



OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NC 27711

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MEMORANDUM

SUBJECT: Condensable PM Adjustment for Ammonium Sulfate Formation in M202 Test Results

FROM: Richard A. Wayland, Director
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TO: Air Division Directors

To quantify emissions of particulate matter (PM), EPA regulations recommend that States use EPA Method 202 to determine the condensable fraction of this air pollutant. Condensable particulate matter (CPM) is defined in 40 CFR 50.50 as follows: "Material that is vapor phase at stack conditions, but which condenses and/or reacts upon cooling and dilution in the ambient air to form solid or liquid PM immediately after discharge from the stack." Method 202 measures the CPM in stationary source emissions after filterable particulate matter has been removed from the sample gas. Some stakeholders have expressed concern that Method 202 overstates the amount of CPM under certain conditions, specifically related to how ammonia reacts with sulfur dioxide within the sampling apparatus. After reviewing available data, EPA does see evidence sufficient to suspect a high measurement bias where ammonia and sulfur dioxide are both present in the effluent stream. Considering this potential bias, where a State has reason to be concerned with elevated bias in Method 202 CPM measurements when using this method in the context of the New Source Review (NSR) permitting program, EPA will support a limited adjustment to the results of Method 202 in the manner described in this memorandum if the pre-requisite conditions described below are demonstrated.

EPA Method 202 has been shown to be quite precise, but the recently lowered annual national ambient air quality standard for PM (PM_{2.5} NAAQS) necessitates a closer look at the absolute accuracy of the method as it relates to the real-world definition of CPM in 40 CFR 51.50. In-plume effluent sampling will be needed to resolve this issue and, to date, no data comparing Method 202 results to actual real-world CPM measurements, as taken from a plume, have been presented. Until such information is available, based on the potential for bias described above, EPA will support applying the approach described below in NSR permit programs to refine the quantification of PM (PM₁₀ and PM_{2.5}) where ammonia is present in the source effluent.

EPA's NSR regulations require CPM to be included in PM_{2.5} and PM₁₀. (See, 40 CFR 51.166(b)(49)(i)(a); 40 CFR 52.21(b)(50)(i)(a); see also 40 CFR 51.165(a)(1)(xxvii)(D).) Accordingly, CPM must be considered for

permits addressing PM₁₀ and PM_{2.5} that are issued under the Prevention of Significant Deterioration (PSD) program and the nonattainment NSR program in areas that are classified attainment/unclassifiable and nonattainment, respectively, for the PM₁₀ and PM_{2.5} NAAQS. Although sources are required to count CPM in measurements of emissions of PM₁₀ and PM_{2.5}, the PSD and nonattainment NSR regulations do not specify the test method to be used for quantifying CPM emissions. The EPA has generally expected that sources and testing contractors measure CPM using Method 202, as promulgated in 1991 (56 FR 65433, December 17, 1991) and revised in 2010 (75 FR 80118, December 21, 2010). Method 202 is included among EPA's recommended test methods in 40 CFR part 51, Appendix M. Further, the EPA defines "PM₁₀ emissions" at 40 CFR 51.100(rr) to include the following: "... as measured by an applicable reference method, or an equivalent or alternative method specified in this chapter or by a test method specified in an approved state implementation plan." This definition is applicable to the use of the terms "PM₁₀ emissions" and "PM_{2.5} emissions" (which should be considered a subset of PM₁₀) in any regulations developed pursuant to part 51, including the regulations for Nonattainment NSR (§51.165) and PSD (§51.166).

Pre-requisite conditions

The adjustment detailed in this memo is only appropriate under the following conditions and only supported by EPA for quantifying CPM in the context of NSR permitting on a prospective basis, such as to determine applicability or NSR permitting requirements, support a permit application, or derive emissions limitations in a permit. To support this adjustment, sources need to demonstrate, via EPA Method 320 or an appropriate ammonia slip monitor, the presence of ammonia and sulfur dioxide in their stack effluent. If ammonia is being injected for NO_x control, sources need to provide the ammonia feed rate and pre and post SCR NO_x concentrations, as determined via EPA Method 320 or EPA Method 7E. This adjustment is not appropriate for determining compliance with emission limitations that were derived without applying this adjustment methodology. Where this adjustment is sought for a new source, the process described below may be applied to an existing similar source, at the discretion of the permitting authority.

Adjustment approach

The basis for this adjustment approach will be the determination of ammonium and sulfate ions in EPA Method 202 condensate via ion chromatography. After conducting a test using EPA Method 202, a source may analyze the aqueous fraction, that includes the filter extraction, prior to neutralization for ammonium and sulfate ions using ion chromatography, using an appropriate column for each ion species. Convert the mass of sulfate and the mass of ammonium to moles of each given that the molar mass of ammonium is 18.04 g/mol and the molar mass of sulfate is 96.06 g/mol. Given this information, determine the maximum number of moles of ammonium sulfate possibly present given the 2:1 molar ratio of ammonium to sulfate in ammonium sulfate.

EPA has developed measurement guidance as part of Other Test Method 59, that will be posted at <https://www.epa.gov/emc/emc-other-test-methods>. The tester should use the procedures in OTM-59 to quantify this adjustment. The tester will define the analytical approach for measuring the anions and the cations as part of a source-specific test plan. For emissions limitations in permits that were developed using an adjustment pursuant to OTM-59, compliance may also be determined using the OTM-59 adjustment, as approved by the regulatory authority.

The maximum mass that may be subtracted from the total Method 202 CPM value is:

Mass adjustment = Maximum moles of ammonium sulfate possible * 18.04 g/mol (molar mass of ammonium) * 2 (moles of ammonium per mole of ammonium sulfate)

And, therefore, the adjusted CPM value that may be reported is:

CPM_{reported} = CPM via Method 202 – Mass adjustment

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