



Standard Test Method for Determining Limits of Detection in Explosive Trace Detectors¹

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1. Scope

1.1 In harmony with the Joint Committee for Guides in Metrology (JCGM) and detection concepts of the International Union of Pure and Applied Chemistry (IUPAC) (**1, 2, 3**)², this test method uses a series of replicated measurements of an analyte at dosage levels giving instrumental responses that bracket the critical value, a truncated normal distribution model, and confidence bounds to establish a standard for determining practical and statistically robust limits of detection to analytes sampled on swabs by explosive trace detectors (ETDs).

1.2 Here, the limit of detection (LOD90) is defined to be the lowest mass of a particular compound deposited on a sampling swab for which there is 90 % confidence that a single measurement in a particular ETD will have a true detection probability of at least 90 % and a true nondetection probability of at least 90 % when measuring a process blank sample.

1.3 This particular test method was chosen on the basis of reliability, practicability, and comprehensiveness across tested ETDs, analytes, and deployment conditions. The calculations involved in this test method are published elsewhere (**4**), and may be performed consistently with an interactive web-based tool available on the National Institute of Standards and Technology (NIST) site: <http://pubapps.nist.gov/loda>.

1.4 *Intended Users*—ETD developers, ETD vendors, ETD buyers, ETD testers, ETD users (first responders, security screeners, and the military), and agencies responsible for public safety and enabling effective deterrents to terrorism.

1.5 While this test method may be applied to any detection technology that produces numerical output, the procedures have been designed for ion mobility spectrometry (IMS) based ETD systems and tested with low vapor pressure explosive compounds. Compounds are deposited as liquid solutions on swabs and dried before use. As some swabs are absorbent, this

deposition procedure may not be optimal for those ETD technologies that rely on high coverage of analyte on the surface of the swab. Background interferences introduced to the test samples were representative of a variety of conditions expected during deployment, but these conditions were not intended as comprehensive in representing all possible scenarios. The user should be aware of the possibility that untested scenarios may lead to failure in the determination of a reliable LOD90 value.

1.6 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.7 *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 and health practices and determine the applicability of regulatory limitations prior to use. Some specific hazards statements are given in Section 8 on Hazards.*

2. Referenced Documents

2.1 ASTM Standards:³

- D6091 Practice for 99 %/95 % Interlaboratory Detection Estimate (IDE) for Analytical Methods with Negligible Calibration Error
- E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods
- E200 Practice for Preparation, Standardization, and Storage of Standard and Reagent Solutions for Chemical Analysis
- E288 Specification for Laboratory Glass Volumetric Flasks
- E456 Terminology Relating to Quality and Statistics
- E542 Practice for Calibration of Laboratory Volumetric Apparatus
- E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method
- E969 Specification for Glass Volumetric (Transfer) Pipets
- E1154 Specification for Piston or Plunger Operated Volumetric Apparatus

¹ This test method is under the jurisdiction of ASTM Committee E54 on Homeland Security Applications and is the direct responsibility of Subcommittee E54.01 on CBRNE Sensors and Detectors.

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

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.