IMPROVE Steering Committee Meeting Summary
September 22-23, 2009
Visitor Center; Wind Cave National Park, SD
10/16/09 Final Version

Overview

The Steering Committee met at the Visitor Center in Wind Cave National Park, SD, on September 22-23, 2009. A copy of the agenda and meeting participants is attached.

Major topics included:

- Aerosol, optical, and scene operation update
- Ion, carbon, and XRF analysis update
- Laboratory audits
- Metadata availability
- Optical absorption on filters
- Urban algorithm for estimating light extinction
- Ammonium nitrate in the East
- IMPROVE report update
- WRAP plans
- RHR implementation status
- Reactive nitrogen monitoring

The following summarizes meeting discussions in greater detail as shown in the agenda.

September 22

Welcome and introductions

The meeting began with a welcome from Wind Cave National Park Superintendent, Vidal Davila. Vidal then provided a few facts about the park; it was established in 1903 (before the creation of the National Park Service) to protect the cave, which is currently the fourth longest cave in the world. A main feature throughout the cave is its boxwork formation which is rarely found in other caves. The park's bison herd is also genetically pure and disease-free; no cattle strains are found in the bison. Black-footed ferrets, once thought extinct, were reintroduced in Wind Cave NP on July 4, 2007. The park operates with 28 full-time staff and over 70 seasonal workers. Meeting attendees then introduced themselves.

Network Review

Aerosol monitoring

A few sites are scheduled to be decommissioned soon. Makah, WA (MAKA1) has been running for three years and will cease October 31. Petersburg, AK (PETE1) will also cease this fall. Neither site has funding to continue. The Bronx, NY (NEYO1) and Pinnacle State Park, NY (ADPI1) sites may or may not continue monitoring. New sites to the network are Gates of the Arctic, AK (GAAR1) which began monitoring November 2008; Ripple Creek, CO (RICR1), which used to be run by another contractor; and Boulder Lake, WY (BOLA1), which began August 2009. The Tuxedni, AK, site has no line power and is run from a combination of wind, solar, and generator power, with residual power stored in batteries. The site received new batteries this summer, which should reduce the need for generator power and its related emissions.

The 2008 sample recovery rates for the entire network (Module A) are: Q1=93%, Q2= 93%, Q3=93%, Q4=94%, and All of 2008=93%. The annual recovery rate for the previous year was 94%. The 2008 sample recovery rates for the entire network (all modules) are: Q1=89%, Q2=91%, Q3=89%, Q4=91%, and All of 2008=90%. The sample loss rate for 2008 is 10% for all modules and is due to equipment problems (45%), operator problems (21%), power problems (15%), improper filter installation (13%), and torn/damaged filters (6%). Thirteen (13) sites failed Regional Haze Rule (RHR) data capture requirements for 2008 (7 sites failed in 2007, 4 sites failed in 2006, 6 sites failed in 2005, 5 sites failed in 2004, and 8 sites failed in 2003). The 13 sites that failed in 2008 are:

- Breton Island, LA – samples lost due to land use disagreement, storms
- Cohutta, GA – pump failure and lightning strikes
- Wheeler Peak, NM – equipment failure and lightning strikes
- Lye Brook, VT – door frozen shut in winter
- Thunder Basin, WY – no winter access due to heavy snow
- Sierra Ancha, AZ – operator called to fire duty, backup operator did not respond
- Quabbin Reservoir, MA – water/ice accumulation in sample lines
- Mohawk Mountain, CT – improperly positioned PM_{10} stack after maintenance
- Brigantine, NJ – dislodged $PM_{2.5}$ cyclone throat
- Sula, MT – dislodged $PM_{2.5}$ cyclone throat
- Nebraska NF, NE – controller failure
- Sawtooth, ID – loose electrical plug
- Swanquarter, NC – controller malfunctions/non-responsive operator

The San Gabriel shelter burned down and its sampler modules were destroyed in August/September 2009 wildfires. A temporary site, Wrightwood, became operational within two weeks of the fire, and is located about 35km east of the old station. UC-Davis (UCD) is currently determining whether or not this station will be a permanent move.

In 2009 through July, three sites failed the RHR data capture requirements: Mohawk Mountain, CT, Indian Gardens, AZ and North Absaroka, WY.

The January-March 2009 aerosol data will be available soon. UCD currently has a six-month lag time in data delivery; this has been a goal for quite some time, which now has been realized.

