

NACRW Reference Materials Working Group Draft Glossary of Terms

The Reference Materials (RM) Working Group of the NACRW is interested in the development of a common glossary of terms to benefit RM users. The draft glossary contained in the following pages is a collection of terms deemed relevant to this user group from various resources, including the *RM Guidelines* published by the AOAC Technical Division on Reference Materials, the Eurachem Guides on *The Selection and Use of Reference Materials* and *Terminology in Analytical Measurement*, Guidelines for the Validation of Chemical Methods for the FDA FVM Program, International Vocabulary of Metrology (VIM), ISO 17034:2016(E), and ISO Guide 30. No specific references to ISO Guide 31 are included because the terms included in that Guide are referenced to other sources that have already been included.

Moving forward, the tasks for the Working Group are:

1. Determine if any important resources are missing from the reference list.
2. Determine if any important terms are missing from the draft glossary.
3. Determine if any terms currently on this list are not necessary.

**NACRW Reference Materials Working Group
Draft Glossary of Terms**

Term	Definition	Source
Accuracy	Closeness of agreement between a measured quantity value (test result) and a true quantity value (accepted reference value) of a measurand. When applied to test results, accuracy includes a combination of random and systematic error. When applied to test method, accuracy refers to a combination of trueness and precision.	FDA [1] VIM [2]
Action level	Level of concern or target level for an analyte that must be reliably identified or quantified in a sample.	FDA [1]
Analyte	The chemical substance measured and/or identified in a test sample by the method of analysis.	FDA [1]
Analytical batch	An analytical batch consists of samples, standards, quality controls, and blanks which are analyzed together with the same method sequence and same lots of reagents and with the manipulations common to each sample within the same time period (usually within one day) or in continuous sequential time periods.	FDA [1]
Bias	The difference between the expectation of the test result and the true value or accepted reference value. Bias is the total systematic error for a measurement for a laboratory or for an analytical method, and there may be one or more systematic error components contributing to the bias.	FDA [1]
Blank	A substance that does not contain the analytes of interest and is subjected to the usual measurement process. Blanks can be further classified as method blanks, matrix blanks, reagent blanks, instrument blanks, and field blanks.	FDA [1]
Calibration	Determination of the relationship between the observed analyte signal generated by the measuring/detection system and the quantity of analyte present in the sample measured. Typically, this is accomplished with calibration standards containing known amounts of analyte.	FDA [1]
Calibration Standard	A known amount or concentration of analyte used to calibrate the measuring/detection system. May be matrix matched for specific sample matrices. Amount or concentration is known through purity evaluation of the pure substance or neat material.	FDA [1]
Carryover (i.e., Memory)	Residual analyte from a previous sample or standard which is retained in the analytical system and measured in subsequent samples. Also called <i>Memory</i> .	FDA [1]
Certificate of Analysis (COA)	An official document that shows the results of scientific tests on a product. Commonly issued as part of quality control of an individual batch of a product, and may be used to confirm that a regulated product meets its product specification.	

