

**THE SELECTION AND USE OF  
REFERENCE MATERIALS  
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# USE OF REFERENCE MATERIALS

- method validation
- calibration
- estimation of measurement uncertainty
- training
- internal quality control
- external quality assurance (proficiency testing)

# OVERLAB BETWEEN FUNCTIONS

- Figure 1 in the publication

# TYPES OF RM

- **Pure substances** characterised for chemical purity and/or trace impurities
- **Standard solutions and gas mixtures** often prepared gravimetrically from pure substances and used for calibration purposes.
- **Matrix reference materials** characterised for the composition of specified major, minor or trace chemical constituents. Such materials may be prepared from matrices containing the components of interest, or by preparing synthetic mixtures.

# TYPES OF RM cont.

- **Reference objects or artefacts** characterised for functional properties such as taste, odour, octane number, flash point and hardness. This type also includes microscopy specimens characterised for properties ranging from fibre type to microbiological specimens.
- **Physico-chemical reference materials** characterised for properties such as melting point, viscosity, and optical density.

# CLASSIFICATION OF RM

- Certified reference materials CRMs
- Reference materials RMs
  
- Primary reference material
- Secondary reference materials
- In-house or working reference material

# DEFINITIONS

- **Certified Reference Material** : Reference material, accompanied by a certificate, one or more of whose property values are certified by a procedure which establishes traceability to an accurate realisation of the unit in which the property values are expressed, and for which each certified value is accompanied by an uncertainty at a stated level of confidence.

# DEFINITIONS

- **Reference material (RM)** : Material or substance one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

# TRACEABILITY

- **Measurement method**
- Primary method
- Method of known bias
- Independent method(s)
- Interlaboratory comparison
- **Traceability**
- SI
- SI/International standard
- Results of specified methods
- Results of specified methods

# USE OF RM:Method Validation and Measurement Uncertainty

- Estimation of bias (the difference between the measured value and the true value) is difficult in method validation, but appropriate RMs can provide valuable information.
- Clearly the RMs must be within the scope of the method in terms of matrix type, analyte concentration etc.
- The uncertainty associated with an RM should be no greater than one third of that of the sample measurement.

# USE OF RM: Verification of the Correct Use of a Method

- The successful application of a valid method depends on its correct use, both with regard to operator skill and suitability of equipment, reagents and standards
- RMs can be used for training, for checking infrequently used methods and for trouble shooting when unexpected results are obtained

# USE OF RM:Calibration

- Normally a pure substance RM is used for calibration of the measurement stage of a method
- The uncertainty associated with RM purity will contribute to the total uncertainty of the measurement
- Some other methods, such as XRF analysis, use matrix RMs for calibration of the complete analytical process

## USE OF RM:Quality Control and Quality Assurance (QC&QA)

- RMs should be characterised with respect to homogeneity, stability, and the certified property value(s)
- For in-house QC adequate homogeneity and stability are essential. Similar requirements apply to samples used to establish how well or badly measurements made in different laboratories agree.

## USE OF RM:Quality Control and Quality Assurance (QC&QA) cont.

- In the case of proficiency testing, homogeneity is essential and sample stability within the time-scale of the exercise must be assessed and controlled
- The cost of certifying the property values of proficiency testing samples often prohibits this being done and consensus mean values are often used instead
- value, ‘the majority’ is not necessarily correct and as a consequence the values carry some undisclosed element of uncertainty

# ASSESSMENT OF THE SUITABILITY OF REFERENCE MATERIALS

- Figure 2 in the publication

# ASSESSMENT OF THE SUITABILITY OF REFERENCE MATERIALS

- analytical specification
  - Measurand including analyte
  - Measurement range (concentration)
  - Matrix match and potential interferences
  - Sample size
  - Homogeneity and stability
  - Measurement uncertainty
  - Value assignment procedures (measurement and statistical)