IMPROVE STEERING COMMITTEE
2017 ANNUAL MEETING

Date: October 24-25, 2017
Location: Grand Ely Lodge, Ely, Minnesota

Time: 10/24: 8:30am – 5:00pm (Technical Session)
10/25: 8:30am – 12:00pm (Business Meeting)

IMPROVE Steering Committee members present:

Scott Copeland (Chair)	CIRA/USFS	scott.copeland@colostate.edu
Bret Schichtel	NPS ARD	bret.schichtel@colostate.edu
Jill Webster	USFWS	jill_webster@fws.gov
Joann Rice	EPA	Rice.Joann@epa.gov
Gordon Pierce	CDPHE	gordon.pierce@state.co.us
Bob Lebens	WESTAR	blebens@westar.org
Charles Turner	VDEQ/MARAMA	charles.turner@deq.virginia.gov

IMPROVE Steering Committee members not present:

Tom Coulter	BLM	ccoulter@blm.gov
Rick Saylor	NOAA	rick.saylor@noaa.gov
Heidi Hales	NESCAUM	heidi.hales@vermont.gov

Additional IMPROVE stakeholders present:

Ann Dillner	UC-Davis	amdillner@ucdavis.edu
Anthony Wexler	UC-Davis	aswexler@ucdavis.edu
Derek Day	CIRA	derek.day@colostate.edu
Emily Vanden Hoek	ARS	evandenhoek@air-resource.com
Jenny Hand	CSU/CIRA	Jenny.Hand@colostate.edu
Joe Adlhoch	ARS	jadlhoch@air-resource.com
John Vimont	NPS	john_vimont@nps.gov
John Watson	DRI	johnw@dri.edu
Judy Chow	DRI	Judy.Chow@dri.edu
Katrine Gorham	UC-Davis	kgorham@ucdavis.edu
Laurie Trinca	EPA	Trinca.Laurie@epa.gov
Margaret McCourtney	MN Pollution Control	Margaret.mccourtney@state.mn.us
Sean Raffuse	UC-Davis	sraffuse@ucdavis.edu
Tony Prenni	NPS	anthony_prenni@nps.gov
Tracy Dombek	RTI	tdombek@rti.org
Trent Wickman	USFS	twickman@fs.fed.us
Warren White	UC-Davis	whwhite@ucdavis.edu
William Malm	CSU/CIRA	wcmalm@colostate.edu

Additional IMPROVE stakeholders present remotely:

Nicole Hyslop	UC-Davis	hyslop@ucdavis.edu

DAY 1: OCTOBER 24, 2017

WELCOME AND AGENDA REVIEW

Scott Copeland opened with welcoming comments and introductions

NETWORK AND LABORATORY REVIEW

Optical and Scene Monitoring

Joe Adlhoch (Air Resource Specialists, Inc.) presented ***National Park Service Visibility Monitoring Network*** (see 01_Adlhoch_IMPROVE_2017). In Summary:

- Eleven (11) nephelometers currently operate in the network.
- Data capture over 90% for all sites. MACA was not operational for two weeks during shelter replacement.
- All landline phone communication has been upgraded to cellular or satellite.
- New shelters in place at Mammoth Cave and Acadia.
- Additional equipment is expected to be donated to NPS from Arizona DEQ.
- Webcams received more than 8 million visits, with 40% of those from mobile devices.
- New archive site gives access to images from the last 20 years.
- New web pages to display concurrent data are in development.
- Raw nephelometer data website is operating.
- Web-based WinHaze has been released and is mobile friendly.

➢ *Tony Prenni commented WinHaze would like to upgrade with high resolution images – if parks have images they could share, they will be gladly accepted and used.*

Network Update: Laboratory and Field

Katrine Gorham (UC-Davis) presented ***Network Update: Laboratory and Field*** (see 02_Gorham_IMPROVE SCM_10.2017). In Summary:

- 158 sites operational, including South Korea and Lake Tahoe
- New sites came on-line in Forest County Potawatomi Community, Wisconsin and Carlsbad Caverns.
- Removed sites from Quabbin Reservoir, MA and Gates of the Arctic, AK.
- Trinity site in California is back on-line
- All 2016 data had been delivered to AQS and FED.

