IMPROVE Steering Committee Meeting Summary
September 5-7, 2007
San Juan Public Lands Center – Durango, CO
9/12/07 draft by Gloria Mercer, edited by Marc Pitchford

Overview

The Steering Committee met at the San Juan Public Lands Center, offices of the USDA-FS and BLM, in Durango, CO, on September 5-7, 2007. A copy of the agenda and meeting participants is attached.

Major discussion topics included:

- Optical/scene operation update
- Aerosol operation update
- Field and laboratory audit updates
- Sampling methods evaluation and development
- XRF, carbon, and ion analysis
- STN conversion to IMPROVE carbon monitoring
- RoMANS and fire science studies
- CASTNET ammonia monitoring
- Wyoming air quality/visibility network
- WRAP Technical Support System
- Four Corners regional air quality issues

The following summarizes meeting discussions in greater detail as shown in the agenda. Presentation materials used during the meeting are available on the IMPROVE Web site at http://vista.cira.colostate.edu/improve/Activities/activities.htm.

Welcome and introductions

The meeting began with an introduction by Howard Sargent – Deputy Forest Supervisor/ Assistant Field Office Manager for the Bureau of Land Management (BLM), who also manages the nearby Anasazi Heritage Center. Federal land managers are responsible for 2½ million multiple-use acres in this Four Corners region. Meeting attendees then introduced themselves.

Network Status and Changes

Optical and scene monitoring. The National Park Service optical network is being reconfigured. One of the two Grand Canyon NP transmissometers is scheduled to be removed this fall; the second one will be used only to support the park's interpretive visitor display. Extinction data will not be collected or archived. Three sites will receive NGN-2 Optec nephelometers: Glacier, Great Basin, and Rocky Mountain National Parks. The current status and size of the optical and digital camera networks was presented. Data have been submitted to CIRA through March 2007 (nephelometer) and December 2006 (transmissometer), and all standard operating procedures are current.

In May 2007, an African dust event was observed by John Molenar of ARS while on vacation in the Caribbean. John showed photos of the event and obtained data from UC-Davis to perform particulate matter analysis. On May 18, 2007, during the peak of this event 41 $\mu g/m^3$ of $PM_{2.5}$ was measured at Virgin Islands National Park. Three days later on May 21, 2007 after the dust cloud had passed $PM_{2.5}$ dropped to 6 $\mu g/m^3$.

Regarding pollution sources in the region, the Four Corners Power Plant began operations in 1973, and because of better visibility monitoring and science, we have seen plant controls and shutdowns in the past 34 years. Desert Rock Power Plant is a proposed new plant in the area, and fast-growing Chinese industry is yet another pollution source that may impact the U.S. IMPROVE may begin looking at these new Chinese plants as pollution sources. Discussion ensued regarding springtime Chinese-Asian-Saharan dust and the amount of selenium in coal being burned in China.

Aerosol sampling. Very few changes occurred in the network this year. Baltimore, MD, discontinued operations; Breton Island, LA, has not yet been replaced after it was lost to hurricane Katrina (scheduled to be replaced in December); and a new site at Haleakala Crater, HI, (in the Class I area) came online. The original Haleakala site, which is about 3000 feet below the elevation of the Class I area though only a few kilometers away, will continue operations for at least a year or two. The Puget Sound site was down for about six months due to a lapse in the leasing agreement at the monitoring location. The urban network currently consists of: Phoenix, Washington DC, Puget Sound, Fresno, Birmingham, New York City, Detroit, Pittsburgh, and Atlanta.

Sample recovery for the year 2006 was 94%. Four sites failed Regional Haze Rule requirements with sample losses: Cadiz, Cohutta, Domeland, and Sierra Ancha. Preliminary data (without X-Ray Fluorescence (XRF)) have been delivered to CIRA through September 2006. October and November 2006 data are scheduled to be delivered in October 2007. Early in 2008, UC-Davis expects to have a six-month lagtime of data delivery; the dual XRF systems and the new relational database are allowing this catch-up. UC-Davis is now designing the new SQL database.

