



IMPROVE Steering Committee 2024 Annual Meeting

Date: October 29 - 30, 2024

Location: Bosque del Apache National Wildlife Refuge

Time: 10/29 8:30am – 3:45pm & IMPROVE Site Visit
10/30 8:30am – 10:30am

IMPROVE Steering Committee members present:

Name	Agency	Email
Jay Baker	WESTAR	jbaker@westar.org
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Additional IMPROVE stakeholders present:

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INTRODUCTION & WELCOME

Scott Copeland opened with welcoming comments and a brief review of the agenda.

NETWORK & LAB REVIEWS

Optical & Scene Monitoring Network Status – Mark Tigges

Visibility Monitoring Contract Updates

- All Optec NGN2 Nephelometers operated in this network have been shut down
- 2WINS have been integrated into 10 sites and the 2024-2025 scope of work includes data validation and reporting (to be submitted to Sean McClure)
- Network challenges for the coming year include limited travel budgets, shelter upgrades, and reintegration of instrumentation at several sites
- ARS has developed a new web application to allow clients, site operators and ARS staff to efficiently review near-real-time data, pollutant plots, checklists and logbooks, past maintenance and calibration trip reports, administrative contacts, and more; 2WIN support for this application is currently being added

Discussion:

- Mark: There were five shelter replacements on the last contract and there will be two more on the next contract. ARS to discuss moving IMPROVE at Canyonlands with UC Davis.

IMPROVE Carbon Analysis Update – Judy Chow

- DRI's Environmental Analysis Facility (EAF) continuously operates 10-13 Model 2015 Multiwavelength Carbon Analyzers
- The carbon backlog has decreased in the last year from just over 7,000 samples to just under 5,000 samples
- 25 mm QAT-UP filter diameters are now being measured before and after pre-firing; lot-to-lot variation was reduced to 0.08 mm which is similar to within-lot variation.
- No filters were rejected/returned to Cytiva.
- Filter diameters are more consistent after pre-firing; DRI has begun to revise SOPs to include diameter
- Will do 2% out of 100 filters

Discussion:

- Bret: How many months does a 400-500 filter backlog take to process?
- Judy: It depends on the schedule and student-availability. They can do about 1,800 per month but receive about 1,500 per month. Judy will push to finish. Winter weather and government shutdowns slow processing down.



Recent Carbon Research – John Watson

Microplastic and Biomass Burning Profiles with a Photoionization Time-of-Flight Mass Spectrometer (PI-TOFMS)

- A Photonion Photoionization-Time of Flight Mass Spectrometer (PI-TOFMS) system has been interfaced with the DRI 2015 Carbon Analyzer; it uses high intensity lasers for soft ionization of volatilized molecules from the carbon analyzer. It's currently being used to examine the profiles for different microplastics.
- Initial tests show vaporization at different temperatures for different plastics, but they're within the OC3 fraction for the most part.
- Biomass laboratory burning tests are examining profiles for fresh and aged emissions. Fresh and aged burn archived samples will be analyzed for comparison.

Discussion:

- Bill: How sensitive are molecular structures to laser intensity?
- John: It has more to do with wavelength; not as fragmented as electron impact ionization. Sometimes molecules are ripped apart, which is an issue. We're still learning the best way to do this.
- Bret: Data seems to show plastics evolving between fractions. Can you change the thermal profile to see more?
- John: We can possibly divide them up within fractions to isolate the materials.

Network Update – Nicole Hyslop

UC Davis 2024 Network Update

- Field team visits half of the sites every year; nearly all visits are done for the current year.
- In April 2024, the XRF lab will return to "old" protocol and add the KBr target back for better As detection.
- There are seven sites that have failed for RHR completeness in 2024 so far.
- Active flow control has been deployed to half of the network and will be finished next year. It's been difficult to find a replacement for the old model AC pumps for PM₁₀ modules; options are still being tested.
- Clogging protocol to stop sampling if flow rate falls below 15 LPM for more than 15 minutes is in place and has been working well so far. A short duration (SD) flag is applied to these samples.
- There is continued interest in IMPROVE sample archives for looking for (COVID) virus DNA, studying biologicals from natural disasters, and other uses. There is an interest in refrigerated samples, but no money for that at this time.
- The existing HIPS has one wavelength (633 nm); the lab is now testing a multi-wavelength HIPS (450, 553, 633, and 730 nm) which was used to analyze filters between October 2023 and April 2024. The new sampler allows for less handling and moves light absorption measurement up in the timeline to after weighing so filters are fresher and not cracked. The precision looks pretty good between the mono and multi-HIPS.