Term	Definition	Source
Certified Reference Material (CRM)	Reference material characterized by a metrologically valid procedure for one or more specified properties, accompanied by a reference material certificate issued by an authoritative body that provides the value of the specified property, its associated uncertainty, and a statement of metrological traceability. Note: Standard Reference Material (SRM) is the trademark name of CRMs produced and distributed by the National Institute of Standards and Technology (NIST).	ISO 17034 [3] ISO Guide 30 [4]
Certified Value	Value, assigned to a property of a reference material that is accompanied by an uncertainty statement and a statement of metrological traceability, identified as such in the reference material certificate.	ISO 17034 [3] ISO Guide 30 [4]
Check Analysis	Result from a second independent analysis which is compared with the result from the initial analysis. Typically, check analyses are performed by a different analyst using the same method.	FDA [1]
Commutability	Property of a reference material, demonstrated by the equivalence of the mathematical relationships among the results of different measurement procedures for a reference material and for representative samples of the type intended to be measured.	ISO Guide 30 [4]
Confirmatory Analysis/Method	Independent analysis/method used to confirm the result from an initial or screening analysis. A different method is often used in confirmation of screening results.	FDA [1]
Coverage Probability	Probability that the set of true quantity values of a measurand is contained within a specified coverage interval.	VIM [2]
Coverage Factor	Number larger than one by which a combined standard measurement uncertainty is multiplied to obtain an expanded measurement uncertainty.	VIM [2]
Error	Measured quantity value minus a reference quantity value.	VIM [2]
False Negative Rate	In qualitative analysis, a measure of how often a test result indicates that an analyte is not present, when, in fact, it is present or, is present in an amount greater than a threshold or designated cut-off concentration.	FDA [1]
False Positive Rate	In qualitative analysis, a measure of how often a test result indicates that an analyte is present, when, in fact, it is not present or, is present in an amount less than a threshold or designated cut-off concentration.	FDA [1]
Fitness for Purpose	Degree to which data produced by a measurement process enables a user to make technically and administratively correct decisions for a stated purpose.	FDA [1]
Guidance Level	Level of concern or action level issued under good guidance practices that must be reliably identified or quantified in a sample.	FDA [1]
Homogeneity	Uniformity of a specified property value throughout a defined portion of a reference material.	ISO Guide 30 [4]

Term	Definition	Source
Identity (Chemical)	Unambiguous structure attributed to a measured analytical feature, supported by evidence, within a defined scope (e.g., isomers). Best determined by qNMR for a pure material and required for traceability to SI. For mixtures or in matrix, often confirmed by a highly specific technique such as mass spectrometry or by demonstration of results from two or more independent analyses in agreement. Used to determine selectivity and sensitivity of a method for the measurand.	FDA [1]
Incurred Samples	Samples that contain the analyte(s) of interest, which were not derived from laboratory fortification but from sources such as exogenous exposure (e.g., pesticide use, consumption by an animal, environmental exposure) or endogenous origin.	FDA [1]
Indicative Value	Value of a quantity or property, of a reference material, which is provided for information only. An indicative value cannot be used as a reference in a metrological traceability chain.	ISO Guide 30 [4]
Interference	A positive or negative response or effect on response produced by a substance other than the analyte. Includes spectral, physical, and chemical interferences which result in a less certain or accurate measurement of the analyte.	FDA [1]
Interlaboratory Comparison	General term for a collaborative study for either method performance, laboratory performance (proficiency testing) or material certification. A common tool for evaluation of reproducibility and/or ruggedness testing for a laboratory or method.	NORDTEST [6]
Intermediate Precision	Measurement precision under a set of conditions that includes the same measurement procedure, same location, and replicate measurements on the same or similar objects over an extended period of time but may include other conditions involving changes. Part of repeatability testing for a laboratory or method.	VIM [2]
Internal Standard	A chemical added to the sample, in known quantity, at a specified stage in the analysis to facilitate quantitation of the analyte. Internal standards are used to correct for matrix effects, incomplete spike recoveries, etc. Analyte concentration is deduced from its response relative to that produced by the internal standard. The internal standard should have similar physico-chemical properties to those of the analyte.	FDA [1]
International System of Units (SI)	The system of metric units which has been adopted by agreement in all major countries for use in science, medicine, industry, and commerce. SI is a coherent system based on the seven basic quantities of length (metre, m), mass (kilogram, kg), time interval (second, s), electric current (ampere, A), thermodynamic temperature (degree Kelvin, K), luminous intensity (candela, cd) and amount of substance (mole, mol).	NIST [5]