Field audit and auditor training. In 2006, 36 sites and 37 aerosol samplers were audited in the networks. Various findings include missing data, flowrate failure, vacuum leaks, missing coefficients, siting issues, insect issues, a safety issue, missing calibration plugs, incorrect sample handling, etc. Audit findings did, however, show more operator effort and fewer adverse findings. EPA is continuing to increase the number of audits and is working on better procedures for providing auditors with site coefficients and for tracking follow-up actions. About 50 auditors have been trained and about 10 of these are very active auditors. Perhaps we can add a short piece to the IMPROVE newsletter “of interest to operators” that discusses audit recommendations, and add short articles to the IMPROVE calendar as well, such as having the operator check and clean the inlets for insects in the springtime. These timely maintenance items should also be added to the standard operating procedures. The goal is to audit at least 25% of the networks annually.

Sampling methods evaluation/development. UC-Davis is working on attaining tighter tolerances on temperature measurements through a redesign of the temperature probe. The old probe had tolerances of ± 10°C and the STN program requested a tolerance of ± 2°C. The new probes will be installed at all sites by Fall 2007 during annual maintenance visits.

During Spring 2005, sampler inlets at several sites were found to be clogged with mud dauber wasps. The inlet was redesigned to alleviate this condition, and was easier to clean, but the inlets still clog on occasion. UC-Davis is retrofitting the inlet with a new screen and will be installing them this year; only very small bugs can get in this new screen, which has smaller holes. Testing of the new screens was performed on eight modules at UC-Davis and results found no statistically significant differences from the new screen vs. the older screen. UC-Davis plans to continue monitoring these screens at sites with icy winter conditions.

UC-Davis is also testing a new, detached screen design in the filter cassettes. The attached filter screens occasionally exhibit rings of deposits around the circumference of the screen. This occurs on about ¼ of all samples, resulting in 5% change in the diameter of matter deposited on the filters, and potentially affecting XRF analysis. This phenomena occurs only on Teflon filters. The new, detached screen sits inside the cassette and does not have a mask, and tests show promising results. Most other types of aerosol samplers have this kind of detached screen. The testing and implementation schedule has not been set at this time but will probably occur over the next several months.

UC-Davis is also replacing the PM_{10} funnels. An interim design of the funnel, present in samplers manufactured around 2001, resulted in sample inhomogeneity during XRF scans. All funnels will now be of the same design, which yields a homogeneous sample.

Jay Turner recently characterized the flowrate/cutpoint dependence of the IMPROVE cyclone and found less dependence on flowrate than previously believed. New flowrate flags have been initiated to represent tighter cutpoints and are effective beginning with January 2005 data. The old flags were based on an incorrect relationship of the flowrate and cutpoint. A data advisory has been added to the IMPROVE Web site.

The controllers for the samplers will receive a revised program. ARS reprogrammed the carbon modules for the STN project. Since the code was rewritten from scratch, it is much cleaner and allows greater flexibility in sampling schedules. Final testing is underway. The program change needs to be documented in the IMPROVE database for future purposes.

A question was asked about whether the sampler controller could be used to record relative humidity (RH) data, which could be used in conjunction with particle composition data to more accurately estimate light extinction. Adding RH sensors at all IMPROVE sites would be expensive; however, it could be added at about a dozen sites if there was sufficient interest. Another approach would be to take advantage of RH data taken from collocated and nearby meteorological monitoring equipment. Due to the fact that RH has large variations with elevation near the surface, along any site path and over the course of the day, several people voiced concerns that the site-specific RH sensors without having collocated optical monitoring might not provide representative values that would meaningfully aid the estimation of light extinction from the aerosol data alone and so should not be added.

LED nephelometer. The new LED nephelometer from Optec, Inc. can operate up to 50,000 hours on a single LED (light-emitting diode) lamp, and without significant heating of the measurement chamber. The instrument operates on low power and is ideal for remote monitoring locations. The state of Arizona installed two LED nephelometers in May 2007. Testing has shown that it compares well to the existing Optec NGN-2 white light nephelometer.

