO<sub>y</sub>, NO<sub>2</sub>, HNO<sub>3</sub>, NO<sub>z</sub>, and NH<sub>x</sub> hourly
  - o Data from EEM/Tdep NH<sub>x</sub> paper show expected increases in NH<sub>x</sub>, summer to winter at Duke Forest and other suburban, forested, coastal, and agricultural sites
- Priorities going forward: Improvements to total deposition of reactive nitrogen
  - o Co-authors of Tdep White Paper and several papers in the STOTEN special edition and EM
    - Using these papers as a framework for prioritizing research
  - o Collaboration with John Walker of EPA/ORD to design low-cost gradient flux system
  - o Integrating CASTNET data/QC systems with flux measurements at Duke Forest
  - o What else can be measured in CASTNET extracts or filters?

#### 15. CAPMoN Update – Rosa Wu (Environment & Climate Change Canada)

- Network Structure
  - o Precip chemistry to calculate wet dep (daily; similar to NADP/AIRMoN)
  - o Filter pack measurements of trace gases and aerosols (similar to CASTNET, IMPROVE??)
  - o Mercury in precip (similar to MDN)
  - o Total gaseous mercury
  - o Ozone
- Status of NADP sites
  - o Mercury Deposition Network:
    - Continue to maintain 5 sites: BC16 (Saturna); SK27 (Pinehouse Lake); ON07 (Egbert); NS01 (Kejimikujik); NF19 (Stephenville)
    - Potentially re-starting Total and MeHg measurements at AB33 (Fort McKay South)
    - Plan to replace ETI gauges with Ott Pluvio at MDN sites
  - o Ammonia Monitoring Network:
    - Continue to maintain 3 sites: SK27 (Pinehouse Lake); SK28 (Flat Valley); NS01 (Kejimikujik)
  - o National Trends Network:
    - Maintain CAN5 Frelighsburg, co-located with CAPMoN
    - There is also a CAPMoN site at Penn State co-located with NTN
- New site online at Jousard, AB
  - o Operator: C. Ross
  - o Start Date: 2018-05-28
  - o Ozone, air concentrations, precip (weekly collection)
- Site in progress: Bratt's Lake, SK

- Planned measurements:
  - Weekly precipitation measurements
  - Air filter pack
  - Ozone
  - Ammonia
- Transition of some CAPMoN sites from daily to weekly precip collection
  - Majority of sites still collect precip daily
  - Three sites were converted to weekly operation 2 years ago: Wood Buffalo NP, Algoma, Lac Edouard
  - Chapais was converted to weekly operation in 2018
  - Jousard, AB is a new site that will operate as weekly
  - Evaluation of other sites for transition to weekly operation (Rosa –others?)
- CAPMoN laboratory update
  - In 2018, the lab analyzed:
    - 5754 precipitation samples
    - 6968 air filter packs (20904 filters)
  - Participation in PT studies
    - Approximately 10% of all samples are related to quality control
  - Instrument replacement (pH Meters, IC systems replacement) and associated testing
  - Nylon filters
    - Working with EPA and Wood to evaluate nylon filters
    - ECCC washes nylon filters in house
    - Working closely with MTL supplier to develop SOP for washing by the vendor, with sporadic testing by ECCC to verify compliance with their lab standards
  - New analytes of interest
    - Interested in organic acids: ECCC noted differences in pH when transitioned from daily to weekly sampling. Possibly related to organic acids
    - Will collect samples for testing using twin D400 collectors at ECCC instrument compound at Downsview, ON site
- Field operations update
  - Hood Gasket
    - Seals the collector lid to the bucket when closed
    - SOP to date has been to replace the gasket on the first Tuesday of every month
    - Seals are not reusable, can get expensive
    - Investigate new materials to reduce waste and cost
    - New SOP is to repackage seals with Teflon sheets and redeploy
    - Now replace at 6 months, with weekly wipe downs
    - Extensive validation of SOP to ensure no effects on samples
  - Precipitation:
    - Deployment of Ott Pluvio gauges – priority to deploy at weekly sites as there are no longer daily visits by site operators, requires additional info from e-gages
    - Deployment of D400 precipitation collectors
    - Will swap out collectors upon site visits
    - 3-4 sites completed; transition will continue
  - Plans
    - Paperless sample history forms (electronic data capture, reduce shipping & cost)
    - Better metadata collection and collation to simplify QA/QC process
- Ecosystem Health Indicator
  - Data analysis and development effort led by Amanda Cole and her team
  - As part of the Addressing Air Pollution Horizontal Initiative, the federal government will contribute to the shared outcomes of “Canadians have clean air”; and “Adverse impacts on human health and ecosystems are reduced”
  - Performance indicators focusing on human health have already been developed (% of Canadians living in areas where air quality standards are achieved)

