International Standard

ISO 14146

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

Radioprotection — Critères et limites de performance pour l'évaluation périodique des services de dosimétrie pour le rayonnement externe

Third edition
2024-07

Reference number
ISO 14146:2024(en)

© ISO 2024



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ... **iv**

1 Scope ... **1**

2 Normative references ... **2**

3 Terms and definitions ... **2**

4 Quantities measured ... **8**

5 Frequency of evaluation ... **8**

6 Test conditions ... **9**
6.1 Standard test conditions and special handling conditions ... 9
6.2 Radiation qualities ... 9
6.3 Dose range ... 10
6.4 Irradiation of dosemeters ... 11

7 Performance limits ... **11**
7.1 Limits to the response ... 11
7.1.1 General requirements ... 11
7.1.2 Requirements at reference conditions ... 12
7.2 Approval criterion ... 12

8 Operational procedures ... **12**
8.1 Evaluation sample size ... 12
8.2 Evaluation procedure ... 13
8.3 Evaluation sequence ... 13

9 Test report ... **14**

Annex A (normative) **Reference conditions and standard test conditions** ... **15**

Annex B (informative) **Graphical illustrations of the performance limits** ... **17**

Bibliography ... **19**

© ISO 2024 – All rights reserved

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

For an explanation of the voluntary nature of 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 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,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 430, *Nuclear energy, nuclear technologies, and radiological protection,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 14146:2018) which has been technically revised.

The main changes are as follows:

— the addition and clarification of several definitions;

— the modification of the requirements to environmental dosemeters;

— the addition of a requirement at reference conditions.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

© ISO 2024 – All rights reserved

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

1 Scope

This document specifies the dosimetric and organizational criteria and the test procedures to be used for the periodic verification of the performance of dosimetry services supplying personal and/or area, i.e. workplace and/or environmental, dosemeters used for individual (personal) and/or area, i.e. workplace and/or environmental monitoring.

NOTE The quality of a supplier of a dosimetry service depends on both the characteristics of the approved (type-tested) dosimetry system[1)] and the training and experience of the staff, together with the calibration procedures and quality assurance programmes.

The performance evaluation according to this document can be carried out by a dosimetry service to demonstrate the fulfilment of specified performance requirements. The irradiation qualities used in this document are representative for exposure situations that are expected or mimic workplace fields from the radiological activities being monitored using the dosemeters from the services.

This document applies to personal and area dosemeters 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 dosemeters needing laboratory processing (e.g. thermoluminescent, optically stimulated luminescence, radiophotoluminescent, track detectors or photographic-film dosemeters) and involving continuous measurements or measurements repeated regularly at fixed time intervals (e.g. several weeks, one month).

Active direct reading as well as semi-passive or hybrid dosemeters, such as direct ion storage (DIS) or silicon photomultiplier (SiPM) dosemeters, for dose measurement, can also be treated according to this document. Then, they are treated as if they were passive, i.e. the dosimetry service reads their indicated values and reports them to the evaluation organization.

In this document, the corrected indicated (corrected indication) value is the one given by the dosimetry systems as the final result of the evaluation algorithm (for example display of the software, printout) in units of dose equivalent (Sv).

Environmental dosemeters usually indicate the quantity $H^*(10)$ but they can, in addition or alternatively, indicate the quantity $H'(3)$, $H'(0{,}07)$, air kerma, K_a, or absorbed dose, D. All these dosemeters can also be treated according to this document. If K_a or D is indicated (in Gy) the dose values in this document stated in Sv shall then be interpreted as equivalent values in Gy.

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 body.

© ISO 2024 – All rights reserved

2 Normative 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, *Radiological protection — X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy — Part 1: Radiation characteristics and production methods*

ISO 4037-2, *Radiological protection — X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy — Part 2: Dosimetry for radiation protection over the energy ranges from 8 keV to 1,3 MeV and 4 MeV to 9 MeV*

ISO 4037-3, *Radiological protection — X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy — Part 3: Calibration of area and personal dosemeters and the measurement of their response as a function of energy and angle of incidence*

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

ISO 6980-2, *Nuclear energy — Reference beta-particle radiation — Part 2: Calibration fundamentals related to basic quantities characterizing the radiation field*

ISO 6980-3, *Nuclear energy — Reference beta-particle radiation — Part 3: Calibration of area and personal dosemeters and the determination of their response as a function of beta radiation energy and angle of incidence*

ISO 8529-1, *Neutron reference radiations fields — Part 1: Characteristics and methods of production*

ISO 8529-2, *Reference neutron radiations — Part 2: Calibration fundamentals of radiation protection devices related to the basic quantities characterizing the radiation field*

ISO 8529-3, *Neutron reference radiation fields — Part 3: Calibration of area and personal dosemeters and determination of their response as a function of neutron energy and angle of incidence*

ISO 12749-2, *Nuclear energy, nuclear technologies, and radiological protection — Vocabulary — Part 2: Radiological protection*

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

ISO 12789-2, *Reference radiation fields — Simulated workplace neutron fields — Part 2: Calibration fundamentals related to the basic quantities*

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

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 12749-2, ISO 29661 and the following apply.

© ISO 2024 – All rights reserved