IMPROVE STEERING COMMITTEE
2021 ANNUAL MEETING

Date: November 9-10, 2021
Location: Virtual

WELCOME AND AGENDA REVIEW

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

NETWORK AND LABORATORY REVIEW

Optical Monitoring Network Status

Mark Tigges presented an update regarding optical and scene network status. A copy of their PowerPoint presentation accompanies these minutes. Summary points are as follows:

- Site visits previously impacted by the pandemic improved.
- Full-service site visits were impacted by reduction of visit frequency in GPMP contract.
- Grand Teton National Park nephelometer discontinued monitoring July 14, 2021. The equipment was removed from the site on October 4, 2021.
- Testing of replacement instruments (Airphoton IN102 and Ambilabs 2-WIN) continues. Optec NGN instruments are no longer supported and replacement parts are difficult to acquire.
- Ambilabs 2-WIN nephelometer was installed at Rocky Mountain National Park for in situ comparison with the Optec NGN.
- Webcam site operator support was impacted by pandemic and widespread wildfires.
- The National Capitol system was rebuilt and reinstalled.
- The Sequoia Kings Canyon camera is back in operation following September 2021 wildfire.
- Web hosting services moved from DOI servers to AWS servers. New pages are available for embedding in individual park pages.
- Low cost sensor data integrated into webcam displays.
- ➤ *Regarding the 2-Win nephelometer RH readings, Bret Schichtel commented that the RH appears to peak at 80%, which is probably a function of the heat produced by the electronics of the instrument.*

Carbon Analysis

Judy Chow presented of the status of carbon analysis from RTI. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- The lab analyzed approximately 1,600 IMPROVE samples per month.

- Operating schedules affect by COVID. Catching up on backlog of samples requires the lab to run 13 hours per day, 5 days a week. Frequency was increased to 18 hours per day, 7 days a week to catch up.
- 2020 analysis was completed in August 2021.
- On average 34 runs per day are dedicated to multiple quality control checks.
- A more efficient oxygen test was implemented to verify trace concentrations in the carrier gas.
- New data validation protocols were established
    - Automated comparisons for replicates, reruns, and collocated samples.
    - Identification of extreme values.
    - Automatic notification of deviation from calibration peaks.
    - Use of visualization tools to examine relationship between light attenuation and brown carbon and temporal variations.
    - Identify missing or mislabeled runs.
    - Using machine learning for future automation of data validation.
        - Rerun prediction is approaching close to 60% accuracy.
- Recent publications highlight the application for multi-wavelength data and brown carbon.
    - Elsevier Particuology 56 (2021) 1-9
    - Environmental Science and Technology 2021, 55, 8561-8572
    - Geophysical Research Letters 10.1029/2020GL090332

> *Bret Schichtel asked about the calibration procedure to measure transmittance or if that is an issue.*
> *Judy responded that the attenuation is a ratio of initial: final transmittance and there is not a way to calibrate. This is more important for urban sites (with implications for other countries and non-IMPROVE sites). Anything $>1.5~\mu g/m^3$ requires an adjustment factor.*

Ion Analysis

Tracy Dombek presented the status of ion analysis. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- Two new laboratory personnel were hired.
- Instruments are calibrated daily.
- Quality control checks are performed before and after every ten samples.
- The MDL is calculated annually.
- For every 50 samples analyzed, 3 are duplicated. The percent difference should be within ±10% but is dependent on sample concentrations (higher limit for lower concentrations).
- If concentrations deviate this could indicate an issue with the sample or with the analysis.

- Nitrate and sulfate are usually stable, so they act as good indicators of issues when those concentrations drift outside of control limits.
- Funding was granted for research and method developments.
- IMPROVE samples were analyzed to look at water soluble organic sulfates.
- Total sulfur concentrations were greater than what sulfate could account for.
- This issue was worse in the summer months.
- Composite samples from nearby sites were analyzed.
- Freeze-dried samples were sent to UNC and analyzed via liquid chromatography instruments and measured against standards.
- Looked at how stable these water soluble compounds are and how different storage methods affect extraction. Appeared stable when refrigerated. Variations seen in room temperature samples, indicating temperature dependence.
- Also looked at how freezing the sample affected analysis. Many compounds were not lost indicating lower volatility.
- Cold storage appears to preserve samples for the ability to perform additional analysis.
- Future plans include working on other compounds, developing methods for PFOAS in samples, and method development for sugars.
- Want to understand the stability of compounds on filters prior to extraction or analysis.

