



SLOVENSKI STANDARD

oSIST prEN ISO 14146:2020

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**Radiološka zaščita - Merila in meje učinkovitosti za periodično ovrednotenje
dozimetričnih storitev (ISO 14146:2018)**

Radiological protection - Criteria and performance limits for the periodic evaluation of
dosimetry services (ISO 14146:2018)

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Radioprotection - Critères et limites de performance pour l'évaluation périodique des
services de dosimétrie (ISO 14146:2018)

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Radiological protection — Criteria and performance limits for the periodic evaluation of dosimetry services

*Radioprotection — Critères et limites de performance pour
l'évaluation périodique des services de dosimétrie*

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ISO 14146:2018(E)

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of the standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This second edition of ISO 14146 cancels and replaces the first edition (ISO 14146:2000) of which it constitutes a technical revision. The main change with respect to the previous edition is the inclusion of beta and neutron radiation as well as eye, extremity and area doseimeters.

Radiological protection — Criteria and performance limits for the periodic evaluation of dosimetry services

1 Scope

The quality of a supplier of a dosimetry service depends on both the characteristics of the approved (type-tested) dosimetry system¹⁾ and the training and experience of the staff, together with the calibration procedures and quality assurance programmes.

This document specifies the criteria and the test procedures to be used for the periodic verification of the performance of dosimetry services supplying personal and/or area dosimeters.

An area dosimeter can be a workplace dosimeter or an environmental dosimeter.

The performance evaluation can be carried out as a part of the approval procedure for a dosimetry system or as an independent check to verify that a dosimetry service fulfils specified national or international type test performance requirements under representative exposure conditions that are expected or mimic workplace fields from the radiological activities being monitored.

This document applies to personal and area dosimeters for the assessment of external photon radiation with a (fluence weighted) mean energy between 8 keV and 10 MeV, beta radiation with a (fluence weighted) mean energy between 60 keV and 1,2 MeV, and neutron radiation with a (fluence weighted) mean energy between 25,3 meV (i.e. thermal neutrons with a Maxwellian energy distribution with $kT = 25,3$ meV) and 200 MeV.

It covers all types of personal and area dosimeters needing laboratory processing (e.g. thermoluminescent, optically stimulated luminescence, radiophotoluminescent, track detectors or photographic-film dosimeters) and involving continuous measurements or measurements repeated regularly at fixed time intervals (e.g. several weeks, one month).

Active dosimeters (for dose measurement) may also be treated according to this document. Then, they should be treated as if they were passive (i.e. the dosimetry service reads their indicated values and reports them to the evaluation organization).

2 Normatives references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 4037-1, *X and gamma reference radiation for calibrating dosimeters and doserate meters and for determining their response as a function of photon energy — Part 1: Radiation characteristics and production methods*

ISO 6980-1, *Nuclear energy — Reference beta-particle radiation — Part 1: Methods of production*

ISO 8529-1, *Reference neutron radiations — Part 1: Characteristics and methods of production*

ISO 12789-1, *Reference radiation fields — Simulated workplace neutron fields — Part 1: Characteristics and methods of production*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

1) If this document is applied to a dosimetry system for which no approval (pattern or type test) has been provided, then in the following text approval or type test should be read as the technical data sheet provided by the manufacturer or as the data sheet required by the regulatory authority.

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ISO/TS 18090-1, *Radiological protection — Characteristics of reference pulsed radiation — Part 1: Photon radiation*

ISO 29661, *Reference radiation fields for radiation protection — Definitions and fundamental concepts*

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

IEC 61267, *Medical diagnostic X-ray equipment — Radiation conditions for use in the determination of characteristics*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 29661 and the following apply.

3.1
approved dosimeter
approved dosimetry system
 personal or area dosimeter and associated processing system that has been approved or authorized for use by the qualification body

Note 1 to entry: Several dosimeters designs can be operated using the same associated processing system (dosimeter reader, etc.). Then, they are regarded as several dosimeters/dosimetry systems.

3.2
control (background) dosimeter
 personal or area dosimeter that provides an estimate of any radiation dose received by the evaluation sample apart from that given by the irradiating laboratory

Note 1 to entry: The control dosimeter provides a means of estimating and eliminating the contribution to the dose from background radiation and that received during the time between zeroing and read out, i.e. the dose during handling, transportation.

3.3
dosimeter
dosimetry system
 radiation meter designed to measure quantities such as an absorbed dose or a dose equivalent

Note 1 to entry: In a wider sense, this term is used for meters designed to measure other quantities related to radiation such as exposure, fluence, etc. Such use is deprecated.

Note 2 to entry: This apparatus may require a separate reader to read out the absorbed dose or dose equivalent.

3.4
dosimetry service
 organization that operates a personal and/or area dosimetry system which includes the evaluation of the reading of dosimeters after their use and includes:

- providing the user with dosimeters;
- recording the results;
- reporting the results to the user.

Note 1 to entry: The dosimetry service fulfils basic quality management and independency requirements if it fulfils the requirements stated in ISO/IEC 17025.

