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X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy —

Part 4: Calibration of area and personal dosemeters in low energy X reference radiation fields

Rayonnements X et gamma de référence pour l'étalonnage des dosimètres et des débitmètres et pour la détermination de leur réponse en fonction de l'énergie des photons —

Partie 4: Étalonnage des dosimètres de zone (ou d'ambiance) et individuels dans des champs de référence X de faible énergie

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies

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.

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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 4037-4 was prepared by Technical Committee ISO/TC 85, *Nuclear energy*, Subcommittee SC 2, *Radiation protection*.

ISO 4037 consists of the following parts, under the general title *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*

— *Part 2: Dosimetry for radiation protection over the energy ranges from 8 keV to 1,3 MeV and 4 MeV to 9 MeV*

— *Part 3: Calibration of area and personal dosemeters and the measurement of their response as a function of energy and angle of incidence*

— *Part 4: Calibration of area and personal dosemeters in low energy X reference radiation fields*

Introduction

This part of ISO 4037 is closely related to the three other parts of ISO 4037. The first, ISO 4037-1, describes the methods of production and characterisation of the photon reference radiations. The second, ISO 4037-2, describes the dosimetry of the reference radiations and the third, ISO 4037-3, describes procedures for calibrating and determining the response of dosemeters and doserate meters in terms of the International Commission on Radiation Units and Measurements (ICRU) operational quantities [1, 2, 3] for radiation protection purposes.

This part of ISO 4037 is the fourth part of the series, and it describes special procedures for low energy X reference radiation fields. In ISO 4037-3, all the dose quantities used are based on the air kerma K_a free in air. Either K_a is the selected measuring quantity, or one of the dose-equivalent quantities $H'(0,07)$, $H_p(0,07)$, $H_p(10)$ and $H^*(10)$ is determined using conversion coefficients from air kerma K_a to the appropriate dose-equivalent quantity. For the dose-equivalent quantities $H'(0,07)$ and $H_p(0,07)$, this procedure is associated with only a small additional uncertainty, because the conversion coefficients depend only slightly on the photon energy and angle of radiation incidence for the ranges given in ISO 4037-3. Therefore, for these dose-equivalent quantities, no special attention is given for the low energy X reference radiation fields. For the two other dose-equivalent quantities $H_p(10)$, and $H^*(10)$, this is different. For them, the use of conversion coefficients can be associated with large additional uncertainties if low energy X reference radiation fields are considered; see the remark already given in these cases in ISO 4037-3. This is because the conversion coefficients depend strongly on the photon energy and the angle of radiation incidence. For nominally the same radiation quality as defined in ISO 4037-1, the conversion coefficients can differ by several tens of percent. A detailed description of all the measurements and methods necessary to avoid these additional uncertainties is given by Ankerhold *et al.* [4, 5] and by Behrens [6].

NOTE For irradiation of the whole body, $H_p(10)$ and $H^*(10)$ are relevant for radiation protection, as long as they are closer to their limit than $H'(0,07)$ and $H_p(0,07)$. This is the case down to about 15 keV.

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