- First semi-annual QA report was delivered in August. Next report will be delivered in January 2018 and will be available on the IMPROVE website.
- 3 broad categories of sites that did not meet RHR completeness requirements for 2017
    - Late sample changes
    - Equipment problems
    - Damage from weather events
- Two more sites lost due to funding/contract issues. More could be lost before year's end.
- Everglades and Hoover were rescued from becoming lost for 2017.
- Mitigating site loss can be aided by
    - Modified maintenance schedules
    - Better diagnosis of field issues
    - Updating aging infrastructure
- Every other year maintenance schedule may be resulting in greater number of site losses.
- New controller deployment has been completed for 9 sites and being tested in extreme (hot/cold) environments. Mass deployment to occur in 2018.
- New controllers are internet capable to allow remotes access, which aids in field testing and troubleshooting.

➢ *Tony Prenni asked how sites without reliable internet access will benefit from new internet capable controllers. Katrine answered that most sites will have some type of communication available, including hot spots and local access.*

Action Item: Jill Webster asked for the maintenance schedule to be provided in advance of maintenance visits so local agencies can work with operators to communicate and remedy known issues

- Field repair shipments were largely controller issues, followed by pumps and electronic boxes.

➢ *John Vimont asked if issues can be identified earlier. Katrine answered that usually issues are more complex than just one issue affecting data.*

➢ *Scott Copeland replied that several problems were from failing controllers – which is being addressed with new controller design – and other issues are worked through as time/resources allow.*

➢ *Bret Schichtel asked if spare pumps can be available on site or should they be replaced on a fixed schedule*

➢ *Scott Copeland responded UCD can be proactive by monitoring flow and getting ahead of the problem.*

- Eight sites have been identified to have field safety and fall protection issues. Most have been addressed – many with the use of harness/anchor system.
- Data advisory posted on website details the laboratory temperature/relative humidity chamber issues.

Quality Assurance – Field Audits

Derek Day (CIRA) presented ***IMPROVE Network QA/QC Results from field audits and initial work on identification of physically unreasonable data*** (see 03_Day_2017AuditPresentation). In summary:

- 2016 goals were to summarize and post audits results, have auditors use like and certified equipment, update audit forms and conduct audit training.
- Auditor training has been updated and posted on website.
- Audit forms have been revised and streamlined.
- Future work to include follow up on stand integrity, tree trimming, more audits, and video of audit procedures.

- *Bill Malm asked who is responsible for addressing audit findings. Answer: UCD is responsible for addressing operational issues during maintenance or with operator assistance. Sponsor agency is responsible for issues related to infrastructure like stands or support systems.*
- *Brett Schichtel commented that if an auditor has a major finding – UCD should be immediately notified to remedy*

Ion Analysis

Tracy Dombek (RTI) presented ***Ion Analysis*** (see 04_Dombek_IMPROVE 2017 Steering Committee_IonAnalysis). In summary:

- New team members and new laboratory space.
- Data reported within 60 days for 2016.
- Slightly behind pace for 2017 due to identifying contamination issues before releasing data to UCD.
- Filter re-extraction and reanalysis on nearly 400 samples began in 2016. QA results are within limits.
- 2017 MDL appears to be an instrument detection limit rather than a true method detection limit.
- Method blanks identify contamination in certain batches. The issue was traced back to lids and led to improved procedures.
- Software upgrades now have data automatically sent to the server via SQL.
- New software is better able to handle data directly from instrument to database and should limit data entry or data transfer errors.

- *Tracy asked the group if current QA analysis is sufficient, or should more comparisons be completed? Answer: good correlation shows new software is likely operating as expected even at the zero or near zero level.*

Update on IMPROVE Carbon Analysis

Judy Chow (DRI) presented ***Update of IMPROVE Carbon Analysis*** (see 05_Chowetal2017IMPROVESteeringCommitteeAnnualSumm). In summary:

- Samples beginning in 2016 have undergone multi-wavelength analysis.
- New analyzer (Model 2015) operational as of January 2016.
- Model 2015 was updated to increase throughput, add mixing chamber, minimize residual carbon, separate ferrule to prevent residual Teflon.
- Several types of mixing chambers were tested for optimization.
- Reporting time improved with new instrument. Approximately 5,000 samples per month can be analyzed.
- Many QC activities can be performed (40% of operations, as opposed to 60% of sample analysis).

➢ *Bill Malm asked what the delay is between replicate runs. Answer: within a week, but usually within a few days. No sample is ever out of refrigerator storage.*

- Method changes from FID to NDIR show small deviations.
- Low concentrations affected due to integration and analyzer differences.
- 2016 data will be reprocessed using reduced threshold (reduced to 0.72 from 2)

➢ *Judy asked group if reprocessed data with lower threshold should be resubmitted. Answer: yes*

Action Item: DRI will resubmit carbon data to UCD using lower threshold to be consistent with data from previous years

Quality Assurance – MEGA PE

Joann Rice (EPA) discussed recent activities related to the MEGA PE.