A presentation and discussion followed the network status, regarding high concentrations of chloride ion observed in the northern Great Plains on December 14, 2008. Chloride has previously been identified as a marker for sea salt. Airmass characteristics and back-trajectories point to the Canadian arctic as the likely source of the material observed in Montana, Wyoming, the Dakotas, and neighboring states as far south as Kansas. Sodium, magnesium, potassium, calcium, and strontium were all present, in the proportions (relative to chloride) found in seawater. The known composition of sea salt led to the identification of a substantial bias in the algorithm for routine correction of matrix effects in XRF as applied to unusual sample compositions such as these. The correction algorithm is now under review. In subsequent discussion of the presentation there was skepticism that sea salt could come from the presumably-frozen Arctic seas in December, and it was suggested that previously unknown salt flats in Canada might account for the high concentrations observed.

Optical and Scene monitoring

Optical and scene networks include Arizona, NPS, Wyoming, Colorado, USFS, Nevada, CENRAP, VISTAS, the Midwest, and the northeast CAMN ET. These networks use a number of transmissometers, nephelometers, Webcamera systems, and visibility exhibits. All optical and scene standard operating procedures are current. Nephelometer data through June 30, 2009 will be delivered to CIRA by September 30. Transmissometer data through 2008 (SAGO and BRID) were delivered July 31.

Olympus-USA and the NPS formed a partnership in September 2008. Olympus will supply new cameras and the NPS will acknowledge Olympus on their Web pages. Half of the NPS camera network has been upgraded to date. An example NPS Web page with Webcamera view and current air quality conditions was shown, along with an associated example 10-day ozone plot, which are components of every NPS Webcamera Web page

Quality assurance field audits

Audit coverage is full in the southeast, northeast, Colorado, Kansas, Missouri, New York, Maryland, Arizona, Alaska, Iowa, and Ohio. The regional offices in these areas are doing a good job. Areas that need some improvement in their auditing schedule include California, Montana, northern Wyoming, North/South Dakota, New Mexico, western Texas, and Utah. Areas missing audit coverage are Nevada, the upper Midwest, Louisiana, Kentucky, Nebraska, Arkansas, and Mississippi.

The IMPROVE QAPP states the program performs 45 audits per year. In actuality, 35-38 audits were performed in 2005-2007 and 29 audits were performed in 2008. Many more calibration issues are being seen with both the vacuum and magnehelic type gauges. The number of sites that failed an audit in 2008 is about the same as for 2007. The problem of loose calibration plugs was resolved by duct taping the calibration plugs in place. The procedure for providing auditors with site coefficients and the transition to new temperature probes and mV readings both have improved.

Ongoing work the EPA audit team is doing includes focusing the auditors on their tasks, implementing air temperature and barometric pressure in the calibration checks, moving training responsibilities to the regions, developing a QA Web page, moving toward additional interpretation of audit data, developing a methodology for challenging the IMPROVE data storage card, and updating the program QAPP regarding audits. Discussion followed concerning how to increase audit coverage.

Laboratory Review & Methods Development

Carbon analysis

Desert Research Institute (DRI) purchased 3 Model 2001 carbon analyzers in 2008-2009, bringing the lab total to 11. The analyzers operate 24 hours/day, 7 days/week with 2 full-time technicians, 2 part-time technicians, and 4 part-time students. DRI has also recruited a full-time electro-mechanical technician for analyzer maintenance. The lab analyzed over 23,000 IMPROVE samples in 2008. Analysis for July 1-December 31, 2008 samples was complete in February 2009 and analysis for January 1-June 30, 2009 samples was complete in July 2009.

Analysis of IMPROVE samples was performed using IMPROVE_A protocols. The analyzers undergo weekly QC checks, a sucrose calibration three times/week, and a daily autocalibration procedure of an injection of CH_4 in varying He/O_2 atmospheres.

Carbon analyzer improvements include the installation of single-stage regulators to ensure consistent flow pressure for He, He/O_2, H_2, and air; adding aluminum-silica ceramic-fiber insulation around the FID to reduce the baseline shift; and the application of National Institute for Standards and Technology (NIST) reference materials for comparability between analyzers.