Term	Definition	Source
Level of Concern	Level of concern is the concentration of an analyte in a sample that must be exceeded before the sample can be considered violative. This concentration can be a regulatory tolerance, safe level, action level, guidance level or a laboratory performance level.	FDA [1]
Limit of Detection (LOD)	The minimum amount or concentration of analyte that can be reliably distinguished from zero. The term is usually restricted to the response of the detection system and is often referred to as the Detection Limit. When applied to the complete analytical method it is often referred to as the Method Detection Limit (MDL).	FDA [1]
Limit of Quantitation (LOQ)	The minimum amount or concentration of analyte in the test sample that can be quantified with acceptable precision. Limit of quantitation (or quantification) is variously defined but must be a value greater than the MDL and should apply to the complete analytical method.	FDA [1]
Limit Test (i.e., Binary Test, Pass/Fail Test)	A type of semi-quantitative screening method in which analyte(s) has a defined level of concern. Also called a Binary Test or a Pass/Fail Test.	FDA [1]
Linearity	The ability of a method, within a certain range, to provide an instrumental response or test results proportional to the quantity of analyte to be determined in the test sample.	FDA [1]
Matrix	All the constituents of the test sample with the exception of the analyte.	FDA [1]
Matrix Blank	A substance that closely matches the samples being analyzed with regard to matrix components. Ideally, the matrix blank does not contain the analyte(s) of interest but is subjected to all sample processing operations including all reagents used to analyze the test samples. The matrix blank is used to determine the absence of significant interference due to matrix, reagents and equipment used in the analysis.	FDA [1]
Matrix Effect	An influence of one or more components from the sample matrix on the measurement of the analyte concentration or mass. Matrix effects may be observed as increased or decreased detector responses, compared with those produced by simple solvent solutions of the analyte.	FDA [1]
Matrix Reference Material	Reference material that is characteristic of a real sample.	ISO Guide 30 [4]
Matrix Source	The origin of a test matrix used in method validation. A sample matrix may have variability due to its source. Different food matrix sources can be defined as different commercial brands, matrices from different suppliers, or in some cases different matrices altogether. For example, if a variety of food matrices with differing physical and chemical properties are selected, the number of sources for each food sample matrix may be one or more.	FDA [1]

Term	Definition	Source
Matrix Spike (i.e., Laboratory Fortified Matrix)	An aliquot of a sample prepared by adding a known amount of analyte(s) to a specified amount of matrix. A matrix spike is subjected to the entire analytical procedure to establish if the method is appropriate for the analysis of a specific analyte(s) in a particular matrix. Also called a Laboratory Fortified Matrix.	FDA [1]
Measurand	Quantifiable property of an analyte to be measured.	
Measurement	Process of experimentally obtaining one or more quantity values that can reasonably be attributed to a quantity.	VIM [2]
Measurement Procedure	Detailed description of a measurement according to one or more measurement principles and to a given measurement method, based on a measurement model and including any calculation to obtain a measurement result.	VIM [2]
Measurement Traceability (i.e., Traceability)	Property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty.	VIM [2]
Method Blank	A substance that does not contain the analyte(s) of interest but is subjected to all sample processing operations including all reagents used to analyze the test samples. An aliquot of reagent water is often used as a method blank in the absence of a suitable analyte-free matrix blank.	FDA [1]
Method Detection Limit (MDL)	The minimum amount or concentration of analyte in the test sample that can be reliably distinguished from zero. MDL is dependent on sensitivity, instrumental noise, blank variability, sample matrix variability, and dilution factor.	FDA [1]
Method Development	The process of design, optimization and preliminary assessment of the performance characteristics of a method.	FDA [1]
Method Validation	The process of demonstrating or confirming that a method is suitable for its intended purpose. Validation includes demonstrating performance characteristics such as accuracy, precision, specificity, limit of detection, limit of quantitation, linearity, range, ruggedness and robustness.	FDA [1]
Method Verification	The process of demonstrating that a laboratory is capable of replicating a validated method with an acceptable level of performance.	FDA [1]
Metrology	Science of measurement and its application.	VIM [2]
Metrological Traceability Chain	Sequence of measurement standards and calibrations that is used to relate a measurement result to a reference.	VIM [2]

