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# Revisions to Methods 4 and 5, Appendix A of 40 CFR Part 60 — Summary of Comments and Responses

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Emission Standards and Engineering Division

U.S ENVIRONMENTAL PROTECTION AGENCY
Office of Air, Noise, and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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Chapter 1

# INTRODUCTION

On September 7, 1982, the U.S. Environmental Protection Agency (EPA) published in the Federal Register (47 FR 39206) "Revisions to Methods 4 and 5." These revisions were proposed under the authority of Sections 111, 114, and 301(a) of the Clean Air Act as amended.

Public comments were solicited at the time of proposal. To provide interested persons the opportunity for oral presentation of data, views, or arguments concerning the proposed revisions, a public hearing was to be held, if requested, after November 8, 1982. The hearing was not held because no one requested to speak. The public comment period was from September 7, 1982, to November 8, 1982.

Twenty-two comment letters on the proposed revisions were received from industry, State air pollution control agencies, trade associations, and testing contractors. The comments that were submitted, along with EPA's responses, are summarized in this document. The summary of comments and responses serves as a basis for the revisions that have been made to the proposed revisions between proposal and promulgation.

## Chapter 2

## SUMMARY OF CHANGES SINCE PROPOSAL

1. Method 2, Section 4.2. The quality assurance procedure has been changed to a quality control (optional) procedure and moved to Section 2.2.7.

2. Method 5, Section 4.4. The quality assurance procedure has been changed to a quality control (optional) procedure.

3. Method 5, Section 4.4.1. The procedure has been changed from an orifice factor determination to a check of $\Delta H_@$ and meter calibration.

## Chapter 3

## SUMMARY OF COMMENTS AND RESPONSES

Commenter IV-D-1

1-1 Comment: The first subparagraph entitled "Orifice Factor Determination" should be labeled "4.4.1" rather than 4.4.

Response: This is corrected in the promulgation version.

1-2 Comment:

a. The units "mm $H_2O$" must appear before "(in $H_2O$)" in the definition of $\Delta H_i$.

b. The empirical constants (a and b) of paragraph 4.4.2 can account for unit conversions in both $Q_i$ and Orifice Factor (OF). However, if a standard temperature and pressure conversion factor is desired, paragraph 6.3 defines K which could be used.

c. Except in paragraph 6.1, $T_m$ is not defined. But using 6.1's definition causes the equation to be invalid. The "+273" should be removed from the denominator.

Response: These are clarified in the promulgated version.

1-3 Comment: Equation numbers for OF and the regression equation of paragraph 4.4.2 should be added.

Response: Although these equations are no longer in the revisions, the new equations are numbered.

1-4 Comment: In the $Q_i$ equation, is the sign minus?

Response: The sign should be plus.

1-5 Comment: Can undried air be properly used to establish the regression equation? The field check procedure of paragraph 4.4.3 may imply that the impinger train is connected, thereby, presenting dried air to the dry gas meter. Does this make a difference?

Response: This should not make any difference as the relationship between the orifice reading and the volume measurement will remain the same.

Commenter IV-D-2

2-1 Comment: The sign in the numerator of the equation in Section 4.4.1 should be a plus.

Response: We agree.

2-2 Comment: The molecular weight of air should appear in the OF equation.

Response: Air in the gas was used for both the calibration and the field check and was considered a constant. Therefore, it was not included as a variable in the equation.

2-3 Comment: "4.4 Orifice Factor Determination" should read: "4.4.1 Orifice Factor Determination."

Response: We agree.

2-4 Comment: It is not clear why the Environmental Protection Agency (EPA) has suggested fitting the data to a straight line. After calibrating a meter box against a wet test meter, a test firm has a table of gas volume data and $\Delta H$ data for the meter box. This tabulated data can be taken into the field and compared with the field test calibration check. The test firm could operate the meter box at a specific $\Delta H$ (i.e., a $\Delta H$ for which there is a corresponding gas volume in the tabulated data), and measure the resulting gas volume. This gas volume can be compared to the gas volume measured at the same $\Delta H$ during the calibration in the lab to see if it meets the 1.5 percent criteria. There is no need to actually plot the data or to fit the data to a straight line. It is also not clear why 1.5 percent and not 2.0 percent was selected as the criterion, since Method 5 specifies a ±2.0 percent accuracy for the gas meter.

Response: We agree, although, because of differences in ambient conditions, even ±2 percent may be too strict. It is possible to perform the calibration at one point and repeat the check at the same point with corrections for condition differences. This is the approach in the final version.

Commenter IV-D-3

3-1 Comment: The commenter restated the intent of the proposal and noted that the changes should be beneficial.

Response: No response necessary.

Commenter IV-D-4

4-1 Comment: The proposed revisions to Method 4 and Method 5, contained in Appendix A of 40 CFR Part 60, is in conflict with allowable pretest calibration limits and adds little if any quality assurance (QA) to the two methods. The revisions, as written, would remove the calibrated wet test meter as the primary standard and replace it with the orifice. The use of a calculated OF for a single point calibration verification in the field (±1.5 percent flow rate error) requires a stricter equipment error tolerance than that required for pretest calibration of the sampling equipment. The single point calibration check must then be subjected to a best-fit curve, obtained by linear regression, which contains an inherent error due to its nature of being "best-fit."