➤ *Bret Schichtel asked what temperature was used for degradation studies.*
➤ *Tracy answered 4°C is the goal. Most temperatures logged were between 0° and 10° C.*
➤ *Bret asked if results were surprising. Observed holding at room temperature is obviously contributing to some loss.*
➤ *Tracy commented that some compounds are more stable than others (MSA is more volatile, and also lost during freeze drying. HMS is reacting but not sure on the details of the reaction). OS wasn't expected to be as volatile. Generally compounds react to lower volatility. It would be interesting to see which compounds are driving the reactions.*
➤ *Bret asked if this has been done with real IMPROVE samples yet.*
➤ *Tracy answered the goal has been to analyze both IMPROVE and CSN sample for future work. More standards need to be developed, which are not ready-made and can be difficult to obtain.*

Quality Assurance – Field Audits

Scott Copeland (on behalf of Derek Day who was in the field) presented updates regarding field audits. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- Sites in the Pacific Northwest and northeast were audited in 2021
- Goals of the audit program were to visit each site once in the course of ten years. All but three sites have been audited.
- Audits have been worthwhile, but not sure another round of visits may not need to start again in this ten year cycle.

➢ *Tom Moore asked about the response to major audit findings (structural, etc)*
➢ *Scott answered that most site infrastructure is the responsibility of different agencies with different levels of support. Most major findings have been addressed, some more rapidly than others.*
➢ *Bret Schichtel says data collection has improved based on audit results. Is in favor of pausing audits for a few years. Asked what the EPA QC requirements are.*
➢ *Tony Prenni answered the language states each site is visited once every ten years.*
➢ *Scott commented that some sites have previously been audited by EPA or state partners, but not all sites were visited.*
➢ *Bill Malm commented that frequency of those visits decreased due to lack of time and personnel.*
➢ *Joann Rice asked what the IMPROVE QAPP says regarding audits.*
➢ *Bret answered the QAPP is due for an update and this could be addressed during the revision.*
➢ *Tom Moore commented that independent audits are meant to capture network quality and it's nice to identify structural issues.*

Aerosol Monitoring Network Status

Sean Raffuse and Nicole Hyslop presented an overview of network status. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

Data Management and Validation Updates:
- Data are delivered through October 2020.
- Backlog due to pandemic shutdowns in early 2020 and lab relocation in late 2020.
- Catch up will be achieved by establishing deadlines, real-time tracking, and some logistical changes.

Laboratory Updates:
- The lab was relocated to an off-campus location.
- MTL filters were showing filter blank mass gain – which could be due to an issue with the filter or the chamber.
  - Pall filters were analyzed for troubleshooting purposes. Results showed the problems were with the filters and not the instrument.
  - Supply issues with Pall filters necessitated the use of MTL filters.
  - Paired $PM_{10}/PM_{2.5}$ filters were sent as field blanks to better understand the issue.
  - Water mass gain was ruled out as the cause of the issue.
  - Could be an issue with the filter ring.
- Multi-wavelength HIPS should be more efficient, there was good agreement with mono HIPS vs multi-HIPS measurements.

- Purple Air sensors were collocated with IMPROVE sensors.

QA Updates:
- An audit was conducted remotely by T&B Systems in December 2020.
- Audit coincided with the lab relocation, providing a good independent check of the move.
- Findings included updates to SOPs and additional checks on source materials.
- Ratio of reconstructed fine mass (RCFM) to $PM_{2.5}$ seems to be increasing. May be due to changes in composition of aerosols.

