



Activities of the Eurachem Education and Training Working Group

David MILDE



Introduction

- E&T WG and its membership
- Overview of activities
 - Workshops
 - Reading list
 - Guides
 - Leaflets
- Impact of WG activities
- Summary



History & membership

- WG was established very likely around 2000.
- **Chairs:**
 - B. Wenclawiak (?-2006)
 - E. Prichard (2007-2010)
 - V. Barwick (2011-2020)
 - D. Milde (2021-2022)
- The group operates in accordance with the Eurachem MoU.
- Membership: 25 members from 17 countries
 - Full and correspondence membership
 - About a half – corresponding members
- WG attempts to have representatives from each member state.



From Terms of Reference

- The E&T WG will collate and evaluate information on the state of education and training in analytical science in different countries. The WG members will promote the concepts and importance of training, in particular, with respect to the development of teaching materials and courses on quality management which emphasise metrology.
- The E&T WG will disseminate information on training courses for professional analysts in the workplace which cover quality management with an emphasis on metrology.
- The E&T WG will collaborate with other organisations having similar or complementary aims.



Previous activities (since 2010)

- Development of a questionnaire to seek information about activities in teaching and training in MiC
- Quality assurance workshop at the 2011 General Assembly (Moscow, 2011)
- Terminology in Analytical Measurement: Introduction to VIM 3 (1st ed, 2011)
- Training course and workshop on key challenges in internal quality control (Berlin, 2012)
- An information leaflet introducing terminology in measurement (2016)
- Guide to Quality in Analytical Chemistry: An Aid to Accreditation (3rd ed, 2016)
- Workshop on Data – Quality, Analysis and Integrity (Dublin, 2018)
- An information leaflet on the revision of ISO/IEC 17025 (2018)
- First Eurachem online WS: Quality Assurance Elements for Analytical Laboratories in the University Curriculum (Bucharest, 2020)
- Reading list – ongoing process of revisions (last edition 2022)



Reading List for Analytical Scientists

- It is based on bibliographies originally produced by TrainMiC[®] and LGC.
- The main focus: metrology in chemistry, particularly quality assurance.
- It is not intended to be a comprehensive list of all publications in the field.
- The aim is to provide a selection of:
 - Websites
 - Standards
 - Guides, books, leaflets
 - Scientific articles and reports
- Many of the references provided in this list are available to download free of charge (Eurachem, JCGM, Euramet, Eurolab, ILAC, EA, ...).
- The aim is to update the bibliography annually.



Reading List for Analytical Scientists



Reading List for Analytical Scientists

Contents

Introduction and scope	2
Introduction to metrology and terminology	3
Traceability of measurement results	5
Uncertainty of measurement	7
Statistics	10
Validation of analytical methods	12
Reference materials	15
Proficiency testing	16
Internal quality control	18
Quality assurance and accreditation	19

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A Focus for Analytical Chemistry in Europe

Home > Publications > Reading list

Font size Bigger Reset Smaller

Hide info >>

Home

About Eurachem

Working groups

Publications

- Eurachem Guides
- Information Leaflets
- Publication Archive
- Reading list**
- Task Views
- Events
- News
- Eurachem Blog
- Contact Eurachem
- Web links
- Tags

Search ...

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Username

Password

Remember Me

The Eurachem reading list

Introduction and Scope

This reading list has been prepared by members of the Eurachem Education and Training Working Group. It is based on bibliographies originally produced by TrainMiC (www.trainmic.org) and LGC - under the UK's Chemical and Biological Metrology programme (www.lgcgroup.com/nmi) - but has been substantially updated. The main focus of the references contained in the list is metrology in chemistry, with a particular focus on quality assurance. However, it is anticipated that that references will also be of interest to those working in other disciplines. It is not intended to be a comprehensive list of all publications relating to quality in analytical measurement. The aim is to provide references to a selection of websites, standards, guides and books which will hopefully be of use to all those involved with chemical analysis (and related disciplines), including laboratory staff, students, lecturers and trainers.

Many of the references provided in this list are available to download free of charge, in particular documents published by Eurachem, JCGM, Euramet, Eurolab, ILAC, EA and accreditation bodies such as UKAS.