Laboratory Status and Changes

XRF and gravimetric. UC-Davis has two Cu anode XRF systems, which were discussed at last year's meeting. The new XRF design operates with a vacuum to eliminate the detrimental effects of argon. In the old system a helium purge was used to flush argon, but helium damaged the detector over time. Having two XRF systems doubles the capacity for measurement; one month of samples can now be measured on each XRF in a one-month timeframe. XRF #1 (the helium system that was converted to vacuum) began with January 2005 samples and XRF #2 (the new vacuum system) began with October 2005 samples. The data base includes information on which of the two XRF systems performed each sample analysis (#1 or #2). Both systems were compared using July 2005 data.

Carbon analysis. DRI will analyze the January through June 2007 samples by September 30, 2007. Scatter plots comparing the old (IMPROVE protocols) and new (IMPROVE_A protocols) analyzers' data for organic carbon (OC) and elemental carbon (EC) on samples collected from 2005 and 2006 showed good agreement.

DRI showed the results of laboratory source sample carbon analysis using the IMPROVE _A protocol on samples from diesel, wood stove, acetylene flame, and electric arc sources. Their presentation showed the differences in the relative amounts of the thermal subfractions. It also showed how these subfractions could be changed or not by the presence of small amounts of inorganic materials in the samples, including sodium salts (NaCl, NaBr, and NaI), ammonium and sodium sulfate, and ammonium chloride. The presence of NaCl (salt) shifts the EC temperature fractions to lower fractions. Among all the halogen salts, NaCl shows the largest effect of this shift. The presence of ammonium sulfate minimizes pyrolysis (no EC shift), but does not suppress pyrolysis (shift EC1 to EC2). Salts appear to increase the EC oxidation rates at lower temperatures. Charring is minimized in the presence of $(NH_4)_2SO_4$ but not Na_2SO_4. Due to the formation of char and EC decomposition at high temperatures without oxygen, optical correction is necessary to separate OC from EC.

Ion analysis. RTI currently performs three services: ion analysis on nylon filters, SO_2 filter preparation, and passive ozone sampler loading and shipping. Filter extraction procedures differ between the IMPROVE and Speciation Trends Network (STN) programs. Round-robin analysis was performed using National Air and Radiation Environmental Laboratory (NAREL) performance evaluation samples and reanalysis of archived extracts. Observations regarding the XRF sulfur/sulfate ratio were recorded; the new XRF system results in a higher ratio than expected. These ratios were also found to not be unique to the IMPROVE networks. In 2005, the IMPROVE program

identified IC as the preferred sulfate measurement and withdrew XRF sulfur from the IMPROVE database. January 2005 data showed a 15% change in IMPROVE data (see data advisory on the IMPROVE Web site); the jump in the data is due to removal of an adjustment.

Laboratory evaluations and innovations. Data are routinely examined using different metrics: in 3-month quarters, and monthly. For example, data review revealed declining aluminum concentrations in the 2003 data due to a failing XRF detector. Quality assurance (QA) reports have been prepared for each calendar quarter for a year now; these can be found on the VIEWS and IMPROVE Web sites. Calibration control charts are also done monthly.

Investigations of the $3S/SO_4^-$ ratio showed a shift occurred in January 2005 data. In 2000, samples were analyzed using PIXE, and beginning in January 2002 they were analyzed using CuXRF (helium), and in January 2005 they were analyzed using CuXRF (vacuum). Data review found the discontinuity of data is due to a reporting change, not the switch to the XRF vacuum system. UC-Davis is participating in round-robin tests to compare elemental data among several laboratories. The tests use 78 filters which will be subjected to ICPMS analysis at several labs following XRF.

Operation of the aerosol generation chamber at UC-Davis was explained. Ammonium sulfate is atomized and drawn into the chamber and a fan mixes this with air in the chamber. Other solutions may be tried in the future but now only ammonium sulfate is used. This is currently in the “proof of concept” phase of testing and only mass is being measured at this time.

About 80 Teflon filters are being tested with ion chromatography (IC) analysis to see if Teflon filters compare to nylon filters. Results may show analytical differences (XRF vs IC analysis) and sampling differences (Teflon vs nylon filters). UC-Davis has not yet tried XRF analysis on a nylon filter.

