

A GUIDELINE FOR EVALUATING COMPLIANCE TEST RESULTS
(Isokinetic Sampling Rate Criterion)

R. T. Shigehara
Emission Measurement Branch, ESED, OAQPS, EPA

Introduction

The sampling rate used in extracting a particulate matter sample is important because anisokinetic conditions can cause sample concentrations to be positively or negatively biased due to the inertial effects of the particulate matter. Hence, the calculation of percent isokinetic (I) is a useful tool for validating particulate test results. Section 6.12 of the recently revised Method 5¹ states, "If 90 percent $\leq I \leq$ 110 percent, the results are acceptable. If the results are low in comparison to the standard and I is beyond the acceptable range, or, if I is less than 90 percent, the Administrator may opt to accept the results."

This guideline provides a more detailed procedure on how to use percent isokinetic to accept or reject test results when the sampling rate is beyond the acceptable range. The basic approach of the procedure is to account for the inertial effects of particulate matter and to make a maximum adjustment on the measured particulate matter concentration.² Then, after comparison with the emission standard, the measured particulate matter concentration is categorized (1) as clearly meeting or exceeding the emission standard or (2) as being in a "gray area" zone. In the former category, the test report is accepted; in the latter, a retest should be done because of anisokinetic sampling conditions.

Procedure

1. Check or calculate the percent isokinetic (I) and the particulate

matter concentration (c_s) according to the procedure outlined in Method 5. Note that c_s must be calculated using the volume of effluent gas actually sampled (in units of dry standard cubic feet, corrected for leakage). Calculate the emission rate (E), i.e. convert c_s to the units of the standard. For the purposes of this guideline, it is assumed that all inputs for calculating E are correct and other specifications of Method 5 are met.

2. Compare E to the standard. Then accept or reject c_s using the criteria outlined below. (A summary is given in Table I):

a. Case 1 - I is between 90 and 110 percent. The concentration c_s must be considered acceptable. A variation of ± 10 percent from 100 percent isokinetic is permitted by Method 5.

b. Case 2 - I is less than 90 percent.

(1) If E meets the standard, c_s should be accepted, since c_s can either be correct (if all particulate matter are less than about 5 micrometers in diameter) or it can be biased high (if larger than 5 micrometer particulate matter is present) relative to the true concentration; one has the assurance that c_s is yielding an E which is definitely below the standard.

(2) If E is above the standard, multiply c_s by the factor (I/100) and recalculate E. If, on the one hand, this adjusted E is still higher than the standard, the adjusted c_s should be accepted; a maximum adjustment which accounts for the inertial effects of particulate matter has been made and E still exceeds the standard. On the other hand, if the

adjusted E is lower than the standard, a retest should be done.

c. Case 3 - I is greater than 110 percent.

(1) If E exceeds the standard, c_s should be accepted, since c_s can either be equal to the true concentration or biased low relative to it; one has the assurance that E is definitely over the standard.

(2) If E is below the standard, multiply c_s by the factor (I/100) and recalculate E. If, on the one hand, this adjusted E is still lower than the standard, the adjusted c_s should be accepted; a maximum adjustment which accounts for the inertial effects of particulate matter has been made and E still meets the standard. On the other hand, if the adjusted E exceeds the standard, a retest should be done.

Table I. Summary of Procedure

Case	I	Category	Decision
1	90 - 110		Accept
2	< 90	$E \leq \text{Em. Std.}$	Accept
		$c_s (I/100) \rightarrow E_{adj} > \text{Em. Std.}$	Accept
		$c_s (I/100) \rightarrow E_{adj} \leq \text{Em. Std.}$	Retest
3	> 110	$E > \text{Em. Std.}$	Accept
		$c_s (I/100) \rightarrow E_{adj} \leq \text{Em. Std.}$	Accept
		$c_s (I/100) \rightarrow E_{adj} > \text{Em. Std.}$	Retest

Summary

A procedure for accepting or rejecting particulate matter test results based on percent isokinetic has been outlined. It provides a mechanism for accepting all data except where anisokinetic sampling might affect the validity of the test results. This procedure is one of several useful tools for evaluating testing results.

References

1. Method 5 - Determination of Particulate Emissions from Stationary Sources. Federal Register. 42(160):41776-41782, August 18, 1977.
2. Smith, W. S., R. T. Shigehara, and W. F. Todd. A Method for Interpreting Stack Sampling Data. Stack Sampling News. 1(2):8-17, August 1973.