



Odor, Dust and Gaseous Emissions

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Federal Reference Method (FRM) Sampler Bias Results in Inappropriate Regulation of Agricultural PM₁₀ and PM_{2.5} Emissions

The U.S. Environmental Protection Agency has the responsibility for establishing National Ambient Air Quality Standards (NAAQS) for particulate matter. In the past, EPA has established NAAQS for total suspended particulate (TSP), PM₁₀ and PM_{2.5} and is currently in the process of establishing a NAAQS for PM coarse (PM_{10-2.5}). All NAAQS are health-based standards with an "adequate margin of safety" for public exposure. The NAAQS for PM₁₀ and PM_{2.5} are 150 and 65 µg/m³ for 24-hour average concentrations, respectfully.

NAAQS are used in two ways by State Air Pollution Regulatory Agencies (SAPRA) with oversight by USEPA. SAPRA must monitor ambient concentrations and report the number of times concentrations exceed the NAAQS. These data are used to define non-attainment areas. The location of the ambient sampler for this use of the NAAQS is limited to locations whereby no one source can dominate the concentration measurements.

A special use of the NAAQS is as a property line concentration limit. Samplers may be placed at the fence line or other locations off property and no measurements may exceed the NAAQS. These measurements may not be used to determine non-attainment because they are dominated by a single source. Rather than using samplers, some SAPRA have chosen to use modeling results for this special use of the NAAQS. If the NAAQS is exceeded by the measured or modeled property line concentrations, the facility may be required to install additional control measures resulting in increased financial burdens for the operation.

The PM emitted from agricultural sources is characterized as large PM. Typical agricultural emissions, such as from disking operations, harvesting, grain elevators, feedlots, confinement buildings and cotton gins, have been found to be composed of particles with mass median diameters (MMD) from 15 to 30 micrometers (µm) aerodynamic equivalent diameter (AED) in contrast to the median size of urban (primarily a consequence of products of combustion) of less than 10 µm AED.

USEPA-approved federal reference method (FRM) PM₁₀ and PM_{2.5} samplers have specified performance characteristics. For example, the PM₁₀ FRM sampler must remove PM larger than 10±0.5 µm AED while allowing PM smaller than 10±0.5 µm AED to penetrate to the filter. In the presence of large PM (characteristic of agricultural PM emissions), FRM PM₁₀ samplers do not accurately measure PM₁₀ concentrations. The larger PM penetrates to the filter and is measured as if the individual particles were less than 10 µm AED. As a consequence, 24-hour average concentration measurements of 300µg/m³ and higher are likely to result when the correct 24-hour average PM₁₀ concentrations are 100µg/m³ and lower. This 3:1 error occurs when the FRM sampler is working as designed. In reality, exposure to large PM can move the cut-point, creating an even larger error. This same problem is more pronounced with FRM PM_{2.5} samplers in the presence of PM emissions from agricultural sources. **Agricultural PM emissions are inappropriately regulated with EPA approved FRM samplers!**

This problem is especially serious when used by SAPRA permit and enforcement personnel working with rural agricultural PM emissions. Recently, USEPA found a laying hen operation (Buckeye) had not obtained the appropriate Title V and PSD permits with thresholds of 100 and 250 tons per year of PM₁₀, when in fact the contractor had reported median particle sizes of 30 µm AED and less than 10 percent of the reported emissions were in fact PM₁₀. Neither threshold was met. The penalties of \$880,000 and \$1.4M for controls and monitoring were not justified. (USEPA followed up and fined the new owner an additional \$500,000 in April of this year.)

USEPA is considering a new PM coarse (PM_{10-2.5}) NAAQS of 60 to 80 µg/m³ with the specified criterion that this new NAAQS standard will be equivalent to the old PM₁₀ standard. There is such a small mass of PM_{2.5} emitted by agricultural sources that any PM_{10-2.5} NAAQS less than 150µg/m³ is, in effect, lowers the PM₁₀ NAAQS. In addition, USEPA is proposing to measure PM_{10-2.5} concentrations by subtracting PM_{2.5} concentration measurements from co-located PM₁₀ concentration measurements. This is referred to as the "subtraction method." The subtraction method for agricultural PM emissions will not result in accurate measurements of PM coarse primarily because over-sampling errors in the two samplers do not offset each other! In order to properly and accurately characterize agricultural PM for regulatory purposes, alternative methods and protocols must be utilized — such as concurrent and co-located TSP monitoring with ensuring particle size distribution analysis to determine the true PM₁₀ and PM_{2.5} fractions of the particles caught on the filters.



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