Ion analysis

Research Triangle Institute (RTI) has sometimes observed unknown peaks in the ion chromatograms of IMPROVE nylon filter extracts. The peaks are between the water dip and the chloride peak, in the general area of fluoride, chloride, bromate, and small organic acids (e.g., formic and acetic). In these same samples, a small peak is also sometimes observed just after, or as a shoulder on, the sulfate peak. RTI hypothesized that these peaks might include an oxidizing agent since some nitrite appeared to have been converted to nitrate in a spiked extract. Lab staff pulled chromatograms of the Trinity, CA (TRIN1) site, where the unidentified peaks were observed in samples collected in late June through mid-July 2008. The unidentified peaks vary in size across the time period, and the peak intensities appear to correlate with the color of the filter. Lassen Volcanic (LAVO1 and LAVOX) collocated samples from July 2008 show similar peaks to the TRIN1 samples, with the collocated samples from each sampling day showing peaks of the same shape and size. Satellite images and other data reveal that there were fires and smoke in the area of the TRIN and LAVO sites when samples were collected. Quality assurance (QA) samples were also collected from the UC-Davis rooftop test site on smoky days in July and August 2008. Do these peaks indicate a woodsmoke marker? What compounds give rise to these observed peaks? To aid in the investigation of these questions, the RTI Ion Analysis Lab obtained internal funding to (1) develop the capability to analyze for levoglucosan as a primary wood smoke marker in the nylon filter extracts and (2) use a different ion chromatography setup and/or UPLC/MS to identify the unknown peaks.

Using information supplied by UC-Davis, RTI selected seven sites from California that were known to have been impacted by wood smoke from mid-June to late July 2008 and plotted the combined area of the unknown peaks vs. the PM2.5 mass concentration (for PM2.5 mass concentrations >8 $\mu g/m^3$). The correlation coefficient was 0.95, suggesting a good correlation between peak area and wood smoke intensity. RTI reanalyzed selected extracts one year after the initial analysis. The unknown peaks observed in the Yosemite, CA (YOSE1) and Bliss, CA (BLIS1) extracts and in the rooftop samples extracts disappeared, so more recent samples that showed the unknown peaks were selected for study. It was found that sample extracts from LAVO1 and LAVOX in July 2009 showed the same unidentified peaks as in 2008. These samples were analyzed by ion chromatography using an AS16 anion separator column, ,which gives baseline separation of the early peaks. The peaks were tentatively identified as fluoride, acetate, formate, and methanesulfonate. The initial UPLC/MS screen suggested acetate, sulfate, and levoglucosan. Through comparisons of retention times and selective detector responses (conductivity, PAD, MS/MS) the presence of methanesulfonate and levoglucosan in sample extracts was confirmed.

To develop the capability for levoglucosan analysis, one of RTI's ion chromatographs was equipped with the appropriate columns and detector and then calibrated using authentic levoglucosan standards. After verifying the accuracy of the calibration with a standard provided by Colorado State University, several samples were analyzed for levoglucosan. The chromatograms for a Glacier, MT (GLAC1) sample extract and for an Upper Buffalo, AR (UPBU1) sample extract each had an unidentified peak prior to the levoglucosan peak. Further experiments were performed to tentatively identify the peak as glycerol. Since the denuder prior to the nylon filter in the "B" channel of the PM2.5 sampler is coated with a carbonate/glycerol solution, this could indicate a carryover from the denuder to the nylon filter. Since these types of peaks can indicate smoke events, does the denuder deteriorate under smoky conditions? Additional experiments are needed to positively identify the large peak prior to levoglucosan.

XRF analysis

Calibration standards for X-Ray Fluorescence (XRF) have some limitations. The Micromatter standards for XRF are not made of particulate matter, they use substrates of nucleopore or mylar, and have 1-2 elements per standard. Most standards are of higher mass than IMPROVE sees. Work is being performed at UCD to create reference filters that overcome some of the limitations of the Micromatter standards. A short-term goal is to characterize the XRF system. A long-term goal is to produce XRF standards to increase the accuracy of reported concentrations. XRF reference materials are made using an aerosol generation and sampling system. Upgrades to the system that have been realized this year are: improved relative humidity monitoring, an upgrade of the sampling line between the chamber and sampler, a new TSI 3076 constant output atomizer, and a new TSI-filtered air supply (continuous) to obtain better control of sampling time.

Two projects are being conducted at UCD, to characterize the XRF response to individual elements, and to measure the interference of silicon measurements by sulfur.

Characterizing the XRF response to individual elements involves creating reference filters and comparing measurements on the same filters analyzed by XRF, mass, and IC. A determination of contamination is being made using XRF, IC, and FTIR to ensure that the gravimetric measurement is an accurate measurement of the compounds of interest. In addition, the filters will be analyzed on a commercial XRF instrument at DRI. Reference filters are made of $(NH_4)_2SO_4$, K_2SO_4, and KCl. A scatterplot shows excellent comparison of S-XRF gravimetry compared to S. S from K_2SO_4, and Micromatter standards all show excellent slope correlation as well. The response at high S loadings becomes non-linear and different responses are seen by the two Cu-XRF systems. The sensitivity on System#2 is about 75% lower than on System#1.

