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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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MEMORANDUM

SUBJECT: Performance Test Calculation Guidelines

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TO: New Source Performance Standards/National Emission Standards for Hazardous Pollutants Compliance Contacts

The following guidelines should be used in calculating and reporting emission rates and concentrations when determining compliance with the new source performance standards (NSPS) and national emission standards for hazardous pollutants (NESHAP). These guidelines can also be used for State implementation plans (SIP's). The areas addressed in this memorandum concern metric and English measurement systems, significant figures (SF's) in the emission standards, SF's to carry in intermediate calculations, and the rounding of final emission value numbers to the proper SF's.

1. **Use only the emission standard in the metric units to determine compliance.**

The policy of using the metric system was established back in the early 1970's. When the Environmental Protection Agency (EPA) proposed standards for seven source categories (38 FR 15406) on June 11, 1973, EPA stated:

> "The Environmental Protection Agency has adopted a policy of expressing standards in the metric rather than English system. Although technical terms in test methods 10 and 11 are expressed in metric units, many of those in test methods 1 through 9 are expressed in English units. Test results derived through calculations in test methods 1 through 9 must be converted to metric units to agree with the form of the proposed standards."

In keeping with this policy, EPA promulgated amendments to Subparts D, E, F, G, and H on June 14, 1974 (39 FR 20790). In the preamble of this rulemaking, EPA stated:

> ".... Also, to be consistent with the Administrator's policy of converting to the metric system, the standards of performance and other numerical entries, which were originally expressed in English

units, are converted to metric units. Some of the numerical entries are rounded after conversion to metric units. It should be noted that the methods in the appendix will be changed to metric units at a later date."

The change to metric units for the test methods were proposed on June 8, 1976 (41 FR 23060) and promulgated on August 18, 1977 (42 FR 41754). Clearly, EPA's intent was to use the metric units to determine compliance.

However, on a practical scale, the use of the metric or the English system of units would not make any difference in determining whether a source is in compliance or out-of-compliance. Only in very rare cases will separate calculations in the metric and in the English systems with the same source test measurement values result in one system showing compliance while the other does not. Therefore, it is not necessary to require source testing firms to submit the results in the metric units on a routine basis. It is suggested that if the value in English units is within 1 percent of the emission standard and if such a difference is of concern in your enforcement strategy, then the value should be converted to metric to determine compliance. The numerical value in English units (in parentheses) are to be considered as close approximations of the metric and should not be used to determine compliance in borderline cases.

2. Consider all emission standards to have at least two SF's, but no more than three SF's.

As a review, an SF is any digit that is necessary to define the specific value or quantity. Zeros may be used either to indicate a specific value, like any other digit, or to indicate the magnitude of a number. Examples are given below:

Ex. 1: 1300 or 1.3×10^3 has two SF's.
Ex. 2: $1300.$ or 1.300×10^3 has four SF's.
Ex. 3: 1300.0 or 1.3000×10^3 has five SF's.
Ex. 4: 13040 or 1.304×10^4 has four SF's.
Ex. 5: 0.034 or 3.4×10^{-2} has two SF's.
Ex. 6: 0.03400 or 3.400×10^{-2} has four SF's.
Ex. 7: 0.03 or 3×10^{-2} has one SF.

Because the emission standards were not written with consideration to the rules of SF's, especially with the use of zeros, all existing emission standards are considered to have at least two SF's, but no more than three SF's, under this guideline. Thus:

Case 1: 90 mg/dscm (Subpart I) is considered to be 90. (two SF's).
Case 2: 520 ng/J (Subpart Da) is considered to be 520. (three SF's).
Case 3: 0.05 kg/Mg (Subpart S) is considered to be 0.050 (two SF's).
Case 4: 0.1 g/kg (Subpart BB) is considered to be 0.10 (two SF's).

Case 5: 0.005 g/kg (Subpart BB) is considered to be 0.0050 (two SF's).
Case 6: 3870 kg/28 days (Subpart BBB) is considered to have (three SF's).

The above rule differs from the previous guidance given by the predecessor of the Stationary Source Compliance Division. In his August 20, 1980 memorandum to Ms. Louise Jacobs, Director of Enforcement Division of Region VII, Mr. Edward E. Reich, Director of the Division of Stationary Source Enforcement interpreted the emission standards as being absolute, i.e., as having an infinite number of SF's. Using the example of an emission standard of 0.04 gr/dscf, Mr. Reich wrote:

> "As a legal matter, anything greater than 0.04 is a violation (e.g., 0.0401). However, since the third digit was not established, most engineers in reporting results would tend to round off and therefore 0.044 would be reported as 0.04 and 0.045 would be reported as 0.05. A better guide would be that anything showing greater than a ten percent excess is worth considering for enforcement action."

Although the new guidance appears to be a major shift in Agency policy, it is not, because only very limited cases, if any, would be involved. For example, if the emission standard is 90 mg/dscm, 90.0000001 mg/dscm would be in violation according to the August 20, 1980 guidance. However, such an occurrence would be highly unlikely. (Note also that strict adherence to an infinite number of SF's would require an infinite number of SF's in conversion factors, which is a practice that is impossible to follow.) Therefore, the effect of the change to two or three SF's in the emission standards would be practically no different from the initial guidance.

3. Carry at least five significant digits in intermediate calculations.

Since the measurement of variables and sample quantities during source performance tests are recorded in metric or English units or a combination of both, specifying specific rules to handle SF's in addition, subtraction, multiplication, and division would become cumbersome. To keep things on a practical basis for emission standards with two or three SF's, English or metric may be used provided that at least five SF's are retained (most calculators retain nine digits) in all intermediate calculations. The final calculation after averaging all the runs should produce the metric units, if necessary. Then the final number should be rounded off as described below to determine compliance.

4. Round off calculated emission numbers to the number of SF's determined by the rule stated in (2) above.

When rounding off a figure, the following procedure, based on practices given under the American Society for Testing and Materials (ASTM) (Standard for Metric Practice E 380), should be used: If the first digit to be discarded is less than five, the last digit retained should not be changed. When the first digit discarded is greater than five, or if it is a five

followed by at least one digit other than 0, the last figure retained should be increased by one unit. When the first digit discarded is exactly five, followed only by zeros, the last digit retained should be rounded upward if it is an odd number, but no adjustment made if it is an even number.

For example, if the emission standard is 90, then 90.357 would be rounded to 90, 90.639 would be rounded to 91, 90.500 would be rounded to 90, and 91.500 would be rounded to 92.

Consideration was given to round upward when the last digit to be discarded is five; however, because the occurrence of the first digit to be discarded being exactly five followed by zeros is rare, it was decided to be consistent with the ASTM practice.

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