The commenter continues with an example using actual calibration data and assumed data errors to show the effect of errors on the OF.

The QA procedures, outlined in Volume III, seem adequate with respect to the existing equipment available for stack sampling. As technological advances improve the quality of the equipment, the accuracy of the sampling methods will increase as well. Therefore, it is recommended the proposed field $\pm 1.5$ percent flow rate QA check not be incorporated into Method 4 and Method 5.

Response: The tolerance limits on the OF are somewhat restrictive for field applications. The final version of the quality control (QC) has greater tolerances of acceptance of $\pm 3$ percent.

Commenter IV-D-5

5-1 Comment: The recent proposal (Federal Register of September 7, 1982) to require a field check of the dry gas meter via orifice meter for Methods 4 and 5 appears to have little practical value.

I can see that there is some merit in having the proposed correlation line equation on hand if the person performing the test suspects his equipment to be faulty. However, one can get a fair indication of how things are going after the first test run if the moisture collected is measured and then the percent isokinetic value is calculated. If the initial moisture guess approximates what is measured and if the percent I then falls within the acceptable range, that is an indication that the dry gas meter is in order (I assume the tester is conscientious in taking data readings and adjusting sampling rates). And, some of the necessary work will be done.

This pretest check will make no difference in the accuracy of the test results. Accuracy depends on the test equipment calibration performed before and after testing as well as on the care given to proper sampling, cleanup, and laboratory procedures by the persons involved.

All that will come from such checks is that, on rare occasions, someone will avoid going through the motions of a test only to have to scrap the results because of a faulty dry gas meter. You certainly could not invalidate a test after the fact because of the absence of this field calibration check since it is in no way involved in calculating the results.

I expect the precheck procedure will seldom be performed (if written into the method) unless a government inspector demands it. In most all cases, such an inspector will be viewed as tedious and obtuse. We do not need the ill will.

Response: The commenter mentions some good equipment specifications and checks that are already required by Method 5 and other regulatory procedures. However, these procedures are not on-site quality control (QC) checks. The intent of a QC check is to prevent the collection of inaccurate sampling data. The QC check before the test can save considerable amounts of time if faulty equipment is discovered before the test. We agree that such a QC check should be optional, but it is a recommended one.

Commenter IV-D-6

6-1 Comment: There appears to be an improper relationship in the published equations. Also, the 1.5 percent criteria is considerably more restrictive than the existing criteria of 5 percent between pre- and post-test meter calibrations presented in Section 5.3 (42 FR 41781). A reference regarding the application of this QA procedure to field data would be helpful.

Response: The equation did not account for small differences in temperature or pressure which can cause the calculations to show greater than 1.5 percent differences without the meter being out of calibration. See also Responses 2-4 and 4-1.

Commenter IV-D-7

7-1 Comment: The proposed revisions would require the source tester to perform a field check of the dry gas volume meter versus the OF prior to a series of emission tests. Methods 4 and 5 currently require extensive calibration procedures which must be conducted before and after the metering system's use in the field. The calibrations must differ by no more than 5 percent for the sampling results to be acceptable. The existing calibration requirement is more than sufficient to guarantee the accuracy of the method. In the absence of strong supportive data, we fail to see that the additional time and trouble involved with the implementation of this revision would be justified by any associated benefits.

Response: We agree. The QA procedure required for each test as stated in the proposal has been revised and designated a QC (optional) procedure. See also Response 5-1.

Commenter IV-D-8

8-1 Comment: We applied the proposed QA procedures to actual equipment operation and found a contradiction between the existing QC regulations and the proposed audit check. The field check resulted in a 2.6 percent deviation from the predicted flow rate, which would require recalibration of the metering system under the proposed regulation. A Method 5 test was then performed, after which the equipment was brought back from the field and the post-test calibration check required in Section 5.3 of Method 5 was conducted. The unit passed this post-test check with a 3 percent deviation from the Y factor calculated during the pretest calibration, well within the limit of 5 percent.

The above discussion shows that the proposed field check can result in needless recalibration of equipment that passes the QC procedures currently included in Method 5. The figure of 1.5 percent deviation between actual and predicted flow rates as a test of acceptability appears to be extremely arbitrary and restrictive. The QA procedure proposed in the regulation must be no more restrictive than the QC function it is designed to audit. The criteria for acceptance must be re-examined to provide a realistic, attainable tolerance level which will provide a check of the calibration and not a completely separate, independent, and arbitrary level as is now the case.

Response: See Responses 5-1 and 7-1.

8-2 Comment: An alternative procedure, using a critical orifice, is allowed if approved by the Administrator. Such a procedure would undoubtedly be quicker and easier than that specified in the proposed rules, and as such would be more readily accepted than that and implemented by the regulated community. But the process of gaining approval for each facility which wants to use this procedure could be so lengthy and involved that few facilities may take this route. Therefore, we request that EPA develop this alternative procedure and promulgate guidelines for its implementation.

Response: The critical orifice approach to calibration check of the dry gas meter remains an alternative procedure. The procedure is under development within the Agency, but is not yet ready for universal use.

