SLOVENSKI STANDARD
SIST EN ISO 29661:2018

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Referenčna sevalna polja za zaščito pred sevanjem - Definicije in temeljni koncepti (ISO 29661:2012, vključno z dopolnilom Amd 1:2015)

Reference radiation fields for radiation protection - Definitions and fundamental concepts (ISO 29661:2012)

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Champs de rayonnement de référence pour la radioprotection - Définitions et concepts fondamentaux (ISO 29661:2012)

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 29661

October 2017

ICS 13.280

English Version

Reference radiation fields for radiation protection - Definitions and fundamental concepts (ISO 29661:2012, including Amd 1:2015)

Champs de rayonnement de référence pour la radioprotection - Définitions et concepts fondamentaux (ISO 29661:2012, y compris Amd 1:2015)

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European foreword

The text of ISO 29661:2012, including Amd 1:2015 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 29661:2017 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of an identical text or by endorsement, at the latest by April 2018, and conflicting national standards shall be withdrawn at the latest by April 2018.

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INTERNATIONAL STANDARD

ISO 29661

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Reference radiation fields for radiation protection — Definitions and fundamental concepts

Champs de rayonnement de référence pour la radioprotection — Défintions et concepts fondamentaux

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 29661 was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection*, Subcommittee SC 2, *Radiological protection*.

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Introduction

International Standards ISO 4037, ISO 6980, ISO 8529 and ISO 12789[1]...[12], with focus on photon, beta and neutron reference radiation fields, are each divided into several parts: one part gives the methods of production and characterization of reference radiation fields, and others describe the dosimetry of the reference radiation qualities and the procedures for calibrating and determining the response of dosemeters and doserate meters in terms of the operational quantities of the International Commission on Radiation Units and Measurements (ICRU)[25] [26] [27] [28] [31].

The subject of these four International Standards is the same; they differ only in the kind of radiation each addresses. Their terms and definitions, and most of the descriptions of methods and procedures given are basically the same — whatever the radiation. Nevertheless, they do differ, more or less, from one to the other in detail. This International Standard brings together terms and definitions and fundamental concepts common to all of them. Thus, it serves to harmonize International Standards on radiation protection.

Besides definitions relating to calibration primary quantities, the operational quantities for area and individual monitoring are specified. For area monitoring, the operational quantities are ambient dose equivalent, $H^*(10)$, directional dose equivalents, $H'(0{,}07,\vec{\Omega})$ and $H'(3,\vec{\Omega})$, and the appropriate dose rates. For individual monitoring using personal dosemeters, the dose equivalent quantities, $H_p(10)$, $H_p(0{,}07)$ and $H_p(3)$, and the respective dose rates are available.

The method used to represent these operational quantities is the following. First, a basic (primary) quantity, such as air kerma free-in-air, fluence or absorbed dose to soft tissue, is measured. Then the appropriate operational quantity is derived by the application of the conversion coefficient that relates the basic (primary) quantity to the selected operational quantity. The procedure for the calibration and the determination of the response of radiation protection dosemeters is described in general terms. Depending on the type of dosemeter under test, the position of the reference point is specified differently and the irradiation is either carried out on a phantom (for personal dosemeters) or free in air (for area dosemeters or area survey meters).

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With the publication of this International Standard, it is intended that ISO 4037, ISO 6980, ISO 8529 and ISO 12789 be revised successively for further harmonization since, among other aspects, certain of their definitions differ from those published here and the symbols chosen for this International Standard are more consistent with ICRU reports and other International Standards used for radiation protection purposes.

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Reference radiation fields for radiation protection — Definitions and fundamental concepts

1 Scope

This International Standard defines terms and fundamental concepts for the calibration of dosemeters and equipment used for the radiation protection dosimetry of external radiation — in particular, for beta, neutron and photon radiation. It defines the measurement quantities for radiation protection dosemeters and doserate meters and gives recommendations for establishing these quantities. For individual monitoring, it covers whole body and extremity dosemeters (including those for the skin and the eye lens), and for area monitoring, portable and installed dosemeters. Guidelines are given for the calibration of dosemeters and doserate meters used for individual and area monitoring in reference radiation fields. Recommendations are made for the position of the reference point and the phantom to be used for personal dosemeters.

This International Standard also deals with the determination of the response as a function of radiation quality and angle of radiation incidence.

It is intended to be used by calibration laboratories and manufacturers.

2 Normative references

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The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories.* Corrected by ISO/IEC 17025:2005/Cor 1:2006

3 Terms and definitions

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

NOTE These terms and definitions are relevant for the calibration of dosemeters and for the quantities and conversion coefficients that are general to ISO 4037, ISO 6980, ISO 8529 and ISO 12789. Special terms and definitions can be found in those International Standards.