Laboratory audits. Laboratory audits of the IMPROVE and Chemical Speciation Network (CSN) are performed by the EPA NAREL in Montgomery, AL. Specific QA activities performed by NAREL include:

- Performance testing using single-blind samples analyzed at different labs.
- Onsite inspection and interviews with lab staff (technical systems audit).
- Experimental investigations at special studies.

Photos were shown of onsite audits at RTI and DRI in 2005. Preparing for an onsite audit includes:

- Obtain current standard operating procedures.
- Obtain the last audit report and performance testing samples.
- Prepare supplies for onsite measurements (e.g., dataloggers, standards).
- Schedule a convenient time for the audit and communicate the agenda.

An audit issue that was raised several years ago concerns the time required to reach equilibrium at any relative humidity (RH) with respect to gravimetric mass

measurements of samples collected on Teflon filters. To test this an experiment was performed at NAREL to assess the equilibrium time at various RH conditions. Test filters were loaded with $PM_{2.5}$ – the filters were weighed several times at 35% and 60% RH, and again at 35%, at a chamber temperature of 70°F. The exposure time to the chamber RH was recorded before each measurement. Results of the tests indicate: 1) the mass measurement can be affected by RH and the kinetics are fast for the 25mm IMPROVE filters, and 2) changes in mass seem to be reversible.

During the UC-Davis audit in March 2005, it was found that AT (ambient temperature) and RH (relative humidity) conditions at UC-Davis are not as well controlled as thought necessary, but laboratory results are very comparable to the onsite audit findings. During a UC-Davis audit in May 2007 the finding was that loaded filters are not weighed more than once and large swings in RH occur inside the weighing room could affect loaded filters. NAREL recommended that UC-Davis weigh some fraction of the filters more than once in order to be able to assess the uncertainty resulting from RH variations. UC-Davis has agreed to do this and is also willing to add data on RH in the weighing chamber to the database in the near future.

Data Analysis

XRF data interpretation guidance. The switch from the helium-purged Cu XRF system to the more stable vacuum XRF system, combined with the addition of a second system (used in comparative experiments), has allowed UC-Davis to more thoroughly understand and document its XRF measurements. Time series analysis of XRF data has shown a stabilization of observed ratios, such as S/SO4= and Fe measured by the Cu and Mo XRF systems, compared to prior results from PIXE and from the Cu helium XRF system. These more stable values allow UC-Davis to better identify subtle changes in the data, such as concentrations drifting due to a failing detector.

The addition of a duplicate Cu anode XRF system has made new comparisons possible. Tests have demonstrated that the measurement uncertainties on the two systems meet expectations for many elements, such as sulfur and vanadium. However, these tests also revealed interferences in the silicon peak when sulfur concentrations are high.

Web site update. A quality assurance data advisory button has been added to the IMPROVE Web site homepage. The purpose of the IMPROVE Web site is educational (2,300 users) while the purpose of the VIEWS Web site is that it is a source of current data. (1,600 users). Staff changes at the Cooperative Institute for Research in the Atmosphere (CIRA) which operates the two Web sites have slowed the pace of innovations. A replacement for Roger Ames, a network programmer is going to be hired. However, the data quality assurance activities of Lindsey DeBell will be accomplished at UC-Davis, now that their new data system permits it to be done there.

Aerosol data are posted on both Web sites through July 2006. Nephelometer data are available through March 2007 and transmissometer data are available through December 2006. Other additions to the Web sites are the Regional Haze Rule

algorithms 1 and 2, and new natural condition estimates for the best/worst 20% conditions at 181 IMPROVE sites. Documentation added includes six data advisories, a QA/QC report, gray literature, a new query wizard, and enhanced tools for graphics.

Archived data are revised once a year in January if necessary. IMPROVE currently has seven datasets: Raw, preliminary, Regional Haze 1, Regional Haze 2, substituted, nephelometer, and transmissometer.