Commenter: IV-D-9

9-1 Comment: The minus sign in the volume flow rate equation in Section 4.4 should be a plus sign.

Response: See Response 2-1.

9-2 Comment: The meter factor, Y, should be the factor, $Y_i$, during run $_i$ instead of the average Y obtained during the calibration procedures.

Response: We agree.

9-3 Comment: This proposal is unnecessary based on Alcoa's use of control consoles. The Environmental Control Laboratory at the Alcoa Technical Center (ATC) is continuously shipping control consoles to Alcoa plant locations all over the country for environmental sampling. Upon return to the ATC laboratory, the units are calibrated, and there are no problems with the units meeting the calibration requirements of Y = 1.00 $\pm$ .02 and $\Delta H_@$ = 1.83 $\pm$ .25.

Response: The criteria mentioned by the commenter are not accuracy checks, but are equipment specifications. Post-test agreement with such specifications are good indications of properly operating equipment, but is not the same as a field QC check. See also Response 5-1.

9-4 Comment: If a ruling is made requiring field checks on control consoles, the proposed method does not fill this need as seen from the field checks attached to this letter, where a new console calibrated and checked on the same day, without moving, showed a 2.8 percent - 4.2 percent difference in predicted vs. actual readings. A more reliable field check should be explored.

Response: The Agency reviewed these data and can find no obvious errors, but note there are two other sets of data showing the checks are within the criterion. There are several possible factors that could have caused such differences: significant temperature differences, inconsistent technique, or malfunctions of the metering system.

9-5 Comment: The ±1.5 percent between the measured and predicted flow rates is too restrictive. For standard calibration, the meter coefficient of the control console is acceptable at 1.00 ± 0.02. As stated in Docket No. A-82-06, Method 5, Section 7.1.1.5, the meter coefficients should be between 0.95 and 1.05 for a dry gas meter used as a calibration standard. The acceptable percent is not consistent for these three cases. From the attached data and the calibration standard, it would seem that the difference between the measured and the predicted flow rate should be at least ±5 percent.

Response: See Response 9-3.

Commenter IV-D-10

10-1 Comment: The proposed changes are discriminatory and place an undue burden on sites that conduct their own emissions testing. The current regulations require that the dry gas meter be calibrated versus a wet test meter before and after every test. The proposed changes would require additional field calibration testing after moving the equipment several feet to the test site. This appears to be redundant and burdensome to those firms which have invested capital and calibrate versus a wet test meter on site.

Response: We agree. The proposed procedure was not intended to supersede other valid calibration procedures and in the promulgated version is an optional one.

Commenter IV-D-11

11-1 Comment: The implementation of these revisions is unwarranted and constitutes an unreasonable burden. Further, that benefits realized to the environment would be minimal, if any at all.

Essentially, EPA's proposed revisions would involve a detailed and lengthy procedure, which attempts to check meter volume to an extremely precise degree (1 1/2 percent), while the EPA's own study of Method 5 precision indicated a standard deviation of 31.1 percent (EPA-650/4-74-013).

Response: See Response 5-1. In addition, the commenter cites a result of a much earlier collaborative study of Method 5 conducted at a power plant. The quoted standard deviation refers to within laboratory precision of particulate sampling results. This is not the same as the precision that can be achieved in calibrating the dry gas meter. Repeated calibrations with EPA Method 5 equipment have demonstrated that the 1 1/2 percent limit can be met; however, the limit suggested for the field check has been raised to 3 percent. The Agency feels that this degree of precision in the field is a good indication of the proper operation of the volume meter.

11-2 Comment: The improvement in test precision would be negligible, due to other large inherent sources of error.

Response: The procedure is a QC measure - a check of system integrity. It will not improve precision of the test data, except to indicate those results collected with faulty equipment.

11-3 Comment: The additional testing time involved (with the unit off economic dispatch) is estimated to be 1 and 1/2 hours. The Florida Power and Light Company has estimated the additional cost to our rate payers to run one of our new units in this manner to be between $24,000 to $100,000 per unit/day.

Response: This comment indicates a misunderstanding of the intent. See Response 5-1.

11-4 Comment: A Florida Department of Environmental Regulation post-test calibration check is already routinely conducted.

Response: See Response 5-1.

Commenter: IV-D-12

12-1 Comment: A pretest check would mainly increase the tester's confidence in the volume metering system prior to testing. If the metering system has not been abused or damaged since its last field use, the post-test calibration check of the volume metering system after its last field use (as specified in Section 5.3) usually assures the tester of the accuracy of the metering system. Any pretest check of the volume metering system should, at most, be recommended at the tester's discretion similar to the Method 5 recommendation of a pretest sampling train leak-check.

Response: We agree.

12-2 Comment: Section 4.4, Orifice Factor Determination, should be renumbered to Section 4.4.1. In accord with the conventions already used in Method 5, the equation for calculating volume flow rate should be numbered and corrected. In a similar manner, the orifice factor, OF, equation should be numbered, and the term OF in the equation should be rewritten as $OF_i$.

Response: See Responses 2-3, 2-1, and 9-2.

12-3 Comment: Section 4.4.2 should have the equations used to determine "a best-fit linear regression equation ..." specified. All mathematical calculations required by Method 5 are presented within Method 5. Specification of the necessary mathematical equations eliminates a tester's confusion as to the appropriate calculations and eliminates potential conflicts between the tester and the observing agency over the methods used.

