



Designation: D7440 – 23

Standard Practice for Characterizing Uncertainty in Air Quality Measurements¹

This standard is issued under the fixed designation D7440; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This practice is for assisting developers and users of air quality methods for sampling concentrations of both airborne and settled materials in characterizing measurements as to uncertainty. Where possible, analysis into uncertainty components as recommended in the International Organization for Standardization (ISO) Guide to the Expression of Uncertainty in Measurement (ISO GUM, (1)²) is suggested. Aspects of uncertainty estimation particular to air quality measurement are emphasized. For example, air quality assessment is often complicated by: the difficulty of taking replicate measurements owing to the large spatio-temporal variation in concentration values to be measured; systematic error or bias, both corrected and uncorrected; and the (rare) non-normal distribution of errors. This practice operates mainly through example. Background and mathematical development are relegated to appendices for optional reading.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This practice is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.01 on Quality Control.

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² The boldface numbers in parentheses refer to the list of references at the end of this standard.

2. Referenced Documents

2.1 ASTM Standards:³

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

D3670 Guide for Determination of Precision and Bias of Methods of Committee D22

D6246 Practice for Evaluating the Performance of Diffusive Samplers

D6552 Practice for Controlling and Characterizing Errors in Weighing Collected Aerosols

2.2 ISO Standards:⁴

ISO GUM Guide to the Expression of Uncertainty in Measurement, ISO Guide 98, 1995⁵

ISO 7708 Air Quality — Particle Size Fraction Definitions for Health-Related Sampling

ISO 15767 Workplace Atmospheres — Controlling and Characterizing Errors in Weighing Collected Aerosol

ISO 16107 Workplace Atmospheres — Protocol for Evaluating the Performance of Diffusive Samplers

ISO 16702 Workplace air quality — Determination of total organic isocyanate groups in air using 1-(2-methoxyphenyl)piperazine and liquid chromatography

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, see Terminology D1356.

3.2 *Other Terms Defined as Follows are Taken from ISO GUM, Unless Otherwise Noted:*

3.2.1 *accuracy*—closeness of agreement between the result of a measurement and a true value of the measurand.

3.2.2 *combined standard uncertainty*, u_c —standard uncertainty of the result of a measurement when that result is

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

⁴ BIPM version available for download from <http://www.bipm.org/en/publications/guides/gum.html>. ISO version available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁵ See Ref (1), for an additional measurement uncertainty resource.