- Testing on undersized quartz filters has shown that any flow variation caused cannot be detected.
- The XRF QC pages now include replicates and failure alerts.
- PM_{2.5} cut point testing has been done to determine why collocated data have large differences in soil-derived elements at soil-dominated sites; however, testing is currently on hold.
- Testing is still underway to compare HIPS measurements on Pall versus MTL filters. The issue seems to be related to filter lots. Tests include:
 - Light absorption – data has not been analyzed yet
 - Optical consistency – no change
 - MTL filter mass gain – related to ring material (static charge)
 - Pixelated deposits – underway
 - Pore size – currently testing 2 µm pore size (what CSN uses) in Fresno
- In cross-network studies between IMPROVE and CSN we've found IMPROVE may underestimate sulfur at high concentrations when filters are damp. There is poor agreement between sulfur and sulfate. We believe it may be because the filter ring is less hydrophobic than Teflon, so water is migrating out to the ring. In addition, decreasing sulfur concentrations are making XRF measurements difficult for sulfur. The Bruker instruments may improve comparison between CSN and IMPROVE for sulfur.

Discussion:

- Bret: The new pumps don't work for the PM₁₀ module?
- Nicole: They work, but we want a cheaper option. We're using old PM_{2.5} pumps, but at some point, those all need to be replaced.
- Tony W: For PM₁₀ there is no flow control like there is for PM_{2.5}. It's measured by the pressure drop across critical orifices.
- Bill: Why is there a bias between 450, but not 633 in the multi- to mono- HIPS comparison?
- Nicole: 633 is the same wavelength on both instruments.
- Bret: Do new DC pumps last longer?
- Nicole: We don't know yet
- Yongjing: We've been testing for 5 years at Denali and Point Reyes. Old DC pumps are lasting 10 years, but new ones are only lasting 1 year so now we're trying to find another replacement.
- Bret: Do you see the same bias for sulfur/sulfate? Is the lost of sulfur similar to the problems in the southeast sites in the 1990s?
- Nicole: Yes, then we used masks on filters and believed S was migrating below the masks. It may be similar to what's happening now.
- Bret: Are the filters pixelated?
- Nicole: We haven't looked yet. Warren wants to get pictures when the instrument is up.



- Tony: Would you recommend RHR look at the sulfate measurement instead of sulfur [due to discrepancies between IMPROVE and CSN]?
- Nicole: We've been looking at CSN; loadings are so much lower. We don't see the same bias in IMPROVE as CSN.
- Bret: The IMPROVE equation, and how it's constructed is guidance, not regulation.

Ion Analysis – Tracy Dombek

- The MDL for nitrate and sulfate increased because the process changed to follow the new CFR. It is generally a more robust process.
- The calibration ranges were established a long time ago, so RTI includes a QA sample to give an indication of how we're doing.
- Total Nitrogen Research includes measuring a sample for inorganic ions and Total N.
- Field blank measurements primarily ON
- Need to do adjustment of data because background on filter
- See reasonable comparability between sites located nearby
- Total organic and inorganic proportions compared between nearby CSN and IMPROVE sites show good agreement.

Discussion:

- Bret: What season?
- Tracy: June

- Tony: Do you see smoke impacts?
- Tracy: Not sure, haven't looked yet. Going to keep doing analysis and be more selective on phosphates and orthophosphates as well.

- Bret: Jeff Collett did soluble nitrate study at Rocky and saw about 5-10%. If we are seeing 20-50%, that is really large. It might be worth discussing with Jeff, or doing some cross-lab experiments.
- Tracy: It is. We still have a lot of questions.
- Bret: Can you look at high nitrate samples at MACA and GRSM this winter? In the next month?
- Tracy: Yes, we keep samples for two years.