The interference in silicon by sulfur as observed in network data resulted in a data advisory. UC Davis has now measured this interference directly. IMPROVE $PM_{2.5}$ samples were collected at a dusty site and analyzed by XRF for sulfur and silicon . Then sulfur was added using the UC Davis aerosol generation and sampling system to obtain a range of sulfur/silicon. Si concentrations are 10-30% higher after sulfur has been added when the S/Si ratio is above 3. Al concentrations are sometimes higher and

sometimes lower after the addition of sulfur. Calcium and Fe are not impacted by S and Ti has a small increase because the XRF system is counting the S doublet as Ti. Future work includes creating reference filters for the other elements and investigating other interferences.

Other analysis and sampling systems

Fourier Transform InfraRed spectroscopy (FTIR) is a method for evaluating organic PM on Teflon. Quartz filters are prone to artifacts, and organic oxygen, hydrogen, nitrogen, and sulfur are not measured; organic mass must be estimated from carbon.

Capabilities of FTIR including the measurement of a fundamental property of organic material and organic functional groups (C-H, C-O, and C=O). Direct measurements of organic mass and source identification can also be made. FTIR uses Teflon filters which are less prone to artifacts than quartz. FTIR does not measure graphitic carbon. The goal is to use this method for special investigations.

FTIR analysis was performed on Teflon filters used in MOUDIs to collect particulate matter at Tonto National Monument (TONM1), Phoenix, and one intermediate site. Results showed the FTIR can measure with high sensitivity. The tests quantified 9 organic functional groups and 2 inorganic compounds. MDLs were $\leq$25 ng/m^3. FTIR quantified 91 ± 38% of gravimetric mass and identified dominant sources of biogenic, urban-influenced, and background sources.

Currently, UCD is using FTIR to measure functional groups in forest fire particulate matter samples collected in Summer 2008 using 8-hour IMPROVE samples over a month at UCD. The study collected $PM_{2.5}$ (mass, XRF elements, carbon (OC, EC, FTIR, HIPS), and ions (sulfate, nitrate, ammonium, and unidentified peaks). Goals of FTIR on the samples are to characterize functional groups from wildfire and non-wildfire samples to determine aging, fires, and fire intensity. Other goals are to characterize spectral infrared signatures from fires, and to develop a non-destructive FTIR method for IMPROVE $PM_{2.5}$ samples. A proposal to the National Science Foundation has been drafted for study and quantification of secondary organic aerosols from woodburning. FTIR is a promising technique for quantifying organic particulate matter.

Laboratory intercomparisons & issues

The National Air and Radiation Environmental Laboratory (NAREL) includes 30 labs in the one facility. It performs three main functions: PT (single blind) samples, laboratory technical systems audits (TSAs), and special studies. Seven speciation laboratories participate with the IMPROVE and Carbon Speciation Network (CSN) programs. These labs are: South Coast Air Quality Management District (SCAQMD), California Air Resources Board (CARB), DRI, Oregon Department of Environmental Quality (ODEQ), RTI, UCD, and NAREL. NAREL has collocated MetOne samplers on its roof. The samplers collect replicate filters which are sent to the seven laboratories for comparison analysis. XRF analysis results show good agreement among the labs for sulfur analysis, as well as iron, zinc, and potassium analysis. This was true for both 25-mm and 47-mm filter replicates which were included, for the first time, in this year's study. Silicon differs between DRI and UCD. The labs also differ with lead and bromine analysis probably due to a more concentrated deposit on the 25-mm filters.

Each lab also received six filters for carbon analysis. CSN/Thermal Optical Transmittance (TOT) provided better inter-lab agreement than the IMPROVE_A/TOR analysis with respect to Total Carbon (TC). A significant amount of Elemental Carbon (EC) was reported by SCAQMD for blank filters and also for a backup filter that was accidently included in the study. The backup filter was created when two clean filters were inadvertently installed into one filter holder cassette at NAREL, and that cassette was used to create PT samples for the study. The reported EC for the backup filter prompted NAREL to investigate particle penetration through quartz filters. Experiments were performed that indicates no significant penetration of EC through a front filter into a rear (backup) filter, even after 200 hours of sampling.

Ion Chromatography (IC) analysis also indicated that each lab compared well. Both Nylon and Teflon filters were included in the study, which were useful to illustrate a known sampling bias between the two filter media. Furthermore, results were presented that show loss of nitrate from a Teflon surface if the filter is exposed to vacuum. Finally, gravimetric analysis was tested using $PM_{2.5}$ and compared generally well. Some differences appeared with results from the CARB lab.