➢ *Bret Schichtel asked if other laboratories use the MTL filters and if they are seeing the same issues.*
➢ *Nicole answered yes, the CSN network uses the MTL filters, but of different size and material (3 micron vs 2 micron). Issue would not have been noticed in a smaller dataset.*
➢ *Xinrong asked if the purple air concentrations bias higher than sample concentrations.*
➢ *There is an algorithm for adjusting PM2.5 purple air value (from the EPA). Adjustments appear to be site-specific and UCDavis is looking for composition differences.*

ANALYTICAL DEVELOPMENT

Light Absorption Measurement Update

Warren White presented an update regarding HIPS analysis performed by UCD. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- Light absorption and light absorbing carbon are important measurements.
- Linearity of concentrations related to non-uniformity of deposits.
- CSN loading is much higher than IMPROVE.
- At collocated IMPROVE/CSN sites, with the same atmospheric conditions, compared samples with two different loadings.
- HIPS response is low at high filter loading, which can be explained by the non-uniformity deposition.
- Beer's Law used to convert attenuation to filter absorption assumes uniform deposition.
- This can explain the non-linear response and a correction can be calculated.
- Charring occurs during heating while making the carbon measurement, changing the optical properties of the sample. This is corrected by monitoring reflection of the sample punch.
- When the correction is large there is a noisier relationship between Abs and carbon.
- Internal reflection/scattering in the system has a more or less constant offset.
- Additive amount varies from week to week.
- Variation comes from reflectance measurement and not the transmittance measurement (stable correlation with HIPS).

- *Bret Schichtel commented there is a lot of variability in reflective measurements across samples, but TOR analysis uses difference between initial and final reflective measurements. A heavily loaded sample will remove the laser signal.*
- *Warren answered they need to know when the reflectance returns to its original value.*
- *Bill Malm commented there is a mathematical equation for pixilation of the filter and asked of the adjustable parameters, could those be applied in a general sense if you had an equation?*
- *Warren answered that is up to the steering committee and those who run the program. Equations can used to straighten out the relationship but would introduce additional scatter. Where the non-linearity issue becomes prevalent are not seen at IMPROVE sites even in fires. This would come into play for urban samples.*

Flow Control with Variable Speed Pump

Ilia Potanin presented an update regarding modified pump control developed by UCD. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- Goal for modified pump performance
    - To regulate flow to compensate for flow rate dropping due to filter loading or air density changes due to temperature.
    - Reduce power consumption
    - Lower pump noise
- Achieved by using cyclone pressure drop to calculate flow rate deviation.
- Feed error signal to variable speed pump.
- Add damping volume between pump and sampler.
- Software modification included the ability to detect clogged filters, ability to adjust pump speed, and ability to remotely initiate sample.
- Modification tested at sites near or on UCD campus.
    - Cobalt site may have seen influence from neighboring farm.
    - On-campus site showed no clear bias, more data are needed.
- Plan to order 300 pumps in 2022 to replace failing existing pumps.
- Plan to deploy active flow control modules to site with collocated modules.

Wildfires and Clogged Filters

Sean Raffuse presented an overview of wildfire impacts on the network. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- Clogged filters invalidate the sample as total sample volume cannot be calculated accurately.
    - $PM_{2.5}$ flow is invalid if <15 LPM for > 6 hours.
    - PM_{10} flow is invalid if <10 LPM for > 6 hours.

- Size cut is affected by lower flow, causing larger particles to reach filter.
- Common in heavy smoke, not as common in dust events.
- Most prevalent in Teflon filter, but all modules can be impacted.
- While samples are still invalid for RHR metrics, modified pump control may save data for modeling, public health communication, etc.
- Proposed protocol is to shut off pump if flow rate fall below 15 LPM for 15 minutes.
    - If this occurs ≥ 18 hours into sample the pump is shut off and data are valid for RHR
    - Prior to 18 hours into sampling, the clogged module and companion module will be shut off. Data invalid for RHR but delivered with accurate, but flagged, concentration.

