

WRAP Ambient Monitoring and Reporting Forum
November 14th 2000 Meeting Summary

In attendance at the meeting were Marc Pitchford (NOAA); Tom Moore, Mark Fitch, Darcy Anderson, and Mike Sundblom (AZ-DEQ); Bill Malm (NPS); Dan Ely (CO-DEQ); and Doug Fox and Bret Schictel (CIRA). The meeting followed the agenda (attached) except for the addition of a discussion led by Dan Ely (Colorado DEQ) concerning a proposal for additional monitoring. The summary is organized by agenda topics and includes several calls for volunteers to help on certain tasks over the next few months (shown in bold face type).

Update of WRAP & AMRF activities and Review of AMRF charter & tasks Since those in attendance were generally aware of the overall activities and progress of the WRAP, only a brief update was presented. The WRAP web page is a good way to stay current with their activities.

In the discussion of the AMRF charter and activities the group generated a table that included activities with corresponding budget and schedule information.

| Activity | Schedule | Budget |
|--|--------------------------|---|
| Database development & maintenance | Development in progress | \$125k until 7/01, then \$50k/year |
| Annual Report | SOW needed early in 2001 | \$75k first year, then \$50k/year |
| Develop method to estimate natural haze levels | January 2002 | Currently unfunded, but will seek resources |
| Causes of Haze Report (prepared every 5 years) | SOW needed by mid-2002 | \$100k/report |

Progress on the database and the development of a method to estimate natural haze levels are discussed in separate agenda item below.

The AMRF needs to determine and document in a scope of work the types of information and analysis that we want included in the annual data report. From the discussion, a summary and display of the data with some limited discussions was favored as the overall approach. The idea was raised that the data report should be distributed solely electronically on the web page that is being developed for the database. This would simplify distribution and allow states and others to prepare custom reports and presentations using selected excerpts from the annual data report.

It was also suggested that the annual data report might be useful to states in their official reporting of the data to EPA as specified in the Regional Haze Rule. The annual report should include calculations of extinction and deciview levels corresponding to each sample period from the aerosol data, determine which sample periods are among the 20th percentile highest and lowest haze conditions, calculate averages of those values for each site, and characterize the sample periods (e.g. time

of year, composition, etc.) that contribute to highest and lowest haze levels. Similarities between data at neighboring sites could be used to identify functional groupings of sites that might be useful in presenting national overviews of the data.

As multiple years of data become available, the annual data report can also show the trends in the highest and lowest haze periods for each site and attempt to identify possible meteorological reasons for differences between years by simple assessments of interannual variations in meteorology (e.g. a longer than usual cold period contributing to more nitrate dominated extinction).

We are seeking volunteers among the AMRF members and other participants to help in generating a technical scope of work for the plan. Anyone interested in participating should contact Marc Pitchford (702-895-0432; marcp@dri.edu) or Tom Moore (602-207-2353; CTM@ev.state.az.us).

There was less discussion of the Causes of Haze Report since its schedule is further in the future. One of the primary purposes of this report is to provide the states with information that they can use to assess the trends and causes for changes in haze levels using monitoring data for their every 5-year required regional haze assessment. This report would explore questions of source types and source areas contributing to haze, as well as atmospheric conditions that effect haze levels. It would attempt to estimate the spatial scale of haze events, the relative importance of local and distant sources, and assess the influence of sources beyond U.S. borders. The opinion was expressed that \$100k per report might be insufficient to do a very ambitious report and that we should seek more resources (e.g. \$250k) so that we can engage quality data analysts to contribute to this report.

CIRA Proposal for the Ambient Monitoring Web Database and Feedback to CIRA

The WGA contract with CIRA to prepare and maintain a web database for WRAP ambient monitoring data was finalized in September. CIRA presented their plans and preliminary work on the database and the AMRF provided feedback to them concerning the desired content, operation, and users they anticipate for the database.

The WRAP web database will mirror most of the features of an IMPROVE web page and database that is being prepared by CIRA. That this would be the case was indicated in the CIRA proposal and the obvious benefits of getting a better product for our resources by having two groups fund very similar work was one of the factors considered in selection of CIRA for this contract. CIRA showed some of the capabilities that have already been developed (or are currently in-development) for the IMPROVE web page. These include educational material on visibility science and regulation, access to the data through a graphic viewer, data related tools, access to scenic photographs, access to meta-data (e.g. site descriptions, operations and quality assurance procedures, etc.), access to reports and other publications, and links to related web sites.

The WRAP web site will share the IMPROVE web capabilities, but will be different in a number of ways. It will include other selected aerosol, optical, and meteorological data. It will have a separate web address and different banner. The graphic viewer will have maps of the western US and high-resolution urban area maps for urban areas that contribute data. The WRAP web database will also have additional data analysis tools, most of which will be subsequently applied to the IMPROVE web address. Some of these would include integration of meteorological and air quality data (e.g. trajectory analysis), and calculations of extinction from aerosol speciation data using the EPA-approved approach and other selected methods.