Response: The promulgated version of the procedure does not require the use of this equation.

12-4 Comment: In Section 4.4.3, the use of the word "run" is confusing and should be replaced with "check run." This would eliminate the possible interpretation that this check should be performed following each emission test run.

Response: We agree.

12-5 Comment: Further, Section 4.4.3 states, "The meter coefficient is determined to be acceptable if the measured flow rate agrees with the predicted flow to within ±1.5 percent of the measured value. If this criterion is not met, the meter shall be recalibrated prior to use as described in Section 5.3." We feel these sentences should be replaced with: "The meter coefficient is determined to be acceptable if the measured flow rate agrees with the predicted flow to within ±5.0 percent of the measured value. If this criterion is not met, at the discretion of the tester, the meter shall be replaced for the test run series or recalibrated after field use as described in Section 5.3." We feel our changes are valid for the following reasons:

a. A criterion of ±1.5 percent agreement between the measured and predicted flow rates is more stringent than the ±5.0 percent criterion specified in Section 5.3 for the post-test meter calibration check. There is no rationale for making the pretest check of the OF more stringent than the post-test requirements.

b. There is no published data base to show that the specified criterion of a ±1.5 percent agreement between the measured and predicted flow rates can be met.

c. The proposed revision is intended to check the accuracy of the volume metering system calibration coefficient by determining the accuracy of the OF at the metering system's $\Delta H_@$. Since the orifice is not an integral component of and is located after the dry gas meter, the accuracy of the dry gas meter is not necessarily dependent on the accuracy of the orifice; i.e., the orifice's accuracy may change without a corresponding change in the accuracy of the meter calibration coefficients. However, a significant change in the meter calibration coefficient without a significant change in the OF would require an independent, compensatory, and highly improbable change in the orifice. Thus, if the OF is accurate, then the meter calibration coefficient is most probably correct, although, the converse is not necessarily true.

d. A difference between the measured and predicted flow rate merely indicates that a problem may exist with the volume metering system. Since the metering system's $\Delta H@$ is only used to establish the isokinetic sampling rate relationship which has a criterion of $\pm 10$ percent, we feel the rejection of the volume metering systems which fail to meet the orifice check criterion prior to recalibration is much too stringent and also unnecessary.

Rather, if the pre-test OF check does not meet the specified criterion, then the tester should have the option of using the metering system for the emission test runs and recalibrating the metering system after the emission test runs as outlined in Section 5.3 or replacing the metering system before beginning the emission test runs.

Response: We agree. See also Responses 5-1 and 7-1.

12-6 Comment: For over 5 years, we have checked the accuracy of our metering systems' $\Delta H@$'s with the enclosed nomograph. By using a nomograph for $\Delta H@$ checks, the necessity of calculating the flow rate ($Q_i$), the orifice factor ($OF_i$), and solving linear regression equations to establish the relationship between Q and OF are eliminated. Further, the use of a nomograph in the field simplifies and expedites pretest orifice checks by eliminating the mathematical calculations required in the proposed revision. To use the enclosed nomograph, only 1 cubic foot is pulled through the metering system; however, the nomograph can be easily modified for greater sample volumes. We suggest that the EPA propose the use of a nomograph as an alternative to their proposed orifice check and that the nomograph to be used be published along with instructions for its use.

Response: We agree. This is essentially the approach we have taken in the promulgation version of the QC check, although, we have not included the use of the nomograph. An equation is included instead. Use of a nomograph is, of course, acceptable.

12-7 Comment: Section 5.3 of reference Method 5 states, relative to post-test meter coefficient checks, "Alternative procedures, e.g., using the orifice meter coefficients, may be used, subject to the approval of the Administrator." By using the linear relationship between flow rates and orifice factors, as specified in the proposed revision, and the actual field data from each emission test run, an alternative procedure for volume metering calibration checks can be proposed. The alternative procedure can be used in lieu of post-test meter coefficient checks.

Using the OF value, the predicted flow rate can be calculated from the linear regression equation for the volume metering system; the actual flow rate is calculated with the flow rate, Q, equation in Section 4.4.1 of the proposed revision. If the measured and predicted flow rates agree within ±5 percent, then the volume metering system is acceptable. Should the flow rates differ by more than ±5 percent, then either a post-test meter coefficient check or a full recalibration of the volume metering system must be performed.

We feel this alternative to post-test meter coefficient checks has several important advantages. Actual field data collected during emission test runs would be used to check the accuracy of the volume metering system. The time and expense associated with post-test meter coefficient checks would be markedly reduced. All emission test reports, where emissions were determined with Method(s) 4 and 5, should contain all the data necessary for the report reviewer to perform the orifice factor checks for each emission test run.

Response: This post-test check of orifice coefficient does not check the metering system for leakage which is a major cause of metering inaccuracy. The post-test calibration in Method 5 is sufficient and no new post-test checks will be added.

Commenter IV-D-13

13-1 Comment: This proposed revision would add time requirements to already very time-consuming source test procedures, with minimal QA benefits. Similar QA benefits could be achieved by calibrating in the laboratory prior to field testing, rather than in the field, with any calibration problems identified and resolved before commencing expensive field sampling activites. We see no justification for performing the calibration check in the field.