The aim is to update the bibliography annually. The Working Group welcomes suggestions for additions to the bibliography. Please see the [contact form for the working group](#) to send additional references.

The complete reading list^{Note 1} can be downloaded in pdf format [here \(pdf, 193kb\)](#).

The following articles provide the same material in web-readable format.

Note: Eurachem provides this list for information and is not responsible for the content or advice given in the resources listed.

Note 1. PDF last updated 2022-02-25

The reading list, by Topic

1. Introduction to metrology and terminology
2. Traceability of measurement results

Frequently requested

- > Measurement Uncertainty
- > Eurachem - a quick reference
- > Eurachem working groups
- > Proficiency Testing
- > 9th International Workshop on Proficiency Testing (2017)
- > Eurachem Workshop - Uncertainty from sampling and analysis for accredited laboratories

Recent updates

- > Bibliography of Proficiency Testing and EQA publications (2007)
- > Leaflet - Traceability of Analytical Results (2005 edition)
- > Accreditation for Microbiological Laboratories (2002)
- > Guide to Quality in Analytical Chemistry - 2nd Edition (2002)
- > Traceability in Chemical Measurement (2003)
- > Selection, Use and Interpretation of Proficiency Testing (PT) Schemes by Laboratories (2011)

Eurachem on YouTube

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Guidance documents

Terminology in Analytical Measurement: Introduction to VIM 3 (1st ed.)

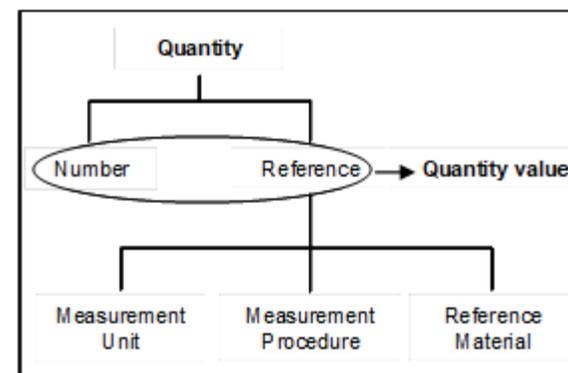
- Guidance to the language in the world of metrology: The International Vocabulary of Metrology.
- The 3rd ed. called VIM 3 was published as ISO Guide 99 and as JCGM 200:2008.
- The scope of the Eurachem Guide: cover a selection of the concepts in VIM 3, focusing on those most likely to be encountered in analytical laboratories. It aims to cover chemical, biological and clinical measurements.
- The Guide is intended for laboratory staff, accreditation bodies, for those commissioning measurements and for those using measurement results.
- Lecturers and trainers may also find this Guide useful when teaching aspects of metrology.
- Contributors
 - Vicki Barwick, LGC, UK
 - Bertil Magnusson, SP Technical Research Institute of Sweden
 - Ulf Örnemark, LGC Standards, Sweden
 - Marina Patriarca, Istituto Superiore di Sanità, Italy
 - Elizabeth Prichard, UK



Guidance documents

Terminology in Analytical Measurement: Introduction to VIM 3 (1st ed.)

- Published in 2011, currently under revision
- Translations: Farsi, German, Italian, Ukrainian, Czech
- 4 main chapters:
 - General metrology (quantity, measurement, measurement procedure, ...)
 - Metrological traceability (calibration, calibrator, commutability, ...)
 - Measurement uncertainty
 - Validation and method performance (trueness, precision, LoD, measurement interval, ...)
- 90 concepts from VIM 3 are discussed.
- Examples to explain concepts are incorporated.
- List of discussed concepts is included as an Appendix.





Guidance documents

Terminology in Analytical Measurement: Introduction to VIM 3 (1st ed.)

$(\Delta \text{indication} / \Delta \text{quantity} = \Delta \text{absorbance} / \Delta \text{mass conc.})$

4.4 Detection limit

VIM defines the limit of detection (LOD) in terms of a **measured quantity value**.

measured quantity value, obtained by a given **measurement procedure**, for which the probability of falsely claiming the absence of a component in a material is β , given a probability α of falsely claiming its presence (VIM 4.18)

This is not consistent with the IUPAC (and other) definitions currently used in analytical chemistry which refer to a **true quantity value** (VIM 2.11) rather than a **measured value**. It is not yet clear whether the difference is intentional or, if so, how it can be implemented. The description below therefore follows recommendations made by IUPAC for establishing detection capability for analytical methods [33].