A schedule for the implementation of the WRAP database web site was agreed to during the discussion. Public release of the WRAP web database with limited capability would be by January 15, 2001; call to states, tribes, and others who may have data set would go out by March 1, 2001; additional IMPROVE optical and photographic data would be added by April 1, 2001; data from other sources would be added as it becomes available during the summer and fall of 2001; and some on-line data processing and data viewing capabilities will be available during the fall and winter of 2001.

The WRAP database web will be the principal means to publish and distribute the annual data reports, which will be available in a searchable format that allows custom-made reports to be fashioned for state or other organizations reporting requirements under the regional haze rule. There was also discussion of the possibility of having the database be used by the states to transmit required visibility monitoring data to EPA. This would apparently necessitate providing states a review and comment period for the data prior to its transmittal to EPA.

AMRF approach for estimating natural haze levels An overview of the proposed approach was presented and discussed (overheads are attached). The essence of the approach is to estimate natural background for every particle sample period at each monitoring site that is used to track haze trends. This would be done by having an estimate of natural source contributions to each of the major particle species (i.e. sulfate, nitrate, organic and elemental carbon, fine crustal material, and coarse mass). This is similar to the often-cited work of John Trijonis (NAPAP State of Science Report #24) except that he made the natural source contribution estimates for each of the major species based upon annual average concentrations for the Eastern and for the Western US, instead of individual sample periods. The advantage of the proposed approach is that natural levels can be aggregated to determine the mean for the best and worst 20th percentile haze conditions, systematic and large sporadic source activity for natural sources can be more realistically accommodated to produce credible estimate of natural source contributions to haze, and with the understanding that natural contributions to haze can vary from year to year and over longer time periods, it allow those variations to be tracked along with the overall haze levels.

The key to making such an approach work is to determine credible approaches to estimate the species contributions from natural sources. Most natural sources are expected to have some type of systematic variation in activity level. For example, secondary organic aerosol from biogenic sources (i.e. terpenes from conifer trees) have emission rates that are highly dependent on temperature, so they vary seasonally and geographically (i.e., most important in and near conifer forests). Some natural sources are expected to contribute only a minor amount to the overall concentrations (e.g. natural sulfates) such that a small constant contribution may be of sufficient accuracy even if there are systematic source activity variations. The process of developing the approach will involve synthesizing information from a combination of literature review, polling of experts in the field, and data analysis (much as John Trijonis did a decade ago).

When the AMRF was tasked with developing an approach about a year ago, we had already prepared our proposals and budgets for the forum, so this task was not budgeted. During the discussions at the meeting it was suggested that we need to obtain resources (~\$150) to contract with subject matter experts in order to prepare a credible approach and to conduct the workshops needed to review, explain and gain acceptance of it. A request for additional resources was forwarded to WRAP during the November 28, 2000 WRAP Planning Team Meeting in Salt Lake City.

AMRF is looking for some volunteers to work on haze contributions from the various natural sources to begin the process of developing the approach by doing the literature searches and identification of subject matter experts. If you are interested contact Marc Pitchford (702-895-0432; marcp@dri.edu) or Tom Moore (602-207-2353; CTM@ev.state.az.us).

Colorado proposal for additional monitoring to aid in regional haze assessments Dan Ely (CO-DEQ) presented a series of concerns of the State of Colorado related to monitoring and data analysis for consideration by the AMRF. The concerns seemed to come from a feeling that modeling should not be used alone to develop and assess emission strategies for the regional haze regulation, and that additional monitoring and analysis of monitoring data could be used instead of, to supplement, or to evaluate the use of models for that purpose.

He asked the AMRF to consider an assessment of the possible benefits of additional monitoring to gather data needed to characterized transport of pollutants towards class I areas, to fill input data deficiencies for regional modeling, to improve our ability to characterize visibility conditions of class I areas, and evaluate the performance of regional scale modeling. Additional monitoring would not necessarily mean more aerosol speciation sampling sites. Perhaps additional routine upper air meteorological monitoring, or use of high-time resolution monitoring (e.g. expanded sites with nephelometers) would be of greater value in helping to characterize the relative importance of local verses long-distance regional sources and as an adequate check on the ability of models to simulate atmospheric processes.

The AMRF agreed there was merit to considering what could be done to reasonably respond to Colorado's overall concerns about how to better integrate monitoring information with modeling in SIP development. The AMRF will include this topic on the agenda for the next AMRF meeting for more in-depth discussion. These issues might be appropriate topics to be jointly addressed by the AMRF and Research and Development Forum, perhaps via an independent assessment by a contractor with a workshop to review and communicate the assessment results. In the mean time the AMRF co-chairs with Colorado will make contact with the TOC and modeling committee to see how these issues evolve as the other forums and committees become involved.