Response: See Response 5-1.

Commenter IV-D-14

14-1 Comment: We feel that this proposed QA field check will provide valuable data to both testers and observers. We feel that the use of calibrated orifices would serve as a more independent check of data for test observers and should be used as the primary technique.

Response: See Response 8-2.

Commenter IV-D-15

15-1 Comment: This division agrees that this is an excellent QA tool for organizations who conduct a number of source tests without recalibration of the dry gas meter. However, this division conducts only a limited number of source tests, and it has been our internal calibration policy since 1974 that the dry gas meter be recalibrated with a wet test meter after one or, at the most, two source tests. A number of industrial firms within the State that conduct source testing follow a similar procedure. Therefore, it is felt that the frequent recalibration with the wet test meter makes the QA procedures outlined in this section unnecessary, and it is requested that these be made optional for situations where there is a frequent recalibration of the dry gas meter.

Response: See Response 10-1.

Commenter IV-D-16

16-1 Comment: Any procedure which has the potential of cancelling a scheduled emission test hundreds of miles from the testing crew's home office becomes an important consideration to all persons involved in that activity. The proposed QA check is certainly meritorious in its objective of assuring a continuing and known relationship between the dry gas meter and the metering orifice installed downstream thereof.

Response: No response is necessary.

16-2 Comment: After reviewing various aspects of this proposed check procedure, I have concluded that from my point of view a more simple procedure would be recommended or lacking the adoption of the suggested alternate procedure, then the percentage variation allowed by the EPA proposed method should be broadened to approximately $\pm 3$ percent deviation. The rationale and considerations leading to these recommendations are discussed in the following text.

It is my position that the proposed EPA QA check method is cumbersome. The development of a least squares derived slope intercept equation relating standard cubic feet per minute (SCFM) to the OF is really not a problem with the advent of modern computers and programmable calculators on the market. The cumbersome aspect derives in the field utilization of this equation wherein the operator must first determine his actual cubic feet per minute (ACFM) for a 10-minute period, a procedure which is not suggested to be cumbersome, and then convert this

ACFM to an appropriate SCFM figure. In making this calculation, he should refer to some written reference for the appropriate equation and the appropriate gas meter coefficient Y in order to get his measured SCFM.

In addition to this calculation, he must calculate the on-site OF for entry into the slope intercept equation from which he derives a predicted SCFM. These two SCFM values are then compared to determine compliance with the proposed ±1.5 percent limitation. This activity is certainly not beyond the ability of a qualified emission testing crew; however, it does add to the time and complexity of a total emission test.

Response: See Response 12-6.

16-3 Comment: In many areas of the country and specifically in the State of Florida, a more simple method has been adopted for accomplishing somewhat the same purpose. In this simpified method the operator determines an on-site ACFM having operated the meter box at the Meter Box $\Delta H_@$ for a period of 10 minutes. This measured ACFM is then compared to 0.75 CFM which is the value that an orifice displacement equal to $\Delta H_@$ should produce.

If the measured ACFM is within ±5 percent of 0.75 CFM, then the meter box is considered to be in satisfactory condition, and the test may proceed or be considered accurate in the case of a post-test QA check. It is suggested to you that this procedure accomplishes the same basic purpose as the one proposed in the Federal Register. The ±5 percent limitation might be questioned as being somewhat lenient; however, it does seem to produce satisfactory results. I would also suggest that in the overall scheme of things as relates to Method 5 sampling a $\pm 5$ percent limitation would seem to be in keeping with the accuracy and capability of the entire system. The computations involved in this method are certainly much easier in the field and do not require reference to any written material to determine compliance or noncompliance.

Response: This approach is the one included in the promulgated version of the QC check, although, the recommended limit will be $\pm 3$ percent rather than 5 percent. See also Response 12-6.

16-4 Comment: It is suggested that there are problems in determining a slope intercept equation by least squares fit using a small number of data points (five or six in this case) along with the $\pm 1.5$ percent limitation at the end of this procedure. The sensitivity on the part of the resulting slope intercept equation to small changes in one or more coordinates of the limited data points suggests to me that the $\pm 1.5$ percent limitation is perhaps too restrictive. I can foresee cases where a testing organization could have what would otherwise be a perfectly good set of calibration data; however, they would never make the $\pm 1.5$ percent check by virtue of the fact that one outlier among their five or six data points is unduly influencing the least squares determined slope intercept equation.

Response: We agree and have recommended $\pm 3$ percent as a limit.

16-5 Comment: In connection with this set of comments, I have surveyed a number of emission testing agencies in our local area with respect to their calibration practices and ability to meet the proposed EPA QA check. It has been my observation that most of these agencies (including mine) have been calibrating meter boxes using a wet test meter having ∿25 liters per minute (0.8 - 1.0 CFM) rated flow capacities. Generally speaking, in the meter box calibration procedure, this designed flow rate is routinely exceeded. There are two considerations in this fact. The first is that the wet test meter in all probability loses some of its accuracy at flow rates exceeding the design value. This fact would tend to skew the elevated flow data points used in the least squares calculation.

