

PM2.5 Emissions Inventories for Permit Modeling

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Model Emission Rates – 24 Hour PM2.5

- Model emission rates for short term NAAQS are computed consistent with the requirements of Section 8.1 of Appendix W to 40 CFR Part 51, Tables 8-1 and 8-2.
 - The maximum allowable (SIP approved process weight rate limits) or federally enforceable permit limit emission rates assuming design capacity or federally enforceable capacity limitation are used to compute hourly emissions for dispersion modeling against short term NAAQS.
 - If a source assumes a limit on the unit capacity of an emission unit, this is reflected in the calculations. Otherwise, the design capacity of the source is used to compute the model emission rate.

Hierarchy of Emission Data Sources

- Source test data from facility or similar
- Vendor supplied emission factor data
- AP-42 Emission Factor Data

Reality Check

- Sparse information for many source categories.
- Most PM information for PM and PM10 based upon source testing requirements from various control technology requirements.
- Most AP-42 information provides little direct data on PM2.5, but rather relies upon particle sizing distributions to extrapolate PM2.5 emission factor information.
- Given data paucity, AP-42 will be relied upon extensively to provide information.
- Many factors in AP-42 have D or E ratings for PM, which is generally poor quality estimate based upon only one or a few source test reports of unknown quality.

Emission Factors at a Glance

$$E = A \times EF \times [1 - (ER/100)]$$

where:

E = emissions,

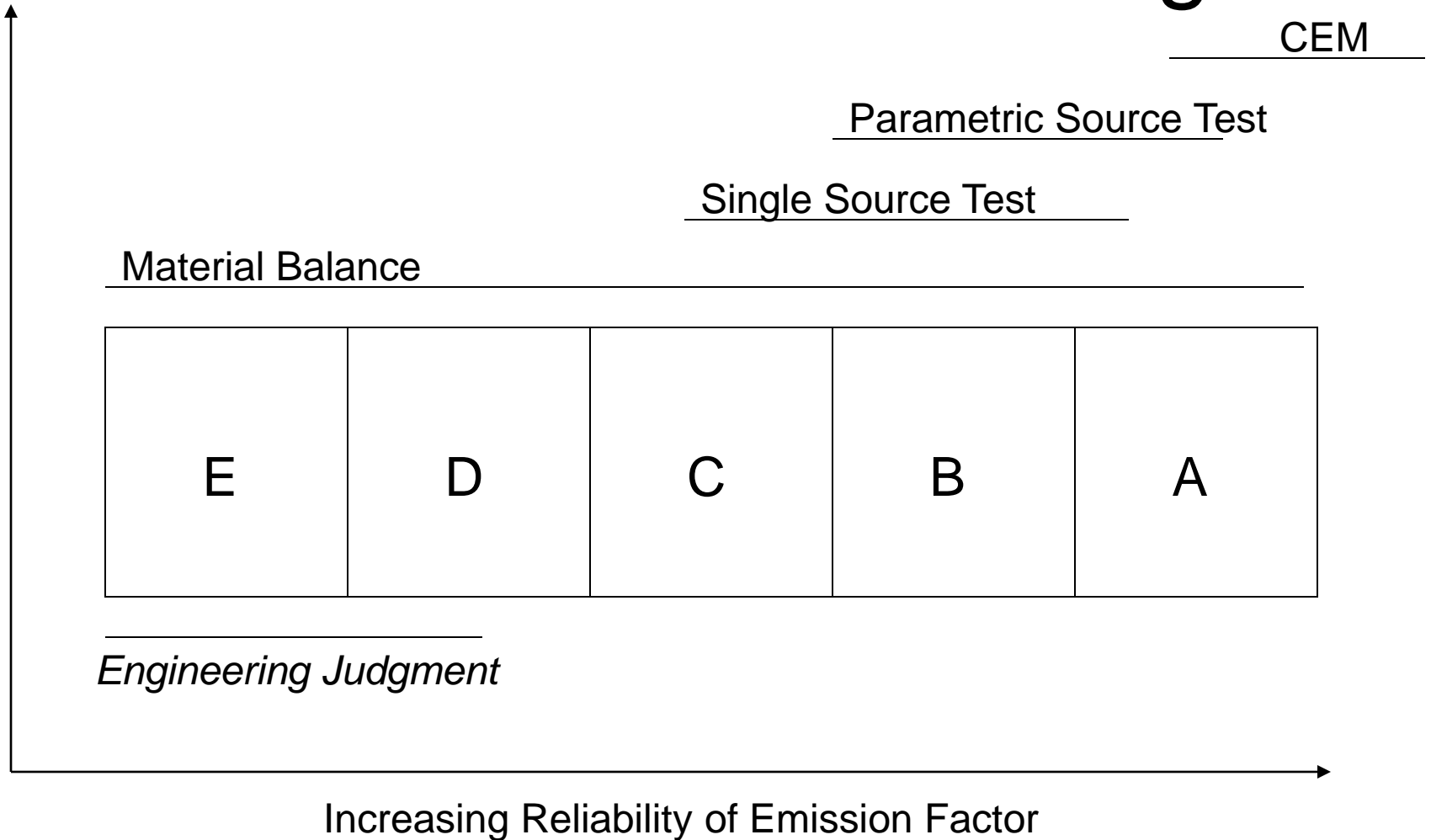
A = activity rate,

EF = uncontrolled emission factor, and

ER = overall emission reduction efficiency, %.