- New QA personnel have been hired.
- Building a manifold system that can take 32 samples at one time.
- Beginning in November, samples were sent to 7 laboratories, including CSN and IMPROVE for auditing.
- Last audit was performed in 2015.
- 72-hour samples will be collected at RTI.
- A systems audit will be part of the program.

Network Update: Data Validation and Software Infrastructure

Sean Raffuse (UC-David) presented ***Data Management and Validation Update*** (see 06_Rafusse_Data Management and Validation). In summary:

- A complete replacement of the legacy system began in 2014.
- Upgrades were required, as previous system was no longer sustainable.
- New software includes tools for lab analysts to catch and remedy issues sooner.
- Software contains tool to aid in validation.

Carbonaceous Aerosol FT-IR Measurements of OC and EC

Ann Dillner (UC-Davis) presented ***Characterizing Carbonaceous Aerosol in National and Regional monitoring Networks with FT-IR*** (see 07_Dillner_2017_10_IMPROVE Steering Committee). In summary:

- Fourier Transform – Infrared Spectrometry is a non-destructive fast technique which produces a lot of information.
- Working to develop calibration methods – TOR, lab standards or other information for OC/EC (OC working well, EC needs refinement).
- Data from IMPROVE and CSN (2011/2013) and data from all networks in 2017 analyzed to support this effort.
- Hybrid model using both standards to develop calibration.
- Bias appeared in data following laboratory move in 2016.
- Further analysis discovered bias was related to standards (lab filter with one chemical vs. lab standard based on ambient). Therefore, lab move did not introduce the bias.
  - *Bret Schichtel asked if samples were analyzed within the week to prevent aging issues.*
  - *Ann responded that moving forward samples will be stored cold to prevent aging/degrading issues.*
- Are separate calibration methods necessary for fire influences or locations like Elizabeth, NJ where fresh emissions from the tollway could be influencing factors?
- Multi-level modeling may be used to address issues related to calibration method and/or location.
- Type of filter changes also may influence calibration (Teflon vs. quartz), especially for EC.
- Developing calibration for functional groups.
- SEARCH monitoring was discontinued due to funding issues, but samples have been stored cold and may be used for functional group and OM analysis.
- Preliminary data shows potential decrease in OC beginning in 2010.

- Source apportionment studies for IMPROVE samples, tunnel study, wildfire and prescribed fires.
- Using non-destructive IR to develop calibration tools – work to continue.

Sulfur/Sulfate Ration Study

Tracy Dombek (RTI) presented ***Sulfur: Inorganic Sulfate Ratios*** (see 08_Dombek_IMPROVE 2017 Steering Committee SulfurSulfate). In summary:

- Looked at sulfur/sulfate ratio from IMPROVE data.
- Showed seasonal trends (more sulfur in summer and fall).
- Looked at various geographical sites (East vs. West vs. Midwest, etc).
- Only water soluble sulfur was measured.
- Different regional VOC contributions could be due to different vegetative species.
- Next step will be to compare 2016 IMPROVE data to study.

XRF Standards Development Leads to Vanadium Discovery

Nicole Hyslop (UC-Davis) teleconferenced in to present ***XRF Standards Development*** (see 09_Hyslop_ISC2017_XRFreferenceMaterials). In summary:

- Commercially available reference materials are limited for XRF.
- Calibration standards were not in the relevant measurement range and not made of appropriate materials.
- UCD developing its own standards that will be useful to analysis of interest.
- Standards for half of targeted compounds have been developed.
- Process is limited by availability of materials and balance of instrumentation.
- Having some success for lighter compounds, harder to achieve for heavier elements.
- Commercially available standards have not been replaced yet, but are being used to refine in-house standards development process.
- Tried aerosolizing commercially available multi-element solutions, which achieves lower ranges for heavier elements.
- Goal is to have one standard to use across all elements instead of running samples 24 times.
- Copper, zinc, and vanadium were outliers.
- Nitric acid used in multi-element solution was causing contamination by reacting with brass fitting
- Additionally, the standard we returned to the manufacturer for recalibration and was confirmed to be 40% high for Vanadium.