Many analysts will be familiar with calculating the **limit of detection** for a **measurement procedure** by multiplying a standard deviation, s (obtained from the results of the analysis of a blank sample or a sample containing a low concentration of the analyte) by an appropriate factor (typically between 3 and 5). The multiplying factor is based on statistical reasoning. The following text explains the background to the commonly used factor of 3.3.

This section deals with LOD in terms of concentration but it applies equally to other **quantities**, e.g. mass fraction. The aim when determining the LOD is typically to establish the lowest concentration of the analyte present in a

sample were exactly equal to the critical value (expressed in terms of concentration), approximately half of the **measurement results** would be expected to fall below the critical value, giving a false negative rate of 50%. This is illustrated by the distribution shown with the broken line in Figure 9. A false negative rate of 50% is obviously too high to be of practical use; the method does not reliably give results above the critical value if the **true value** for the concentration is equal to the critical value. The LOD is intended to represent the true concentration for which the false negative rate is acceptable given the critical value. The false negative error, β , is usually set equal to the false positive error, this is largely for historical reasons (IUPAC recommends default values of $\alpha = \beta = 0.05$). Using $\alpha = \beta = 0.05$, the LOD needs to be 1.65s above the value specified for the critical value. This is illustrated by the shaded distribution on the horizontal axis in Figure 9. The factor for calculating the LOD with $\alpha = \beta = 0.05$ is thus $1.65 + 1.65 = 3.30$. This is based on several approximations which are described in the literature [33].

Figure 9 Illustration of statistical basis of detection limit calculations.



Terminology in Analytical Measurement

Introduction to VIM 3

First Edition 2011

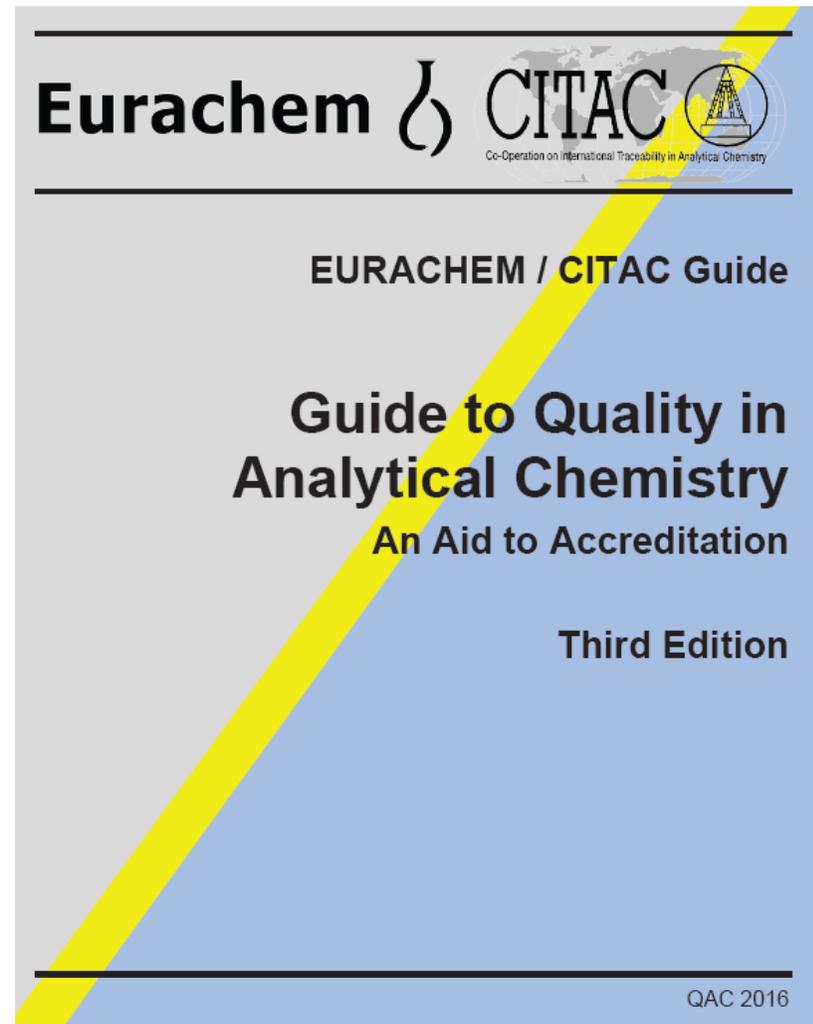
Available on www.eurachem.org free of charge



