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Standard Practice for Use of Terms Relating to the Development and Evaluation of Methods for Chemical Analysis¹

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INTRODUCTION

ASTM methods for determining the chemical composition of materials usually are developed in four stages: (1) experimental development of procedures and techniques, (2) translation of research into text suitable for analysts (in ASTM format), (3) demonstration of performance in an interlaboratory study (ILS), and (4) acceptance as a method published for use in laboratories. Details of the development processes may be complex, but the common concepts and terms needed to discuss them are relatively simple. The concepts must be carefully defined and terms selected to represent them unambiguously in the intended contexts.

A list of terms and definitions does not guarantee clear communication. Many terms have different common and technical meanings while representing different concepts when used in various contexts. The use of important terms and concepts in the context of methods of chemical analysis is illustrated by descriptions and by examples to help task group and subcommittee members communicate clearly.

1. Scope

1.1 This document covers terms and concepts used in developing and evaluating the performance of methods for determining chemical composition. Although useful with many types of methods, they are dealt with in this document in the context of chemical analysis of metals and related materials.

2. Referenced Documents

2.1 *ASTM Standards*:²

[E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials](#)

[E1601 Practice for Conducting an Interlaboratory Study to Evaluate the Performance of an Analytical Method](#)

[E1763 Guide for Interpretation and Use of Results from Interlaboratory Testing of Chemical Analysis Methods](#)

3. Terminology

3.1 *Definitions*—For definitions of terms used in this Practice, refer to Terminology [E135](#).

¹ This practice is under the jurisdiction of ASTM Committee E01 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.22 on Laboratory Quality.

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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.

4. Analytical Science and Analytical Methods

4.1 Analytical science deals with the development and use of methods for determining chemical composition of materials. Chemical analysis is the application of written analytical methods.

4.2 Analytical method development consists of selecting chemical and physical systems that respond to a specific analyte in a defined suite of material types. The purpose is to define a process that produces a physical change proportional to analyte content unaffected by other sample components. The measurement system (instrument) yields a numerical result that represents the quantity of analyte. A good analytical method has the following desirable properties:

4.2.1 *Accuracy*—When a method is applied to materials containing various quantities of analyte, it has the property of accuracy if results equal the numerical values of the analyte contents. This property relates solely to a method's average response at each analyte level, ignoring random statistical fluctuations of individual results. Actual methods are never known to be perfectly accurate and this term is usually used in a relative sense to compare different methods or the behavior of a single method under different conditions.

4.2.2 *Precision*—When a method is applied a number of times to a homogeneous sample, it has the property of precision if the result is always the same. This property relates solely to time-related variations in the response of a method and ignores systematic (averaged) differences between results and analyte content that may occur at various analyte levels.