Term	Definition	Source
Minimum Detectable Concentration (MDC)	In qualitative analysis, an estimate of the minimum concentration of analyte that must be present in a sample to ensure at a specified high probability (typically 95% or greater) that the measured response will exceed the detection threshold, leading one to correctly conclude that an analyte is present in the sample.	FDA [1]
Minimum Sample Size	Lower limit of the amount of an RM, usually expressed as a mass quantity, that can be used in a measurement process such that the values or attributes expressed in the corresponding RM documentation are valid.	ISO Guide 30 [4]
Neat Material (i.e., Pure Substance)	A material consisting of only one type of atom or molecule; free from impurities.	
Nominal Value	Value of a quantity or property, of a reference material, which is the best representation of a true value but may not represent all sources of uncertainty or bias.	
Operationally Defined Measurand	A measurand that is defined by reference to a documented and widely accepted measurement procedure to which only results obtained by the same procedure can be compared.	ISO 17034 [3]
Precision	The closeness of agreement between independent test results obtained under specified conditions. The precision is described by statistical methods such as a standard deviation or confidence limit of test results. See also Random Error. Precision can be further classified as Repeatability, Intermediate Precision, and Reproducibility.	FDA [1]
Primary Standard	Measurement standard that is designated or widely acknowledged as having the highest metrological qualities and whose property value is accepted without reference to other standards of the same property or quantity, within a specified context.	ISO Guide 30 [4]
Production Batch or Lot	Definite amount of material produced during a single manufacturing cycle and intended to have uniform character and quality.	ISO Guide 30 [4]
Purity	Compositional evaluation of a substance to determine the fraction of the substance that consists of the atom or molecule of interest. The acceptable purity of a substance may vary depending on intended scope for use of that substance.	
Qualitative Analysis/Method	Analysis/method in which substances are identified or classified on the basis of their chemical, biological or physical properties. The test result is either the presence or absence of the analyte(s) in question.	FDA [1]
Quality Control Material (i.e., In-House Reference Material)	A material that is stable, homogeneous, and similar in composition to the samples of interest, characterized by comparison to a CRM.	

Term	Definition	Source
Quantitative Analysis/Method	Analysis/method in which the amount or concentration of an analyte may be determined (or estimated) and expressed as a numerical value in appropriate units with acceptable accuracy and precision.	FDA [1]
Quantity Value	Number and reference together expressing magnitude of a quantity.	VIM [2]
Random Error	Component of measurement error that in replicate measurements varies in an unpredictable manner. See also Precision.	FDA [1]
Range	The interval of concentration over which the method provides suitable accuracy and precision.	FDA [1]
Reagent Blank	Reagents used in the procedure taken through the entire method. Reagent Blanks are used to determine the absence of significant interference due to reagents or equipment used in the analysis.	FDA [1]
Recovery	The fraction or percentage (incurred or added) remaining at the point of the final determination from the analytical portion of the sample measured. Total recovery is based on recovery of the native plus added analyte, and marginal recovery based only on the added analyte (the native analyte is subtracted from both the numerator and denominator).	FDA [1] AOAC [Error! Bookmark not defined.]
Reference	Term assigned to materials (matrix, target analytes) or methods used for testing that have been designated by an authoritative body and are used as a source of information in order to perform analysis, such as an official method of analysis or material used for quantitation.	
Reference Material	A material, sufficiently homogenous and stable with respect to one or more specified properties, which has been established to be fit for its intended use in a measurement process or in examination of nominal properties. Uses may include calibration, validation, verification, or interlaboratory comparison.	FDA [1]
Reference Material Certificate	Document containing the essential information for the use of a CRM, confirming that the necessary procedures have been carried out to ensure the validity and metrological traceability of the stated property values.	ISO Guide 30 [4]
Reference Material Certification Report	Document giving detailed information, in addition to that contained in a reference material certificate, e.g. the preparation of the material, methods of measurement, factors affecting accuracy, statistical treatment of results, and the way in which metrological traceability was established.	ISO Guide 30 [4]
Reference Material Characterization	Typically refers to assignment of quantity values through analytical testing, but may also include other non-quantitative information such as homogeneity and stability testing, confirmation of identity, and binary testing results (yes/no or presence/absence) related to the overall fitness for purpose of the material.	