IMPROVE monitoring site visit
Marc Ohms site operator hosted the monitoring site tour and backup operator Beth Burkhart attended as well. Participants viewed the aerosol shelter and sampler, as well as other air quality and meteorological instrumentation at the site operated by other programs.

Data Processing & Distribution

Data advisories
Two new data advisories have been filed recently. One advisory concerns a 1-in-6 day copper contamination from foreign samplers (Hi Vols) and the other advisory concerns an undercorrection of chloride concentrations for filter blanks. It is recommended that scientists postpone analysis pending redelivery of revised 2005-2008 data, which is under investigation. The advisories are posted on the IMPROVE Web site.

Meta and hidden data
Last year an advisory of bias was posted concerning masked and unmasked elemental measurements. It is recommended that scientists consider the masking status when evaluating small differences in time and space.

Open discussion of metadata procedures
A proposal was brought before the committee to provide public access to IMPROVE metadata using a 3-tiered approach:

1) Download metadata through the VIEWS Query Wizard. This would include OC, EC, and TC by TOR and TOT, and HIPS primary outputs, dates of analyses, filter deposit data, and pyrolitic carbon;
2) Download flat files not through the Query Wizard. This would include monthly artifact corrections, field blank loadings, carbon secondary filter loadings, analytical uncertainties, and QA external audit reports; and

3) Have all other metadata available from direct request from the laboratories, with contact information and examples of metadata on VIEWS. All other metadata may include 15-minute flowrates, flowrate calibrations, maintenance details, filter lot information, weighing records, laboratory replicate analyses, etc.

Discussion ensued for what time period we should make this information available for. Collecting metadata prior to 2000 would be too expensive and time-consuming to gather and adequate records may not exist for years prior to 2000. No negative comments were presented, so a plan to have metadata available using the 3-tiered approach from calendar year 2010 forward was approved. After this is in place then metadata for 2009 back to 2000 will be made available. The system should be functional by January 1, 2010. Data providers may ask the requestor to pay for the time needed to acquire the requested information under the third tier.

IMPROVE/VIEWS Web sites update

The purpose of the IMPROVE Web site is to document the activities, users, laboratories, etc. of the program, be traceable, and provide access to the data. There are currently 2,200 unique users per month from 164 nations. There are 1,500 registered VIEWS users and that site receives 7,000 visitors per month

Final aerosol data are available through October 2008. October through December 2008 data is still preliminary. Final nephelometer data is available for 1993 through March 2009 and transmissometer data are available through 2008. NESCAUM network particulate data are available from 1988-1993. RHR metrics are available through 2007.

Data advisories #20 and #21 have been resolved and advisory #24 should be resolved soon. These then become historical/archived advisories.

Special studies to be added to the Web site include RoMANS and Apportionment of Biomass Burning Contribution to Haze and $PM_{2.5}$. Other items added include the 2009 IMPROVE calendar, three new data advisories, and information from the Urban Visibility Workshop. Six new EPRI reports are expected to be added soon.

The VIEWS-2 Web site is expected to launch soon.

Data Comparability & Interpretation

Relationship between b_{abs} and EC

DRI performed a study on light absorption, or b_{abs}, using Teflon filters from over 200 sites since 1987, to estimate EC from light transmission/absorption/attenuation. b_{att} is measured by the old LIPM and new HIPS methods in the IMPROVE program and by DIPM (Densitometer Integrating Plate Method) in other networks. Comparable results were found with the DIPM and LIPM methods for the Denver Brown Cloud Study. DIPM results in twice the attenuation as HIPS. Similar relationships between networks and sites were also found. A slope of 0.9 to 1.1 was obtained using b_{abs} to predict EC. For IMPROVE, small seasonal variations are seen. To conclude, filter light attenuation is reasonably connected with IMPROVE EC, b_{att}-EC relationship differs among filter transmission methods, but is consistent over time, EC can be estimated from b_{att} within

± 20% at urban concentrations, and OLS regression gives lower RMS error, but greater median errors than weighted PLS regressions.

Brown carbon is evident at the Fresno supersite. Fresno has enhanced light absorption at shorter wavelengths in winter.

Optical absorption on IMPROVE, CSN, & FRM filters

A very high correlation exists between elemental carbon (EC) and optical measurements of urban $PM_{2.5}$, and better relationships exist between the IMPROVE carbon method and NIOSH. EPA is transitioning the OC-EC protocol from the NIOSH-type method to IMPROVE protocol (the transition began in May 2007). Another motivation for the switch is lack of temporal and spatial detail in EPA speciation networks, it supports the $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) implementation, and there is potential legislation regarding black carbon. Optical measurements highly correlate with EC. The 50-year old method used in Europe is Smoke Stain Reflectometry using Teflon filters.