Secondly, in using these smaller flowmeters (a use dictated by economics) the procedure develops pressure differentials across the wet test meter which are not recognized to be significant in the EPA publications on this subject. All of the EPA documentation assumes that the pressure drop across the wet test meter is essentially equal to zero. In these small test meters being used as described, this pressure drop assumes significant magnitudes, on the order of 2 to 3 inches of water, and therefore, should be included in the computations associated with the meter box calibration in the same sense that the pressure drop across the orifice is included where its magnitude perhaps is higher but not so much so that one could justify ignoring equivalent pressure drops in the wet test meter. This erroneous assumption with respect to wet test meter pressure drop also contributes to some inaccuracy in the calculated data of a meter box calibration. It is reasonable to think that these additional built-in errors could adversely affect the slope intercept by least squares computation.

Response: Exceeding the capacity of the wet test meter will certainly affect the accuracy of the calibration. The October 10, 1982 (47 FR 44350) proposal addresses the problem to some extent by allowing the use and specifying a procedure for calibrations using a dry gas meter as the standard. The standard dry gas meter is calibrated against a wet test meter or spirometer periodically. Otherwise, this issue is not within the scope of the QC.

16-6 Comment: As indicated above, I have made a limited survey of emission testing groups in our local area to determine whether the ±1.5 percent QA check as proposed would be realistic. It is quite evident that some among this group can comply with the ±1.5 percent. Others cannot.

Response: See Response 16-4.

16-7 Comment: The proposed QA check does not suggest that the coordinates of zero and zero be included in the series of data points used to determine the least squares fit equation. The case may be argued that this point is part of the calibration procedure and should be included. It is my suggestion that this point be included. It was pointed out earlier in this text that a 2 percent change in one coordinate resulted in an approximate 1/2 percent change in the predicted SCFM. The inclusion of the origin or the coordinates zero and zero in the set of data materially reduces this problem.

Response: The development of a linear, best-fit curve with calibration data is no longer required.

16-8 Comment: In conclusion, my recommendations would be that EPA consider the alternate and more simple QA check described herein, and secondly, that if EPA feels it necessary to adopt the more complex procedure proposed, that they consider making the compliance limits more liberal, say $\pm$3.0 percent in order that the field personnel have a better chance to comply in view of potential limitations in the least square computation.

Response: We agree. The promulgated QC check is a one-point check with a recommended $\pm$3 percent tolerance.

Commenter IV-D-17

17-1 Comment: The equation for calculating $Q_i$ in Section 4.4, Orifice Factor Determination, is incorrect and several of the variables have not been correctly defined.

$V_{m(std)}$ should be calculated according to Equation 5-1 of Method 5.

Response: See Response 2-1.

17-2 Comment: The equation for OF, does not correct the OF for pressure and temperature. Since $Q_i$ is calculated under standard conditions, OF should also be calculated for standard conditions.

Response: The OF factor equation is no longer part of the QC check.

17-3 Comment: It has been specified that the agreement between the estimated and the calculated values of Q should be within 1.5 percent, at or near $\Delta H@$. However, the following error analysis suggests this requirement to be too restrictive.

Some calculations based on orifice calibration data provided to the National Council of the Paper Industry for Air and Stream Improvements, Inc. by member companies result in a total error of ±5 percent.

It is our suggestion that since error analysis has shown much greater possible errors than are allowed in the present proposal, the allowed error in the correlation equation should be based upon actual field data.

Response: See Response 16-4.

17-4 Comment: Consideration should be given to making these requirements optional with a higher number (at least 5 percent) for percent difference between actual and estimated values. The present Method 4 and 5 requirements of post-test meter check and 5 percent agreement are adequate to satisfy the QA needs.

Response: See Response 7-1.

Commenter IV-D-18

18-1 Comment: These proposed changes are not justified by a hard data base, but only by the unsupported statement that "(t)he current regulation involves only limited QA requirements and, as a result of this proposed regulation, the quality of compliance data will improve." As before, we urge EPA to withdraw this proposal pending the presentation of hard supporting data and the public's opportunity to review and comment on the supporting data base.

Response: The Agency has a mandate to include in all test methods QA and QC procedures to assure and assess the accuracy of measured data. The Agency feels the promulgated QA procedures are adequately supported and are achievable.

18-2 Comment: The term (- $\Delta$H/13.6) in the first equation should carry a positive rather than a negative sign.

Response: See Response 2-1.

18-3 Comment: The equation will fail for English units if the metric constant of "273" is used, but this is not made clear.

Response: We agree.

18-4 Comment: The parameter $T_m$ must carry °C units whereas $T_m$ as defined in Section 6 can carry either °K or °R units but not °C units.

Response: Agree.

18-5 Comment: If $T_m$ is to carry °C units, then the constant "273" should be carried to four significant figures or 273.2° for consistent precision.

Response: $T_m$ is defined in °R.

18-6 Comment: The constant 0.3855 should be 0.3858 as already defined in Section 6. The 0.3855 value results when 293°K, rather than

293.2°K, is divided by 760.0 mm Hg, but four-place precision demands the more precise 293.2°K value.

Response: This constant does not appear in the promulgation version.

