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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 16149-2026

Replacing GB/T 16149-2012

Method of dose estimation for chronic radiation sickness from external exposure

外照射慢性放射病剂量估算方法

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1.Scope This document establishes the basic principles for dose estimation of chronic radiation sickness caused by external irradiation and describes the physical dose estimation for chronic radiation sickness caused by external irradiation. method. This document applies to the estimation of physical dose for chronic radiation sickness caused by external irradiation, as well as acute radiation sickness, radiation-induced cataracts, and radiation-induced skin conditions. The physical doses used to determine the etiology of diseases and suspected radiation-induced tumors are estimated with reference to this document.

4.1 General Principles

4.1.1 In dose evaluation of chronic radiation sickness caused by external irradiation, organ absorbed dose is used to evaluate tissue response caused by ionizing radiation.

4.1.2 When estimating organ absorption dose, personal monitoring data should be used first; site monitoring should only be used when personal monitoring data is unavailable. The data is used for approximate estimation.

4.1.3 Typically, organ absorbed dose estimation is performed using individual monitoring data from the corresponding location of the organ being estimated; only in the case of photons and neutrons... Only when the radiation field can be considered to be uniformly distributed can routine personal monitoring data be used to estimate organ absorbed dose.

4.1.4 This document only lists commonly used dose estimation parameters. For parameters not listed, please refer to ICRP Publication 116 and ICRU Report 95. The relevant parameters; or obtained through simulation experiments or relevant research data under actual or similar irradiation conditions.

4.2 Methods for estimating organ absorbed dose

4.2.1 Estimating Organ Absorbed Dose Given Particle Flux When the flux Phii of type i particles at the location of the organ of interest is known, the estimated dose absorbed by the organ is given by formula (12).

4.2.2.2 Known personal dose monitoring values When the monitored value of the individual dose Hp,i caused by type i particles at the location of the organ of interest is known, the calculation of the dose Phii is given by formula (13).

4.2.2.3 Known Individual Absorbed Dose Monitoring Values for the Lens When the individual absorbed dose Dplens,i of the lens caused by type i particles is known, the injection volume Phii is calculated as shown in formula (14).

4.2.3 Estimating Organ Absorbed Dose Based on Known Old Usage Monitoring Values

4.2.3.1 General Principles When only old practical dose monitoring values from ICRU Report No. 39 or ICRU Report No. 51 are available, such as ambient dose equivalent H*(d), directional... The dose equivalent H'(d,Omega) or individual dose equivalent Hp(d) can be used to estimate the type i of the organ location using previously used dose monitoring values. The particle fluence Phii is then used to estimate the organ absorbed dose according to formula (12). For a mixed radiation field of strong penetrating radiation and weak penetrating radiation, according to... The neutron personal dose monitoring method specified in GBZ 128 is used to monitor and obtain personal monitoring data. The dose is then estimated using the following method.

4.2.3.2 Photon If instrument measurements are available and calibrated to ambient dose equivalent H*(10) and directional dose equivalent H'(0.07,0°), they can be divided by Appendix H. The conversion coefficients from the corresponding energy to the old practical quantity in Table H.1 are used to obtain the photon fluence value.

4.2.3.3 Neutron When monoenergetic neutrons are incident on the ICRU sphere or plate phantom under different geometric conditions, if the neutron monitoring instrument has been set according to the individual dose equivalent Hp(d)... Or, the ambient dose equivalent H*(d) for instrument calibration can be obtained by dividing by the individual dose equivalent per unit neutron fluence corresponding to the energy in Table H.3. The neutron injection value is obtained by measuring the amount or the surrounding dose equivalent.

4.2.3.4 Electronics When monoenergetic electrons are incident perpendicularly, if the electron monitoring instrument has been calibrated according to the directional dose equivalent H'(d,Omega), it can be determined by dividing by the value in Table H.4. The electron flux value is obtained by taking the directional dose equivalent of the unit electron flux corresponding to the corresponding energy.

4.2.4 Estimating Organ Absorbed Dose Given Source Term Information

4.2.4.1 General Principles When source term information such as radioactive source activity is known, it can be converted into fluence Phii using the following method, and then organ absorption can be estimated according to formula (12). dose.

4.2.4.2 Photon Source Under normal circumstances (especially in the case of non-point sources), the activity of the radioactive source, the distance from the source to the organ of interest, and the radiation field distribution are known. When considering source information such as characteristics, the Monte Carlo method is recommended to estimate organ-absorbed dose.

4.2.4.3 Neutron Source When source term information such as the radioactive source activity is known, the neutron fluence at the location of the organ of interest can be estimated, as shown in formula (21).

4.2.4.4 Electronic Source When source term information such as the activity of the radioactive source is known, the electron fluence at the location of the organ of interest can be estimated, as shown in formula (22).

4.3 Example of dose estimation for chronic radiation sickness from external irradiation Examples of dose estimation for chronic radiation sickness from external irradiation are provided in Appendix I.