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

GB/T 12162.2-2025

Replacing GB/T 12162.2-2004

**X and gamma reference radiation for calibrating dosimeters and dose rate meters and for
determining their response as a function of photon energy - Part 2: Dosimetry for
radiation protection over the energy ranges from 8 keV to 1.3 MeV and 4 MeV to 9 MeV**

(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 2 of GB/T 12162 "X and gamma reference radiation for calibrating dosimeters and dose rate meters and determining their energy response".

GB/T 12162 has been published in four 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 12162.2-2004 "X and gamma reference radiation for calibrating dosimeters and dose rate meters and determining their energy response".

Part 2: Dose Measurement of Reference Radiation with Energy Ranges of 8keV to 1.3MeV and 4MeV to 9MeV for Radiation Protection Compared with GB/T 12162.2-2004, the main

technical changes in the revised version are as follows, except for structural adjustments and editorial modifications.

- a) Added definitions and measurement methods for the matched reference radiation field and the characteristic reference radiation field (see 5.1);
- b) Added different practical quantities specified according to $H^*(10)$, $H_p(10)$, $H'(3)$, $H_p(3)$, $H'(0.07)$, and $H_p(0.07)$.

Methods for measuring the matched reference radiation field and the characteristic reference radiation field (see Chapter 6);

- c) Added relevant technical content on photon fluence spectroscopy methods (see 10.5.4).

This document is equivalent to ISO 4037-2:2019 Radiation protection for the calibration of dosimeters and dose rate meters and for the determination of their energy response.

And gamma reference radiation, Part 2: Dose for radiation protection in the energy range of 8 keV to 1.3 MeV and 4 MeV to 9 MeV.

Measurement.

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 2" Part. Dosimetry for radiation protection in the energy ranges of 8keV~1.3MeV and 4MeV~9MeV.

Please note that some content in this document may involve patents, and 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 for continuously filtering X-ray radiation in the energy range of approximately 8 keV to 330 keV, and in the energy range of 600 keV to 1.3 MeV.

The gamma radiation emitted by radionuclides in the energy range of 4 MeV to 9 MeV, and the light produced by accelerators in the energy range of 4 MeV to 9 MeV.

Sub-radiation; according to the usage method of the conversion coefficient from air kerma to operational practical quantity, "matching reference radiation" and...

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

---Part 2: Dose determination for radiation protection in energy ranges of 8 keV to 1.3 MeV and 4 MeV to 9 MeV. Purpose it specifies the methods and procedures for determining reference radiation dosimetry values of 8keV~1.3MeV and 4MeV~9MeV, and guides the use of...

Air kerma in the energy ranges of approximately 8 keV to 1.3 MeV and 4 MeV to 9 MeV, and above 1 $\mu\text{Gy/h}$.

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 personal and regional dosimeter calibration, as well as conversion coefficients 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 regional dosimeters in low-energy X-ray reference radiation fields, providing guidance for the calibration of site 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 energy.

Part 2: Radiation Response of X and gamma Reference Radiation the energy range for protection is 8keV to 1.3MeV.

Dosage determination from 4MeV to 9MeV

1 Scope

This document describes the use of instruments for calibrating radiation protection, with energy ranges of approximately 8 keV to 1.3 MeV and 4 MeV to 9 MeV, in air-to-water ratios.

Procedure for determining X and gamma reference radiation doses with kinetic energy release rates higher than 1 $\mu\text{Gy/h}$.

This document applies to the air kerma K_a in free air and the operational quantities $H^*(10)$, $H_p(10)$, $H'(3)$, and $H_p(3)$.

Dosage determination of $H'(0.07)$ and $H_p(0.07)$.

The requirements and methods presented in this document aim to reduce the expanded uncertainty of operational dose (rate) related to the reference field and the phantom.

($k=2$) is approximately 6%~10%. Therefore, ISO 4037-1 provides two methods for generating the reference field.

The first method strictly follows the requirements to generate a "matching reference field" and can directly use the recommended transformation coefficients. This document...