SLOVENSKI STANDARD
SIST EN ISO 19017:2017

01-december-2017

Navodilo za merjenje aktivnosti radioaktivnih odpadkov z gama spektrometrijo (ISO 19017:2015)

Guidance for gamma spectrometry measurement of radioactive waste (ISO 19017:2015)

Leitfaden für gammaspektrometrische Messungen von radioaktivem Abfall (ISO 19017:2015)

Lignes directrices pour le mesurage de déchets radioactifs par spectrométrie gamma (ISO 19017:2015)

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17.240	Merjenje sevanja	Radiation measurements
27.120.30	Cepljivi materiali in jedrska gorivna tehnologija	Fissile materials and nuclear fuel technology

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EUROPEAN STANDARD

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English Version

Guidance for gamma spectrometry measurement of radioactive waste (ISO 19017:2015)

Lignes directrices pour le mesurage de déchets radioactifs par spectrométrie gamma (ISO 19017:2015)

Leitfaden für gammaspektrometrische Messungen von radioaktivem Abfall (ISO 19017:2015)

This European Standard was approved by CEN on 13 September 2017.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

The text of ISO 19017:2015 has been prepared by Technical Committee ISO/TC 85 “Nuclear energy, nuclear technologies, and radiological protection” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 19017:2017 by Technical Committee CEN/TC 430 “Nuclear energy, nuclear technologies, and radiological protection” the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2018, and conflicting national standards shall be withdrawn at the latest by April 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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Endorsement notice

The text of ISO 19017:2015 has been approved by CEN as EN ISO 19017:2017 without any modification.

INTERNATIONAL STANDARD

ISO 19017

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Guidance for gamma spectrometry measurement of radioactive waste

Lignes directrices pour le mesurage de déchets radioactifs par spectrométrie gamma

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection*, Subcommittee SC 5, *Nuclear fuel cycle*.

This first edition of ISO 19017 cancels and replaces ISO 14850-1:2006, which, in particular, did not take into account segmented measurements performed with collimators, the possible use of numerical simulation for calibration and uncertainty assessment, and gamma radiation detectors other than high-purity germanium semiconductors.

Introduction

A variety of non-destructive assay techniques are routinely used within the nuclear industry to measure or provide information to otherwise enable quantification of the radionuclide inventory of packages containing radioactive materials. This International Standard specifically considers gamma spectrometry measurements made on packages containing radioactive waste.

The methods and techniques discussed within this International Standard find application in the routine assay of various types of radioactive waste, packaged in a variety of ways, employing a variety of container sizes, and types. They range from basic techniques, which have been in use for many years, through to state of the art techniques that have been developed because of the increasing variety and forms being assayed and the demands to satisfy increasingly challenging performance criteria.

Where guidance is provided, this is viewed as best current practice and is based on experience of operating quantitative gamma spectrometry measurement systems, within a variety of applications, for the purpose of providing radionuclide identification and activity information.

The objective of this International Standard is to promote a consistent approach to gamma spectrometry measurements made on packages containing radioactive waste.

Guidance for gamma spectrometry measurement of radioactive waste

1 Scope

This International Standard is applicable to gamma radiation measurements on radioactive waste.

Radioactive waste can be found in different forms and exhibit a wide range of characteristics, including the following:

— raw or unconditioned waste, including process waste (filters, resins, control rods, scrap, etc.) and waste from dismantling or decommissioning;

— conditioned waste in various forms and matrices (bitumen, cement, hydraulic binder, etc.);

— very low level (VLLW), low level (LLW), intermediate level (ILW) and high level radioactive waste (HLW);

— different package shapes: cylinders, cubes, parallelepipeds, etc.

Guidance is provided in respect of implementation, calibration, and quality control. The diversity of applications and system realizations (ranging from research to industrial systems, from very low level to high level radioactive waste, from small to large volume packages with different shapes, with different performance requirements and allowable measuring time) renders it impossible to provide specific guidance for all instances; the objective of this International Standard is, therefore, to establish a set of guiding principles. Ultimately, implementation is to be performed by suitably qualified and experienced persons and based on a thorough understanding of the influencing factors, contributing variables and performance requirements of the specific measurement application.

This International Standard assumes that the need for the provision of such a system will have been adequately considered and that its application and performance requirements will have been adequately defined through the use of a structured requirements capture process, such as data quality objectives (DQO).

It is noted that, while outside the scope of this International Standard, many of the principles, measurement methods, and recommended practices discussed here are also equally applicable to gamma measurements of items other than radioactive waste (e.g. bulk food, water, free-standing piles of materials) or to measurements made on radioactive materials contained within non-traditional packages (e.g. in transport containers).