Carbon replicate analyzer data analysis. Continuity of IMPROVE carbon data was shown starting in 2000 by plotting trends in network median values, in order to assess any discontinuity that may have occurred when DRI switched to its newly-designed laboratory analyzer beginning with the January 2005 samples. Some of the individual components (OC1, EC1, etc.) exhibited marked discontinuities with the January 2005 samples, and of the composite components EC has the largest relative change when viewed in this way. This observation was not consistent the assessment that DRI had provided prior to the switch to the new analyzers or when analyzing the two years of overlapping analysis using both methods for ~5% of the samples. More analysis of this discrepancy will be done to better understand the reasons and to try to identify approaches for compensating for this discontinuity in the carbon component trends.

Other Monitoring/Assessments Topics

WRAP SIP workgroup. The Western Regional Air Partnership (WRAP) is the organization of western states, tribes, and others who are developing the technical information needed to implement the Regional Haze Rule (RHR) for the western U.S. WRAP has developed example State Implementation Plan (SIP) language that can be adapted by states for their Regional Haze Rule SIPs due in several months. The SIPs need to include monitoring plans for all of the visibility-protected federal Class I areas. IMPROVE is the primary source of data for these areas, so the SIP language by WRAP indicates the need for continued use of IMPROVE data for tracking haze trends as required by the RHR. The IMPROVE Steering Committee was asked to comment on the language that has been developed by WRAP and to consider updating IMPROVE's statement of its objectives to acknowledge its responsibilities to generate consistent high quality data for use by states for the RHR. There was discussions of IMPROVE's need to adopt new monitoring and analytical methodologies in the future where appropriate, while continuing to ensure data continuity so that trends can be tracked over a multi-decadal time frame. Marc Pitchford will work with Tom Moore and others to generate appropriate changes and expanded language for the IMPROVE objectives that support the needs for the RHR SIPs. Any proposed changes will be circulated to the Steering Committee for approval prior to adoption.

STN conversion to IMPROVE carbon. The Clean Air Scientific Advisory Committee recommended the Chemical Speciation Network (CSN) change to IMPROVE-type carbon samplers. A map of the CSN network was presented along with IMPROVE vs. CSN sampling differences (principally that CSN uses a mass flow controlled orifice, includes a self-supporting stand, and has new firmware for the controller). CSN conversion to an IMPROVE style carbon monitor will take two to three years to

complete. Phase I of the change-over is complete (57 sites) and Phase II is scheduled to begin early next year. ARS has been tasked with purchase, installation, calibration, operator training, and firmware development for the project. URG is supplying the sampler (the URG model 3000N). The instrument collects 15-minute averages of flowrate, ambient temperature, barometric pressure, vacuum, etc., can perform a semiautomatic 3-point calibration, and saves all calibration information and data to a compact flash card. Sampling began at the Phase I sites on May 3, 2007, with some collocated IMPROVE monitoring. RTI is handling the filters and DRI is performing the carbon analysis. When sufficient data are available from the collocated site an assessment will be conducted.

RoMANS update. Rocky Mountain National Park (RMNP) is experiencing a number of deleterious effects due to atmospheric nitrogen and sulfur compounds. These effects include visibility degradation, changes in ecosystem function and surface water chemistry from atmospheric concentrations/deposition, and human health concerns due to elevated ozone concentrations. The goals of the study are to characterize the atmospheric concentrations of sulfur and nitrogen species in gaseous, particulate, and aqueous phases (precipitation and clouds) along the east and west sides of the Continental Divide, identify the relative contributions to atmospheric sulfur and nitrogen species in RMNP from within and outside of the state of Colorado, identify the relative contributions to atmospheric sulfur and nitrogen species in RMNP from more emission sources along the Colorado Front Range versus other areas within Colorado, and identify the relative contributions to atmospheric sulfur and nitrogen species from mobile sources, agricultural activities, large and small point sources within the state of Colorado.

Two field campaigns were conducted, in spring and summer 2006, to characterize pollutant transport and deposition during seasons with historically high nitrogen inputs. Several measurements sites were operated within the park, at locations west and east of the park boundaries, and at locations near the NE, NW, and SE boundaries of the state of Colorado. Measurements at several sites included 24-hour integrated gas concentrations (ammonia, nitric acid, sulfur dioxide), $PM_{2.5}$ composition, and wet deposition. A core measurement site in the park included more detailed and higher time resolution chemical, optical, and particle size distribution measurements.

