INTERNATIONAL STANDARD

**ISO 6980-2**

Third edition
2023-11

# Nuclear energy — Reference beta-particle radiation —

## Part 2: Calibration fundamentals related to basic quantities characterizing the radiation field

*Énergie nucléaire — Rayonnement bêta de référence —*

*Partie 2: Concepts d'étalonnage en relation avec les grandeurs fondamentales caractérisant le champ de rayonnement*



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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 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).

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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*.

This third edition of ISO 6980-2 cancels and replaces ISO 6980-2:2022, of which it constitutes a minor revision.

The main changes are as follows:

— editorial changes throughout the document.

A list of all the parts in the ISO 6980 series can be found on the ISO website.

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.

# Introduction

ISO 6980 series covers the production, calibration, and use of reference beta-particle radiation fields for the calibration of dosemeters and dose-rate meters for protection purposes. This document describes the procedures for the determination of absorbed dose rate to a reference depth of tissue from reference beta particle radiation fields. ISO 6980-1 describes methods of production and characterization of the reference radiation. ISO 6980-3 describes procedures for the calibration of dosemeters and dose-rate meters and the determination of their response as a function of beta-particle energy and angle of beta-particle incidence.

For beta particles, the calibration and the determination of the response of dosemeters and dose-rate meters is essentially a three-step process. First, the basic field quantity, absorbed dose to tissue at a depth of 0,07 mm (and optionally also at a depth of 3 mm) in a tissue-equivalent slab geometry is measured at the point of test, using methods described in this document. Then, the appropriate operational quantity is derived by the application of a conversion coefficient that relates the quantity measured (reference absorbed dose) to the selected operational quantity for the selected irradiation geometry. Finally, the reference point of the device under test is placed at the point of test for the calibration and determination of the response of the dosemeter. Depending on the type of dosemeter under test, the irradiation is either carried out on a phantom or free-in-air for personal and area dosemeters, respectively. For individual and area monitoring, this document describes the methods and the conversion coefficients to be used for the determination of the response of dosemeters and dose-rate meters in terms of the ICRU operational quantities, i.e., directional dose equivalent, $H'(0,07;\Omega)$ and $H'(3;\Omega)$, as well as personal dose equivalent, $H_p(0,07)$ and $H_p(3)$.

# Nuclear energy — Reference beta-particle radiation —

# Part 2: Calibration fundamentals related to basic quantities characterizing the radiation field

## 1 Scope

This document specifies methods for the measurement of the absorbed-dose rate in a tissue-equivalent slab phantom in the ISO 6980 reference beta-particle radiation fields. The energy range of the beta-particle-emitting isotopes covered by these reference radiations is 0,22 MeV to 3,6 MeV maximum beta energy corresponding to 0,07 MeV to 1,2 MeV mean beta energy. Radiation energies outside this range are beyond the scope of this document. While measurements in a reference geometry (depth of 0,07 mm or 3 mm at perpendicular incidence in a tissue-equivalent slab phantom) with an extrapolation chamber used as primary standard are dealt with in detail, the use of other measurement systems and measurements in other geometries are also described, although in less detail. However, as noted in ICRU 56[5], the ambient dose equivalent, $H^*(10)$, used for area monitoring, and the personal dose equivalent, $H_p(10)$, as used for individual monitoring, of strongly penetrating radiation, are not appropriate quantities for any beta radiation, even that which penetrates 10 mm of tissue ($E_{max} > 2$ MeV).

This document is intended for those organizations wishing to establish primary dosimetry capabilities for beta particles and serves as a guide to the performance of dosimetry with an extrapolation chamber used as primary standard for beta-particle dosimetry in other fields. Guidance is also provided on the statement of measurement uncertainties.

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

ISO/IEC Guide 99, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 29661, ISO/IEC Guide 99 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

**3.1**
**extrapolation curve**
curve given by a plot of the corrected ionization current versus the extrapolation chamber depth