Designation: E2549 – 14

Standard Practice for Validation of Seized-Drug Analytical Methods[1]

This standard is issued under the fixed designation E2549; 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 reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice addresses the validation of qualitative and quantitative seized-drug analytical methods. It discusses the validation of analytical methods in terms of their part in analytical schemes and in terms of performance characteristics including brief mention of measurement uncertainty and quality control parameters.

1.2 This practice does not replace knowledge, skill, ability, experience, education or training and should be used in conjunction with professional judgment.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E2327 Practice for Quality Assurance of Laboratories Performing Seized-Drug Analysis

E2764 Practice for Uncertainty Assessment in the Context of Seized-Drug Analysis

3. Significance and Use

3.1 Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled. There are numerous documents that address the topic of validation but there are few validation protocols for methods specific to seized drug analysis. This practice makes recommendations for the validation of both qualitative and quantitative methods used for the analysis of seized drugs.

4. Analytical Scheme

4.1 An analytical scheme shall be comprised of validated methods that are appropriate for the analyte.

4.2 The combinations of methods chosen for a particular analytical scheme shall identify the specific drug of interest, preclude a false positive and minimize false negatives.

4.3 For quantification the method should reliably determine the amount of analyte present.

4.4 If validated methods are used from published literature or another laboratory's protocols, then the methods shall be verified within each laboratory

4.5 If non-routine validated methods are used, then the method shall be verified prior to use.

4.6 Verification should, at a minimum, demonstrate that a representative set of reference materials has been carried through the process and yielded the expected results.

5. Individual Laboratory Responsibility

5.1 Each laboratory should determine whether their current standard operating procedures have been validated, verified, or require further validation/verification.

6. Operational Environment

6.1 All methods shall be validated or verified to demonstrate that they will perform in the normal operational environment when used by individuals expected to utilize the methods on casework.

7. Documentation

7.1 The entire validation/verification process shall be documented and the documentation shall be retained for a period in accordance with laboratory policy. Documentation shall include, but is not limited to the following:

7.1.1 Personnel involved;

7.1.2 Dates;

7.1.3 Observations from the process;

7.1.4 Analytical data;

7.1.5 A statement of conclusions or recommendations, or both; and

7.1.6 Authorization approval signature.

[1] This practice is under the jurisdiction of ASTM Committee E30 on Forensic Sciences and is the direct responsibility of Subcommittee E30.01 on Criminalistics.

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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.

8. Recommendation

8.1 To meet the requirements of Sections 4 through 7, it is recommended that laboratories follow the applicable provisions of Section 9 [General Validation Plan] when validating seized-drug analytical methods.

NOTE 1—For further information, see http://www.swgdrug.org for Supplemental Documents SD-2 "Preparing Validation Plans, Section I: Analytical Techniques – Elements to Consider" and Section II: "Example Validation Plan for GC/MS Identification and Quantitation of Heroin," SWGDRUG.

9. General Validation Plan

9.1 *Purpose/Scope*—This is an introductory statement that will specify what is being tested, the purpose of the testing and the result(s) required for acceptance.

9.1.1 *Performance Specification*—A list of specific objectives (for example, trueness and precision) should be determined prior to the validation process.

9.1.2 *Process Review*—After completion of the validation process the objectives should be revisited to ensure that they have been satisfactorily met.

9.2 *Analytical Method*—State exactly the method to be validated. It is essential that each step in the method be demonstrated to perform satisfactorily. Steps that constitute a method for the identification or quantification, or both, of seized drugs may include:

- Visual characterization (for example, macroscopic examination)
- Determination of quantity of sample, which may include:
  - Weight
  - Volume
  - Item count
- Sampling (representative or random, dry, homogenized, etc.)
- Stability of analyte
- Sample preparation:
  - Extraction method
  - Dissolution
  - Derivatization
  - Crystallization
  - Techniques for introducing sample into instrumentation
- Instrumental parameters and specifications:
  - List the instruments and equipment (for example, balance and glassware) utilized
  - Instrument conditions
- Software applications (for example, software version, macros)
- Calculations:
  - Equation(s) to be used
  - Unit specification
  - Number of measurements required
  - Reference values
  - Significant figure conventions
  - Conditions for data rejection
  - Uncertainty determination

9.3 *Reference Materials*—Appropriate reference material(s) (see Practice E2327) shall be used to develop and validate analytical procedures for qualitative and quantitative procedures. The validation documentation and operating protocol should define the frequency of usage of the relevant reference materials and their minimum specification (for example, salt form, minimum purity, isomeric form). Traceability of the reference material is required.

9.4 *Performance Characteristics:*

9.4.1 *Selectivity*—Assess the capability of the method to identify/quantify the analyte(s) of interest, whether pure or in a mixture.

9.4.2 *Matrix Effects*—Assess the impact of any interfering components and demonstrate that the method works in the presence of substances that are commonly encountered in seized drug samples (for example, cutting agents, impurities, by-products, precursors).

9.4.3 *Recovery*—May be determined for quantitative analysis.

9.4.4 *Accuracy:*

9.4.4.1 *Precision (Repeatability/Reproducibility)*—Determine the repeatability and reproducibility of all routine methods. Conditions under which these determinations are made shall be specified.

NOTE 2—Reproducibility determination may be limited to studies within the same laboratory.

(1) Within the scope of the validation, determine acceptable limits for repeatability and reproducibility.

(2) For qualitative analysis, run the qualitative method a minimum of ten times.

(3) For quantitative analysis, run the quantitative method a minimum of ten times.

(4) Validation criteria for non-routine methods may differ from what is stated above.

9.4.4.2 *Trueness:*

(1) Trueness shall be determined for quantitative methods to assess systematic error. Trueness can be assessed through various methods such as:

- Comparison of a method-generated value for the reference material with its known value using replicate measurements at different concentrations,
- Performance of a standard addition method,
- Comparison to proficiency test results, and
- Comparison with a different validated analytical method.

9.4.5 *Range*—Determine the concentration or sample amount limits for which the method is applicable.

9.4.5.1 *Limit of Detection (LOD)*—Limit of detection shall be determined for all qualitative methods.

(1) Determine the lowest amount of analyte that will be detected and can be identified.

(2) The results obtained at the LOD are not necessarily quantitatively accurate.

9.4.5.2 *Limit of Quantitation (LOQ)*—Limit of Quantitation shall be determined for all quantitative methods. Determine the lowest concentration that has an acceptable level of uncertainty.

9.4.5.3 *Linearity*—Linearity shall be determined for all quantitative methods.

(1) Determine the mathematical relationship (calibration curve) that exists between concentration and response over a selected range of concentrations.

(2) The LOQ effectively forms the lower end of the working range.

(3) Determine the level of acceptable variation from the calibration curve at various concentrations.

(4) Determine the upper limits of the working range.

9.4.6 *Robustness*—Robustness shall be determined for either qualitative or quantitative methods. Alter method parameters individually and determine any changes to accuracy.

9.4.7 *Ruggedness*—Ruggedness may be determined for either qualitative or quantitative methods. Ruggedness should assess the factors external to the method.

9.4.8 *Uncertainty*—The contribution of random and systematic errors to method result uncertainty shall be assessed and the expanded uncertainty derived for quantitative methods (see Practice E2764).

10. Quality Control

10.1 Acceptance criteria for quality control parameters should be adopted prior to implementation of the method.

11. Keywords

11.1 analytical scheme; methods; performance characteristics; seized-drug analytics; validation