Concentrations of N species in RMNP varied significantly with local and regional transport patterns. High concentrations of nitrate/nitric acid and ammonia/ammonium observed routinely on the eastern plains of Colorado reflect a mixture of urban and agricultural emissions. Total N deposition was about twice as high during the summer vs spring. Deposition of N is about 2/3 wet (rain and snow) and 1/3 dry (particles and gases). About 45% of N deposition is not being measured in the current monitoring programs (NADP & CASTNET). Organic N may be about 30% of total deposition and is not currently being measured. The highest concentrations of N species in RMNP were generally associated with upslope transport from the east. Nitrogen deposition in RMNP during the spring campaign was dominated by a single, upslope snowstorm. A combination of high pollutant concentrations and heavy precipitation during this upslope event acted to produce N deposition fluxes that far outweighed other spring precipitation events. During the summer study, by contrast, numerous events contributed more

equally to total N wet deposition fluxes. Organic nitrogen, ammonium, and nitrate were all important contributors to N wet deposition.

CASTNET ammonia monitoring. There is no national program to monitor ambient non-source-influenced ammonia, so a new CASTNET passive ammonia monitoring program has begun to fill in the gaps. The program began in October 2003 when the Central States Regional Air Partnership (CENRAP) and the Midwest Regional Planning Organization (MRPO) formed a network of 10 sites, performing 1:7 day sampling. Budget cutbacks led to network reduction, site shutdown, and finally a switch to passive sampling. The passive network now consists of 6 sites for 3-week intervals beginning December 2006. CASTNET plans to absorb the current CENRAP/MRPO network and expand it to about 17 sites with four years of funding. The Midwest is the area of study because it is the region of highest ammonia emissions in the U.S., and the ammonia/nitrate link is strong there (high ammonia corresponds to high nitrate). Consistent regional data was shown from the custom-built passive samplers currently operated in the 10-site network (Cincinnati, Blue Mounds, Athens, Bondville, Boundary Waters, Illinois #1, Illinois #2, Indianapolis, Allen Park, Green River Bluffs, and Mayville).

Fire Science update. Carbonaceous aerosols are a major component of fine particulate mass which can adversely affect health and contribute to haze in national parks and wilderness areas. Recent results from radiocarbon studies have shown that 80% to 100% of the fine particulate carbon measured in rural areas and ~50% in two urban areas is from biogenic sources. Smoke from fire-related activity is thought to be a large contributor to the biogenic carbon particularly in the Western and Southeastern United States. However, federal land managers and policy makers currently lack tools necessary to separate carbonaceous aerosols originating from fire from industrial and mobile source activities and secondary organic aerosols (SOA) from vegetation on a routine basis. For example, more than half of aged smoke can be comprised of SOA, and the composition of SOA from smoke is similar to SOA from vegetation. Therefore, tools such as receptor models cannot separate the smoke and vegetation contributions to SOA. Fires have both natural sources (i.e., wildfires), and anthropogenic sources (e.g., agricultural fires, prescribed fires, and residential wood burning). Some control is possible with the anthropogenic fires, but the implementation of meaningful control strategies requires understanding the relative contributions of the natural and anthropogenic fires.

Two related projects are being conducted by the National Park Service and Colorado State University to develop smoke apportionment tools capable of separating contributions from difference types of smoke (e.g., wild and prescribed fire, and smoke SOA from vegetation SOA). One project, FLAME, is characterizing the physical/chemical/optical properties of primary smoke aerosol. A primary goal of FLAME is to develop inexpensive smoke marker measurement approaches, suitable for application in routine aerosol monitoring networks, and source profiles that can be used in receptor oriented source apportionment models. In conjunction with Forest Service at the Missoula Fire Science Lab and other collaborators hundreds of burns of materials including, ponderosa and lodge pole pine, sage, rice straw, and duff were conducted at the Fire Science Lab and the smoke characteristic analyzed. The analysis included a promising new method based on anion exchange with electrochemical detection to

measure common smoke marker species in the carbonaceous aerosols including levoglucosan and mannosan. The detection method can measure concentration at low levels with good precision and is equivalent to ion chromatography in cost.