EPA's Office of Air Quality Planning and Standards (OAQPS) and DRI performed a pilot densitometer study 2007. The optical EC study involved 20 IMPROVE sites using Teflon filters, and 3 collocated CSN urban sites. A Magee transmissometer was used at 7 CSN urban sites. Four of these switched from the old EC-CSN to the new EC-TOR protocols in May 2007. The EC-CSN method resulted in a correlation of r=0.91 and the new EC-TOR method resulted in a correlation of r=0.95 in this study. Filter attenuation can help identify potential outliers in measured EC. Predicted EC matches measured EC.

Preliminary evaluation of the Magee transmissometer was performed comparing 2 sites with HIPS b_{abs} and 10 $PM_{2.5}$ filters. Both sites (880 nm) correlated well (r=0.991 and r=0.996) but an offset of the 1:1 slope was seen. Could this be a wavelength dependency? Using 370nm resulted in a higher than 1:1 slope and one outlier had the highest iron seen. Higher absorption was attained when higher iron is found. Are there multiple sources of iron? If so, they may absorb differently under different wavelengths.

Different sites have varying relationships between EC and iron. Urban EC correlations track well at some sites but the Gary, IN, does not correlate strongly. Optical absorption is dependent on wavelength, thermal optical protocol used, filter material, and iron concentrations. EPA is pursuing optical measurements using a non-destructive analysis method. Discussion followed.

September 23

Urban algorithm for estimating light extinction

To estimate scattering from speciated $PM_{2.5}$ measurements we can compare carbon across samplers, and convert the CSN carbon concentrations to match IMPROVE on the average (accounting for different thermal optical methods and account for positive additive and multiplicative negative artifacts). Urban areas monitor with 5-6 types of samplers, while rural areas only have 1 (IMPROVE sampler). Studies show that the IMPROVE network generally sees more negative artifact; is IMPROVE losing more carbon? Expectation is $[TC]^{CSN}=[EC]^{IMP}+(1+B^{IMP})[OC]^{IMP}+A^{CSN}/V_{METONE}$. We can convert carbon $C^{(TC)}$ measurements to match IMPROVE measurements, using statistics. EC shows little to no positive artifact for CSN and IMPROVE.

A bias is seen between estimated fine mass and gravimetric fine mass at higher mass concentrations. Reconstructed mass bias is lower. Assumptions in the bias equations are that estimates of R_{OC} using the mass approach, regression approach, and seasonal considerations. The SEARCH network was used to show the seasonality of gravimetric mass. Summer shows an underestimation of FM (negative bias) while winter showed an overestimation of fine mass (positive bias) using data from the Atlanta and Birmingham sites.

A 70-80% loss of nitrates is seen on the Teflon filter. Summer shows a loss near 100%. Some theoretical discussion followed. POM vs OC urban is lower than POM vs OC suburban. Some conclusion can be drawn using regression analysis; diurnal variations of b_{extp} (RH) shows that speciated pollutants peak at sunrise and drop throughout the day.

Ammonium nitrate in the east

A winter ammonium nitrate bulge used to be a problem only in southern California. By 1995 a small bulge became apparent in the upper Midwest, which became more noticeable by 1999. By 2004 the bulge was also noted in the Pennsylvania-New Jersey-Washington DC area. CASTNET data also show this bulge. Gradient maps show where the air has been prior to showing up as heavy concentrations of ammonium nitrate in these areas. Arendtsville, PA shows the second most highest nitrate concentrations in the country, while nearby Lancaster, PA has the highest, especially in spring, with gradient decreases outward from there.

IMPROVE report update

The committee decided last year to begin production of another IMPROVE report, which will be the 5th in a series of reports. The preliminary outline for the report includes: discussion of the network and objectives of the program, protocol or equipment changes, IMPROVE vs CSN comparison and homogenization, spatial distributions of IMPROVE and CSN data, spatial variability in monthly means mass concentrations, and b_{ext} (IMPROVE and CSN) for major aerosol species. Other topics to be included are RHR metrics, rural vs. urban signatures, aerosol and b_{ext} trends, and special studies.

➔ Bret Schichtel will distribute a revised outline for review.

Discussion followed concerning which IMPROVE equation (original or newly revised) should be used in the report. Some think both algorithms need to be discussed in the report since it is an archive of what the program does and did in the past. The report is read by regulatory people for regulatory decisions, so we cannot abandon the new equation, however, IMPROVE should not let the Regional Planning Organizations determine what is in the report.

