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_ of 4

Glossary – Definitions / Terms / QC Equations

SCOPE / PURPOSE:

- This glossary is to define common terms used, and establish consistent nomenclature or terminology use throughout the laboratory.
- The following is also a compilation of terms and equations used in quality control calculations.
- This list is not to be considered exhaustive, but instead should be viewed as a work in progress. Terms and definitions will be added by future revisions etc.
- Some terms/definitions may be method specific and will be defined within the framework of a specific procedure.

GLOSSARY:

AAS: Atomic Absorption Spectroscopy

ACCURACY: A measure that reflects the closeness of a measured value to its true value. (1)

ASTM: American Society for Testing and Materials.

ATG: Analytical Test Group, as defined by MISA. (2)

ANALYTE: The chemical species (i.e. metal, anion, or organic) to be identified and quantified.

BATCH: A group of samples processed together, at the same time, through each step of an analytical procedure. (2)

BIAS: Consistent deviation of measured values from the true value, caused by systematic errors in a procedure. (1)

$$B = (x_s - x_u) - K$$

x_s = measured value of spiked sample

x_u = measured value of unspiked sample

K = known value of the spike in the sample

i.e. $B = (50.8 - 45) - 5$
 $5.8 - 5 = 0.8$

BLANK: See Calibration Blank, Method Blank.

BTEX: Benzene, Toluene, Ethylbenzene, (ortho, meta and para)- Xylenes

BTEXS: BTEX plus Stylene

CAEAL: Canadian Association of Environmental Analytical Laboratories.

CALIBRATION BLANK: Deionized water that has been acidified to the same level as found in the standards and samples. The calibration blank serves as the rinse solution between samples and standards. Also used for all initial and continuing calibration blank determinations. (3)

CALIBRATION CURVE: A plot of concentrations for known analyte standards versus the instrument response to the analyte. Calibration standards are typically prepared which cover the working, linear range of the instrument. The calibration standards should be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. (3)

COMPOSITE SAMPLE: A final sample made up from a collection of sub-samples or grab samples that have been combined volumetrically or gravimetrically through automatic or manual means. (2)

CONTINUING CALIBRATION VERIFICATION (CCV): A calibration standard used to verify continuing calibration. Used to assure calibration accuracy during each analysis run. It must be run for each analyte as described in the particular analytical method. At a minimum, it should be analyzed at the beginning of the run and after the last analytical sample. Its concentration should be at or near the mid-range levels of the calibration curve. (3)

CERTIFIED REFERENCE MATERIAL (CRM): A matrix sample containing analytes at concentration values which have been certified by multiple laboratory analysis.

CSA: Canadian Standards Association

CVAAS: Cold Vapour Atomic Absorption Spectroscopy.

DATA VALIDATION: The process of evaluating the available data against established quality criteria.

DE-IONIZED WATER: Water that has been purified, with no detectable concentration of the analyte to be measured, at the detection limit of the analytical method. Water that is free of interfering analytes and / or contaminants.

ECD: Electron Capture Detector.

EXTERNAL REFERENCE STANDARD (EXT REF): A certified or independently prepared standard / solution used to verify the accuracy of the initial calibration. It is also known as the INITIAL CALIBRATION VERIFICATION (ICV) standard. (3)

FID: Flame Ionization Detector

FIELD DUPLICATES: Independent samples which are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. These duplicates are useful in documenting the precision of the sampling process. (3)

GC: Gas Chromatography

GC-MS: Gas Chromatography - Mass Spectrometry.

GFAAS: Graphite Furnace Atomic Absorption Spectroscopy.

GLP: Good Laboratory Practices.

GRAB sample: Volume of effluent of at least 100 mL (except for volatiles) collected over a period not exceeding 15 minutes and immediately transferred to an appropriate laboratory sampling container. (2)

IC: Ion Chromatography.

ICP-AES: Inductively Coupled Plasma - Atomic Emission Spectroscopy.

INTERNAL STANDARD (IS): Quantitation analyte added to each sample or sample extract/digestate prior to sample analysis. Internal standards should mimic the analytes of interest but not interfere with the analysis. (1)

ISE: Ion Selective Electrode.

HPLC: High Performance (Pressure) Liquid Chromatography.

LIMIT OF DETECTION (LOD): The point (typically a concentration) at which a measured value is larger than the uncertainty with which it can be measured. The LOD is set at a concentration that gives a signal that is 3 times the standard deviation (SD) of the measurement process at zero concentration or $3 \times SD_0$ (~ MDL). (4)

LIMIT of QUANTITATION (LOQ): The lowest concentration at which a result can have a meaningful uncertainty assigned to it. The LOQ is set at a concentration that gives a signal that is 10 times the standard deviation (SD) of the measurement process at zero concentration or $10 \times SD_0$ (~ 3.33 x MDL). (4)

LINEAR DYNAMIC RANGE: The concentration range over which the analytical curve remains linear. (3)

MATRIX: The physical environment (e.g., water, soil, gas, hydrocarbon), which contains the analyte of interest.