WRAP Ambient Monitoring & Reporting Forum (AMRF)

November 14, 2000 Meeting Agenda

Room 280 (Second Floor)

Phoenix Corporate Center, 3003 North Central Avenue, Phoenix, AZ 85012

| <u>Time</u> | <u>Topic</u> | <u>Discussion</u> |
|---------------|--|-------------------|
| <u>Leader</u> | | |
| 8:30am | Welcome and introductions | Marc Pitchford |
| 8:45am | Agenda review | Marc Pitchford |
| 9:00am | Update of WRAP & AMRF activities | Tom Moore |
| 9:30am | Review of AMRF charter & tasks | Tom Moore |
| 9:45am | Break | |
| 10:00am | CIRA Proposal for Ambient Monitoring Web page | Bret Schictel |
| 12:00am | Lunch | |
| 1:15pm | AMRF feedback to CIRA on Web page | Marc Pitchford |
| 2:15pm | Annual data report Scope of Work | Tom Moore |
| 3:15pm | Break | |
| 3:30pm | AMRF approach for estimating natural haze levels | Marc Pitchford |
| 5:30pm | Adjourn | |

This meeting is being held at the offices of the Arizona Department of Environmental Quality.

Please contact Tom Moore at 602-207-2353 or moore.tom@ev.state.az.us with questions about directions, parking, ground transportation, and/or hotel accommodations.

The Phoenix Corporate Center is 10-15 minutes by taxi from the airport.

Here are 2 government-rate hotels within easy walking distance:

Hampton Inn **\$79/night**
160 West Catalina Drive
602-200-0990

Quality Hotel **\$89/night**
3600 North 2nd Avenue
800-256-123

Approach for Estimating Natural Haze Levels

11/9/00 Draft
by Marc Pitchford

Regional Haze Rule Requirements

- Natural haze levels for each protected area
- Natural haze levels for the worst 20% of current haze levels
- Needed at the beginning of the program (2003 to 2008) for a reasonable progress assessment [rate = (current – natural)/60]
- During implementation need to attribute haze to sources, including natural

Other Considerations

- Natural levels are not constant, they change daily, seasonally, and from year to year
- Natural levels vary geographically and with elevation
- Conditions responsible for extreme haze levels (high or low) cause some natural sources to contribute more & others to contribute less to haze
- Some natural sources are highly sporadic, with modest impacts most of the time but with rare periods of dominate impacts (e.g. biomass burning, wind suspended dust)

Available Natural Haze Estimates

- Annual mean values for the East is $26 \pm 7 \text{Mm}^{-1}$ and for the West is $17 \pm 2.5 \text{Mm}^{-1}$
- Developed by John Trijonis for the NAPAP State of Science Report #24
- Started by estimating the aerosol concentrations from natural sources
- Multiplied each by extinction efficiency values and summed the component results

Annual Mean Natural Background Aerosol Estimates¹

| Particle Component | East ($\mu\text{g}/\text{m}^3$) | West ($\mu\text{g}/\text{m}^3$) | Error Factor |
|---|-----------------------------------|-----------------------------------|--------------|
| PM _{2.5} | | | |
| Sulfate (NH ₄ HSO ₄) | 0.2 | 0.1 | 2 |
| Organics | 1.5 | 0.5 | 2 |
| Elemental Carbon | 0.02 | 0.02 | 2 – 3 |
| Ammonium Nitrate | 0.1 | 0.1 | 2 |
| Soil Dust | 0.5 | 0.5 | 1.5 – 2 |
| Water | 1.0 | 0.25 | 2 |
| PM ₁₀ | 3.0 | 3.0 | 1.5 - 2 |

1. From John Trijonis, NAPAP State of Science #24, Appendix A, 1991

Improving the NAPAP Estimates

- Include the water component with the sulfate & nitrate
- Use updated extinction efficiencies, consistent with those used for calculating haze trends
- Incorporate the systematic variations in natural source contributions where significant
- Identify periods of sporadic natural source impacts and estimate effects
- Calculate natural contributions for every sample period, so natural levels on worst & best 20% can be calculated

Examples of Systematically Varying Natural Sources

- Organic carbon from secondary formation of biogenic hydrocarbon emissions (e.g. terpenes) are highly related to temperature & and will be more important in conifer forests
- Oceanic sulfates are most important at coastal areas
- Natural wind suspended dust and biomass smoke is greatly reduced in areas that are snow-covered

Approach for Systematic Sources

- For species where natural contributions are a small fraction of the total, use either a constant or a constant fraction of the total as natural (e.g. sulfates & nitrates)
- For species where natural contribution sources are substantial but vary in a systematic way use a varying value or fraction of the total as natural (secondary biogenic aerosol)
- Allow for geographic differences (e.g. higher coastal sulfate from the ocean)

Sporadic Natural Sources

- Organic & black carbon (& perhaps crustal material) in natural biomass burning smoke
- Wind suspended dust from undisturbed land (probably only an issue for natural sand dune and dry lake beds)
- Sulfate & nitrate from volcanoes (not an issue now, but could be in the future)

Approach for Sporadic Impacts

- In general, treat these sources as systematic except for sample periods that are likely to be impacted substantially
- For biomass burning, use the daily fire emissions inventory to determine whether natural smoke may be substantial for any sample
- For dust from undisturbed soil, use the locations of dunes & dry lakes along with wind speed exceeding the threshold to determine whether natural dust may be substantial for any sample

Next Steps

- Prepare a strawman method using literature & communications with the experts
- Conduct workshop(s) with technical experts to critique & revise the strawman method
- Conduct workshop(s) to present the revised method to WRAP & other decision makers