> *In the chat Rick Saylor commented, "As an AQ modeler I'd like to see as much data as possible during smoke-impacted events. We have many, many uncertainties in trying to model smoke emissions and transport. The IMPROVE data is going to be tremendously useful for us over the coming years as we try to lessen some of these uncertainties. However more smoke-impacted data can be obtained, the better for our efforts."*

The Future of Carbonaceous Aerosol Measurements in the IMPROVE Trend Tracking Monitoring Program

Bret Schichtel presented an overview of carbon measurements in the network. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- Costs are driving potential change for carbon measurements.
- Looked at inter-comparisons between TOR (current method) vs OC/EC Infrared FTIR vs. total carbon filter absorption over the last 3-5 years.
- Final report is available on the IMPROVE website.
- All methods have pros and cons, but any given method must:
    - Be able to meet network goals – be able to measure low concentrations in remote environments and higher concentrations in urban or smoke-heavy areas.
    - Produce stable and reproducible results.
    - Cost effective.
    - Suitable for use in remote environments.
- Limitations and issues with TOA
    - Dependent on temperature and aerosol composition.
    - Instruments cannot be fundamentally calibrated for OC and LAC.
    - Instruments can be calibrated for total carbon
- FTIR as alternative method
    - Can be calibrated to standards.

- o Empirically calibrated to TOR OC and LAC with multiple model needed (smoke, non-smoke, urban, etc.)
- Derive OC and LAC from TC and fabs as alternative method
  - o TC measured using a thermal method.
  - o Filter absorption measured using IMPROVE hybrid integrating plate and sphere (HIPS) method.
  - o Can be made comparable to methods in the past but cannot account for future changes
- HIPS is reproducible long term and independent of instrument type.
  - o No instrument drift.
  - o Good precisions.
- Recommendations include moving to a TC and fabs measurement to track trends in organic and light absorbing carbon and reconstructed light extinction and haze, if significant cost savings can be achieved.

➢ *Xiaoliang asked if this method uses the quartz filter*
➢ *Bret replied this is a ratio of the Teflon filter which is very efficient at scattering light on the clean side.*

XRF Inter-Comparisons

Nicole Hyslop presented an overview of XRF measurements in the network. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- IMPROVE and CSN filters were compared to address concerns with different techniques with different standards and materials.
- IMPROVE results were compared using UCD XRF analysis vs. Wisconsin State Laboratory of Hygiene ICP-MS.
- CSN results were compared using UCD XRF vs. TRI XRF and ICP-MS
- Conclusions show very strong correlations for 13 of 20 elements.

Purple Air/Optical Measurement Studies

Bill Malm presented an overview of purple air and optical measurements in a collocated study. Summary points are as follows:

- Ten pairs of collocated Purple Air Sensors were deployed.
- One malfunctioned, data from 19 total sensors were collected.

➢ *Xiaoliang commented that the sensor is not measuring pulses, but measures an intensity or voltage based on the introduction of the aerosol. It is an 8-9 mm beam that the aerosols*

are crossing except under very clean conditions. There can't be scattering with large volume.

➢ *Bret commented that is makes a good reciprocal nephelometer and is better as a scattering instrument. Not only are you seeing a smaller fraction of light with larger particles but they're simply not getting into the chamber due to the aspiration issue. Multiplicative issue with sensor seeing larger particles.*

DAY TWO – November 10, 2021

ANALYTICAL DEVELOPMENT (CONTINUED)

ASCENT Network

Ann Dillner presented an overview of the ASCENT network. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- ASCENT: Atmospheric Science and Chemistry mEasurement NeTwork is a new long-term, ground-based high time-resolution air quality monitoring network.
- Three years are funded by a NSF infrastructure grant. This is an outreach grant, and not a research grant. The hope is it will also be used by researchers.
- Ten additional years are expected to be funded by the NSF.
- Twelve monitoring sites measure $PM_{2.5}$ in existing networks, such as IMPROVE, NCore/PAMs, SCAQMD, NEON, and HNET.
- Using existing sites leverages personnel, infrastructure and provides additional data for these sites.
- Data are open and freely available, hosted by NCAR.
- Automated QA/QC.
- Aim to improve FTIR functional groups measurements and real-time source apportionment using these data.
- Data from ASCENT will address questions related to:
  - Changes in composition and abundance of aerosols.
  - Changes in sources.
  - Impacts on health and climate-relevant variables.