➢ *Warren White asked if interlab comparison showed high Vanadium with XRF?*

- *Nicole responded that answer in unknown. Micromatter said the batch was bad, but unsure of when problem was addressed by manufacturer.*

DATA ANALYSIS

Trends

Jenny Hand (CIRA) presented ***IMPROVE Data Analysis: Update on Gravimetric and Reconstructed Fine Mass Discrepancy*** (see 10_Hand_IMPROVE17_small). In summary:

- Trends indicate that fine mass (FM) has not decreased at the same rate as reconstructed fine mass (RCFM).
- Comparing 2005-2008 vs. 2012-2015, RCFM was overestimated.
- FM bias has increased.
- Ratios show increases beginning 2011 from $AmmSO_4$ (likely due to volatilization), OC, and dust.
- RH became variable following lab move in 2011.
- Analysis conducted to remove humidity influence to subtract from fine mass.
- Adjusted for particle bound water to minimize influences for $AmmSO_4$.
- Goal is to determine if changes are real or due to analytical differences or changes.
- Multiple factors:
    - Analytical
    - Seasonal
    - Particle bound water influences
    - Dust equation

- *John asked if ring on outside of filter is hydro-inert and a possible contributing factor in the weighing chamber.*
- *Nicole responded there is a very small effect.*
- *John: what about the mass of the fine compared to the mass of the filter.*
- *Nicole: the only mass that would be affected would be mass absorbed by filter, need to more accurately measure, was told it was a small effect and would not have changed over the years. Biggest effects were found in humid environments. Ring is almost identical to Teflon.*
- *Bret: We see seasonal variation in ROC factor. What spatial variation can be seen?*
- *Jenny: results are noisier.*
- *Bret: do we want to refine equation and change ROC factor? (would like to only make a change once).*

Update on Nephelometer Analysis

Tony Prenni (NPS) presented ***Update on Nephelometer Analysis: A Potential Approach for Correcting the IMPROVE Equation*** (see 11_Prenni IMPROVE Equation 2017). In summary:

- There is disagreement between measured and reconstructed light scattering.
- Measured scattering is under predicted, and getting progressively worse.
- Therefore, progress at many sites may be overestimated.
- Focus on small/large fractions for sulfates, nitrates, and organics for analysis.
- As concentrations have decreased, less aerosol is found in the large mode.
- Should the small/large split have a different denominator?
- Average mass scattering efficiency remain roughly unchanged as mass changes.
- Agreement has never been ideal in the west, but was good in the east in early years with higher concentrations.
- All sites show better agreement using 95% of annual mass distribution as the denominator in size split calculation.
- Can be too low for sulfate in some cases – moves into large mode and over predicts, while under predicting at higher RH.
- Comparison between RHR2 and hypothetical solution shows differences in glide slopes between methods.

➢ *Bill Malm commented dry mass scattering efficiencies are dependent on average size distribution and associated fRH.*

➢ *Brett Schichtel commented if size distributions have not changed in the last 20 years independent of concentration, why use the split mode? Would constant size distribution (seasonal or spatial) be more appropriate?*

Temperature Calibration of Thermal/Optical Carbon Analyzer

John Watson (DRI) presented ***One Year Survey of Brown and Black Carbon Contributions in the U.S.*** (see 12_Watsonetal2017IMPROVESteeringCommitteeBrownBlackCarbonUS). In summary:

- The most common way to discern black vs. brown carbon is via wavelength.
- Diesel is mostly black carbon, while smoldering fires are mostly brown carbon.
- Ratios of brown/black carbon are different for different parts of the fires (smolder vs. flames).
- Varies with different calculation methods (wavelength fit).

➢ *John Vimont asked why brown carbon peaks were seen during winter wood burning.*

➢ *John Watson responded that further refinement is necessary by site and specific fire activity.*

- *Scott Copeland asked if the brown carbon calculation occurs prior to data delivery to UC-Davis?*
- *John responded that it is a post-process step for now. Calculations will be provided and may happen automatically for future data deliveries.*

Carbon, Iron and Light Absorption

Warren White (UC-Davis) presented ***The Dance of Carbon, Iron, and Light Absorption.*** (see 13_White-Ely_Oct-2017). In summary:

- Blank measurements are needed for each sample because sample media is so non-homogenous.
- Samples with a M2 flag are indicative of mineral particles in deposit and red areas are noted on punch following carbon analysis.
- Comparison of total absorption against portion of absorption that was lost during analysis (presumably BC).
- Iron loading is a continuous metric that offers more information and corresponds to a percentage of M2 flags.
- Iron contribution to absorption leads to iron interference EC determination.