ANALYTICAL DEVELOPMENT

FTIR Autoloader – Yongjing Zhao



- The current FTIR analyzer requires manual filter loading of a single sample.
- UC Davis has developed a prototype of a sample autoloader that has an input silo that holds 50 filters. If effective, this will greatly reduce sample analysis time and remove the need to have an individual place every sample prior to analysis.

XRF Measurement Consistency – Nicole Hyslop

Evaluation of New XRF Instruments

- The PANalytical Epsilon 5 XRF instruments used to analyze CSN and IMPROVE samples will need to be replaced in the next few years. Three new Bruker Puma XRF instruments are currently being tested for CSN samples and being integrated into lab operations.
- The foremost challenge is that the Pumas are primarily used by industrial and extraction industries using bulk concentrated samples, while IMPROVE/CSN samples are small. It's difficult to get the manufacturer to help with low concentration measurements.
- The Pumas have better detection limits but can damage samples. The spectral software is also inadequate, but PymcaR offers a reasonable solution and is being tested with the Puma.
- The Puma is better at the low end of the spectrum and the same in the middle. It's not good for In or Sn, but we don't see those a lot.
- Intercomparison of XRF replicates is difficult as there is repeatable noise.
- Elements that are precisely measured on the existing PANalytical instruments are also precisely measured on the Bruker instruments, although some biases exist.
- UC Davis is ready to move ahead with utilizing the Brukers after further discussions with the EPA, which are expected in the next few months. Then they'll work on further integrating the software, QA/QC, etc.

Discussion:

- Melinda: Are you going to shield the chamber to improve background?
- Nicole: We tried, but it didn't work because the snout is made out of brass. PANalytical is working on shielding, but we don't expect to hear back. The spectral processing software allows for background corrections on segments. This has improved the noise in Cu and Zn.
- Bret: Which elements will be winners/losers with the change from PANalytical to Bruker analyzers?
- Nicole: The Bruker is doing better on lighter elements; the peaks appear cleaner. The spectra are cleaner than they are on the PANalytical instrument, and we hope many elements will be better. It's difficult because most of what you're measuring for CSN is noise, but we can't analyze 25 mm filters. We're trying to create a sample cup for 25 mm filters to give higher concentrations and get comparison between ICPMS analysis and Bruker. We think we'll be able to measure tin. A Rb and Sr comparison will be valuable because they're 10 times denser so you can get more believable measurements.



- Bret: What elements are worse on the Bruker?
- Nicole: There are different levels of noise, so we don't know for sure if it's better or worse; P and As don't look great, but more analysis is needed.

Planned Changes to CSN Shipping Procedures – Melinda Beaver

Revisiting the Chemical Speciation Network's Shipping Practices

- Costs have increased while budgets haven't so OAQPS is looking for ways to cut costs. Shipping costs have doubled and it's estimated that CSN could save \$400,000 annually by moving to ambient shipments (lighter, slower shipments)
- Cold shipping has always been used, but it's expensive. A 2005 study did not indicate any adverse effects when shipments were not chilled.
 - Network-wide medians for sulfate, nitrate, EC and OC were marginally affected by data from filters that arrived > 4°C
 - CSN sites showed no loss or gain of mass when shipments were > 4°C. There doesn't appear to be an impact on the RCFM vs PM_{2.5} mass relationship.
 - Inter-network (CSN-IMPROVE) and intra-network (CSN-CSN) precision are similar for the species likely to be most affected by shipping conditions (i.e., nitrate and OC).
 - This would better align CSN, IMPROVE and CASTNET practices.
- EPA plans to stop cold shipping of CSN filters with the January 2025 sample shipments. RTI is working to implement the change; however, the COC for when filters arrive at the lab will remain unchanged for the time being (filters will continue to be cooled once they arrive at the lab).
- We'd like to provide best practices for site operators that align with IMPROVE best practices (ex. don't leave filters in hot places like vehicles or direct sunlight).
- Other CSN design changes are currently being assessed to meet budget reductions.

