



Summary of IEC standards TC 45 W9

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General Information about IEC Standards

- International Electrotechnical Commission (IEC) have members come from all around the world
- Standards are developed under Technical Committees (TCs)
- TC 45 covers nuclear instrumentations
- Scope of TC 45:
 - To prepare international standards relating to electrical and electronic equipment and systems for instrumentation specific to nuclear applications.
- WG 9 is under TC 45 covers Detectors and systems
- Scope of WG 9:
 - Preparation of standards and guides concerned with detectors of ionizing radiation and systems, associated electronics and multichannel analyzers, and integrated systems containing such detectors and analyzers, with particular emphasis on characteristics and test procedures.
- IEC standards are used to develop European Standards – adopted by CENELEC

How to Become a Member of an IEC TC

- Within the IEC, each country has a National Committee
- Any person interested in being a member of a technical committee needs to contact the Technical Advisory Group (TAG) Technical Advisor (TA) - in this case it is the TA for TC 45
- The CV of the applicant needs to be provided to the TA that in turn sends it to the TAG administrator that circulates it within the National Committee members for approval
- Members of technical committee can attend the TC 45 meetings – but it is not required
- Comments for a standard need to be provided through the National Committee of your country – Comments are sent to the TA

**Experts are needed to revise and develop IEC standards under
TC 45 WG 9**



IEC Standards Related to Metrology – TC 45 WG 9

New standard under development:

- IEC 63047 - Data format for list-mode digital data acquisition used in radiation detection and measurement.

Lead by Jan Paepen from JRC and John Keighley from NPL

Published standards that need revision:

- IEC 60462 Ed.2: Photomultiplier tubes for scintillation counting - Test procedures
- IEC 61145 Ed.1.0: Calibration and usage of ionization chamber systems for assay of radionuclides
- IEC 61304 Ed.1.0: Liquid scintillation counting systems – Performance verification
- IEC 61452 Ed.1.0: Measurement of gamma-ray emission rates of radionuclides - Calibration and use of germanium spectrometers

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IEC 61452 Standard

Subjects covered by the standard:

- Instrument installation
- Peak analysis and calibration procedures
 - ✓ Peak-finding algorithm
 - ✓ Peak position and area measurements
 - ✓ Energy calibration
 - ✓ Efficiency calibration measurement
 - ✓ Standardization for specific radionuclides
 - ✓ Detector efficiency as a function of energy
 - ✓ Large source-to-detector distances
 - ✓ Small source-to-detector distances
 - ✓ Reentrant (Marinelli) beakers
 - ✓ Efficiency function or look-up table

IEC 61452 Standard (Cont.)

Subjects covered by the standard:

- Gamma-ray measurements
 - ✓ Measurement of gamma-ray energies
 - ✓ Measurement of gamma-ray emission rates and radionuclide activity
 - ✓ Subtraction of interference peaks in the background
 - ✓ Radioactive decay
 - ✓ Radioactive decay during the counting period
 - ✓ Radioactive decay prior to the counting period
 - ✓ Pulse pile-up (random summing)
 - ✓ Cascade (coincidence summing)
 - ✓ Attenuation corrections
 - ✓ Attenuation within the sample
 - ✓ Calculations from uniform plane source
 - ✓ Measured correction

IEC 61452 Standard (Cont.)

Subjects covered by the standard:

- Performance tests of spectrometry system
 - ✓ Multichannel-analyzer clocks
 - ✓ Energy calibration
 - ✓ System efficiency and resolution
 - ✓ Pulse pile-up (random summing)
- Performance test of the analysis software
 - ✓ Test of automatic peak-finding algorithm
 - ✓ Test of independence of peak-area from the gross peak height
 - ✓ Test of the doublet-peak finding and fitting algorithm
- Verification of the entire analysis process
 - ✓ Assessment of the magnitude of cascade summing
 - ✓ Absolute error in the relative full-energy-peak efficiency
 - ✓ Accuracy of the full-energy-peak efficiency

IEC 61452 Standard (Cont.)

Subjects covered by the standard:

- Radionuclide identification
- Uncertainties and uncertainty propagation
- Annex A – Procedures for characterization of the gamma-ray spectrometer
 - ✓ Adjustment of the pole zero cancellation and d.c. level
 - ✓ Adjustment of the lower-level discriminator, ADC zero and initial energy scale
 - ✓ Check of the multichannel analyzer (MCA) real time clock
 - ✓ Measurement of energy resolution and peak-to-Compton ratio
 - ✓ Correction for losses due to counting rate
 - ✓ Measurement of the full-energy peak efficiency curve
 - ✓ Preparation of reference sources from standard solutions
- Annex B – Measurement of peak position, net area and their uncertainties
 - ✓ Non fitting technique
 - ✓ Fitting techniques

IEC 61452 Standard (Cont.)

Subjects covered by the standard:

- Annex C – Equations for the corrections of cascade gamma-ray summing
 - ✓ Equations for cascade summing correction factors
 - ✓ Summing correction factors for a simple decay scheme
 - ✓ Correction factor for the 591 keV gamma ray emitted in the decay of ^{154}Eu
- Annex D – Construction of shields for spectrometer
 - ✓ Construction materials
 - ✓ Shielding design

Suggest the need to change the following:

- Discuss the need to add digital electronics
- Additional information on uncertainty evaluation
- Correction factors
- Monte Carlo simulation