➢ *In the chat Tom Moore commented, "How can you control for residential wood combustion in Delta Junction to achieve the 'remote, background….' Intended characteristics of that site? What emission inventory data sources are being used to characterize potential impacts at the ASCENT sites?"*
➢ *Ann replied that the faculty member running that site would have that answer.*
➢ *Daniel Tong asked what the estimated time lag of data access would be*

DATA ANALYSIS

Long-Term Trends and Association with Valley Fever Infection

Daniel Tong presented a PowerPoint discussing using IMPROVE data to study Valley Fever. Summary points are as follows:

- During The Dust Bowl in the 1930's drought-stricken southern plains suffered severe dust storms.
- Another Dust Bowl could happen as a result of climate change and the trend of precipitation moving away from the subtropic regions.
- One problem in studying the possibility or probability of another dust bowl is due to a lack of a long-term data set.
- Satellite and IMPROVE data were used in this study.
- Having both $PM_{2.5}$ and PM_{10} helps differentiate fire from dust.
- Copper, lead, and zinc are indicators of anthropogenic sources.
- Changes in sea temperature and soil moisture contribute to becoming more arid, leading to more dust storms in the west.
- Dust storms can cause soil-dwelling fungus, which causes Valley Fever, to be inhaled.
- Increased cases of Valley Fever are being recorded in southern Arizona, New Mexico, and West Texas.
- Cases will likely migrate north with the entire West being impacted by 2095.
- Other impacts from dust storms include accidents due to decreased visibility and lower production of solar farms.

➢ *Nicole Hyslop asked if higher calcium in rain water is evident*
➢ *Daniel responded that calcium in rain water comes from more loading in the air.*
➢ *Bret commented that data goes back to the 1970's with the original stacked filter units. Would be fascinating if trend could be extended back into the 70's. The rate of increase goes up in the 2000's after being fairly flat from the 1980's. Data are available on the FED website.*

Preview of the IMPROVE VI Report

Jenny Hand presented a PowerPoint discussing the IMPROVE Report. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- The purpose of the report historically has been to provide updates on the network and its data.
- Previously distributed every five years. The last report was produced ten years ago.
- Organization structure of the report:
  - Chapter 1 – IMPROVE Network Overview
  - Chapters 2 and 3 – Aerosol Mass Concentration and $PM_{2.5}$ Mass Budget
  - Chapters 4 and 5 – Total Aerosol Extinction, Deciview, and b_{ext} Budget
  - Chapter 6 – Trends in Aerosol Mass
  - Chapter 7 – Trends in Total b_{ext} and Deciview
  - Chapter 8 – Regional Haze Rule Progress Tracking Metrics
- First draft of full report is expected in March 2022.
- Public comment period in April 2022.
- Final draft is expected in June 2022.
- Changes in reconstructed fine mass were seen several years ago. Namely that fine mass and reconstructed fine mass are diverging.
  - Could be related to analysis, method, or could be real.
  - Seasonality became more prevalent in recent years.
  - Carbon is a major contributor to $PM_{2.5}$.
  - Empirical model that defined the split or apportionment needs to be updated.

➢ *Brett Gantt commented that the EPA made the transition from a yearly trends report to an on-line format. Asked if that model would be appropriate for this report? EPA received more feedback on the web-based report with maps and clickable content that is updated annually.* *https://gispub.epa.gov/air/trendsreport/2021/#home*
➢ *Bret Schichtel commented that the IMPROVE website has links to data visualization tools that allow the user to look at long-term trends in a dynamic fashion. The one missing piece is contour maps.*
➢ *Tom Moore asked how many people work on the EPA report.*
➢ *Brett answered that the initial effort involved contractor help with a lot of upfront investment. Year to year work is now 3-4 people and has become much more efficient.*
➢ *Rick Saylor comments in the chat, "do you have any sense of how the smoke-related clogged filter issue that was discussed yesterday might impact the EC trends you see in the Western US?"*
➢ *Jenny answered the data here end in 2017, likely to have many impacts in 2018-2019.*

DATA PROCESSING, DISTRIBUTION, AND QUALITY

IMPROVE Data and RHR Metrics

Scott Copeland presented a PowerPoint summarizing the status of 2020 IMPROVE data. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- Expect to deliver 2020 data with RHR metrics to be available in January 2022.
- SIAN1 is no longer a site. Attempts to relocate site have been unsuccessful.
- BLIS1 has operated in a temporary trailer. The Forest Service is trying to find a way to restore power to the original location, or relocate the site.
- Relocated and/or combined sites will be updated in RHR metric files.
- New link to google drive that houses RHR data.

