

Ohio EPA

Division of Air Pollution Control

Engineering Guide #28

**Question:**

Paragraph (A)(2) of OAC rule 3745-17-11 states, in part, that:

"(a) 'Figure II' shall not apply:

(i) to any source where the uncontrolled mass rate of emission cannot be ascertained;"

What are considered valid methods for determining the uncontrolled mass rate of particulate emissions from a process? Would the use of emission factors from the U.S. EPA document "AP-42" be considered an acceptable method? Can Ohio EPA require an emissions test for particulate emissions prior to control equipment for the purpose of ascertaining the uncontrolled emission rate? How far can we go (technically and economically) in requiring such a determination? (These questions were submitted by David Schuetz of the Southeast District Office on August 13, 1980.)

**Answer:**

The valid methods for determining the uncontrolled mass rate of emissions (UMRE) from a process, for purposes of OAC rule 3745-17-11, are:

1. reliable emissions tests,
2. emission factors, and
3. material balance calculations.

Reliable emissions tests are the preferred means for determining the UMRE. OEPA's authority for requiring emissions tests is based upon ORC section 3704.031, which reads as follows:

*"Prior to issuance or renewal of a permit or a variance under division (F), (G), or (H) of section 3704.03 of the Revised Code, the director of environmental protection may require the applicant to install such equipment and conduct such tests and analyses as the director finds reasonable and necessary to determine adequately the amount and content of any emissions from such sources, the ambient air quality at the proposed site and in areas that may be affected by emissions from such*

*sources, and any violation or potential violation of Chapter 3704. of the Revised Code, or the regulations or orders promulgated thereunder."*  
[emphasis added]

The above section grants the Director the authority to require emissions tests if they are "*reasonable and necessary.*" This law also enabled the Agency to promulgate OAC rule 3745-15-04<sup>1</sup> and paragraph (A)(1)(c)(ii)<sup>2</sup> of OAC rule 3745-31-02 which can be used to require emissions tests. Other specific rules define the appropriate test methods and procedures to be employed in measuring specific pollutant emission rates, for example OAC rule 3745-17-03 defines the acceptable particulate emission measurement methods and procedures.

Emission factors can be used when there is evidence that emissions tests would be technically infeasible and/or economically unreasonable. In some cases emission factors may be the preferred choice for determining the UMRE (e.g., if the flat portion of Figure II (OAC rule 3745-17-11) is applicable to the source).

Emission factors may be obtained from USEPA's "Compilation of Air Pollutant Emission Factors," Publication No. AP-42. Emission factors in AP-42 are characterized by their "ratings," which are descriptions of the quality of the emission factors. Only those emission factors that are rated "A", "B," and "C" ("excellent", "above average," and "average," respectively) should be used for calculating the UMRE. Emission factors rated "D" and "E" ("below average" and "poor," respectively) normally should not be used for UMRE calculations. Emission factors that are not based on AP-42 should be examined and researched prior to use in any emission calculations.

Material balance calculations may be an appropriate method in certain cases for accurately determining the UMRE. Material balance can be defined as follows (references 2-4):

*"A material balance is based on the law of conservation of matter, which states that the total mass of materials entering a system in a fixed period of time must equal the mass of all materials leaving plus the mass of any accumulation that has taken place."*

Another text (reference 5) describes material balance as follows:

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<sup>1</sup> In part, OAC rule 3745-15-04 states: "The director may require any persons responsible for emission of air contaminants to make or have made tests to determine the emission of air contaminants from any source whenever the director has reason to believe that an emission in excess of that allowed by these rules is occurring or has occurred from time to time."

<sup>2</sup> Regarding what may be included in a PTI or PTIO, OAC rule 3745-31-02 (A)(1)(c)(ii) states: "Requirements for performance tests that demonstrate that the source is in compliance with applicable emission limitations and other applicable laws, at the applicant's expense, in accordance with methods prescribed by the Ohio environmental protection agency."

*"In its simplest form a material balance is nothing more than an accounting of mass. The law of conservation of mass states that the total mass of all substances taking part in a process remains constant. Although there are exceptions to this law for nuclear reactions and processes where the reacting materials are moving at or near the velocity of light, for general engineering purposes the law is inviolate. Semantically this law may be written as: mass input = mass output + mass accumulation."*

In some instances, it may not be possible to calculate a material balance around a process to determine the UMRE, but it may be possible to do so around the emission control system. If this is the case, then the material balance calculations should be performed around the control system. The technical limitations in determining the UMRE are defined by the specific limits of the appropriate emissions sampling technique, by the emission factor quality rating (i.e., reliability), and by the availability and accuracy of the data for all the "in and out" streams included in the material balance. These limitations have to be examined carefully at the time of the review.

New emissions test methods may periodically be promulgated, and existing emissions testing methods may be revised or modified. Also the quality ratings for specific emission factors may change as more or better information becomes available. Therefore, a case-by-case evaluation of the best method for determining the UMRE for a source is essential.

Regarding the reasonableness of requiring UMRE determinations, if it is reasonable and necessary to conduct tests to determine the controlled emission rate for a source, then generally it will not be unreasonable to ask for tests to determine the UMRE. However, in the event that emissions tests for the UMRE are not technically feasible and/or economically reasonable, material balance calculations cannot be performed around either the process or control equipment, and the applicable and appropriate emission factors are only "D" or "E" rated, then a field office may conclude that the UMRE cannot be ascertained and that Figure II of OAC rule 3745-17-11 does not apply to the source.

#### References:

1. "Compilation of Air Pollutant Emission Factors" Publication No. AP-42, U.S. EPA, Research Triangle Park, North Carolina 1973 and updates.
2. Max S. Peters, Elementary Chemical Engineering, McGraw-Hill Book Co., Inc., New York (1954), p. 8.
3. O. A. Hougen, K. M. Watson & R. A. Ragatz, Chemical Process Principles-Page I, Material and Energy Balances, John Wiley & Sons, Inc., New York, 1956, p. 24.

4. W. L. Badger and J. T. Banchero, Introduction to Chemical Engineering, McGraw-Hill Book Co., Inc., New York, 1955, p.2.

5. A. S. Foust, et. al., Principles of Unit Operations, John Wiley & Sons, Inc., New York, 1960, p. 391.

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