MATRIX SPIKE: An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs **prior** to sample preparation and analysis. A spiked sample is used to document the bias of a method in a given sample matrix. (1)

$$\% \text{ Recovery} = ((\text{Measured spike value} - \text{sample value}) / \text{known spike concentration added}) \times 100\%$$

METHOD BLANK: An analyte-free matrix to which all reagents are added in the same proportions as specified in the analytical procedure under sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process. (3)

METHOD DETECTION LIMIT (MDL): Is a statistically defined decision point such that the measured results (from an analytical method) falling at or above this point are interpreted to indicate the presence of analyte in the sample with a specified probability (99 % confidence level). (2)

MIDES: MISA Data Entry System. (2)

MISA: Municipal and Industrial Strategy for (Pollution) Abatement. MOE document. (2)

MOE: Ontario Ministry of Environment. (2)

NIST: National Institute for Standards and Technology.

NRC: National Research Council of Canada.

P&T: Purge and Trap.

PAH: Polynuclear Aromatic Hydrocarbon.

PCBs: Polychlorinated Biphenyls

PRECISION: The agreement among a set of replicate measurements without assumption of knowledge of the true value. Precision is estimated by means of replicate analyses. The most commonly used estimates of precision are Relative Standard Deviation (RSD). (1)

QUALITY ASSURANCE (QA): A definitive plan for laboratory operation that specifies the measures used to produce data of known precision and bias. (2)

QUALITY CONTROL (QC): A set of measures within a sample analysis methodology to assure the process is “in control”. (2)

QMS – Quality Management System.

RCRA: The Resource Conservation and Recovery Act (USEPA).

REAGENT GRADE: “Analytical reagent (AR) grade”, “ACS reagent grade”, and “reagent grade” are synonymous terms for reagents that conform to the current specifications from the Committee on Analytical Reagents of the American Chemical Society. (3)

RELATIVE STANDARD DEVIATION (RSD): $RSD = 100\% \times \left(\frac{S}{\bar{x}} \right)$, where \bar{x} = the arithmetic mean of x_i measurements, and S = standard deviation.

REPLICATE: Separate aliquots of sample taken from the same container and analyzed independently.

RESPONSE FACTORS (RF): Is the ratio of the measured analyte (x) response (area (A) or height) for a given analyte and its corresponding concentration. $RF(x) = A_x / C_x$

RMDL: Reporting Method Detection Limit. The RMDL is the maximum allowable value for a Laboratory MDL (LMDL) under the Effluent Monitoring and Effluent Limits Regulations. (2)

SAMPLE STORAGE TIME: Period of time between sample collection and initiation of sample analysis. (2)

SCC: Standards Council of Canada.

SIGNIFICANT FIGURES: Is the number of digits that are known accurately, plus one that is uncertain or doubtful. For example, a balance indicating 13.0234g, the first 5 digits are known accurately, but the last number is doubtful. (5)

SOP: Standard Operating Procedure.

SPIKED BLANK: Reagent water spiked with compound(s) representative of the target analytes and carried through the preparation and analysis procedure as a sample. This is used to document method performance.(1)

SRI (SMALLEST REPORTING INCREMENT): MDL/3 and then rounded down to the nearest 1, 2 or 5. (2)

SRM (STANDARD REFERENCE MATERIAL): Material that has been certified by a regulatory body (i.e. NIST, USEPA, NRC or other agency of equal reliability). (2)

STANDARD ADDITION: The practice of adding known amounts of an analyte to a sample immediately prior to analysis. It is typically used to evaluate interferences.

STANDARD DEVIATION (SD):

$$S = \sqrt{\frac{\sum (X_i - \bar{X})^2}{(n-1)}}$$

where:

X_i = the final analytical results, in the typical reporting units for the 8 or more replicate aliquots

\bar{X} (i = 1 to n).

\bar{X} = the average of the replicate results.

SURROGATE STANDARD (SS): An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples (such as deuterated compounds). Surrogates are added prior to extraction to monitor extraction efficiency and percent recovery in each sample. (3)

TAT: Turn Around Time.

TCLP: Toxicity Characteristic Leaching Procedure, US EPA Method 1311.

THMs: Trihalomethanes.

TRAVELLING BLANK: A sample of analyte-free media taken from the laboratory to the sampling site and returned to the laboratory unopened. Used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organics samples.

TRAVELLING SPIKED BLANK: A sample of uncontaminated reagent water free of any interfering substances to which a known amount of standard solution and appropriate preservative have been added by the laboratory performing the analysis. The travelling spiked blank must be prepared within 24 hours of accompanying the sample containers to the sampling location. The travelling spiked blank is brought to the field and returned, unopened to the lab for analysis. (2)

USEPA: US Environmental Protection Agency.

VOCs: Volatile Organic Compounds.

VOC FREE WATER: Water in which an organic interferent is not observed at the method detection limit of the compounds of interest (for volatiles and semi volatiles analytcs).

REFERENCES:

- (1) Standard Methods for the Examination of Water and Wastewater, 20th^{edition}, Introduction section 1000
- (2) MISA – Protocol for the Sampling and Analysis of Industrial / Municipal Waste Water, revised January 1999
- (3) EPA SW-846
- (4) CAEAL Policy on the Estimation of Uncertainty of Measurement in Environmental Testing, R 1.0, August 2002.
- (5) Chemical Technicians' Ready Reference Handbook, 3rd Edition

FUTURE TERMS / DEFINITIONS (to be included / considered in the next revision of this SOP):

- PALCAN
- ILAC
- EURACHEM / CITAC