Discussion:

- Bill: Why did you use sulfur instead of sulfate when reconstructing mass?
- Melinda: We thought IMPROVE did that, so we duplicated the process. Sulfur/sulfate is not likely to be affected by ambient shipping.
- Bret: Would ammonium be impacted by temperature? Have you looked at ammonium and sulfate comparisons?
- Melinda: Not sure, it wasn't flagged as a species affected. We could look at the ammonium to nitrate and sulfate ratio and TT flag maybe.
- Bret: I'd expect nitrate and sulfate to be stable; organic carbon may not be.
- Tony W: Didn't nitrate comparison look ok?
- Melinda: Just precision was a little higher.
- Bret: Using nylon filter because ammonium nitrate can be lost? Are there any organics that were lost?



- Melinda: CSN measurements are higher than IMPROVE; cold shipping may have an impact, but it's hard to know.
- Nicole: How long do filters sit in the field?
- Melinda: They can sit for four days before being taken out and shipped.
- Nicole: IMPROVE sits for a while – three weeks of samples.
- Melinda: Do you have any guidance for operators?
- Bonne/Nicole: IMPROVE operators are just told not to leave filters in direct sunlight; most operators just leave them on site.
- Bret: One difference between IMPROVE and CSN is organics; CSN is higher; there's potential evidence of loss from IMPROVE warm storage.

DATA ANALYSIS

Seasonal and Spatial Variability of IMPROVE and CSN Composition- Jenny Hand

- Evaluating seasonal and spatial variability in urban and rural aerosol composition is important for understanding the $PM_{2.5}$ budget, aerosol sources and impacts, and changes in seasonality over long periods of time.
- East
 - Organics are now a major contributor in the east and make up 50-60% of reconstructed mass
 - AN is high in winter in northern sites
 - Nitrates higher in urban areas
- Northwest
 - Smoke impacts are influencing the seasonality of POM
- Southwest
 - Sulfate seasonality still exists in the southwest, but not in the east
 - We've started to see AN year-round, but in lower concentrations than in the east
- Evidence of biomass smoke in NW and SW
- OC and EC follow each other in the NW and SW, but not in the E
- Similar pattern with CSN as IMPROVE; different in comparisons, but spatial patterns are similar
- AS: ~20% contributions, seasonally flat, Urban ~ Rural
- AN: Annual contributions are 10%-20% and highly seasonal. Urban > Rural.
- POM: Annual contributions around 40%, highly seasonal, Urban > Rural.
- EC: Annual contributions: 5% (rural), 10% (urban), seasonality followed POM, except in winter, Urban > Rural.
- FD: Influenced by both long-range and regional transport in both rural and urban areas.
- We want to look at seasonality in sulfate in the SW versus the E.
- Is it appropriate to use the IMPROVE equation to calculate dust in urban regions?



Discussion:

- Bret: Could we do some bounding exercises to look at oxidant compounds in fine dust?
- Jenny: We'd like to see the contributions of iron.

Nitrate Study – Bret Schichtel

Southeastern US Winter Particle Nitrate Study

- Ammonium nitrate is becoming a larger fraction of human-caused haze impairment in the southeastern US. We want to know why; we know that sulfate is decreasing, but what else might be happening?
- Ambient Nitrate concentrations and NO_x emissions have both decreased, while NH₃ emissions have increased. Nitrate has decreased at less than half the rate of NO_x.
- Throughout the Southeastern US particulate nitrate formation is more sensitive to changes in total NO₃ today than in the early- to mid-2000's. At most sites, secondary inorganic aerosol (SIA) formation is equally sensitive to changes in total NH₄ and total NO₃, but some sites (Dolly Sods, WV) are still more sensitive to changes in total NH₄. Additional research is needed to understand the changing sensitivity and interplay of SIA to NH₃ and NO_x emissions.
- The purpose of the Southeastern US Nitrate Pilot Field study, which will run from January 8, 2025 – February 14, 2025 is to:
 - Assess the sensitivity of particulate matter, haze and reactive nitrogen to changes in ambient concentrations of NH₃ + NH₄, HNO₃ + pNO₃.
 - Assess the sensitivity of ammonium nitrate to the total regional NO_x and NH₃ emissions and, where possible, to point, mobile, and agricultural sources
- New measurements will be added to Mammoth Cave and Great Smoky Mountain sites including:
 - PILS
 - URG
 - NO_x
 - Continuous Nitric Acid
 - Continuous Ammonia
- New data will be used to explore known and unknown relationships, for high time resolution thermodynamic modeling, back trajectory analysis, and chemical transport models.
- Collaborations are welcome.