Documented Process for Relocated IMPROVE Sites

Tom Moore and Brett Gantt presented a PowerPoint proposing documenting the process for relocating and/or combining sites. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- The process for closing, relocating, or opening new sites can be improved.
- This process should include affected users, supporting agencies, and the state doing the Regional Haze planning.
- Documentation needed on how to prepare trends for these sites.
- Process for handling combined sites being developed for NAAQS sites as well.
- Considerations include distance, spatial, temporal, seasonal, and jurisdictional boundaries.
- Some sites are able to have overlapping operations for a year or more to compare and support the move. This is not always possible.
- For SIP purposes good documentation is needed for merged sites.
- Data are not usable until they reach the FED or TSS websites.
- Data processing should be documented more formally.
- Effect of wildfire and increase prescribed fire activity will be really important to understand via monitoring data as they are outside control of the state.
- Re-evaluation of natural conditions may be required as they might not be a good predictor of fire in the future.
- Regional Haze support needs to include expertise of the IMPROVE community on the assumption of natural conditions.

➢ *Bret Schichtel commented that 20 years ago a procedure was written for moving sites, including a request for a year of collocated monitoring. The document needs to be resurrected and updated. The role of IMPROVE in the Regional Haze Rule is up for discussion including exactly what and what does not fall under IMPROVE purview or responsibility.*

IMPROVE BUSINESS

IMPROVE Charter

Scott Copeland presented a PowerPoint discussing the IMPROVE Charter. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- A November 2020 letter from the GAO report gives two priority recommendations:
  - o Implementation of framework for consistently sustaining a national ambient air quality program.
  - o A public airy quality monitoring modernization plan should be developed.
- A May 2021 letter from WESTAR commenting states are required to use data over which they have little access to quality assurance and control procedures.
- In June 2020 WESTAR staff met with NPS/CIRA staff for discussion and agree that better communication and a governance document and Charter would be beneficial.

IMPROVE Charter and Governance Document

Bret Schichtel presented a PowerPoint discussing the IMPROVE Charter. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- Set out to formalize and define procedures and roles for IMPROVE.
- Goals are to:
  - o Inform people about the program and function of the steering committee.
  - o Codify and formalize activities of steering committee.
  - o Increase involvement of steering committee members and stakeholders.
  - o Formalize subcommittees and workshops.
- Review and update of IMPROVE documents are needed.
  - o Quality Assurance Project Plan (QAPP)
  - o Quality Management Plan (QMP)
  - o Data User's Guide (last version from the 1990's)
  - o IMPROVE Report (coming in 2022)
- IMPROVE Charter:

- o Outlines principles, functions, and organization of program and steering committee.
  - o Define clear boundaries on IMPROVE program responsibilities
  - o Document authority and responsibility of steering committee, EPA, FLM, States and other sponsors.
- IMPROVE Program Mission:
  - o Measure haze causing particulate matter and its chemical composition and optical properties in rural and remote settings in support of visibility regulations using scientifically credible methods capable of tracking decadal long trends.
  - o This can be viewed as a speciated fine particulate monitoring network that supports investigation into haze and Regional Haze tracking, or a regulatory visibility monitoring program that measures particulate matter to accomplish its goals.
- IMPROVE Objectives:
  - o Provide Regional Haze monitoring representative of Class I Areas, where practical.
  - o Establish current visibility and aerosol conditions.
  - o Identify chemical species and emission sources for man-made visibility impairment.
  - o Document long-term trends in visibility.
- Steering Committee Manual of Operations/Guidance
  - o Define roles and responsibilities.
  - o Formalize procedures.
  - o Develop committee structure.
  - o Create standing subcommittees and workgroups.