In most cases, these emission factors are simply averages of available data of acceptable quality, and are generally assumed to be representative of long-term averages for all facilities in the source category.

Emission Factor Ratings



Emission Factor Ratings

- A = Excellent. Emission factor is developed primarily from A- and B-rated source test data taken from many randomly chosen facilities in the industry population. The source category population is sufficiently specific to minimize variability.
- B = Above average. Emission factor is developed primarily from A- or B-rated test data from a moderate number of facilities. Although no specific bias is evident, is not clear if the facilities teste represent a random sample of the industry. As with the A rating, the sourcecategory population is sufficiently specific to minimize variability.
- C = Average. Emission factor is developed primarily from A-, B-, and C-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source category population is sufficiently specific to minimize variability.
- D = Below average. Emission factor is developed primarily from A-, B- and C-rated test data from a small number of facilities, and there may be reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source population.
- E = Poor. Factor is developed from C- and D-rated test data from a very few number of facilities, and there may be reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population.

Calculating Uncontrolled Emissions

- The first step in extrapolating PM_{2.5} emission factors is to calculate uncontrolled emissions. This is accomplished by multiplying the cumulative percentage of the aerodynamic particle diameter (µm) in the 0 – 2.5 range by the total particulate emission factor.
- For example, it is necessary to calculate PM_{2.5} emissions from the grain conveying operations at an ethanol facility. Using data from AP-42, Section 9.9.1 (Feed and Grain Mills and Elevators), the PM_{2.5} emission factor would be established as follows:
- Uncontrolled EFPM_{2.5} = Total PM Emission Factor x Mean Cumulative Percentage in the 0 – 2.5 µm diameter range.
- Uncontrolled EFPM_{2.5} = 0.5 kg/Mg of grain conveyed (AP-42, Section 9.9.1) x 0.168 (Appendix B.1, Section 9.9.1(16.8%)) = 0.084 g PM_{2.5}/Mg of grain conveyed.
- To calculate the uncontrolled model emission rate, the uncontrolled emission factor for PM_{2.5} is then multiplied by the hourly throughput of the conveyer system. For this example, we assume 1,000 Mg/hr of grain is conveyed across a particular transfer point.
- Uncontrolled hourly PM_{2.5} = 0.084 g PM_{2.5}/Mg x 1,000 Mg/hr or 84 g/hr of uncontrolled PM_{2.5} from grain conveying.

Calculating Controlled Emissions

- If PM_{2.5} emissions are controlled by a control device such as a baghouse or scrubber, two additional calculations are necessary to calculate controlled hourly PM_{2.5} values that would be used as input into a dispersion model.
- The first step is to determine the collection efficiency of a particular control device. The collection efficiency is the percentage of uncontrolled emissions that are captured and presented to the particulate control device. The remainder of the emissions that are not captured by the control device are considered uncontrolled and simulated as a fugitive release in the model.
- In the second step, the uncontrolled hourly PM_{2.5} captured by the control device collection system is then multiplied by the control efficiency of the control device.
- In the example above, emissions from a conveyer transfer point are being calculated. The conveyer transfer point is controlled by a baghouse. The uncontrolled particulate matter is captured by a collection hood. The baghouse vendor estimates that 97% of uncontrolled particulate matter is captured by the collection hood. The vendor further estimates that the baghouse is 99.5% efficient for particulate matter in the 0 – 2.5 μm diameter range.

Calculating Controlled Emissions

- Controlled hourly PM2.5 = Uncontrolled hourly PM2.5 x Control Device Collection Efficiency x Control Device Efficiency
- Controlled hourly PM2.5 = 84 g/hr PM2.5 x 0.97 (collection efficiency) x 0.005 (control efficiency) = 0.407 g/hr controlled PM2.5
- The uncontrolled fugitive emissions are calculated as follows:
- Uncontrolled hourly PM2.5 = 84 g/hr PM2.5 x (1 – 0.97) = 2.52 g/hr uncontrolled PM2.5
- In this example, the model emission rate for the baghouse stack servicing the conveyer transfer point would be 0.407 g/hr PM2.5. The model emission rate for fugitives from grain handling would be 2.52 g/hr PM2.5.