Discussion:



- Tony W: The DOE is performing a large study at Sipsey (Ann Dillner: study has already started) that will run for three years that could be of use to Bret's research. There may be two more sites in agricultural areas.
- Bret: Let's talk more about this offline. These are all rural areas (rural-limiting factors); these will be much different than urban areas; would like to entice urban collaborations.
- Angie: LADCO is concerned about winter nitrate and will be very interested in hearing Bret's results. There will be a NOAA study in Utah in 2028.
- Bret: NCAR may also be interested; one goal of the pilot is to generate excitement.
- Angie: EPA has a CASTNet site in western Illinois (Stockton) that measures nitrate, etc.; data may be of interest to this study.
- Bill: It may be a good idea to run a POPS instrument for size distribution.
- Bret: We may also try to put out a sampler with acid to analyze for total N and total S.

DATA PROCESSING, DISTRIBUTION AND QUALITY

IMPROVE Audits – Bonne Ford

Technical System Audits

- Every IMPROVE site must be audited once every 10 years to comply with QAPP and SOPs.
- 2017 – 2024 results show that most flow rates are within acceptance criteria. Some other issues noted include trees needing trimming, modules not properly seated, mouse droppings, and incorrect clocks.
- Would like to begin reaching back out to states to recruit and train auditors.
- The QAPP will be rewritten next year; this may be an opportunity to reassess any changes to the program.
- Work will continue to build a database of all previous audit results.

Quality Management Plan (QMP)

- IMPROVE's QMP is required by the EPA and hadn't been revised since 2002; the current QAPP is from 2016 and also needs to be reviewed. Both should be updated every five years.
- The QMP was updated this year and is currently under review by EPA. We're hoping it will be available via the IMPROVE website by the end of the year.
- We need to tackle the QAPP next year. Laboratories will be asked to update their section of the QAPP.

Discussion:

- Tony P.: When is UCD going to Virgin Island?
- Bonne: November, the audit will likely be done after they visit.
- Scott: What do we need to improve in the QMP and QAPP?



- Bonne: It took a lot, but the QMP is updated now so there shouldn't be a need for enormous improvements unless things change dramatically. The QAPP is much more detailed and will take time to sort through; this has not been started yet.
- Jenny: Is data dissemination documented?
- Bonne: I've spoken with Sean about providing more detail for this section. We don't have great documentation about how data gets into FED.
- Marcus: Each lab should have a QAPP?
- Bonne: UC Davis currently only has one for CSN; it mentions IMPROVE.
- Melinda: IMPROVE needs a QMP and QAPP; each lab should have a QAPP. This is how it's written in their contracts, but she will double-check with Doug for clarity.

IMPROVE Data and RHR Metrics – Scott Copeland

- Latest IMPROVE data delivered is February 2024. RHR metrics through 2023 posted on my Google Drive, and available through FED.
- No data for SD flagged samples; none of the XRF or fine mass data came through. This will be reported on at next meeting.
- A number of FS sites are offline for various reasons including, no operator, inaccessible location, etc. GAMO1 will be relocated to MAPA1 (this will also represent Scapegoat) in hopes that the location would be more accessible for site operators.
- This is the first year with enough data for DINO to calculate Most Impaired Days, and in 2023 it is the highest non-urban impairment measured.
- There are clear smoke impacts in the summer months on the haziest days.

Discussion:

- Bret: Did smoky days kick out summer most impaired days in the NE?

NPS RHR Comments – Bret Schichtel

- Comments and feedback for the RHR were submitted by 6/28/24.
- Melanie Peters and other NPS representatives who regularly review SIPS, etc. have provided comments.
- NPS has prepared recommendations on a number of topics including the following:
 - RAVI, NSR, FLM
 - Reasonable Progress
 - Pollutant & Source Selection
 - Four-Factor Analyses
- Many recommendations, as detailed in the presentation are focused on clarifications of existing roles and measures.



