November 21, 2001

Bill:

I am submitting the following comments for your evaluation in response to your request for comments on the draft sections of AP-42 that address paved and unpaved roads.

Section 13.2.1 "Paved Roads"

I certainly endorse the addition of a "precipitation correction term" to the emission factor equation. Should equation 2 state that one is dealing with precipitation in the form of rain? Since snow will have a different effect than rain on mitigating dust emissions, shouldn't this be addressed, especially if the temperature is below freezing such that the snow remains on the roadway and is a physical barrier to road dust resuspension?

Without actual data showing the effect of precipitation on paved road emissions, either option has its merits. I believe that Option 1 (i.e., making an adjustment on a daily basis) is superior to Option 2 (i.e., making an adjustment on an hourly basis) from the stand point that the amount of precipitation that occurs in the period following the initial precipitation will have a cumulative effect on increasing the moisture content of the surface road dust, and consequently decrease the probability of dust emissions. However, I disagree with the amount of precipitation being proposed that would effectively reduce dust emissions to zero (see my comments below). On the other hand, Option 2 has a nice simplicity to it in that it allows one to set the emissions to zero for that single hour. Whatever option is selected, there should be a provision that addresses a reduction in emissions in subsequent time periods following a precipitation event (i.e., next day, or next several hours) that is dependent on the total amount of precipitation.

As I interpret equation 2 (Option 1), this equation states that paved road dust emissions on days with at least 0.01" precipitation are only half that of days with less than 0.01" precipitation. However, I don't see any scientific documentation for the incorporation of a factor of "2" in the precipitation correction term for paved roads. It appears to more of a "WAG" than a sound scientific fact. Furthermore, whether one accepts for the moment the assumption that precipitation of at least 0.01" per day will reduce paved road dust emissions to zero (a claim that I address below), it is inconsistent to set different threshold values for zero emissions for both options being considered, namely 0.01"/day for Option 1 and 0.01"/hour for Option 2. If 0.01"/hour is the correct value for Option 2, then shouldn't one be using a value of 0.24"/day for Option 1?

There should be consistency between the models used for paved roads and those used for unpaved roads for evaluating the effect of precipitation. Figure 13.2.2-5 indicates that the control efficiency for fugitive dust emissions from unpaved roads is assumed to be zero for a ground inventory of less than 0.05 gallons of petroleum resin applied per square yard if the time between applications is 2 weeks to 1 month. Unfortunately, this figure doesn't show what the control efficiency would be if the time between applications were a day let alone one hour. Assuming for a moment that water has an equivalent effect on mitigating dust as petroleum resin at least in the short term, precipitation amounting to 0.01" per hour, which is equivalent to 0.056 gallons/square yard, will have a negligible effect on controlling fugitive dust emissions from unpaved roads, and by extension, from paved roads. In fact, according to the data presented in Figure 13.2.2-5, it will require 0.25 gallons of petroleum resin per square yard applied at intervals of 2 weeks to one month to reduce dust emissions by 80%. Again, assuming that water will have an equivalent effect on mitigating dust as petroleum resin at least in the short term, precipitation of 0.25 gallons/square yard per hour is equivalent to 0.045"/hour or 1.08"/day. The bottom line is that I don't see any evidence or documentation that 0.01" of precipitation per hour, let alone 0.01"/day, will reduce fugitive dust emissions to zero.

I believe that using a mean vehicle weight (W) for cars and trucks for calculating PM emissions from paved roads has a major logical flaw. Logically it makes more sense to look at the sum of all the sources contributing to the total emission rate. In fact this is the practice recommended by the South Coast AQMD. To illustrate the fallacy of averaging the weight of all vehicles on the road, consider the simple case where there is one car weighing 3 tons and one loaded truck weighing 39 tons. Using the average weight of these two vehicles in the emission factor equation for paved road dust results in a PM10 emission rate of 0.1225 lbs/mile per vehicle, or 0.243 lbs/mile for both vehicles. Calculating the emission rate for the car and the truck separately and adding the two terms results in a total PM10 emission rate of 0.314 lbs/mile with 0.307 lbs/mile contributed by the truck. By averaging the vehicle weights, the total emission rate is less than that of the truck by itself. Obviously, averaging the vehicle weights does not give an accurate account of the true situation. (Note: my estimates of PM10 emission rates were taken from emission factors published by the South Coast AQMD.)

<u>Section 13.2.2 "Unpaved Roads"</u>

I am certainly happy to see that the new equations for public unpaved roads include a speed correction term. My review of Sehmel's original field test results (Atmos. Environ, 1973) for public unpaved roads indicate that TSP emissions from light duty passenger cars appear to increase with speed to the second power for speeds of 30 mph or lower and appear to increase with speed to the first power for speeds over 30 mph. Sehmel did not measure PM10. I would like to suggest that the EPA consider two speed regimes for estimating PM emissions from public unpaved roads: (a) $\leq$ 30 mph, and (b) greater than 30 mph.

Furthermore, Sehmel's original field data for a ¾ ton truck indicates that TSP emissions are proportional to speed to the 0.4 power. Perhaps, you need an option to calculate the PM emissions separately from light duty cars and from trucks. Again, as I discussed above, I believe that using a mean vehicle weight (W) for cars and trucks for calculating PM emissions from unpaved industrial roads is flawed.

Since the PM emissions data of Roberts et al (J.APCA, 1975) for a car traveling on a gravel road indicated that the PM10/TSP ratio increases with increasing speed, the new emission factor equations for unpaved roads should account for this fact. My review of the original field results indicate that for speeds up to 30 mph the TSP emissions increase as a function of speed to the 1.7 power, whereas the PM10 emissions increase as a function of speed to the 2.65 power.

The R-squared values for the proposed emission factor models for PM10 reported in Greg Muleski's September 27th memo to you (see Table 1) would be considered low by most individual's standards. Hopefully, adopting one or more of my suggestions will improve the R-squared values, and thus the accuracy of the fugitive dust emission prediction equations.

Please contact me if you have any questions regarding my comments.

Sincerely,

Richard J. Countess, Ph.D.
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