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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 12162.3-2025

Replacing GB/T 12162.3-2004

**X and gamma reference radiation for calibrating dosimeters and dose rate meters and for
determining their response as a function of photon energy - Part 3: Calibration of area
and personal dosimeters and the measurement of their response as a function of energy
and angle of incidence**

(English Translation)

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document is Section 3 of GB/T 12162 "X and gamma reference radiation for calibrating dosimeters and dose rate meters and determining their energy response".

Parts. GB/T 12162 has published the following parts.

---Part 1: Radiation Characteristics and Generation Methods;

---Part 2: Dosimetry for Radiation Protection in the Energy Ranges of 8keV to 1.3MeV and 4MeV to 9MeV;

---Part 3: Calibration of site dosimeters and personal dosimeters and determination of their energy and angular responses;

---Part 4: Calibration of site and personal dosimeters in low-energy X-ray reference radiation fields.

This document replaces GB/T 12162.3-2004 "X and gamma reference radiation for calibrating dosimeters and dose rate meters and determining their energy response".

Part 3: Calibration of site dosimeters and personal dosimeters and determination of their energy and angular responses, in accordance with GB/T 12162.3-Compared to 2004, aside from structural adjustments and editorial changes, the main technical changes are as follows.

a) Two types of reference radiation fields corresponding to Part 1 have been added. a matched reference radiation field and a characteristic reference radiation field.

The conversion coefficient from atmospheric kerma to practical quantity (see 4.1.2);

b) Added specific conversion factors for irradiation conditions at 1m and 2.5m (see Chapter 7);

c) Added technical content such as the $H'(3)$ and $H_p(3)$ conversion coefficients related to ocular lens dose (see Chapter 9);

d) Added provisions for practical cylindrical phantoms related to ocular lens dosage (see 9.1, 9.5 and 9.6).

This document is equivalent to ISO 4037-3:2019 Radiation protection for the calibration of dosimeters and dose rate meters and for the determination of their energy response.

Part 3: Calibration of site dosimeters and personal dosimeters and determination of their energy and angular responses.

The following minimal editorial changes have been made to this document.

---The standard title has been changed to "X and gamma Reference Radiation for Calibration of Dosimeters and Dose Rate Meters and Determination of Their Energy Response, Part 3" Part 1: Calibration of site dosimeters and personal dosimeters, and determination of their energy and angular responses.

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed and is under the jurisdiction of the National Nuclear Energy Standardization Technical Committee (SAC/TC58).

Introduction

Establishing X-ray and gamma-ray reference radiation is a prerequisite for calibrating dosimeters and dose rate meters and determining their energy responses; therefore, it is necessary to specify the corresponding radiation.

Field and measurement methods.

GB/T 12162 "X and gamma reference radiation for calibrating dosimeters and dose rate meters and determining their energy response" is applicable to...

For calibrating dosimeters and dose rate meters and determining their energy response using X and gamma reference radiation, with the development of domestic nuclear energy, nuclear medicine and radiotherapy, the development of nuclear technology applications, environmental protection, and national defense has led to a continuous increase in the number of locations and applications involving radioactivity, and the demand for dosimeters and dose rates has also grown.

The use of instruments is increasing significantly, and the accompanying demand for metrological calibration is also growing. Therefore, calibration of dosimeters and dose rate meters and determination of their energy are crucial.

The response to X and gamma reference radiation has increased significantly in China in recent years.

GB/T 12162 "X and gamma reference radiation for calibrating dosimeters and dose rate meters and determining their energy response" is proposed to consist of four parts.

constitute.

---Part 1: Radiation Characteristics and Generation Methods. The purpose is to define the radiation characteristics and generation methods of three sets of six series of reference radiation.

Methods include continuous filtering of X-ray radiation in the energy range of approximately 8 keV to 330 keV, and filtering of X-ray radiation in the energy range of 600 keV to 1.3 MeV.

Gamma radiation emitted by radionuclides in the energy range, and photon radiation generated by accelerators in the energy range of 4 MeV to 9 MeV.

Radiation; according to the usage method of the conversion coefficient from air kerma to operational practical quantity, the "matching reference radiation" and "table radiation" are specified respectively.

"Reference radiation" guides the establishment of a reference radiation field for calibrating dosimeters and dose rate meters and determining their energy responses.

---Part 2: Dosimetry for Radiation Protection in the energy ranges of 8 keV to 1.3 MeV and 4 MeV to 9 MeV. Purpose the document specifies the methods and procedures for determining reference radiation dosimetry values of 8keV~1.3MeV and 4MeV~9MeV, providing guidance for their application.

Air kerma in the approximate energy ranges of 8keV to 1.3MeV and 4MeV to 9MeV, and above 1μGy/h.

Determination of reference radiation standard values.

---Part 3: Calibration of site dosimeters and personal dosimeters and determination of their energy and angular responses. The purpose is to specify...

Methods and requirements for calibrating personal and location dosimeters, as well as the conversion factor from air kerma to operational quantities, to guide the use of...

Calibration of dosimeters and personal dosimeters for personal and location monitoring in radiation protection.

---Part 4: Calibration of site and personal dosimeters in low-energy X-ray reference radiation fields. The aim is to specify calibration procedures at 30 keV and above.

Special requirements for the calibration of personal and location dosimeters in low-energy X-ray reference radiation fields, providing guidance for the calibration of location dosimeters (rate meters) and personal dosimeters.

Calibration of the dosimeter in low-energy photon reference radiation and determination of its energy and angular responses.

GB/T 12162 (all parts) systematically defines and specifies the technical requirements for X-ray and gamma reference radiation, effectively standardizing this type of radiation.

The performance of metrology equipment effectively improves the accuracy and reliability of dosimeter and dose rate meter calibration results, thereby reducing the cost of dosimeter and dose rate meter calibration.

The technical risks and costs for manufacturers.

Used for calibrating dosimeters and dose rate meters and determining their...

Part 3: Energy Response of X and gamma Reference Radiation Calibration of site dosimeters and personal dosimeters Measurement of its energy response and angular response

1 Scope

This document specifies the procedures and required data for calibrating personal and site monitoring dosimeters and dose rate meters for radiation protection.

This document applies to the calibration of whole-body and limb doses for personal monitoring in radiation fields with an air kerma rate higher than 1 $\mu\text{Gy/h}$.

Instruments, as well as portable and fixed-installation dosimeters for site monitoring.

This document does not apply to in-situ calibration of fixed-location dosimeters.

This document uses a photon reference radiation field with average energies between 8 keV and 9 MeV as specified in ISO 4037-1. Appendix D Additional information is provided