Term	Definition	Source
Reference Material Document	Document containing all the information that is essential for using any reference material, covering both the product information sheet and reference material certificate.	ISO 17034 [3]
Reference Material Producer	Body (organization or company, public or private) that is fully responsible for project planning and management; assignment of, and decision on property values and relevant uncertainties; authorization of property values; and issuance of a reference material certificate or other statements for the reference materials it produces.	ISO 17034 [3] ISO Guide 30 [4]
Reference Material Source	Body (organization or company, public or private) that is fully responsible for providing reference materials and their accompanying documentation. May or may not be a reference material producer.	
Secondary Source	Alternate source for a material, either from a producer or manufacturer. Level of sourcing depends on scope and purpose of analytical test (e.g. regulatory vs. survey). Should be a different accredited provider (or lot number if provider not available), and often used to identify degradation or bias in materials.	
Reference Standard (i.e., Standard)	A substance of known identity and purity, generally with a certificate of quality from an authoritative body and used to prepare calibration standards.	FDA [1] VIM [2]
Repeatability	Precision obtained under observation conditions where independent test results are obtained with the same method on identical test items in the same test facility by the same operator using the same equipment, materials, solvents, and consumables within short intervals of time.	FDA [1]
Repeatability Conditions	Conditions where independent test results are obtained with the same method on identical test items in the same laboratory by the same operator using the same equipment within short intervals of time.	NORDTEST [6]
Repeatability Limit	Performance measure for a test method or a defined procedure when the test results are obtained under repeatability conditions.	NORDTEST [6]
Representative Analyte	An analyte used to assess probable analytical performance with respect to other analytes having similar physical and/or chemical characteristics. Acceptable data for a representative analyte are assumed to show that performance is satisfactory for the represented analytes. Representative analytes should include those for which the worst performance is expected. Representative analytes are used mostly for non-targeted analysis and unknown screening procedures.	FDA [1]
Representative Matrix	Matrix used to assess probable analytical performance with respect to other matrices, or for matrix-matched calibration, in the analysis of broadly similar commodities. For food matrices, similarity is usually based on the amount of water, fats, protein, and carbohydrates. Sample pH and salt content can also have a significant effect on some analytes.	FDA [1]

Term	Definition	Source
Reproducibility	Precision obtained under observation conditions where independent test results are obtained with the same method on identical test items in different test facilities with different operators using different equipment. May also include different lots of chemicals, target analytes, reagents, etc.	FDA [1]
Reproducibility Conditions	Conditions where test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment.	NORDTEST [6]
Reproducibility Limit	Performance measure for a test method or procedure when the test results are obtained under reproducibility conditions.	NORDTEST [6]
Reproducibility Standard Deviation	Can be estimated from validation studies with many participating laboratories or from other interlaboratory comparisons (e.g., proficiency testing).	NORDTEST [6]
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding quantity value provided by a measuring instrument or a measuring system.	VIM [2]
Ruggedness/ Robustness	A measure of the capacity of an analytical procedure to remain unaffected by small but deliberate variations in method parameters and provides an indication of its reliability during normal usage.	FDA [1]
Sample	A portion (mass or volume) of a material selected from a larger mass or volume (batch) to ensure representation of the whole.	Thiex et al. [7]
Screening Analysis/Method	An analysis/method intended to detect the presence of analyte in a sample at or above some specified concentration (action or target level). Screening methods typically attempt to use simplified methodology for decreased analysis time and increased sample throughput.	FDA [1]
Secondary Reference Material	A reference material that maintains traceability through another reference material used for calibration or other qualification. See also <i>Secondary Source</i> .	
Secondary Standard	Measurement standard whose property value is assigned by comparison with a primary measurement standard of the same property or quantity. See also <i>Secondary Source</i> .	ISO Guide 30 [4]
Selectivity	Property of a measuring system, used with a specified measurement procedure, whereby it provides measured quantity values for one or more measurands such that the values of each measurand are independent of other measurands or other quantities in the phenomenon, body, or substance being investigated. Typically determined using the measuring system that was used to determine the known identity (chemical) of the measurand.	VIM [2]
Sensitivity	The change in instrument response which corresponds to a change in the measured quantity (e.g., analyte concentration). Sensitivity is commonly defined as the gradient of the response curve or slope of the calibration curve at a level near the LOQ.	FDA [1]

