

# IMPROVE Steering Committee Meeting

November 1-2, 2016

Santa Fe, NM

*(1<sup>st</sup> part of 2<sup>nd</sup> day held in conjunction with the NADP Annual Meeting)*

Major discussion topics:

- Network Review
- Laboratory Review and Methods Development
- Data Processing, Distribution and Quality
- Regional Haze / Data Analysis
- Data Analysis
- IMPROVE Business
- Topical Presentations with NADP

## *Network Review*

- Optical, Scene Monitoring
  - 11 nephelometers in operation, all LED-based
    - 4 are “self-service” where the NPS staff maintain (except for annual)
    - 7 are “full-service” that ARS (Air Resource Specialists) maintain
    - 2-year service interval to save costs
  - Arizona DEQ donated 14 nephelometers and 17 data loggers
    - These are newer than existing IMPROVE nephelometers and the data loggers have twice the storage capacity
    - Working on modifying and integrating into network as time and monies permit
  - 21 camera sites operational in 19 parks
    - Over 10 million hits on NPS website, over 8 million to the cameras page
    - 40% of these are mobile users
    - [www.nature.nps.gov/air/webcams/index.cfm](http://www.nature.nps.gov/air/webcams/index.cfm)
  - 30 sites in USFS camera network
- QA-Field Audits
  - Derek Day is the new QA person for IMPROVE field audits
  - Plan is to visit sites at least once every 5 years
  - Using 2 TetraCals to get replicate samples, plus magnahelic readings, to look at uncertainty over time
  - 4 external groups/states currently doing field audits
  - 3-4% error as overall average
  - Auditor training/certification program to be re-started
    - Spring 2017 for CO, AZ, CA auditors
    - Fall 2017 for east/SE US
- Aerosol Monitoring Network Status (UC Davis)
  - Yongjing Zhao is the new field manager
  - 2 new sites in the works: Wisconsin (tribal), Carlsbad Caverns
  - Data deliveries ~7-10 months behind

- XRF analyses being done within 1-month of receipt
- 94-95% data recovery
  - 5 sites in 2015 missed meeting the 3 RHR completeness criteria
  - 2-4 sites so far in 2016
- Doing more full site safety checks, especially electrical and fall hazards
  - Checklist being developed for use by other auditors
- Relative humidity control in UC Davis lab is still a problem
- Sampler re-design mostly complete
  - More modular for electronic components
  - New controller board that is simpler and much cheaper
  - Larger 7" touch screen with redesigned interface
  - Testing underway
  - Start some installations in 2017
- Working on new lab data management system transition from FoxPro to SQL with .NET applications
  - More efficient and flexible
  - Finalize transition by end of 2016
- CSN and IMPROVE OC and EC measurements are comparing well
- Seeing decrease in Ni and V due to low-sulfur bunker fuel regs

### ***Laboratory Review and Methods Development***

- Ion Analysis (RTI)
  - New data review process and new database
  - Duplicate precision ~1.6% on average for nitrate, 1.1% for sulfate
  - Now doing routine filter re-extractions on a select number of filters to look at extraction efficiency
    - Generally 95% or better except nitrite at 91%
  - MDL method needs evaluation on what is best/correct to do
    - Current IMPROVE MDLs based on field blank analysis, not instrument DLs
- Improve Carbon Analysis (DRI)
  - New "Model 2015" to has replaced obsolete "Model 2001" system
    - Smaller, lower cost and more efficient...uses off-the-shelf components
    - 7 wavelengths (from 405-980 nm) instead of 6
    - NDIR CO<sub>2</sub> detector instead of methanator and FID
    - 5-15% lower MDLs
    - Will have 13 in lab by end of 2016
    - Will be able to process up to 4000 samples/month
    - 142 parameters with 7 wavelengths plus supplemental laser information
  - Approx. 140 days from sample to reporting, should start dropping with new Model 2015 now on-line
- Additional Chemical/Optical Characterization
  - Working on using marker compounds in existing data to identify source types
  - EC<sub>405</sub>>EC<sub>635</sub> for woodsmoke impacted samples
  - BC almost 100% of diesel exhaust
  - BrC dominates over BC for smoldering fires, BC dominates over BrC in flaming

- Could add GC/MS to existing samples to get a lot more information
- With GC/MS, can derivatize samples to get more organics
- Use FTIR for organic functional group analyses
- Need better source profiles

### ***Data Processing, Distribution and Quality***

- IMPROVE/CSN Mega PE and TSAs
  - OAQPS now responsible for CSN and IMPROVE QA oversight for labs
    - Getting equipment set up in EPA lab
    - QAPP, SOP, DQO
    - Referee labs (current plan is to use ORD labs)
  - Mega PE Program is to evaluate lab performance and ID problems
    - Audit samples, TSAs
    - Gravimetric mass, IC analysis, TOR analysis, XRF analysis
- Environment Canada Monitoring
  - 4 visibility monitoring areas
    - 2 of areas include IMPROVE and speciation
    - Lower Frazier Valley has 7 sites: [www.clearairbc.ca](http://www.clearairbc.ca)
  - NAPS (Nat'l Air Pollution System) has 12 speciation sites
  - Monitoring started in 2003
  - NAPS vs IMPROVE
    - NAPS uses a little different equation than IMPROVE
    - Generally a good comparison, but some differences due to some different sampling methods and the different equation
    - High S in eastern Canada, high C and NO<sub>3</sub> in western Canada