3.1 General

3.1.1
angle of radiation incidence
α
angle, in the coordinate system of the dosemeter, between the direction of radiation incidence and the reference direction of the dosemeter in unidirectional fields

3.1.2
area dosemeter
area survey meter
meter designed to measure the ambient dose equivalent (rate) or the directional dose equivalent (rate)

[SOURCE: IEV 394-22-08, modified.]

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3.1.3
background indication
indication obtained from a phenomenon, body or substance similar to the one under investigation, but for which a quantity of interest is supposed not to be present, or is not contributing to the indication

[SOURCE: ISO/IEC Guide 99:2007, 4.2.]

3.1.4
calibration
operation that, under specified conditions, in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and the corresponding indications with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication

[SOURCE: ISO/IEC Guide 99:2007, 2.39.]

Note 1 to entry: A calibration may be expressed by a statement, calibration function, calibration diagram, calibration curve, or calibration table. In some cases, it may consist of an additive or multiplicative correction of the indication with associated measurement uncertainty.

Note 2 to entry: The measurement standard can be a primary standard, a secondary standard or a working measurement standard.

Note 3 to entry: Often the first step alone in the above definition is perceived as being calibration.

3.1.5
calibration coefficient
$N(\mathrm{U},\alpha)$
quotient of the conventional quantity value to be measured and the corrected indication of the dosemeter normalized to reference conditions

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Note 1 to entry: The calibration coefficient $N(\mathrm{U},\alpha)$ for the reference radiation quality U and the angle of incidence α is equivalent to the calibration factor multiplied by the instrument coefficient (see Annex B). It is given by

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$$N(\mathrm{U},\alpha) = \frac{H_\mathrm{o}}{G_\mathrm{corr}} = C_\mathrm{f}(\mathrm{U},\alpha)\cdot c_\mathrm{i} \qquad (1)$$

where

H_o	is the conventional quantity value;
G_corr	is the corrected indication;
$C_\mathrm{f}(\mathrm{U},\alpha)$	is the calibration factor for the radiation quality U and the angle of incidence α; and
c_i	is the instrument constant.

Concerning the dimension of the calibration factor and the calibration coefficient, see the Notes to 3.1.7 and 3.1.17.

Note 2 to entry: The reciprocal of the calibration coefficient is the response under reference conditions. The value of the calibration factor may vary with the magnitude of the quantity to be measured. In such cases a dosemeter is said to have a non-constant response (or a nonlinear indication).

Note 3 to entry: To distinguish between the indication of the standard and the dosemeter, subscripts ‘s’ and ‘d’ are used and the respective coefficients are named $N(\mathrm{U},\alpha)_\mathrm{s}$ and $N(\mathrm{U},\alpha)_\mathrm{d}$.

[SOURCE: ICRU Report 76 modified.]

3.1.6
calibration conditions
conditions within the range of standard test conditions actually prevailing during the calibration measurement

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3.1.7
calibration factor
$C_f(U,\alpha)$
factor by which the product of the corrected indication, G_{corr}, and the associated instrument constant, c_i, of the dosemeter is multiplied to obtain the conventional quantity value to be measured under reference conditions

Note to entry: The calibration factor is dimensionless.

[SOURCE: ICRU Report 76, modified.]

3.1.8
conventional quantity value
H_o
quantity value attributed by agreement to a quantity for a given purpose

Note to entry: The conventional quantity value H_o is the best estimate of the quantity to be measured, determined by a primary standard or a secondary or working measurement standard which are traceable to a primary standard.

[SOURCE: ISO/IEC Guide 99:2007, 2.39.]

3.1.9
correction factor
k
numerical value by which the indication is multiplied to compensate for the deviation of measurement conditions from reference conditions or for a systematic effect (e.g. ion recombination)

Note to entry: If the correction of the effect of an influence quantity requires a multiplicative factor, the influence quantity is of type F, see Note to entry 1 for 3.1.16.

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3.1.10
correction factor for non-constant response
k_n
numerical value by which the indication is multiplied to compensate for the non-constant response (or non-linear indication) of the dosemeter, i.e. for the variation of the calibration factor or calibration coefficient with the variation of the magnitude of the quantity to be measured

Note to entry: For a dosemeter with constant response with respect to the selected measuring quantity, k_n is equal to unity.

3.1.11
corrected indication
G_{corr}
indication of a dosemeter corrected for any differences of the values of the influence quantities from reference conditions

Note 1 to entry: The corrected indication, G_{corr}, can be calculated with the correction factor, k_n, for non-constant response, the q correction factors, k_f, for the influence quantities of type F and the p correction summands, G_w, for the influence quantities of type S. It is given by

$$G_{corr} = k_n \cdot (G - \sum_{w=1}^{p} G_w) \cdot \prod_{f=1}^{q} k_f \qquad (2)$$

which is a model function of the measurement necessary for any determination of the uncertainty according to ISO/IEC Guide 98-3.

Note 2 to entry: To distinguish between the indication of the standard and the dosemeter, Subscripts 's' and 'd' are used and the respective indications are named $G_{s,corr}$ and $G_{d,corr}$.

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