



## Technical Aspects on the Development and Use of Standards

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### **Documentary Standards**

Documentary standards are great tools for many applications that rely on ionizing radiation measurements, these include:

- radiation protection
- homeland security
- nuclear medicine
- nuclear power
- radiation instrumentation
- source manufacturing
- etc.











There are several national and international standard organizations that publish documentary standards, examples of these include:

- International Electrotechnical Commission (IEC)
- International Organization for Standardization (ISO)
- Institute of Electrical and Electronics Engineers (IEEE)
- American National Standards Institute (ANSI)

These standards address different aspects of the radiation measurement instruments







For example:

ANSI, IEC or IEEE standards mainly focus on performance and design requirements and their associated test methods. These standards are mainly used for:

- procurement
- calibration and testing of instruments or sources
- setup of radiation detection instruments

ASTM and ISO standards concentrate on the use and applications of different types of instruments. These standards are mainly used for:

- developing laboratory and field procedures
- how to carry out measurements and sample collections

#### Many standards are used as part of regulations, guidance or procurement processes

### How are Standards Developed?



- Most documentary standards are developed under a Technical Committee within a standard organization
- Working groups are created to develop individual standards
- Working groups are composed of experts that include instrument users, manufacturers, testers and subject matter experts
- After the working group agrees on the requirements and test procedures, the standard goes out to ballot (the process depends on the organization publishing the standard)
- The standards are finally published after all comments are addressed
- Standards can be purchased from the standard organization

**IEEE get Program:** <u>https://ieeexplore.ieee.org/browse/standards/get-program/page/series?id=83</u>

### What Activities are Part of the Standard Development? NIST

- Development of the standard requirements and test methods (under a working group)
- Write standard (mainly carried out by working group chair or project leader, with input from the WG members)
- Work with experts and users to improve the standard requirements and test methods
- Perform calculations
- Perform validation measurements
- Read the standard and provide comments
- If voting member, provide ballot for the standard





#### Standards have a stability date (5 to 10 years) where they can be: revised, reaffirmed or withdrawn

### Examples of IEC and ANSI standards

# Standards developed for homeland security and detection of illicit trafficking of radioactive materials (selected number)

• ANSI N42.32 / IEC 62401 PRDs

Alarming Personal Radiation Devices (PRD) for detection of illicit trafficking of radioactive material

• ANSI N42.34 / IEC 62327 RIDs

Hand-held instruments for the detection and identification of radionuclides and for the indication of ambient dose equivalent rate from photon radiation

• ANSI N42.35 / IEC 62244 RPMs

Installed radiation portal monitors (RPMs) for the detection of illicit trafficking of radioactive and nuclear materials

#### • ANSI N42.43 / IEC 63121 VMSs

Vehicle-mounted mobile systems for the detection of illicit trafficking of radioactive materials

#### • ANSI N42.38 / IEC 62484 SRPMs

Spectroscopy-based portal monitors used for the detection and identification of illicit trafficking of radioactive material

#### • ANSI N42.53 / IEC 62694 BRDs

Backpack-type radiation detector (BRD) for the detection of illicit trafficking of radioactive material

#### • ANSI N42.42 / IEC 62755 Data Format

Data format for radiation instruments used in the detection of illicit trafficking of radioactive materials











### Examples of IEC and ANSI standards

#### Standards developed for radioactivity measurements and radiation protection instruments

#### IEC 61145 (it is now going to be revised as a combined IEC and ISO standard – equivalent ANSI N42.13 standard was withdrawn)

Calibration and usage of ionization chamber systems for assay of radionuclides

#### • IEC 61452 (the equivalent ANSI N42.14 standard was withdrawn)

Measurement of gamma-ray emission rates of radionuclides - Calibration and use of germanium spectrometers

• ANSI N42.22

Traceability of radioactive sources to NIST and associated instrument quality control

#### • ANSI N42.23

Measurement and associated instrument quality assurance for radioassay laboratories

#### • ANSI N323AB

Radiation protection instrumentation test and calibration, portable survey instruments

#### • ANSI N42.20

Portable survey instruments performance criteria for active personnel radiation monitors



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### Standards Content – In General

• General tests: display, weight, size, data format, alarms, user interface, battery life, intrinsically safe

• Radiological tests: exposure rate, background changes, false alarm, gamma response, neutron response, angular dependence, over-range, accuracy, radionuclide identification capabilities

• Environmental tests: temperature, humidity, ingress protection (dust and water), cold and hot temperature start-up

- Mechanical tests: mechanical shocks, vibration, drop test
- Electromagnetic tests: external magnetic fields, radio frequency, conducted disturbances (burst and radio frequencies), surges and oscillatory waves, electrostatic discharges

Some standards provide information for instrument setup and optimization before testing









### Use of the Standards – Homeland Security

- Helium-3 (<sup>3</sup>He) Alternative Implementation Backpack Program (HAIBP) Low-Rate Initial Production (LRIP) – Used N42.53 and IEC 62694 standards
- Securing the Cities Personal Radiation Detectors (PRDs) Testing Used N42.32 standard
- Radiation Portal Monitor Replacement Project Used N42.35 standard
- Mobile Urban Radiation Search (MURS) Used N42.43 standard

#### All these systems require compliance with Data Format Standard N42.42











#### FEMA Program Manual (uses ANSI N323AB, ANSI N13.11, ANSI N42.14):

Radiological Emergency Preparedness - *FEMA P-1028 / December 2019* <u>https://www.fema.gov/sites/default/files/2020-06/FEMA\_REP\_Program\_Manual\_Dec\_2019.pdf</u>

#### NRC (uses ANSI N42.22, ANSI N42.23, ANSI N13.11, ANSI N42.18, ANSI N42.14):

**Regulatory Guide 4.15** (Revision 2. Draft was issued as DG-4010, dated November 2006) Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License termination) – Effluent Streams and the Environment.

This regulatory guide describes a method that the U.S. NRC considers acceptable for use in designing and implementing programs to ensure the quality of the results of measurements of radioactive materials in the effluents from, and environment outside of, facilities that process, use, or store radioactive materials during all phases of the facility's life cycle.

https://www.nrc.gov/docs/ML0717/ML071790506.pdf





- Standards are living documents that evolve with time based on changing user needs and new technical developments
- Standards are used by instrument manufacturers and many users including agencies that provide guidance and set regulations in the US
- The content in the standards depend on the type of instrument and application they address
- When standards are used for acquisition, the users need to consider what are the main requirements that are needed for their use as the standards may cover a very large number of requirements that may not be applicable to their need
- Several laboratory accreditation programs exist for testing instruments against standards (e.g., NVLAP, A2LA)

# Thank you!

### For any additional questions please contact: Dr. Leticia Pibida <u>leticia.pibida@nist.gov</u>

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