18-7 Comment: Although it is not clear from the definition given for $Q_i$, it reflects volume flow rate at standard, not actual, conditions.

Response: This is correct.

18-8 Comment: The nomenclature of OF, or orifice factor, does not seem appropriate for a grouping of variables and tends to be easily confused with the more conventional meaning of "orifice factor," which is an orifice meter constant.

Response: The conventional terminology in defining the constant for an orifice is "orifice coefficient."

18-9 Comment: There is also a fundamental problem with the consistency check procedure of Section 4.4.3. It calls for the dry gas meter flow at standard conditions to be compared with the orifice flow at actual conditions. This problem would be eliminated by inversion of the $(T_o/P)$ term to give $(P_b/T_o)$ within the OF equation. This simple rearrangement can be shown to yield an orifice flow rate at standard conditions.

Response: See Response 17-2.

18-10 Comment: One final problem with Section 4.4.3 is the use of the parameter $\Delta H_@$. This parameter is not presently defined in Method 5.

Response: This is defined in the proposed revisions.

Commenter IV-D-19

19-1 Comment: The proposed changes are good and have, in fact, been used by the American Boiler Manufacturers Association members successfully for about 10 years. Not only does the proposed change result in a better quality test, but it also makes the test easier to perform. To insure greater QA results should be compared with a theoretical combustion analysis and should be within ±5 percent (inclusive of moisture in air!), and Method 5 results should be checked for percent isokinetic sampling for each sample point. This proposed change for Method 5 would be tedious. However, as it now stands, test result averages may indicate an isokinetic rate within the required 90 percent to 110 percent when none of the individual test points were within this range.

Response: Such additional QC or QA checks are not within the scope of this proposal.

Commenter IV-D-20

20-1 Comment: We believe the concept of field checking the volume metering system is a good idea; it could avoid costly retests. We do not, however, feel that the proposed agreement limit of 1.5 percent is realistic. Potential reading errors in the orifice pressure, barometric pressure, and temperature can account for nearly all of the

1.5 percent variation with no actual change in the dry gas meter.

The meter should be checked in the field before and after the testing program to assure accurate data during the test. Predicted vs. measured values should agree with ±5 percent, as the method currently allows. It seems completely unreasonable to insist on ±1.5 percent agreement under field conditions when it has been generally recognized that ±5 percent variation in the before and after calibration is acceptable.

Response: See Responses 16-4 and 16-8.

20-2 Comment: The second listing of Section 4.4 appears to be improperly labeled, and should be corrected to read Section 4.4.1.

Response: See Response 1-1.

20-3 Comment: In Section 4.4.1 (corrected reference) the units for $\Delta H_i$ should be mm $H_2O$ (in. $H_2O$).

Response: See Response 1-2.

20-4 Comment: In Section 4.4.1 (corrected reference) the term "$t_m$" should be defined. We suggest the same definition used in Section 6.1 for this term.

Response: See Response 1-2.

<u>Commenter IV-D-21</u>

21-1 Comment: The main point of confusion with Methods 4 and 5 are timing and applicability. When specifically is "prior to the start of the first emission test run of a series of runs"? If a boiler is to be tested on one day for velocity, reference moisture, and $NO_x$, then next day particulates, would one meter field QA check suffice on the first day? Would the meter field QA check be acceptable on the afternoon prior to the first day of testing? If tandem boilers are to be tested consecutively with the same console, would one field check suffice?

Response: The QC check is recommended prior to the first test in order to check the operation of the metering system. Repeat checks are not necessary as other QA/QC checks are required in the method, e.g, leak checks, post-test calibrations. See also Response 5-1.

21-2 Comment: The QA procedure makes no mention of alternatives when in the field, other than recalibration, a laboratory operation. If the meter does not meet specification or if the calibration paper is lost, the test crew would have no alternative but to obtain another specially calibrated meter console. Even if a replacement (normally) calibrated dry gas meter were obtainable near the field site, it would be unusable due to the lack of this special extra calibration.

Responses: See Response 5-1.

21-3 Comment: The calculation equation and legend contain some omissions and questionable material. Y factor is not stated to be individual or average. There is no $T_m$ figure in the legend, and the addition of 273 is for °K only; no mention is made of conversion to °R. $\Delta H_i$ is not listed as primarily having values in mm Hg. Also, why is the $\Delta H_i$ factor subtracted?

Response: See Responses 1-1, 1-2, 1-3.

21.4 Comment: Upon review of the existing QA requirements and recommendations, another calibration seems primarily redundant. A sample meter console is required to be fully calibrated initially, with mandatory calibration checks to be performed after each field use. These calibration checks may also be used as pretest checks for the following sample program. The QA objectives seem substantially imbalanced when it is entirely optional to perform pretest leak checks of the sample system (post-test checks, of course, mandatory), but a specific extra pretest calibration at a specific time is mandatory. Obviously, it is in the best interest of the sampler (and his client) to insure that the equipment will perform adequately. However, it is the sampler's ultimate responsibility to obtain a valid sample, with QA data proving its validity. How the equipment is maintained and calibrated before the test is a responsibility belonging solely to the sampler.

If there is a need for additional QA, it is the enforcement of current (and valid) QA procedures. If not enforced, additional QA procedures will only hinder the personnel responsible enough to perform and present the required QA work.

