

Summary of WRAP Dust Emissions Joint Forum Projects

April 12, 2005

1. **Establish a Common Definition of Dust and Dust Emission Types**

Project Leaders: Rob Farber and Lee Alter

Project Participants: All Forum members

Project Funding: \$65,000

This project is important to develop a common set of terms and definitions and to identify types and examples of dust emissions that should be considered natural and anthropogenic. With these terms and definitions established, a policy can be developed to categorize and track dust emissions and their contributions to regional haze. Most of this definition and policy development will be undertaken directly by Forum members, with review and input from other stakeholders and the WRAP oversight committees. As was the case when developing the WRAP Policy for Categorizing Fire Emissions, a facilitator will be hired if necessary to maintain documentation and communication with stakeholders and to conduct 1-2 public workshops.

A draft definition and examples of natural and anthropogenic dust were sent to the Forum in March 2004. Some revisions were made and further reviewed. In the fall of 2004 it was decided that a feasibility analysis should be performed to determine if the data and methods exist to implement the definition and the approximate time and cost of doing so. A contract was signed with ENVIRON in March 2005 to support this project. This work is expected to continue until August, at which point a definition and categorization policy can be finalized and implemented.

2. **Examine the 20% Worst Visibility Days in Which Dust Dominates the Light Extinction Budget**

Project Leaders: Marc Pitchford and Lee Alter

Project Team: Rob Farber, Bruce Friedl, Jean-Paul Huys, Tom Moore, Duane Ono, Tom Pace

Project Funding: \$50,000

Preliminary analysis provided by Jin Xu at Desert Research Institute and posted on DEJF website on January 14, 2004. Proposal submitted by DRI to extend causes of haze contract to accelerate and enhance dust assessment work on March 16, 2004. Progress reports are available via PowerPoint presentations on the WRAP website.

Dust, as defined by the sum of the fine soil and coarse material measured at IMPROVE sites, typically comprises 10 to 20 percent of the aerosol light extinction budget in the WRAP region, with exceptions in the Cascades (7 percent) and much of AZ and NV (25 percent). The contribution of dust on any given day, however, can vary dramatically, as can the largely uncertain portion attributable to anthropogenic sources.

The purpose of this work is to characterize the frequency and magnitude of dust impacts in the WRAP region, and to the extent possible their probable sources. This work will be a product of (or enhancement/supplement to) the causes of haze work under contract with the Desert Research Institute. Its results will help prioritize the Forum's emission inventory and control development work and will support (e.g., by providing concrete examples) development of dust definitions and a categorization policy.

DRI has identified the 20% worst visibility days at each IMPROVE monitoring site where dust is the largest contributor to visibility impairment. To the extent possible these site-days are being categorized as Asian dust, local windblown dust, regional windblown dust, fire-related dust, and uncertain or mixed. This work is about half done.

3. Evaluate the U.S. EPA's Fugitive Dust Emission Factor Test Methods for PM_{2.5}

Project Leaders: Roger Isom and Duane Ono

Project Participants: Gail Cook, Bruce Friedl, Jean-Paul Huys, Barbara Trost, Rob Farber, Susan Hardy, John Bosch, Tom Pace, Lee Alter, Don Arkell, Ken Cronin, Gerry Mansell, Tom Moore

Project Funding: \$120,000

A contract was signed with Midwest Research Institute in February 2005. The work should be completed by October 2005.

Background: Most of the PM-2.5 emission factors in the US EPA's AP-42 guidance for fugitive dust sources were determined by using hi-volume samplers fitted with a PM-10 cyclone and cascade impactor. Particle bounce on the cascade impactor stages may have resulted in higher PM-2.5 concentrations than the actual conditions. If so, this may help to explain why the AP-42 emission factors for fugitive dust sources appear to overestimate PM-2.5 emissions. In addition, the wind blown dust modeling study conducted for the WRAP assumes an average PM-2.5 to PM-10 ratio of 22% for wind blown dust. This ratio has not been well-documented, but it is a significant assumption used in the windblown dust model.

Proposal: Under the same conditions, the PM-2.5 mass for a monitor that measures emissions from a source should be nearly identical to the mass collected using an ambient PM-2.5 sampler that meets US EPA ambient monitoring requirements. A comparison of the PM-2.5 concentrations measured using a hi-volume cascade impactor and the US EPA reference method for PM-2.5 should be performed to determine if there is a significant difference. This test can be conducted in an exposure chamber, where concentrations and filter loadings can be controlled. This test should also be performed with US EPA approved PM-10 samplers to evaluate the PM-2.5 to PM-10 ratio for fugitive dust from different geologic sources to help determine if a consistent sampling bias exists. The ratio of PM-2.5 to PM-10 measured in these tests may also be useful to help apportion the fine and coarse fractions of particulate matter associated with wind blown dust.