Term	Definition	Source
Specificity	In quantitative analysis, specificity is the ability of a method to measure analyte in the presence of components which may be expected to be present. The term Selectivity is generally preferred over Specificity.	FDA [1]
Spike Recovery	The fraction of analyte remaining at the point of final determination after it is added to a specified amount of matrix and subjected to the entire analytical procedure. Spike Recovery is typically expressed as a percentage. Spike recovery should be calculated for the method as written. For example, if the method prescribes using deuterated internal standards or matrix-matched calibration standards, then the reported analyte recoveries should be calculated according to those procedures.	FDA [1]
Stability	Characteristic of a reference material, when stored under specified conditions, to maintain a specified property value within specified limits for a specified period of time.	ISO Guide 30 [4]
Standard Reference Material (SRM)	A certified reference material issued by the National Institutes of Standards and Technology (NIST) in the United States. (www.nist.gov/SRM).	FDA [1]
Systematic Error (i.e., Bias)	Component of measurement error that in replicate measurements remains constant or varies in a predictable manner. Also called Bias.	FDA [1]
Threshold Value (i.e., Cut-off Concentration)	In qualitative analysis, the concentration of the analyte that is either statistically lower than the level of concern (for limit tests) or at which positive identification ceases (for confirmation of identity methods).	FDA [1]
Transportation Stability	Stability of a reference material property for the time period and conditions encountered in transportation to the user of the reference material.	ISO Guide 30 [4]
Trueness	The degree of agreement of the mean value from a series of measurements with the true value or accepted reference value. This is related to systematic error (bias).	FDA [1]
Uncertainty	Non-negative parameter characterizing the dispersion of the values being attributed to the measured value.	FDA [1]
Working Standard	Measurement standard that is used routinely to calibrate or verify measuring instruments or measuring systems.	VIM [2]

Other Resources

AOAC TDRM RM Guidelines, AOAC INTERNATIONAL, Gaithersburg, Maryland, USA (2015)

Eurachem Guide: The Selection and Use of Reference Materials (2002) <https://www.eurachem.org/index.php/publications/guides/usingrm>

VJ Barwick and E Prichard (Eds.), *Eurachem Guide: Terminology in Analytical Measurement – Introduction to VIM 3* (2011)

<https://www.eurachem.org/index.php/publications/guides/terminology-in-analytical-measurement>

KE Sharpless, KA Lippa, DL Duewer, AL Ruhkin, *NIST Special Publication 260-181: The ABCs of Using Standard Reference Materials in the Analysis of Foods and Dietary Supplements: A Practical Guide* (2014) <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-181.pdf>

AOAC INTERNATIONAL *Official Methods of Analysis: Definition of Terms and Explanatory Notes*.

<http://eoma.aoac.org/web%20definition%20of%20terms%20and%20explanatory%20notes.pdf>

References

- [1] *Guidelines for the Validation of Chemical Methods for the FDA FVM Program*, 2nd Ed., US Food & Drug Administration Office of Foods and Veterinary Medicine (2015)
- [2] International Vocabulary of Metrology (VIM) *Basic and general concepts and associated terms*, 3rd Ed., 2008 version with minor corrections. Bureau International des Poids et Mesures (BIPM) (2012) <https://www.bipm.org/en/publications/guides/vim.html>
- [3] ISO 17034:2016(E) *General requirements for the competence of reference material producers*, ISO, Geneva, Switzerland (2016)
- [4] ISO Guide 30, *Terms and definitions used in connection with reference materials*, ISO, Geneva, Switzerland (2015)
- [5] NIST *SI Units*. <https://www.nist.gov/pml/weights-and-measures/metric-si/si-units>
- [6] NORDTEST Handbook for calculation of measurement uncertainty in environmental laboratories (NT TR 537 - Edition 3.1, 2012) <http://www.nordtest.info/index.php/technical-reports/item/handbook-for-calculation-of-measurement-uncertainty-in-environmental-laboratories-nt-tr-537-edition-3.html>
- [7] Thiex and Ramsey, J. of Regulatory Science, 02(2016) 1-8