



Standard Guide for Preparing and Interpreting Precision and Bias Statements in Test Method Standards Used in the Nuclear Industry¹

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^{ε1} NOTE—Changes were made editorially in June 2012.

INTRODUCTION

Test method standards are required to contain precision and bias statements. This guide contains a glossary that explains various terms that often appear in these statements as well as an example illustrating such statements for a specific set of data. Precision and bias statements are shown to vary according to the conditions under which the data were collected. This guide emphasizes that the error model (an algebraic expression that describes how the various sources of variation affect the measurement) is an important consideration in the formation of precision and bias statements.

1. Scope

1.1 This guide covers terminology useful for the preparation and interpretation of precision and bias statements. This guide does not recommend a specific error model or statistical method. It provides awareness of terminology and approaches and options to use for precision and bias statements.

1.2 In formulating precision and bias statements, it is important to understand the statistical concepts involved and to identify the major sources of variation that affect results. **Appendix X1** provides a brief summary of these concepts.

1.3 To illustrate the statistical concepts and to demonstrate some sources of variation, a hypothetical data set has been analyzed in **Appendix X2**. Reference to this example is made throughout this guide.

1.4 It is difficult and at times impossible to ship nuclear materials for interlaboratory testing. Thus, precision statements for test methods relating to nuclear materials will ordinarily reflect only within-laboratory variation.

1.5 No units are used in this statistical analysis.

1.6 This guide does not involve the use of materials, operations, or equipment and does not address any risk associated.

2. Referenced Documents

2.1 *ASTM Standards*:²

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 *ANSI Standard*:

ANSI N15.5 Statistical Terminology and Notation for Nuclear Materials Management³

3. Terminology for Precision and Bias Statements

3.1 *Definitions*:

3.1.1 *accuracy (see bias)* —(1) bias. (2) the closeness of a measured value to the true value. (3) the closeness of a measured value to an accepted reference or standard value.

3.1.1.1 *Discussion*—For many investigators, accuracy is attained only if a procedure is both precise and unbiased (see *bias*). Because this blending of precision into accuracy can result occasionally in incorrect analyses and unclear statements of results, ASTM requires statement on bias instead of accuracy.⁴

3.1.2 *analysis of variance (ANOVA)*—the body of statistical theory, methods, and practices in which the variation in a set of data is partitioned into identifiable sources of variation.

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² 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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Refer to *Form and Style for ASTM Standards*, 8th Ed., 1989, ASTM.