Note 2 to entry: The user includes not only external clients but also internal personnel who wear dosimeters provided by their own organization and are engaged in radiation protection activities inside or outside the organization. The same quality of dosimetry service which is provided to external users is also provided to organizations' employees (internal users), in accordance with their own quality management system.

3.5**evaluation sample**

randomly selected representative group of personal or area dosimeters used to evaluate the performance of a dosimetry service

Note 1 to entry: The evaluation sample includes dosimeters that are irradiated, remain unirradiated or serve as control dosimeters for the evaluation procedure.

3.6**independent evaluation organization
evaluation organization**

independent organization that administers the performance evaluation of dosimetry services and assesses the results

Note 1 to entry: The evaluation organization may include the irradiating laboratory.

Note 2 to entry: The evaluation organization fulfils basic quality management and independency requirements if it fulfils the requirements stated in ISO/IEC 17025.

3.7**independent irradiating laboratory
irradiating laboratory**

independent laboratory possessing radiation sources, calibration equipment and associated facilities [all traceable to national (i.e. to primary or secondary) standards] that is able to irradiate dosimeters from the evaluation sample to a high degree of accuracy

Note 1 to entry: The irradiating laboratory fulfils basic quality management and independency requirements if it fulfils the requirements stated in ISO/IEC 17025.

3.8**independent qualification body
qualification body**

independent organization empowered by a governmental, regulatory or advisory agency to approve a dosimetry service or authorize the use of a dosimetry system

Note 1 to entry: The qualification body may include the evaluation organization (see 3.6).

Note 2 to entry: The qualification body fulfils basic quality management and independency requirements if it fulfils the requirements stated in ISO/IEC 17025.

3.9**indicated value**

G

value of the measurand given directly by a measuring instrument on the basis of its calibration curve

Note 1 to entry: In this document, the indicated value is the one given by the dosimetry systems as the final result of the evaluation algorithm (for example, display of the software, print out) in units of dose equivalent (Sv).

Note 2 to entry: It may be necessary that a measured dose (e.g. by control dosimeters) or a calculated transport and/or background dose be subtracted by the dosimetry service or by the evaluating organization.

3.10**irradiated dose**

H_{ref}

conventional quantity value of the dose to which the dosimeter is irradiated

3.11**lower dose limit**

H_0

dose below which irradiations should not be performed

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3.12

upper dose limit H_{top}

dose above which irradiations should not be performed

4 Quantities measured

The quantities measured in the evaluation shall be the personal dose equivalent $H_p(10)$, $H_p(3)$ or $H_p(0,07)$, the ambient dose equivalent $H^*(10)$ or the directional dose equivalent $H'(3)$ or $H'(0,07)$ as recommended by the ICRU in Report 47^[3] and Report 51^[4]. All irradiations for $H_p(d)$ shall be performed on ISO phantoms in accordance with ISO 29661, unless other quantities or other phantoms are specified.

5 Frequency of evaluation

As a general rule, performance evaluations should be repeated at regular intervals, e.g. every one or two years. If any significant change of the dosimetry system or the dosimetry service occurs after an evaluation which may change the performance of the dosimetry service and/or dosimetry system, performing a new evaluation shall be considered.

For approved dosimeters/dosimetry systems only: the qualification body shall be notified of the results of the evaluations and of any significant change of the dosimetry service and/or in the dosimetry system after approval. The qualification body shall recommend a new evaluation when it believes that the modifications may change the performance of the dosimetry service and/or dosimetry system.

6 Test conditions**6.1 Standard test conditions and special handling conditions**

The dosimetry service shall supply complete dosimeter badges, i.e. complete dosimeter package worn by a monitored individual or posted as a workplace or environmental monitor. A badge consists of the radiation detector(s), possible supplemental filtering materials, labelling and/or identification typically placed within an enclosure suitable for the environment used and equipped with a means to attach the enclosure to the wearer or within the workplace/environment (e.g., a clip).

The dosimetry service shall not be aware of the radiation qualities and doses used for the irradiations.

One or more dosimeter can be irradiated per irradiation condition.

The quantities which may influence the result, such as ambient temperature, relative humidity, background radiation and contamination by radioactive elements, shall conform to the standard test conditions as given in ISO 29661.

During the performance evaluation cycle, the evaluation sample, including the control dosimeters, shall be stored in environmental conditions that do not affect the measurement results obtained from the dosimeters. Alternative storage conditions may be used in order to mimic real conditions, especially for environmental dosimeters.

The background radiation shall be as small as possible. For an accurate subtraction of the background radiation from the readings of the test dosimeters, the amount of time that the controls and test dosimeters are separated (i.e., the time that it takes to perform the tests) shall be minimized. Ideally, the difference between the accumulated control background and the effective background of the test dosimeters should be less than $\pm 0,01$ mSv, or as small as possible.

6.2 Radiation

The radiation sources shall be chosen from those specified in ISO 4037-1 (reference photon radiation fields), ISO 6980-1 (reference beta radiation fields), ISO 8529-1 (reference neutron radiation fields),