Results:

- A. The monitor comparison test should show the accuracy of the cascade impactor measurement to the reference method monitor for PM-2.5. The results could show 1) that there is no sampling bias and that the AP-42 emission factors for fugitive dust are okay, 2) that a consistent bias exists and that it can be corrected, or 3) that there are significant differences that can't be explained using this test method and that additional testing is necessary. At least two soils will be tested under this task.
- B. The results of the PM-2.5 and PM-10 measurements will provide information on the fine and coarse particle size ratio for fugitive dust from different geologic sources. This information can be used with the wind erosion emissions for the regional haze model and may replace the current assumption that 22% of the wind blown dust is in the fine fraction. At least five soils will be tested under this task. State staff from AK, AZ, CA, NM, and WY are collecting samples for potential analysis.

4. Refine Windblown Dust Inventory

Project Leaders: Michael Uhl, Tom Moore

Project Participants: Lee Gribovicz, Tom Pace, Duane Ono, Dale Gillette, Gerry Mansell, Ralph Morris, Mohammad Omary (Richard Countess also invited)

Project Funding: \$100,000

The initial goals for the "Determining Fugitive Dust Emissions from Wind Erosion" study have been achieved: to develop a general methodology and program code for estimating fugitive dust emissions from wind erosion, and to develop a PM_{2.5} and PM₁₀ emissions inventory for the WRAP region modeling domain for 1996. The sheer scope and complexity of the project necessitates additional fine-tuning of the methodology. The purpose of the follow on project is to refine "The MacDougal Method". To date, study results have been compared to data from two distinctly different sites, which demonstrated good correlation. Refinement efforts should focus on validation of emission factors and in-depth research of ongoing and existing wind tunnel studies for expansion of the dataset used to derive the emission factors. Ongoing research in this arena by Washington State University and the USDA for the Columbia Basin and the ICAR5 and GCTE-SEN Projects will provide extensive data. Additionally, assumptions used in the initial application of the methodology require enhancement. The methodology may achieve the most significant and cost effective gains through an improvement of the assumptions.

Phase II of the windblown dust inventory project is nearly complete. Emissions and air quality modeling results are being compared with ambient data. In addition, the emissions will be recalculated based on new, finer-resolution MM5 meteorological data, agricultural adjustment data, and transportation fractions. A draft report is expected in April 2005.

5. **Fugitive Dust Handbook and Website**

Project Leaders: Duane Ono and Lee Alter

Project Team Members: Ed Barry, Jean-Paul Huys, Wayne Leipold, Toni Richards, Susan Hardy, Don Arkell, Rob Farber

Project Funding: \$75,000

This project has been completed, and the handbook is available via the WRAP website.

The Fugitive Dust Handbook (handbook) and website will be used for technical and policy evaluations by WRAP members, stakeholders, and other interested parties. The handbook and website are expected to incorporate available information into a comprehensive document that will be useful to all WRAP members when addressing specific air quality issues and when developing regional haze implementation plans.

The handbook and website will provide a comprehensive technical reference for the following fugitive dust source categories:

- Paved Roads
- Unpaved Roads
- Materials Handling
- Wind Erosion From Material Storage Piles
- Construction and Demolition
- Open Area Wind Erosion
- Agricultural Tilling
- Agricultural Wind Erosion

For each fugitive dust source category, the following information will be compiled using the available information:

- **Emission Estimation Methods.** Complete text of PM₁₀, PM_{2.5} and PM_{2.5-10} emission estimation methods included in AP-42. Useful methods of obtaining activity level information for the emission estimates, or alternative methods that can be used to improve the emission estimates for these source categories should also be briefly discussed. The user may be referred to other documents for more information on methods not discussed in AP-42.
- **Control Techniques.** Discuss fugitive dust control methods that have been implemented to reduce or prevent emissions, emission reductions associated with each control method, method for estimating control method cost, range of control measure cost, and cost effectiveness for each control method.
- **Fugitive Dust Compliance Tools.** Discuss methods used by facility operators and regulators to determine compliance with fugitive dust regulations. Provide examples (and web links) of regulatory language or facility permit conditions used to implement control measures.

6. Analysis of Sources and Control Options in High-Dust Areas

Project Leaders: Gail Cooke and Lee Alter

Project Team Members:

Project Funding: \$80,000

This project is a pilot study to test and demonstrate how various WRAP technical and policy products can be integrated to address the contribution of dust to regional haze at Class I areas in the WRAP region. Strengths and weaknesses of the WRAP products will be identified so that they may be improved before state and tribal implementation plans are finalized. Results will be shared with other WRAP members to inform their planning and assessment processes.

The NM Environment Department Air Quality Bureau (AQB) will take the lead in this effort and provide project results. The Class I area(s) selected in NM for the pilot project will have many of its 20% worst visibility days dominated by dust and will be representative of other dust-impacted Class I areas in the Southwest. The WRAP products to be used in the study, to the extent available, will include the Desert Research Institute's analysis of ambient data; ENVIRON's fugitive dust emissions inventory and modeling procedure for wind erosion; Countess Environmental's Fugitive Dust Handbook; the dust definition under development; and the Attribution of Haze results.

The duration of the study would be nine months. The study would include the development of a general emissions inventory of all sources associated with dust-related haze within the selected Class I Area. The emission inventory would be contracted out and the AQB would act as project manager to ensure completion of the project in a timely and costly manner. The AQB would use the emission inventory and the tools provided by the WRAP to develop a SIP-quality analysis for dust-related haze in Class I areas. Work is expected to begin in the spring of 2005.