- *Bill Malm asked what are the implications for the IMPROVE equation?*
- *Warren responded some absorption is missing and some OC scattering is overestimated.*
- *Bret Schichtel asked if there are other dust effects or just iron?*
- *Warren responded it is hard to distinguish iron from other covarying elements. Are other dust elements being picked up by iron? Carbon and zinc are potential soot suppressors.*
- *Tony Wexler asked if urban sites have been separated, given the two different sources of iron (dust and combustion exhaust).*
- *Warren responded urban site were excluded for a more homogenous dataset in the presentation. No big differences were seen during the analysis.*
- *Trent Wickman commented it would be curious to compare the Boundary Waters and Voyageurs sites as Boundary Waters is near large iron mining activities.*

DAY 2: OCTOBER 25, 2017

DATA PROCESSING, DISTRIBUTION, AND QUALITY

IMPROVE Data and RHR Metrics

Scott Copeland (CIRA/USFS) presented a ***Update on IMPROVE Data, RHR Metrics, FED, QA*** (see 14_Copeland IMPROVE data). In summary:

- 2016 data are available on the FED website (http://views.cira.colostate.edu/fed/) – will be updated after DRI resubmittal of carbon data.
- New tools are available:
  - Ability to move map
  - Wet deposition data
  - CASTNET dry deposition data
  - Expansion of visualization tools underway
  - Accepting feedback if there are additional tools that would be helpful
- Guidance for calculating impairment metrics has not been finalized – therefore data are still considered DRAFT.
- 2000-2007 substituted data has been included in the database for the first time.
- Substituted data are flagged.
- Overall – clean days are getting cleaner (20% best days)
- Examples of disconnected data sets (Lye Brook site moved location) and can datasets be stitched together, combined in some fashion, or need to be treated as distinct datasets.
- EPA draft guidance suggests using first 5 years of data from new site for baseline calculation. (could result in baseline being quite clean).
- Requires buy-in from states, IMPROVE community, EPA, etc to make final decision on a case-by-case basis.

➢ *Warren White asked what conditions for moving a site trigger a new site code*

➢ *Answer – and move > 1 km or significant change in elevation requires a new site code.*

➢ *John Vimont commented the state is the ultimate decider and can combine data if they want to as long as the decision is documented and explained.*

➢ *Scott suggested IMPROVE could combine site data on state's behalf and possibly offer support and guidance for such decisions.*

➢ *John Vimont would like to see combined datasets flagged or identified in some way.*

➢ *John Watson commented that EPA would have to approve. Baseline conditions are important to states, guidance gives options for data handling, suggesting IMPROVE wait to weigh in until EPA feedback is received.*

- *John Vimont suggested cleanest path is to provide data both ways (datasets for individual sites and combined site) and document.*
- *Scott Copeland noted that a new site would not have the 5-year baseline period and therefore not be able to compute impairment metrics.*
- *Gordon Pierce commented that EPA would treat a similar situation with criteria pollutants as two separate sites. States would have to justify their position in SIP regardless.*
- *Scott Copeland noted that each site could be considered on a case-by-case basis, as combining data for some sites would be much more straightforward than for others. Suggests working with EPA regional offices for clarification and guidance. For a site to be eligible for merging it must not result in major changes to the dataset, changes in the baseline period, or changes in the end point goal.*
- *Bret Schichtel asked if glide slope should be determined by Class I Area instead of site.*
- *John Vimont responded they should be considered on a case-by-case basis.*

Judging Visual Air Quality

Bill Malm (NPS) conducted a visual air quality perception study using images from Great Smoky Mountains National Park. The goal of the study is to develop a quantitative method for assessing human judgements of visibility conditions using the webcam images themselves with the goal of using this metric to reflect perceived visibility on the webcam page, and to quantify the distribution of perceived visibility conditions for the webcam image of interest.

BUDGET

Budget Analysis

Tony Prenni (NPS) presented the current status of the IMPROVE budget and expected funds for the next contract year.

IMPROVE Steering Committee Business

Scott Copeland led a discussion regarding IMPROVE business updates and upcoming priorities.

- Two main topics of discussions for work to be done in the next year were
    - Should the IMPROVE algorithm be refined
    - Preparation of another IMPROVE report

- *Any changes to the equation would need to be completed in time for states to use in SIPs and planning and understand how the SIP process would be impacted.*
- *Some states are planning to submit SIPs in 2018, others will wait until 2021.*
- *Some states will wait to make decision until the guidance is finalized, if possible.*
- *Work should continue to identify areas of improvement in the equation.*
- *The IMPROVE report has not been updated for some time. A revised report could summarize work that has been done without providing recommendations, but this would take resources away from finalizing analysis on equation.*

- Scott indicated that he was available to continue as chair of the committee

Hearing none opposed, Scott Copeland was retained as Chair of the IMPROVE Steering Committee.

- Discussion was opened regarding the location of next year's meeting location.

- *Suggestions include Colorado Front Range (Golden or Estes Park), the FWS Saint Marks site in Florida, or Point Reyes.*