Other Related Programs/Activities

Western Regional Air Partnership (WRAP) future plans

In 2008, WRAP completed work related to RHR implementation support, which was developed based on regional scale analyses. Its 2008-2012 plan was adopted March 2008, and it held two technical and one planning workshops. The Web data systems (i.e.,TSS, FETS, EDMS) were described and other regional technical analyses were defined (ozone, mercury, ammonia/nitrogen deposition modeling and analysis).

The existing WRAP charter, developed in 1997, and board structure focused on regional haze. In July 2009 a new charter was proposed, to maintain regional haze work, develop an understanding of regional air quality issues, evaluate air quality impacts, consult with air quality agencies, collaborate with the EPA, and evaluate climate change. WRAP includes agencies within 15 states; interested agencies should submit a letter to WRAP to apply for membership.

RHR implementation status

Planning was completed in December 2003 for portions of Arizona, New Mexico, Utah, and Wyoming under section 309 of the RHR. For the remainder of WRAP, State Implementation Plans (SIPs) were due December 2007. States that completed their SIPs in Summer 2009 were California, Nevada, Oregon, and Utah. Most other states will finish in late 2009 or early 2010. The California Regional Haze Plan was adopted January 22, 2009 and can be found at: (www.arb.ca.gov/planning/reghaze/final/rhplan_final.pdf). California had only one Best Available Retrofit Technology (BART) source to deal with and they relied heavily on regional work performed by WRAP. BART has been a holdup for many SIPs.

Reactive nitrogen monitoring

Ammonium and reactive nitrogen is an issue for both IMPROVE and CASTNet, however, these parameters are not currently being monitored. Species of interest include SO_2/SO_4, HNO_3/NO_3, and NH_4. Missing species are NH_3, NO/NO_2 (NO_x), and oxidized organic gases. SO_2/SO_4 is measured reasonably well, but nitrogen accuracy is problematic due to large errors in data and the cutpoint is not well defined. NH_4 is underestimated. HNO_3/NO_3 split has a large error. A typical dry deposition budget shows that 40%-60% of nitrogen deposition is not measured, including ammonium. Research is planned for next year, to measure the total ammonium at 10 western sites using an IMPROVE or modified SASS sampler.

Researchers are also developing and testing a prototype compact denuder for ambient air sampling applications.

Night sky modeling

Chad Moore is leading the night sky visibility team. Night sky modeling is determining how urban lighting and haze affect nighttime visibility and how well one can see the stars. A WinHaze-type modeling application would be useful for this effort. Using the Monte Carlo model we should be able to determine how lights below the horizon affect visible stars; it is a complicated problem. Phase I has been developed and Phase II of the project is now underway.

Other IMPROVE Topics

IMPROVE budget summary

UCD received $3.25 million (2/3 of the budget) for elemental analysis. Other labs and contractors receive funds for laboratory analysis of filters or program support as well. The total IMPROVE budget for July 1, 2009 through March 31, 2010 is just under $5 million, similar to other years. All participants work together in a tightly knit program.

Since the last meeting, the program has seen the laboratories significantly reduce the filter analysis reporting backlog; the CSN carbon sampler conversion project for the OAQPS will be completed by the end of September 2009; and CSU has begun a RoMANS II study at Rocky Mountain National Park.

IMPROVE newsletter & calendars

ARS produces the quarterly newsletter, which is delivered as hardcopy to over 600 interested parties, including all site operators, steering committee members, laboratory staff, state agencies, 12 universities, 18 tribes, 4 Canadian agencies, and several private, environmental firms. The newsletter is also distributed via e-mail to 15 recipients and is also available on the IMPROVE Web site.

CIRA staff are currently producing the 2010 IMPROVE calendar. Possible technical articles for which they are currently obtaining information include BART, CAIR, RHR, a possible new secondary visibility standard, a night-skies article, and an update on the RoMANS study. Technical articles are needed by early October. The calendar is expected to be completed and delivered by late December.

Future considerations may include interesting IMPROVE facts or interesting historical facts for specific days.

Next meeting location & time of year

Discussion of the next meeting brought up Grand Canyon, or if the USFS will host, Lake Tahoe, Columbia River Gorge, or Lye Brook. The next location should have adequate services for the meeting attendees and include a site or lab visit. Location and time of year were not decided upon.

Cave tour

The group participated in a tour of the cave after the meeting adjourned.