Response: See Response 5-1 and 7-1.

<u>Commenter IV-D-22</u>

22-1 Comment: Section 4.4.3. This field check is a good QA tool but requires additional time to perform. The agreement limit of $\pm 1.5$ percent between the calibration in the laboratory and the field check is tight, and there may be difficulty in meeting it. The value of this check is to ascertain that no changes have occurred in handling equipment. Therefore, if the field check is performed and the limits are met, there is little value in continuing the now required post calibration. If the field check is successful and the post calibration fails, the change most likely would be caused by post-testing handling. A post-test field check would make more sense.

Response: See Response 5-1.

22-2 Comment: Methods 4 and 5, in most instances, pre- and post-test calibration fall within acceptable limits. A field check of the volume metering system's calibration may, on rare occasions, identify a problem incurred during handling after calibration. However, the company takes exception to the ±1.5 percent tolerance which is the same as laboratory limit and which may be difficult to attain during adverse weather conditions. A field check tolerance of ±5 percent limit is more realistic.

Response: See Response 16-4.

Table 1. LIST OF COMMENTERS

| Document Number | Commenter |
|---|---|
| IV-D-1 | From Jon M. Rueck, Kansas Department of Health and Environment to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-2 | From Jim Steiner, Pape and Steiner Environmental Services to Roger Shigehara, U.S. Environmental Protection Agency. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-3 | From C.D. Malloch, Director of Regulatory Management, Monsanto Company to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-4 | From Jerry Wayne Powell, Texasgulf Chemicals Company to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-5 | From Robert E. Wooten, North Carolina Department of Natural Resources and Community Development to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-6 | From Frank Rower, Armco, Inc. to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-7 | From Dale S. Harmon, Texas Industries, Inc. to Docket Numbers A-82-05 and A-82-04. Subject: Comments on proposals of revisions to Methods 3, 4, and 5. |

Table 1. LIST OF COMMENTERS
(Continued)

| Document Number | Commenter |
|---|---|
| IV-D-8 | From James H. Boyd, Director of Environmental Affairs, Newmont Services Limited to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-9 | From Michele E. Eller, Aluminum Company of America to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-10 | From J.F. Kane, Plant Manager, E.I. duPont de Nemours and Company to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-11 | From W.J. Barrow, Manager, Environmental Permitting and Programs, Florida Power and Light Company to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-12 | From Bruce G. Hawks, Supervisor, Quality Assurance, Entropy Environmentalists, Inc. to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-13 | From Danny E. Sjolseth, Section Manager, Air Technology Research and Development, Weyerhauser Company to Docket Numbers A-82-05 and A-82-04. Subject: Comments on proposals of revisions to Methods 3, 4, and 5. |

Table 1. LIST OF COMMENTERS
(Continued)

| Document Number | Commenter |
|---|---|
| IV-D-14 | From L. Blaine DeHaven, Chief, Source Testing and Monitoring Section, Pennsylvania Department of Environmental Resources to Docket Number A-82-04. Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-15 | From Harold E. Hodges, Director, Tennessee Air Pollution Control Division, Tennessee Department of Public Health to Docket Numbers A-82-04 and A-82-05. Subject: Comments on proposal of revisions to Methods 3, 4, and 5. |
| IV-D-16 | From Robert S. Sholtes, Sholtes and Koogler Environmental Associates to Docket Number A-82-06 (changed to A-82-04). Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-17 | From Ashok K. Jain, Engineering Projects Research Manager, National Council for Air and Stream Improvement, Inc. to Docket Number A-82-05 (added to A-82-04). Subject: Comments on proposal of revisions to Methods 4 and 5. |
| IV-D-18 | From S.L. Estes, Union Camp Corp. to Roger Shigehara, Emission Standards and Engineering Division. Subject: Comments on proposals of revisions to Methods 3, 4, and 5. |

Table 1. LIST OF COMMENTERS
(Continued)

| Document Number | Commenter |
|---|---|
| IV-D-19 | From W.H. Axtman, Executive Director, American Boiler Manufacturers Association to Roger Shigehara, Emission Standards and Engineering Division. Subject: Comments on proposals of revisions to Methods 3, 4, and 5. |
| IV-D-20 | From Richard H. Russell, Supervisor, Environmental Testing, Owens-Illinois to Docket Number A-82-05 (added to A-82-04). Subject: Comments on proposals of revisions to Methods 3, 4, and 5. |
| IV-D-21 | From Randall J. Richert, Southwestern Laboratories to Docket Number A-82-05 (added to A-82-04). Subject: Comments on proposal of revisions to Methods 3, 4, and 5. |
| IV-D-22 | From R.A. Reckert, Vice President Fossil and Hydro Production, Northeast Utilities to Docket Number A-82-05 (added to A-82-04). Subject: Comments on proposal of revisions to Methods 3, 4, and 5. |

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15. SUPPLEMENTARY NOTES

16. ABSTRACT


Document is summary of comments submitted as a result of the September 7, 1983, proposal of revisions to Methods 4 and 5 to add quality assurance and quality control procedures. Included are the Agency's responses to the comments.


17. KEY WORDS AND DOCUMENT ANALYSIS

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
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