- With regards to pollutant and source selection, NPS stresses that these determinations must be made from current data (not 15+ year old data as it sometimes has been in the past).
- The purpose of the recommendations made for the four-factor analysis is to prevent states from saying that a source isn't contributing so they don't have to control it.
- The RHR guidance poses that by 2064, there should be no human-caused impairment. The tracking of progress towards this goal creates a glidepath. Some states say that the glidepath should be treated like NAAQS, meaning that if they fall below it, they don't have to do anything. NPS strongly recommends against this.
- NPS would like comment periods for EPA SIP determinations as 60 days.
- Consistency could be improved by setting a reference date for time-sensitive information at the beginning of each planning period for emissions data, facilities, cost years and cost of compliance metrics.
- NPS poses the question of whether FLMs should be responsible for tracking progress. They are more interested in establishing progress in each planning period than progress from the baseline period.
 - An alternative tracking metric may be to get rid of the 2064 endpoint and instead report impairment above natural visibility levels at every planning period. Although many people want to keep the 2064 endpoint, so perhaps a moving glidepath makes sense because it will get progressively harder to make a 1DV change as states get closer to natural conditions.
- Sources outside of a state's control should be explained not "adjusted" away.
- Natural levels are still based on Trijoni's estimates. An assessment is needed to refine natural haze estimates and account for spatial and seasonal variability. As we get closer to natural visibility levels, we need better estimates of the distribution of daily natural conditions. As natural estimates improve, the RHR end point goals could be based on the daily natural haze for each new planning period

Discussion:

- Bill: As more oxidants become available with reduction of SO₂, they can form secondary organic particles. Are we talking about the increase in organics?
- Bret: We haven't talked about that.
- Tony W: We can track OC and see if it's going up, down, or staying flat.
- Bret: Bill's paper is about how the stability of the atmosphere will affect secondary organic material.

Third IMPROVE Light Scattering Algorithm – Bonne Ford



Analysis of the IMPROVE Equations for Estimate Light Extinction

- IMPROVE Equation 1 was developed and evaluated using co-located nephelometer measurements. Comparison with nephelometer data suggested low bias at high concentrations and high bias at low concentrations.
- Equation 2 adjusted scattering efficiencies by mass, but agreement between the measured and calculated scattering has deviated over time.
- Should we update the IMPROVE equation to add newer science, or update the mass extinction efficiencies and fRH curves? Should we keep Equation 2, or return to Equation 1 with updates?
- Some of the trend in bias may be due to aging or poorly calibrated Optec NGN nephelometers. NPS is replacing Optecs with Ambilabs 2WIN nephelometers; the 2WIN data may suggest that Equation 2 is not significantly “better” than Equation 1.
- Work on the Equation will continue:
 - The Equation could use an official update that includes more current knowledge (ie, seasonal Roc, water growth for organics, updating mass extinction coefficients).
 - Part of the discrepancy between Equation 2 calculated scattering and measurement data appears to be due to the Optec nephelometers, which are being replaced.
 - Further data from 2WIN should confirm necessary updates to the equation.

Discussion:

- Bret: We’re not seeing big changes between Equations 1 and 2, but the addition of sulfate modes may be important with large changes in sulfate.
- Tony W: Ann and Tony W. have a DOE grant to measure the hygroscopic nature of organics. The first paper is about to be published.

Group Discussion on Implementation of New Algorithm

- Scott believes that this discussion may be premature based on Bonne’s presentation. The new 2WIN data and potential revised SIP deadlines will suggest postponing this discussion. He’s hoping to onboard a new light extinction equation in the next couple of years, as appropriate.

Day 2

IMPROVE BUSINESS

2024 IMPROVE Budget Summary – Tony Prenni

- Jim Miller will be the new COR for IMPROVE



- A BLM Interagency Agreement is now in place – hopefully there will be more funding next year.
- USFS Interagency Agreements will have to go through regional offices from now on.
 - Karen Dillman is retiring
- The costs presented are an estimate at this point; however, we have a deficit again this year. We can likely cover this with surplus from previous years, but we will run out of funding in the next 1-2 years at current inflation rates.
- We need to start planning for more cost savings in the coming years.

Discussion:

- Scott: Do we need to prepare now for cost savings?
- Tony: We are covered this year and probably next.