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IMPROVE Steering Committee Meeting Agenda
September 22-23, 2009
Visitor Center; Wind Cave National Park, SD

Time	Topic	Discussion Leader
	Tuesday, September 22	
8:30am	Welcome	Vidal Davila
8:45am	Introductions and agenda review	Marc Pitchford
	Network Review	
9:15am	Aerosol monitoring	Chuck McDade
10:15am	Break	
10:30am	Optical & scene monitoring	Mark Tigges
11:00am	Quality assurance field audits	Dennis Crumpler/ Jeff Lantz
	Laboratory Review & Methods Development	
11:30am	Carbon analysis	Judy Chow
12:00pm	Lunch (pizza delivered to meeting room)	
1:00pm	Ion analysis	Eva Hardison
1:20pm	XRF analysis	Chuck McDade
1:40pm	Other analysis and sampling systems	Chuck McDade
2:00pm	Laboratory intercomparisions & issues	Jewell Smiley
2:250m	Break	
	Data Processing & Distribution	
3:30pm	Data advisories	Warren White
3:45pm	Meta and hidden data	Warren White
4:00pm	Open discussion of metadata procedures	Marc Pitchford
4:15pm	IMPROVE website update	Brett Schichtel
	Data Comparability & Interpretation	
4:30pm	Relationship between b_{abs} and EC	Judy Chow/ John Watson
500pm	Adjourn for the day	
	Wednesday September 23	
8:30am	Urban algorithm for estimating light extinction	Bill Malm
9:00am	Ammonium nitrate in the East	Rich Poirot
9:30am	IMPROVE Report Update	Bret Schichtel
	Other Related Programs/Activities	
9:45am	Western Regional Air Partnership future plans	Tom Moore
10:00am	Break	
10:15am	RHR implementation status	Tom Moore
10:30am	Reactive nitrogen monitoring	Bill Malm
10:45am	Night sky modeling	Bill Malm
	Other IMPROVE Topics	
11:00am	IMPROVE budget summary	David Maxwell
11:15am	IMPROVE Newsletter & calendars	Gloria Mercer
11:30am	Next meeting location & time of year	Marc Pitchford
11:45am	Meeting adjourned & Lunch (sandwiches provided)	
1:00pm	Cave tour (~90 minutes)	
2:30pm	Activities completed -- have a safe trip home.	

IMPROVE Steering Committee Meeting Participants
September 22-23, 2009
Visitor Center; Wind Cave National Park, SD

Joe Adlhoch	ARS	970-484-7941	jadlhoch@air-resource.com
Scott Archer	USDI-BLM	303-236-6400	scott_archer@blm.gov
Judith Chow	DRI	775-674-7050	judy.chow@dri.edu
Scott Copeland	USDA FS	307-332-9737	copeland@cira.colostate.edu
Dennis Crumpler	US EPA	919-541-0871	crumpler.dennis@epa.gov
Ann Dillner	UC Davis	530-752-1124	dillner@ucdavis.edu
Neil Frank	US EPA	919-541-5560	frank.neil@epa.gov
David Hardison	RTI	919-541-5922	davidh@rti.org
Eva Hardison	RTI	919-541-5926	eva@rti.org
Keith Jones	Environment Canada	604-664-9123	keith.jones@ec.gc.ca
David Krask	MD/MARAMA	410-537-3756	dkrask@mde.state.md.us
Calvin Ku	MDNR/NACAA	573-751-8406	calvin.ku@dnr.mo.gov
William Malm	NPS ARD	970-491-8292	malm@cira.colostate.edu
Dave Maxwell	NPS ARD	303-969-2810	david_maxwell@nps.gov
Chuck McDade	UC Davis	530-752-7119	mcdade@crocker.ucdavis.edu
Gloria Mercer	ARS	970-484-7941	gmercer@air-resource.com
Tom Moore	WGA / WRAP	970-491-8837	mooret@cira.colostate.edu
Marc Pitchford	NOAA	702-862-5432	marc.pitchford@noaa.gov
Rich Poirot	VT/NESCAUM	802-241-3807	rich.poirot@state.vt.us
Joann Rice	EPA	919-541-3372	rice.joann@epa.gov
Bret Schichtel	NPS	970-491-8581	schichtel@cira.colostate.edu
Jewell Smiley	EPA	334-270-7073	smiley.jewell@epa.gov
Mark Tigges	ARS	970-484-7941	mtigges@air-resource.com
John Vimont	NPS	303-969-2808	john_vimont@nps.gov
John Watson	DRI	775-674-7046	johnw@dri.edu
Jill Webster	US FWS	303-914-3804	jill_webster@fws.org
Warren White	UC Davis	530-752-1213	white@crocker.ucdavis.edu