Guidance documents

Guide to Quality in Analytical Chemistry: An Aid to Accreditation (3rd ed.)

- This edition reflects changes that were introduced ISO/IEC 17025:2005.
- The Guide focuses on the requirements of ISO/IEC 17025, the content should also be of use to organisations seeking accreditation or certification against the requirements of standards such as ISO 15189 or ISO 9001, or compliance with the Principles of GLP.
- The Guide will also provide useful information both for laboratories that wish to establish a quality management system but are not seeking formal recognition, and for those involved in education and training.
- Published 2016, under revision (reason: to ISO/IEC 17025:2017)
- Translations: Farsi & Czech



Accessible from www.eurachem.org



Guidance documents

Guide to Quality in Analytical Chemistry: An Aid to Accreditation (3rd ed.)

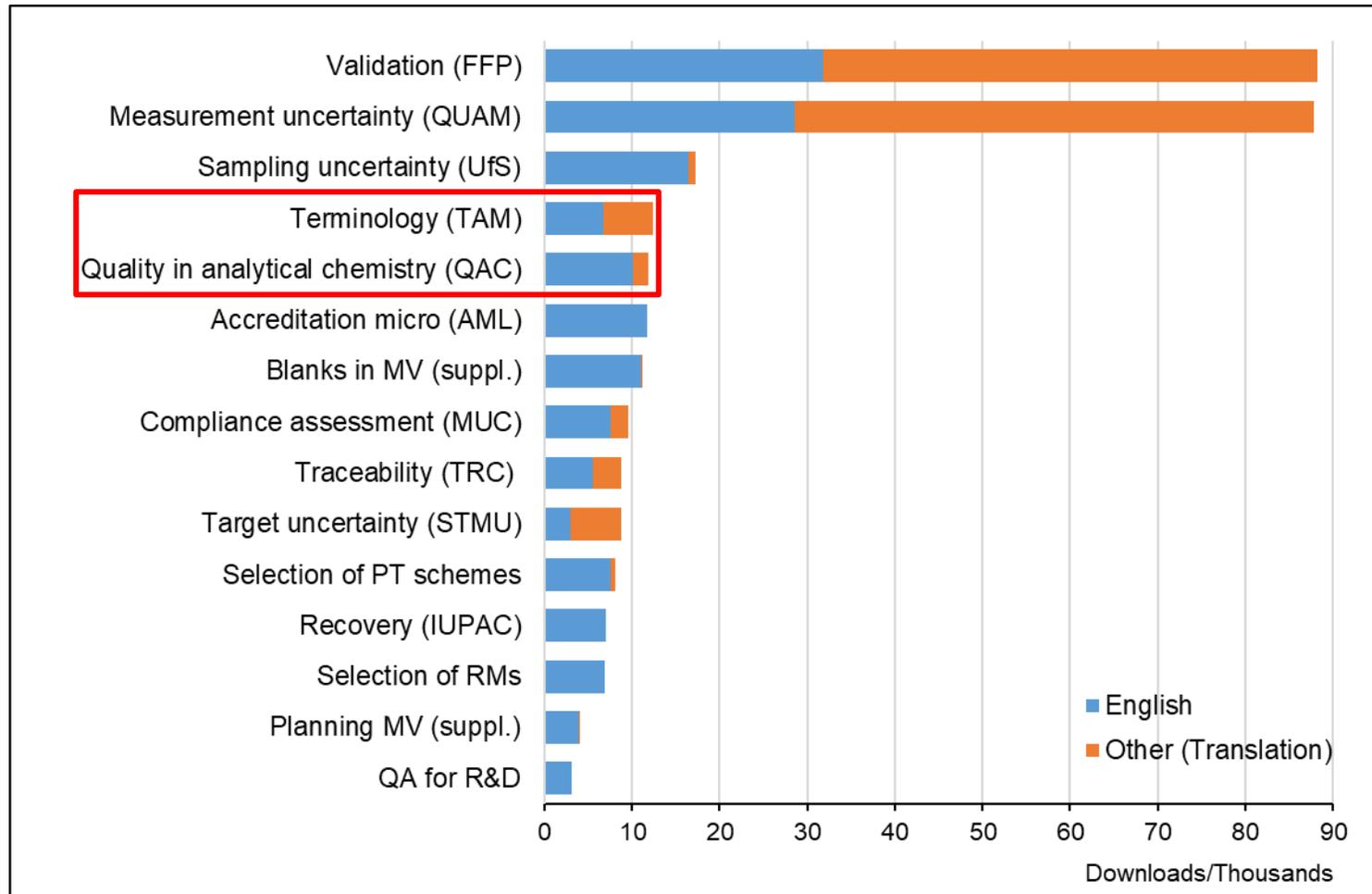
- Editor: Vicki Barwick LGC (UK)
- Task Group: Fatma Akçadağ, Ulusal Metroloji Enstitüsü, Mine Bilsel, Renata Borroni, Pedro Pablo Morillas Bravo, Ales Fajgelj, Martina Hedrich, Nineta Hrastelj, Perihan Yolcu Ömeroğlu, Mariana Arce Osuna, Marina Patriarca, Elizabeth Prichard, Riin Rebane, Lorens Sibbesen, Kevser Topal, Kyriacos Tsimillis, Isabelle Vercruysse, Alex Williams
- Appendices:
 - Appendix A: Quality audit: Areas of particular importance to a chemistry laboratory
 - Appendix B: Instrument calibration and performance checks