- Scott: Last time we performed a cost assessment was in 2014, when the atmosphere was very different. We need to redo the analysis in this pollution regime. Should we review cost-cutting options now?
- Tony P., Bret, Nicole: Yes
- Bret: Even changing filters takes a year, so we need to start right away.
- Tony P: With RFPs coming out, we need a plan to develop the SOW.

- Bret: Should we just shut down the “trouble” sites that Nicole discussed in her presentation (issues with access, consistent operators, etc.)?
- Nicole: RAFA, SAGA, AGTI – possibly.
- Tony P: Do we have to get approval from the states to do this?
- Melinda: All Class I regional haze areas states need to be informed before shutting down sites.
- Jay: Most states aren’t in a position to pitch in funding.
- Jenny: We need to look at how changes will affect the RHR metrics.
- Ann: Shutting down 2-3 sites won’t save a ton. What sites can we reduce that won’t affect data and would actually save money?
- Tony: We need to do a reanalysis to see if we need 110 sites to represent Class I areas. Can we get by with less?
- Scott: We’ve studied reducing redundant sites in the past and removing measurements, e.g. Module D. We need to know how many sites to shut down to save enough money from operations. We need a run-down of shifting sampling, etc.

- Scott: Who is responsible for doing the cost analysis? Can we delegate this to the data analysis group?
- Bret: Can we form an ad-hoc committee dedicated to this.
- Scott: Who will join this committee?
 - Bret, Scott, Jenny, Tracy, Nicole, Kip, Melinda, Chuck



- Melinda: We are currently exploring EPA purchasing PM_{2.5} filters directly, which may eliminate some overhead. It will be a big change to the contract so will need a modification; this is not a quick solution. She will keep the committee posted though. A contract directly with MTL could save ~\$100,000.
- Scott: We need to start now. I'll send a kick-off email out to remind everyone of the previous cost analyses we've done.
- Jim Renfro: How many sites represent more than 1 Class I areas?
- Scott: About 45 sites represent more than 1 Class I areas.

Network Operations Subcommittee Report – Melinda Beaver

- Melinda reviewed subcommittee responsibilities, current members, and recent and planned activities.
- There haven't been any subcommittee meetings this year, but they will try to meet in coming years.
- Currently, the committee is very focused on QA/QC; if there are other items members would like this subcommittee to focus on, they should let her know.

Discussion:

- Tony P.: Can the committee help to understand the implications of shutting down IMPROVE monitors?
- Melinda: We can help work on the regulatory perspective, but analysis would have to come from Jenny/the ad-hoc committee.

Data Analysis and Reporting Subcommittee – Jenny Hand

- Jenny reviewed subcommittee responsibilities and major activities over the past year.
- She reminded members that the IMPROVE Data User Guide is available on the website.
- If anyone has trouble accessing the Google Drive, please talk with Scott.

Discussion:

- Bret: Does the IMPROVE QAPP need to move to the Network Operations subcommittee? Also, who is going to maintain the Charter?
- Scott: The Steering Committee will maintain the Charter. We can move the responsibility of the QAPP within the Charter. (Also add responsibility for the Code of Conduct).
- Ann: There are a lot of people in the ASCENT Network using IMPROVE data; more people than ever in the academic community are talking about IMPROVE data.
- Jenny: Would outreach at an ASCENT meeting be helpful?



- Ann: Yes, we have an annual meeting in May. A short outreach video about how to use IMPROVE (and CSN) data would be useful.

Outreach and Communication Subcommittee – Jay Baker

- The committee's current focus is on training (webinars).
- A half-day training will be provided to the WESTAR Planning Committee in December; site operators are invited to attend.
- The website is due for an update to include additional training presentations, information for site operators, and a subscription service for people who wish to sign up for notifications.

Discussion:

- Jay: Who should I talk to about involving site operators?
- Yongjing: This is a good idea; will share a list with Scott so that he can facilitate this.

- Tony: Should we promote IMPROVE 40-year anniversary next year?
- Bret: Yes, we could have a session at the upcoming AWMA Visibility conference with a focus on promoting the network.
- Tony: We could write a paper too.
- Melinda: We should also leverage social media posts.
- Tony P.: New hats as well?