### ***Regional Haze***

- RHR Metrics Reporting
  - New metric: impairment resulting from man-made air pollution
    - Need a humanly perceptible change
  - SO<sub>2</sub> the original issue, but fire/smoke and dust now dominate
  - New impairment approach:
    - Identifies natural events
    - Sorts days on impairment, not haze
    - Does not distinguish US vs international anthropogenic
  - With new metric:
    - Organic mass from fires reduced
    - Shift in baseline and glide slope
    - Nitrate likely to now show up as an issue in places
    - NOTE: Organics in eastern US are being reduced too much
- IMPROVEs ROLE in Tracking Changes in Visibility
  - Need a new IMPROVE report – last one was done in 2011
  - Need to tease out source contributions better for RH planning needs
  - Need to determine if speciated monitoring will ID any sources that states would not otherwise consider
  - EPAs RH guidance promises analysis help from IMPROVE

- Reconstructed Fine Mass
  - Gravimetric mass and RCFM trends are diverging – why?
    - FM/RCFM ratio varies by season
    - 2005-2008: FM<RCFM
    - 2011-2014: FM>RCFM
  - RH issues in UC Davis lab since 2011 possibly part of the issue and need to be ruled out

### *Data Analysis*

- Aerosol Derived Extinction
  - f(RH) accounts for hygroscopic growth for sulfate and nitrate
  - Calculated scattering (bsp-calc) minus measured scattering (bsp-neph) is decreasing at 8 of 11 sites over time
    - In late 1990s, bsp-calc/bsp-neph ~ 0.97
    - 2013-2015, bsp-calc/bsp-neph ~ 0.71
  - NH<sub>3</sub>SO<sub>4</sub> mass scattering has dropped as S has decreased
  - R<sub>oc</sub> increasing over time
  - Result: calculated scattering is underpredicting versus measured
- Future Priorities
  - Time for a new IMPROVE equation?
    - Will affect a report and other information
    - Different equations needed for different time periods as atmosphere changes?
  - R<sub>oc</sub> (organic multiplier) is trending higher and is seasonal
    - Need to look at R<sub>oc</sub> values for O1, O2, O3 and O4 individually by season?
  - Soil fraction is increasing
  - FM/RCFM is increasing
  - bsp-calc/bsp-neph is decreasing
  - Effect of SO<sub>4</sub> reduction may be overestimated
  - New RH metric emphasizes NO<sub>4</sub> and SO<sub>4</sub> more than in the past in the western US, no real change for eastern US
  - Influence of SOA and change over time
  - Can FTIR or other measurements help?
  - Lab RH issue
  - Filter storage issues
  - PRIORITIES FOR FOCUS:
    - New (3<sup>rd</sup>) IMPROVE equation?
      - understand and quantify R<sub>oc</sub> in space and time
      - new soil equation
      - new split component ext efficiency relationship
      - organic f(RH) function
    - Revise natural conditions targets (avg. haze nat. cond. III)?
    - Better data substitutions for missing/incomplete data?
    - Quantitative RHR metric uncertainty model?
      - (what is perceptible/measurable?)
    - Next IMPROVE report?

<p><b>Need to get input from States/Agencies on order of priorities for focus</b></p>
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- Workgroup to be created to look at issues
  - Outline of work needed to be developed
  - Resolve  $R_{oc}$  then move to the IMPROVE equation

### ***IMPROVE Business***

- Budget
  - New Carbon and Ion contracts awarded (cover 3 years)
  - 9 Protocol sites shut down over past year
  - Some site repairs funded
  - 4/1/2016 – 3/31/2017:
    - Budget \$5,947,287
    - Expenses \$5,562,259
    - Surplus \$385k
  - Projected cost-neutral for 2017-2018, ~ \$320k deficit for 2019-2020
    - Will need to revisit cost savings in a couple of years
- Website
  - New website built off WordPress now active
    - [www.vista.cira.colostate.edu/improve](http://www.vista.cira.colostate.edu/improve)
  - WinHaze being made into an online tool and will include GIS masking techniques
- QAPP
  - Has been revised as v 1.0 (dated 3/2016) and was signed
  - Will be fully revised every 5 years
  - Will receive interim updates as a living document
- Steering Committee Business
  - Scott Copeland the chair for next year
  - Next meeting: Northern Class I area (Minnesota?)

### ***JOINT with NADP***

- State of the NADP Network
  - Over 120 NADP sites
  - 260 NTN sites
  - 39 years of measurements
  - Increasing interest in urban wet deposition
    - Boston, NY City, Denver, Rochester NY, Birmingham AL
  - Will replace remaining analog rain gauges with digital systems in 2017
- Estimating Temporal Trends in Biogenic SOA
  - As S is decreasing, SOA formation is decreasing
  - Isoprene → IEPOX → SOA
  - More SOA at higher RH
  - Significant decreases in  $\text{NH}_3\text{SO}_4$  and POM in SE US over time
- Fine Dust in the SW US in Spring
  - Natural and anthropogenic (i.e. cropland) dust sources
  - More potential for dust with drought and increased land disturbance
  - Shift to earlier dust season by 7-15 days starting ~ 2007
    - Correlates to Pacific Decadal Oscillation shifting to a negative phase
  - Fine dust (calculated) contributes up to 51% of measured fine mass in SW US

- Especially in spring (March)
  - Also seen in Arabian Peninsula
- IR for Non-Destructive OC & EC
  - Current TOR method off quartz filter is destructive
  - Alternative is FTIR on Teflon filter to predict OC and EC
    - Non-destructive
    - Faster, ~ 5 mins/sample
  - FTIR spectra can also be used to measure functional groups, OM, other
  - Baseline-correct the data to eliminate the teflon filter influence
  - MDLs not too far off the TOR method
  - EC is noisier than OC
  - Will need to keep some TOR analyses to calibrate the FTIR predictions