- Discussion on committee charter and subcommittees are as follows:
  - o Need for drafting or finishing charter and governing documents

> *Tom Moore stated support for drafting of these documents*
> *Gordon Pierce also voiced support. Not a lot is formalized and the state of Colorado does receive a lot of questions.*
> *Chuck Turner said moving forward it is a good idea to revisit mission statement, to include state groups, and term limits should be followed if in the documents.*

- o Structure of steering committee – chair, vice-chair, etc. and/or term limits

➢ *Scott Copeland commented candidates for chair would come from current steering committee members.*
➢ *Chuck Turner is not suggesting specific terms, just to follow what is written in governing documents.*
➢ *Bret Schichtel asked if the function of roles should be defined before terms are determined. (Answer: yes)*
➢ *John Vimont commented that IMPROVE could model after NADP with a board, roles that rotate. IMPROVE is smaller so it may not be a sensible arrangement. Asked if the secretary role fall to IMPROVE members or remain with contractor support. Should vice-chair move to chair role over time?*
➢ *Bret replied that a vice-chair position is a good place to learn and gain experience.*
➢ *Tom Moore commented that having worked with member organizations and that an executive role helps with meeting deadlines, functional roles, and logistics, need to make sure people who fill those roles have the requisite skills.*
➢ *Xinrong supported the idea of chair/vice-chair. Asked if terms should be shorter or longer? 3, 5, 10 years?*
➢ *Warren White commented as a long term observer/non-member have been impressed by the commitment the chairs have shown historically. Would not want to lose such intense focus and jay-job forgiveness. Would not want to see it become a decorative role.*
➢ *Scott commented that collaborative work makes it less burdensome on the chair.*

- o Implementing subcommittees

➢ *Scott Copeland asked if members would be willing to join or participate in subcommittees, committees would also serve on a subcommittee.*
➢ *Joann Rice replied in the affirmative*
➢ *John Vimont commented that is important for any workgroup to define roles.*
➢ *Bret commented a data analysis group development or RHR metrics will go on long-term.*
➢ *Tony suggested an outreach or communications workgroup for states, users, operators, etc.*
➢ *Chuck stated he was willing to serve on a subcommittee. Suggested inviting MARAMA, or other RPO members.*
➢ *Bill Malm asked about products, deliverables, and timelines.*
➢ *Bret suggested those would be first objectives defined in subgroups.*
➢ *Bill suggested a strawman structure to help people decide if they want to or are able to participate.*
➢ *Bret replied that the list has been started, but needs completion.*
➢ *John Vimont stated a need for deadline so progress will be made before next steering committee meeting.*
➢ *Bret stated another draft should be available in January.*
➢ *Bill commented staffing issues would hinder work.*

> ➢ *Bret stated some of this work can begin before charter is finalized. Asked if a spring meeting would be helpful. Most responses were yes. Hopes to have groups in place by Spring 2022.*

Implementing Subcommittees

Tom Moore presented a PowerPoint discussing the subcommittees from the WRAP perspective. A copy of the PowerPoint presentation accompanies these minutes. Summary points are as follows:

- Focus on mechanisms for better communication.
  - o Transparent communication is key.
  - o Charter and process improvements will help.
  - o Communicate meaning and applications of data between users and IMPROVE community.
- Uses for data
  - o Calibrate model response to set future goals for visibility improvement.
  - o Track progress.
- Proposed workshops
  - o Annual meeting each fall.
  - o Spring meeting for data review for all users.
  - o Summer meeting for network operations for all users.

BUDGET

Budget Analysis & Discussion

Tony Prenni led a discussion regarding the IMPROVE budget.

IMPROVE Steering Committee Business

Scott Copeland led a discussion regarding IMPROVE business updates.

> ➢ *Spring virtual meeting is possible to advance subcommittees and charter.*
> ➢ *Fall meeting ideally in person. New Hampshire suggested as location again.*