GUEST SPEAKER

Drone, Ground-Based, and Lab Measurements of Biomass Combustion Aerosols in New Mexico – Kip Carrico

- USFS is now spending ~half its budget on fire suppression and smoke exposure affects the entire contiguous U.S.
- Performed analyses of plants and soils (using IMPROVE-like analyses as a starting point) to determine the soil to plant to smoke inorganics relationship. Soils & plants relationship to aerosol hygroscopicity showed some level of ecosystem level correlation.
- Found that burn temperature is a key driver on aerosol properties. Fuel is less important to physical properties of smoke.
- Lab experiments were conducted to compare low cost sensors to benchtop sensors using various “smoke” sources. Online sensor agreement is good, but we need more comparisons between FEMs, FRMs with non-volatile aerosols. We can get reasonable PM_{2.5} readings from the PurpleAir if the aerosol of interest is calibrated to (size/refractive index).
- Drone measurements are also being used to assess PM_{2.5} during various phases of wildfires.



- The New Mexico State Fire Training Center has allowed NMT to measure black carbon/light absorption for a variety of different materials burning (structure, diesel spill, vehicle, etc.). NMT has been able to make AOD column measurements for different types of fires.
- Field measurements are showing consistency with what we observed in the lab (Flaming/smoldering, BC vs. BrC)
- Combustion temperature/phase plays a key role for aerosol physical properties
- Biomass burning aerosol properties—an important climate component—are diverse, variable and fuel/phase specific
- Sensors such as PA strongly benefit from an aerosol-specific ground truth
- Pursuing further field measurements and sensor validation studies (urban & wildland fuels)

Discussion:

- Bret: Did you look at EPA correction for PurpleAir data?
- Kip: Yes, but it wasn't a good fit because they were measuring aged smoke.

- Bret: How robust was the aethalometer?
- Kip: Pretty sturdy; it survived a hard landing on the drone (although it was in an enclosure).

- Bill: What was the cost? What wavelengths? Filter-based?
- Kip: It costs \$8,000 - \$10,000; has 5 wavelengths with filter tape (Aethlabs)

- Bill: What's the linearity?
- Judy: Quite good; worked with them to add 450 nm for carbon

- Bill: Did you do any extractions?
- Kip: We're doing extractions on filters from the FLAME experiment; we're having a hard time getting enough materials though.

- Bill: Have you looked at the hygroscopicity of smoke?
- Kip: This is of interest, but no.

- Bill: The 24-hour correction for the equation doesn't work because RH can change considerably throughout the day.
- Kip: Yes, this will affect the comparison.

- Ann: The SPARTAN network is also using microAeths, PAs and BAMS. They've had a lot of success with microAeths; they seem to be robust and have been compared to FTIR and HIPs.

IMPROVE BUSINESS CONTINUED

IMPROVE Code of Conduct – Scott Copeland



A draft of the Code of Conduct was distributed via email to Steering Committee members prior to this meeting for review.

- Tony is the only person whose email address is on the IMPROVE website as a contact for issues. Should we have other contacts?
- Everyone else is ok their email addresses being added back to the website except Tim Allen.
- Email addresses can be embedded in the Code of Conduct so that they can't easily be scraped.
 - *Tim Allen made a motion to adopt the Code of Conduct as presented.*
 - *Jay Baker seconded the motion.*
 - *Vote: 7 yes votes, 3 not available; Adopted*
- The code will be updated on the website.

Committee Business – Scott Copeland

- A representative [Morgan Dickie?] from APCAA may be interested in joining the Steering Committee.
- Scott has been reaching out to tribal nations to foster some interest. We may have a tribal member in the future.
- We will continue to work on cost savings measures.
- Jenny is traveling to WESTAR to give three training presentations in December.
- Scott now has the new data file with SD data(that he reported was missing yesterday); he will report on this the next opportunity.
- Next years' meeting:
 - Pair with AWMA Visibility Conference in Asheville (hold somewhere nearby – Lake Junaluska, perhaps)
 - 1 day Steering Committee Meeting on Monday before the AWMA Meeting starts
 - Site visit to Great Smoky Mountains or Shining Rock
 - This will be Scott's last year of acting as the Steering Committee Chair; the position will be turned over to Tim Allen next fall.

Meeting Adjourned