Contents

Foreword	1
Abbreviations and symbols	2
1 Notes for the reader	4
2 Introduction	5
3 Definitions and terminology	7
4 Accreditation	10
5 Scope of accreditation	12
6 The analytical task	13
7 Specification of analytical requirement	14
8 Analytical strategy	15
9 Non-routine analysis	16
10 Personnel	17
11 Sampling, sample handling and preparation	19
12 Environment	23
13 Equipment	24
14 Reagents and consumables	27
15 Metrological traceability	28
16 Measurement uncertainty	30
17 Methods/procedures for calibrations and tests	32
18 Method validation	33
19 Calibration	36
20 Reference materials	38
21 Quality control and proficiency testing	40
22 Computers and computer controlled systems	42
23 Laboratory audit and review	45
Appendix A – Quality audit: Areas of particular importance to a chemistry laboratory	46
Appendix B – Instrument calibration and performance checks	51
Bibliography	55



Downloads of guides



Downloads* of Eurachem Guides
Apr 2020 - Mar 2021

*Downloads: HTTP requests ("hits") – all versions



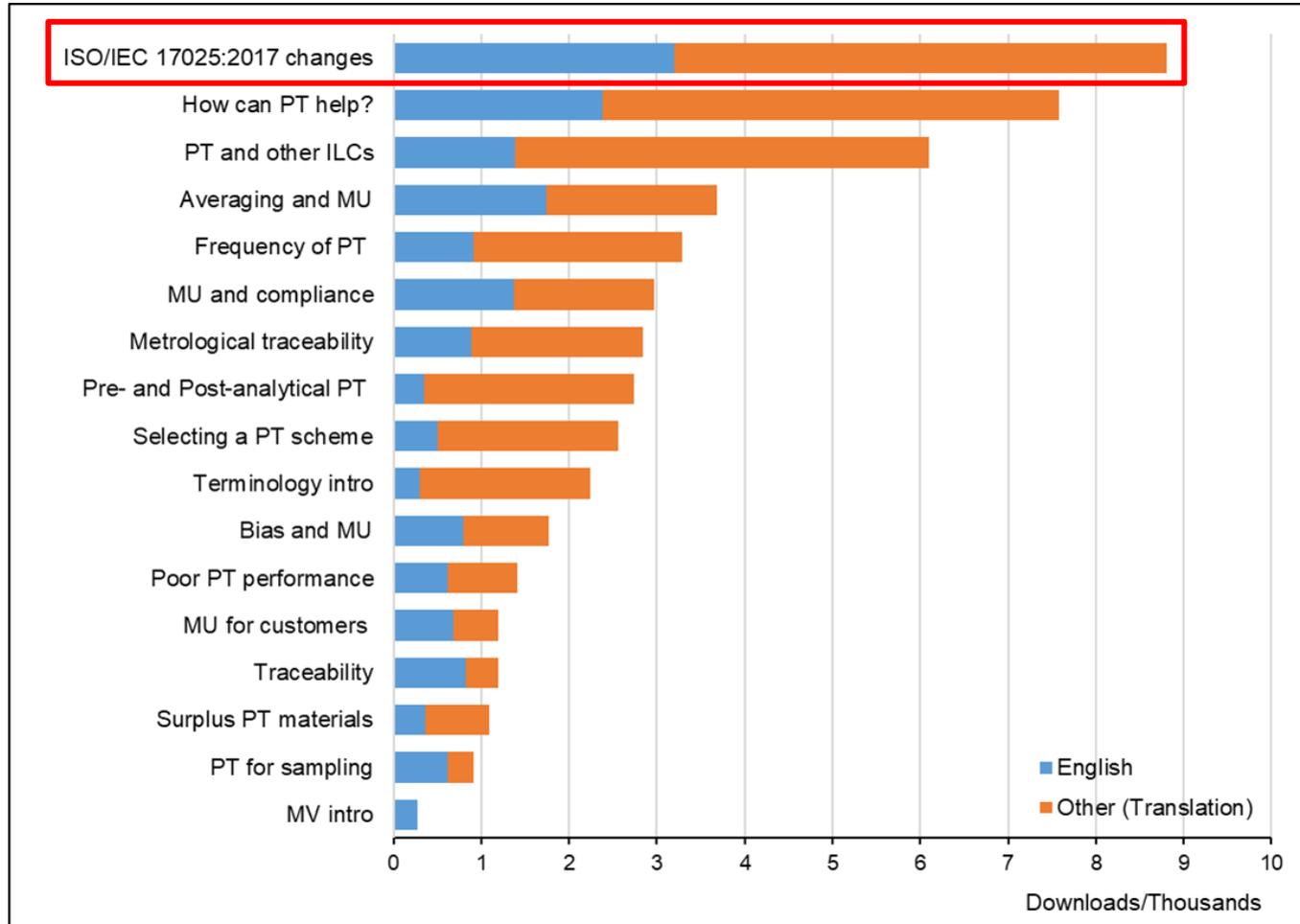
Information leaflets

- **Accreditation: ISO/IEC 17025:2017 – A New Accreditation Standard (2018)**
 - Gives a quick overview of the main changes in the 2017 edition of the Standard
 - Advices how can laboratories proceed smoothly transition process
 - Translations: Bulgarian, Estonian, Farsi, Georgian, Russian, Spanish, Turkish
- **Terminology: You talk, we understand – The way out of the tower of Babel (2016)**
 - Emphasises need of common terminology/language
 - Introduction to VIM 3 Guide
 - Example: trueness, precision, accuracy
 - Translations: Czech, German, Greek, Italian, Romanian, Russian, Serbian, Spanish, Swedish, Turkish, Ukrainian





Downloads of information leaflets



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Summary

- “Mission” of the E&T WG: contribute to the development and delivery of education and training in chemical metrology and quality assurance for both analytical scientists and the broader community by producing freely available materials.
- (Main) current activities:
 - Development and maintenance of a reading list
 - Revision of the Eurachem/CITAC '*Guide to Quality in Analytical Chemistry: An aid to accreditation*'
 - Revision of the Eurachem Guide '*Terminology in Analytical Measurement: Introduction to VIM 3*'
- Organisation and support of the workshops.
- Collaboration with other interested partners (EuCheMS, Eurolab, ...).



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