Findings include levoglucosan emission rates a factor of 2 to 4 lower than found in fireplace studies. However, these emission rates still vary by more than a factor of 2 for different material with grasses having lower rates than branches and needles. Levoglucosan is a product of the thermal decomposition of cellulose and grasses have less cellulose than branches and needles. The lab component of FLAME has been completed and in the spring/summer of 2008 a field study will be conducted to measure young smoke from a prescribed fire. This will allow the evaluation of the source profiles derived from the lab experiments against the field data.

The second project related to FLAME is the development of a hybrid source apportionment tool that integrates measured tracer species of smoke (e.g., levoglucosan and other sources of carbonaceous material) with atmospheric modeling results. The model will be used for retrospective analysis to determine the contributions from different sources to the carbonaceous particulate fraction as well as different types of fires. The model will be set up in the receptor framework where the modeled results will be used to aid in the identification and separation of the contributions from the various source types. A synthetic data has been developed including contributions from area, point, fire, and vegetation to particulate carbon. This synthetic dataset is being used to develop and test the receptor-hybrid model.

Wyoming air quality/visibility network. Wyoming currently has a 12-site air quality and visibility monitoring network throughout the state. All collected data are posted in real-time on http://www.WyVisNet.com. In the Jonah Basin, oil and gas development is occurring at an increasing rate; the area may see up to 3,100 new gas wells. Shell Oil is funding a year-long ammonia monitoring study in Boulder using a URG sampler. Integrated samples are taken on a 3-day and 4-day schedule. A peak in the data was apparent during March 12-16, 2007, and HYSPLIT modeling shows this may have been due to nitrate/fertilizer application in the Snake River Valley, ID. Elevated ozone, 8-hr peaks over 80 ppb, have been measured in the Pinedale Jonah Anticline during February 2005 and 2006. Ozone has traditionally been considered only a summertime issue due to low UV-B radiation, short days, and low temperatures during winter months. One hypothesis is: (1) low vertical ozone results in increased UV-B radiation reaching the surface, (2) during the winter fresh surface snow reflects the UV-B radiation essentially doubling the total Actinic flux, and (3) high ambient concentrations of NO_x and VOC from oil and gas emissions results in an enhance winter O_3-NO_x-VOC cycle. Modeling of the photolysis rates for important photolytic ozone forming reactions shows that under these conditions, peak photolysis rates can exceed mid-summer rates. A special study was performed during the Winter 2007. Preliminary results should be available by the end of 2007.

WRAP – Technical Support System (TSS). To aid WRAP states and tribes in the use of ambient monitoring, emissions and model output data sets and products in preparing RHR SIPs, a new Web-based capability named the TSS was developed. It was designed to facilitate access to information from multiple other Web sites in a way that

promotes comparisons among the information and provides insights concerning the causes of haze for western Class I areas, including aerosol components, emission source types, and source regions responsible for haze. A demonstration of the TSS was given. A user: 1) chooses a site on the map, 2) selects monitoring, modeling, or emissions source apportionment, and 3) picks a date and species to graph. Timeseries projections are available on a wide range of bar charts, pie charts, line graphs, and glide slopes. The TSS Web site address is http://vista.cira.colostate.edu/tss/ .

Four Corners regional air quality issues. The Weminuche Wilderness encompasses about 500,000 acres in Colorado. Potential visibility impacts to the wilderness are the San Juan Generating Station, the Four-Corners Power Plant, the Navajo Generating Station, and the proposed Desert Rock Power Plant. Existing and proposed oil and gas development in the San Juan Basin shows a marked increase (20,000 wells to an estimated 40,000 wells soon). The lifetime of a single well is about 30-50 years. Durango is a boom area and federal land manager funds provided to the air program for the region has increased in recent years from near zero in the 1990s to over $170k per year last year.

The Weminuche IMPROVE site was established in 1988. The Weminuche site is too far north to adequately assess the regional energy development, so the USDA-FS established the Shamrock Mines site in 2004 at a lower elevation an nearer to the energy development to document changes to visibility conditions as the regional energy development increases.

