# Summary of IEC standards TC 45 W9

**Leticia Pibida**

*leticia.pibida@nist.gov*

# *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

# *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 – Revision lead by Jan Paepen and John Keighley 2019
- 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 – Revision lead by Marie Christine Lepy and Leticia Pibida 2019

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# *HPGe Related Standards*

- IEC 60973:1989 – Test procedures for germanium gamma-ray detectors (Developed under IEC TC 45 WG 10)
- ISO/DIS 20042:2019 - Measurement of radioactivity — Gamma-ray emitting radionuclides — Generic test method using gamma-ray spectrometry (Developed under ISO TC 85 SC 2 WG 17)
- IEC 61435 – High-purity germanium crystals for radiation detectors – Test methods (Developed under IEC TC 45)
- ISO 19017:2015(en) - Guidance for gamma spectrometry measurement of radioactive waste (Developed under ISO/TC 085/SC 05)
- ISO 19581:2017(en) - Measurement of radioactivity — Gamma emitting radionuclides — Rapid screening method using scintillation detector gamma-ray spectrometry (Developed under ISO TC 85 SC 2)
- ISO 18589-3:2015(en) - Measurement of radioactivity in the environment — Soil — Part 3: Test method of gamma-emitting radionuclides using gamma-ray spectrometry (Developed under ISO TC 85 SC 2)
- ISO 10703:2007(en) - Water quality — Determination of the activity concentration of radionuclides — Method by high resolution gamma-ray spectrometry (Developed under ISO TC 147)
- IEEE 63147-2017 - IEEE/IEC International Standard - Criteria for accident monitoring instrumentation for nuclear power generating stations. 759-1984 - IEEE Standard Test Procedures for Semiconductor X-Ray Energy Spectrometers

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# *IEC 61452 Standard – Subjects Covered*

- Instrument installation
- Peak analysis and calibration procedures – energy calibration, peak fitting, efficiency
- Gamma-ray measurements – all corrections applied to measurements
- Performance tests of spectrometry system
- Performance test of the analysis software
- Verification of the entire analysis process
- Radionuclide identification
- Uncertainties and uncertainty propagation
- Annex A – Procedures for characterization of the gamma-ray spectrometer
  - ✓ Mainly analog electronics need to add digital electronics
- Annex B – Measurement of peak position, net area and their uncertainties
- Annex C – Equations for the corrections of cascade gamma-ray summing
- Annex D – Construction of shields for spectrometer

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# *IEC 61452 Standard (Cont.)*

**First draft of the revision added the following changes:**

- Digital electronics
- Additional information on uncertainty evaluation
- Correction factors
- Monte Carlo simulations
- Newer references – will be added in the next draft

During the April 2019 IEC TC 45 meeting it was decided to add more information to each of these sections

# *IEC 60973:1989 Standard*

**Covers the following:**

- Describes the types of detectors
- Describes the photon interactions with matter
- General requirements: high voltage max., when recalibration is needed
- Calculation of peak area and spectral background
- Calculation of peak center, FWHM, FW0.1M, FW0.2M, peak-to-Compton ratio
- Describes peak asymmetry, linewidth, resolution
- Describes efficiency measurements of point sources and reentrant beakers
- Describes certified solutions and standard materials and required certificates
- Time resolution measurements
- Low background Ge detectors

It provides description as a text book without to many requirements, it gives general information, can use ISO 20042 and IEC 61452 standards instead

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# *ISO/DIS 20042:2019 Standard*

**Covers the following:**

- Calculation of peak area and spectral background
- Customer requirements and selecting the equipment to perform the measurements
- Instrument operation and maintenance
- Nuclear decay data
- Energy and efficiency calibration procedure (not as detailed as IEC 61452)
- Reference sources
- Sample measurement procedure
- Spectrum analysis
- Reporting measurement results – Test report
- Quality assurance and quality control program

# *Observations*

- It will extremely valuable if members of the ICRM gamma-ray spectrometry working group will provide input in the revision of this standard
- It is possible to circulate a water marked document within the ICRM GSWG so comments can be sent back to the project leaders
- It is also possible to become an IEC TC 45 member within your country
- We are working with ISO TC 85 SC 2 WG 17 so we can get their comments to ensure that standards are not contradicting/overlapping each other

# *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**