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Definitions presented here are confined mainly to those terms not defined in common nuclear material glossaries or whose use is specific to this document. Important key terms are repeated here for the convenience of the reader.

2.1
assay
procedure to determine quantitatively the amount of one or more radionuclides of interest contained in a package

2.2
attenuation
physical process based on interaction between a radiation source and matter placed in the path of the radiation that results in a decrease in the intensity of the emitted radiation

Note 1 to entry: Attenuation experienced in *non-destructive assay* (NDA)(2.27) of waste packages includes *self-attenuation* (2.37) by the radioactive material itself as well as attenuation effects in the *waste matrix* (2.23), internal barrier(s) and external container(s).

2.3
attenuation correction factor
used to correct (compensate) for the effect of attenuation within an NDA measurement equal to the ratio between the un-attenuated and the attenuated radiation flux

Note 1 to entry: After attenuation correction the measured quantity is considered to be representative of the un-attenuated activity of the radioactive substance assayed.

2.4
bias
estimate of a systematic measurement error

2.5
calibration standard
primary standard
designated or widely acknowledged as having the highest metrological qualities and whose value is accepted without reference to other standards of the same quantity

Note 1 to entry: The calibration standard should be physically, radiologically, and chemically similar to the items to be assayed, for which the activity of the radionuclide(s) of interest and all relevant properties to which the measurement technique is sensitive are known with sufficient accuracy.

[SOURCE: www.french-metrology.com]

2.6
calibration
set of operations that establish, under specific conditions, the relationship between values of quantities indicated by a measuring system, or values represented by a material measure or a reference material and the corresponding values realized by Standards

Note 1 to entry: The result of a calibration permits either the assignment of values of measurands to the indications or the determination of indications with respect to indications.

Note 2 to entry: A calibration may also determine other metrological properties such as the effect of influence quantities.

Note 3 to entry: The result of a calibration may be recorded in a document, sometimes called a calibration certificate or a calibration report.

[SOURCE: www.french-metrology.com]

2.7
collimation
method to restrict the field of view of the detector to specific parts of the item to be measured

Note 1 to entry: A shield around the side of the detector that still allows the detector to view the entire item is technically not a collimator. Such shielding does not change the efficiency of the detector due to its presence.

2.8
collimator
device for collimating the radiation beam, usually constructed from highly attenuating material(s) such as tungsten or lead. Collimators can be of parallel wall type or divergent

2.9
collimated (detection) geometry
measurement configuration where only a part of a waste package can contribute to the response of the detection system

Note 1 to entry: The whole activity is measured by scanning the entire package, or by assuming that the part of the package within the detector's field of view during one or more measurements is representative of the entire package.

2.10
compton continuum
continuous pulse amplitude spectrum due to Compton electrons released in a detector

Note 1 to entry: The full-energy peaks are superimposed to this continuum and their "net areas" are determined by subtracting the average Compton level estimated below each peak, as detailed in ISO 11929 for instance.

[SOURCE: IEC 60050-395:2014]

2.11
container
vessel into which the *waste form* (2.41) is placed for handling, transport, storage and/or eventual disposal

Note 1 to entry: Also the outer barrier protecting the waste from external intrusions.

[SOURCE: IAEA Radioactive Waste Management Glossary 2003 Edition]

2.12
coverage factor

although the combined standard deviation is used to express the uncertainty of many measurement results, for some commercial, industrial, and regulatory applications (e.g. when health and safety are concerned), what is often required is a measure of uncertainty that defines an interval about the measurement result within which the value of the measurand can be confidently asserted to lie

Note 1 to entry: The measure of uncertainty intended to meet this requirement is termed expanded uncertainty and is obtained by multiplying the standard deviation by a coverage factor, suggested symbol k. In general, the value of the coverage factor k is chosen on the basis of the desired level of confidence to be associated with the interval within which the true value is supposed to lie.

[SOURCE: http://physics.nist.gov/cuu/Uncertainty/coverage.html]

2.13
data quality objectives process
DQO
seven stage requirements capture process used to determine the type, quantity, and quality of data needed to support a decision

Note 1 to entry: The purpose of this process (published by the US Environmental Protection Agency) is to provide general guidance to organizations on developing data quality criteria and performance specifications for decision making.

2.14
dead time
non-operative time of the detection system during the measurement period

Note 1 to entry: The length of time, directly following an instance of detection, associated with signal processing, during which the system is not able to process further gamma events. This is a system performance parameter which is usually expressed as a percentage of the measurement period. The measured counts would be less than the actual counts due to the dead time and hence needs to be corrected.