Visibility data representing Weminuche. Weminuche Wilderness was one of the first 20 IMPROVE sites, 20 years ago. Data from the Weminuche and Shamrock Mines sites show that Shamrock Mines has significantly greater nitrate concentrations. Shamrock Mines also has greater ozone and oxides of nitrogen. The similar impacts from energy developments have been seen in Wyoming and Montana.

Wrap-up Topics

Budget summary and future expectations. The IMPROVE network and research budget from EPA and the federal land manager total for the current year are ~$8.1 million in funds plus ~$1.0 million of in-kind contributions (federal salaries and travel). Most of the funding comes from the EPA, with the NPS, USDA-FS, and FWS contributing in that order. Funds are distributed as follows:

- UC-Davis 50%
- CIRA 11%
- ARS 6%
- CSU 6%
- DRI 11%
- RTI 4%
- RoMANS/Fire Science studies 12%.

The EPA contribution to IMPROVE is expected to remain the same for fiscal year 2008.

Next meeting plans. Locations considered for the next IMPROVE Steering Committee meeting include Seney National Wildlife Refuge, in Michigan's Upper Peninsula; Boundary Waters Canoe Area Wilderness, MN; Isle Royale National Park, MI; northern California; Lake Tahoe, NV (Bliss State Park); and Reno, NV (DRI laboratory).

Field site tour. The final day of the meeting consisted of a field site tour of the Shamrock Mines monitoring site. The group listened to site operator Brian Parker explain monitoring at the IMPROVE and ambient air quality stations. Ozone, oxides of nitrogen, and meteorological parameters are also monitored at the site. The group then hiked to the top of a nearby ridge where the digital camera system is located, and listened to comments on oil and gas reserve development in the San Juan Basin by a representative of British Petroleum and by a local concerned citizen.

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IMPROVE Steering Committee Meeting Agenda
September 5-7, 2007
San Juan Public Lands Center – Durango, CO

Time	Topic	Discussion Leader
	Wednesday, September 5	
1:00pm	Welcome and self-introductions	
1:30pm	Agenda review	Marc Pitchford
	Network Status and Changes	
1:40pm	Optical & Scene monitoring	John Molenar
2:10pm	Aerosol sampling	Chuck McDade
3:10pm	Break	
3:25pm	Field audit and auditor training	Dennis Crumpler, Jeff Lantz
3:40pm	Sampling methods evaluation/development	Chuck McDade
3:55pm	LED Nephelometer	John Molenar
	Laboratory Status and Changes	
4:25pm	XRF and gravimetric	Chuck McDade
4:55pm	Carbon analysis	Marc Pitchford (for DRI)
5:10pm	Adjourn for the day	
	Thursday, September 6	
8:00am	Ion analysis	Eva Hardison
8:15am	Laboratory evaluations and innovations	Chuck McDade
8:45am	Laboratory audits	Jewell Smiley
	Data Analysis	
9:15am	XRF data interpretation guidance	Warren White
10:00am	Break	
10;15am	Web site update	Bret Schichtel
10:30am	Carbon replicate analyzer data analysis	Warren White
	Other Monitoring/Assessments Topics	
10:45am	STN conversion to IMPROVE carbon	Mark Tigges
11:00am	RoMANS update	Bill Malm
11:30am	Fire science update	Sonia Kreidenweis
12:00pm	Lunch	
1:00pm	Wyoming air quality/visibility network	John Molenar
1:45pm	WRAP – Technical Support System	Tom Moore
2:30pm	Break	
2:45pm	Four-Corners regional air quality issues	Kelly Palmer

Time	Topic	Discussion Leader
	Wrap-up Topics	
3:30pm	Budget summary and future expectations	Marc Pitchford
3:45pm	Next meeting plans	Marc Pitchford
4:00pm	Unscheduled topics and over-schedule time	
5:00pm	Meeting adjourned	

Friday, September 7

7:45am	Site tour – leave the San Juan Public Lands Center in USFS carpool

IMPROVE Steering Committee Meeting Agenda
September 5-7, 2007
San Juan Public Lands Center – Durango, CO

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