- Performance indicators also required for ecosystems to track that adverse impacts on ecosystems are reduced
- Proposed indicators all relate to acidifying pollutants, specifically Sulphur and Nitrogen, as represented by the exceedance of the critical loads in aquatic or terrestrial systems
- Critical load exceedance estimates
  - Amanda has used CAPMoN data Adagio products to calculate wet and dry deposition of S and N and assess for critical loads exceedance
  - Critical loads are exceeded over 7% of the total area of Canada
  - Lakes are much more fragile than soil and 45% of the sampled lakes are in exceedance
  - Meet with critical loads and deposition experts to discuss considerations with the data and recommendations for most useful indicator
  - Determine best option for single value indicator or a couple of indicators
- CAPMoN scientific assessment
  - Review the science and policy drivers for the monitoring conducted by CAPMoN
  - Is the network still meeting the relevant science and policy needs? Is it positioned to address upcoming science/policy questions?
  - Guide/document for network-related activities and decisions moving forward

#### 16. NADP paper archives - Mark Olson (PO)

- In moving the Program Office from UI to WSLH
  - 67 banker boxes of paper archives were transferred from UI to WSLH
  - Storage capacity has been reached
  - Policy uncertainty, how long to keep them – do we dispose of paper? When?
  - We scan all paper documents, since 2000
  - Gaps in scanning files, early to mid '90's to 2000
  - File Structure; Network\Sites\Year
  - 4 networks, hundreds of sites, dozens of years; at one folder per year per site, 1000s of folders
  - Need to formulate a policy to treat/dispose of paper records
    - For example we have every AIRMoN document ever collected
    - Belfort charts, etc.
- Old policy
  - Policy was learned by word of mouth, with some documentation within CAL
  - PO would save paper for 3 years, then Bob and Roger would dispose due to space issue
  - Once UI library was made available to the PO, disposal ceased and records were stored there.
  - CAL policy was to save paper for 2.5 years, then disposed of them
- WSLH Environmental Health Division policy
  - Save paper records for 6 years then dispose
  - Send records to State archive
  - Access to files after 48 hours of transfer
  - State will dispose of records at end of calendar year of the 6-year term
  - Documents are accessible until disposal
  - All records will be held for 12 months by WSLH
  - Then sent to State archive where they will be held for 5 years
- Proposal
  - Continue to scan all paper documents
  - Hold paper records internally for at least 12 months then pack for State archive storage
  - State will dispose of records after an additional 5 years
  - PO will access files as needed
  - NADP will follow EHD RDA which requires a minimum of 6 year retention of all associated records after testing is complete unless otherwise instructed by the NADP Executive Committee.
  - ALL original site files (site surveys, etc.) will be retained in the PO indefinitely

**Motion by Mark Olson to Adopt WSLH Environmental Health Division (EHD) records storage and disposal policy for all NADP sampling paper records.**

**Procedure:**

**Continue to scan all paper documents**

**Hold paper records internally for at least 12 months then pack for State Archive storage**

**NADP will follow EHD RDA which requires a minimum of 6 year retention NADP**

**Executive Committee**

**All site files will be retained in the PO indefinitely**

**So moved by Greg Wetherbee, seconded by Amy Mager**

Discussion:

- Bob Larson stated that the 12 month retention timeline by the PO may not be sufficient. Data for previous year is typically done after 18-21 months. In the case of a bad scan of a document, one has to go back to the original paper records.
- Mark Olson replied that the 12-month deadline is a loose one and could be pushed to 18 months, and would retain all scanned records.
- Eric Hebert was asked about the length of time that operators keep paper records on site. He stated that for a lot of sites, such as CASTNET, the records can date back to the installation of the site.
- Richard Tanabe said that NADP specifies a 24-month hold for the on-site copy.

**Amendment:**

**Hold paper records internally for at least 12 months after the end of the calendar year.**

**Motion approved.**

General Discussion:

- Greg Wetherbee stated the urgent need to formulate a plan to ensure that NADP networks maintain function in the event of future government shutdowns. This threatens the viability of the networks. To begin, every site needs to have in place a backup operator who is not a federal employee. There must also be sufficient prepaid postage on hand to allow sample/supply shipment without violating the Anti-Deficiency Act.
- Mike Olson responded that he will give a talk on this topic and suggested continuing the discussion there.
- Melissa Puchalski pointed out that site access (e.g., national parks) often prevented sample collection. Greg suggested there might be work arounds.

**Motion to Adjourn: So moved by Tom Butler, Mark Olson, and Pam Padgett**

**Motion approved**