
**Reference radiation fields for
radiation protection — Definitions and
fundamental concepts**

*Champs de rayonnement de référence pour la radioprotection —
Définitions et concepts fondamentaux*



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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.

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.

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.

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

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 dosimeters 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 dosimeters, 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 dosimeters is described in general terms. Depending on the type of dosimeter under test, the position of the reference point is specified differently and the irradiation is either carried out on a phantom (for personal dosimeters) or free in air (for area dosimeters or area survey meters).

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.

Reference radiation fields for radiation protection — Definitions and fundamental concepts

1 Scope

This International Standard defines terms and fundamental concepts for the calibration of dosimeters 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 dosimeters and dose rate meters and gives recommendations for establishing these quantities. For individual monitoring, it covers whole body and extremity dosimeters (including those for the skin and the eye lens), and for area monitoring, portable and installed dosimeters. Guidelines are given for the calibration of dosimeters and dose rate 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 dosimeters.

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

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.

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 dosimeters 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 dosimeter, between the direction of radiation incidence and the reference direction of the dosimeter in unidirectional fields

3.1.2

area dosimeter

area survey meter

meter designed to measure the ambient dose equivalent (rate) or the directional dose equivalent (rate)

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