

# Procedure for Speciation of Emissions for VISTAS BART Modeling

## July 18, 2006

### 1. Overview

In many cases, the speciation of the particulate matter required for a BART analysis will not be known. For source types with guidance provided by sources such as AP-42, the use of these factors is recommended. Information for many source types is provided on the VISTAS web site (<http://www.vistas-sesarm.org/BART/index.asp>) and the National Park Service web site (<http://www2.nature.nps.gov/air/Permits/ect/index.cfm>).

The following memo outlines an approach to estimate speciation characteristics with a reasonable degree of conservatism in situations with incomplete data when the guidance is not available from VISTAS or the NPS.

### 2. Approach

The extinction efficiency of the various pollutants considered for a visibility analysis varies. According to the FLAG procedures, the extinction efficiencies for non-hygroscopic pollutants are:

Elemental Carbon (EC)	10.0
Fine PM (SOIL)	1.0
Coarse PM (PMC)	0.6
Organics (OC)	4.0

and for hygroscopic pollutants:

Sulfate (SO <sub>4</sub> )	3.0 x f(RH)
Nitrate (NO <sub>3</sub> )	3.0 x f(RH)

The information that may be provided in an emissions inventory includes the following:

- PM<sub>10</sub> emissions
- Filterable emissions
  - o Elemental carbon (EC)
  - o Fine PM (SOIL)
  - o Coarse PM (PMC)
- Condensable emissions
  - o Primary H<sub>2</sub>SO<sub>4</sub> emissions (SO<sub>4</sub>)
  - o Non-H<sub>2</sub>SO<sub>4</sub> inorganic emissions (SOIL)
  - o Organic emissions (OC)

The general rules applied to estimate speciation in the absence of complete data are the following:

- (1) Use as much information on the speciation as is available
- (2) Assume all unknown PM falls in the highest reasonable speciation category
- (3) Assume all condensable emissions are in the fine (< 2.5  $\mu\text{m}$ ) size category
- (4) Assume all unknown filterable PM is in the fine size category

A clarification of (2) above is that it is considered overly conservative to assume 100% of PM is elemental carbon, so the default assumption is that organics (OC) is the highest extinction category. Any unknown PM (after primary  $\text{H}_2\text{SO}_4$  emissions are removed from the total) as assigned to the OC category.

### 3. Examples

The following are examples of the application of the above rules.

- (1) Known: PM10 emission rate only. No other information.  
Assumed speciation: 100% of the PM is assumed to be OC in the submicron size categories.
- (2) Known: PM10 emission rate, filterable/condensable fraction,  $\text{H}_2\text{SO}_4$  emissions.  
Assumed Speciation: 100% of filterable mass assigned to SOIL,  $\text{H}_2\text{SO}_4$  emissions assigned to SO4, 100% of non-  $\text{H}_2\text{SO}_4$  condensable mass assigned to OC. SOIL mass is split equally in sub-2.5  $\mu\text{m}$  size categories. OC mass is assumed to be in the submicron size categories. SO4 mass is assigned to default CALPUFF size distribution.
- (3) Known: PM10 emission rate, PM2.5 emission rate. No other information.  
Assumed Speciation: 100% of PM2.5 mass assigned to OC. 100% of difference (PM10-PM2.5) assigned to PMC.
- (4) Known: PM10 emission rate, filterable speciation fractions (EC, SOIL, PMC).  
Assumed Speciation: EC, SOIL, PMC fractions used directly. 100% of difference PM10-PM2.5 assigned to PMC.
- (5) Known: PM10 emission rate,  $\text{H}_2\text{SO}_4$  emission rate.  
Assumed Speciation:  $\text{H}_2\text{SO}_4$  emissions assigned to SO4 category. 100% of the remainder (PM10- $\text{H}_2\text{SO}_4$ ) assigned to OC.
- (6) Known: PM10 emission rate,  $\text{H}_2\text{SO}_4$  emission rate, filterable/condensable fraction.  
Assumed speciation:  $\text{H}_2\text{SO}_4$  emissions assigned to SO4 category. PM10 split between filterable and condensable components using known fractions. 100% of filterable mass assigned to SOIL. SOIL mass is split equally in sub-2.5  $\mu\text{m}$  size categories. 100% on non- $\text{H}_2\text{SO}_4$  condensable mass assigned to OC. OC mass is assumed to be in the submicron size categories. SO4 mass is assigned to default CALPUFF size distribution.

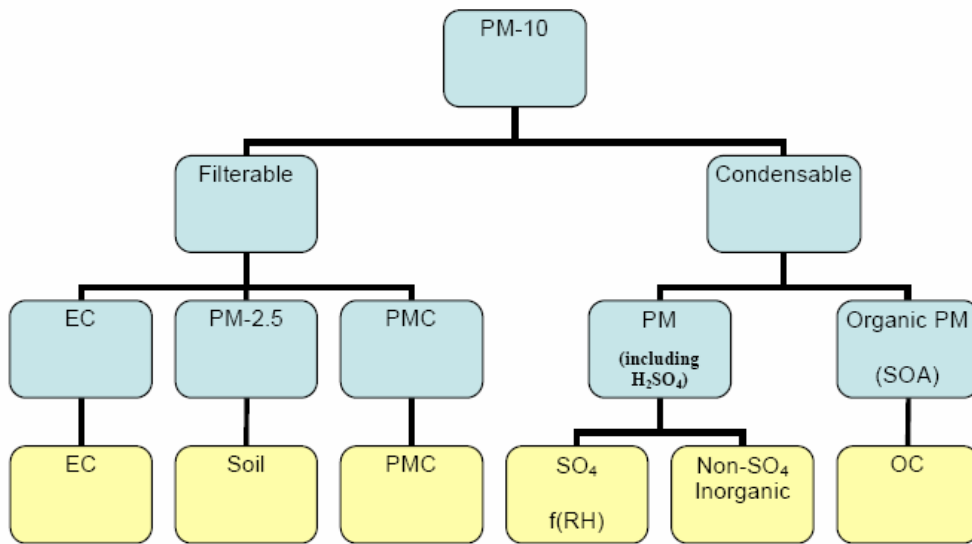


Figure 4-3. Speciation of PM-10 Emissions. (PMC is coarse particulate matter -- 2.5 to 10  $\mu\text{m}$  diameter.)