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Withdrawn

Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation –

Part 2: High range beta and photon dose and dose rate portable instruments for emergency radiation protection purposes

Instrumentation pour la radioprotection – Instruments pour la mesure et/ou la surveillance de l'équivalent de dose (ou du débit d'équivalent de dose) ambiant et/ou directionnel pour les rayonnements bêta, X et gamma –

Partie 2: Instruments portables de grande étendue, pour la mesure de la dose et du débit de dose des rayonnements photoniques et bêta dans des situations d'urgence de radioprotection

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RADIATION PROTECTION INSTRUMENTATION – AMBIENT AND/OR DIRECTIONAL DOSE EQUIVALENT (RATE) METERS AND/OR MONITORS FOR BETA, X AND GAMMA RADIATION –

Part 2: High range beta and photon dose and dose rate portable instruments for emergency radiation protection purposes

FOREWORD

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International Standard IEC 60846-2 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

This part of IEC 60846 is to be used in conjunction with IEC 60846:2002.

NOTE IEC 60846:2002 is currently under revision and will be issued as IEC 60846-1 around 2008-2009. This part of IEC 60846 will then be revised with references to the new publication IEC 60846-1.

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The text of this standard is based on the following documents:

FDIS	Report on voting
45B/542/FDIS	45B/549/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 60846 series, under the general title *Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,
- replaced by a revised edition, or
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RADIATION PROTECTION INSTRUMENTATION – AMBIENT AND/OR DIRECTIONAL DOSE EQUIVALENT (RATE) METERS AND/OR MONITORS FOR BETA, X AND GAMMA RADIATION –

Part 2: High range beta and photon dose and dose rate portable instruments for emergency radiation protection purposes

1 Scope and object

This part of the IEC 60846 series applies to portable or transportable dose equivalent (rate) meters and/or monitors for the measurement of ambient and/or directional dose equivalent (rate) from external beta, X and gamma radiation during emergency situations. It applies directly to dose equivalent (rate) meters intended for the determination of the dose equivalent or dose equivalent rate from external beta and/or X and gamma radiation of energies up to 10 MeV during emergency situations.

The object of this part of the IEC 60846 series is to specify the design requirements and the performance characteristics of dose equivalent (rate) meters intended for the determination of ambient and/or directional dose equivalent (rate) as defined in ICRU Report 47 under emergency conditions. With the exception of modified or new clauses listed below, all clauses in IEC 60846:2002 are applicable for instruments used for emergency purposes.

This part of the IEC 60846 series does not specify which instruments are required nor does it consider the numbers or specific locations of such instruments. This part of the IEC 60846 series does not identify instrumentation for specific types of accidents. It is essential that the rated ranges of the instruments and the radiological and non-radiological conditions for which the instruments are designed adequately cover the accident and post-accident conditions as determined by accident analysis and/or specified by appropriate regulatory authorities or qualified individuals. It is expected that accidents will involve both dose equivalent (rate) and environmental extremes (e.g. temperature and humidity). Specifications for instruments for measuring dose equivalent rates less than the minimum detectable dose rate level specified in this part of the IEC 60846 series are contained in IEC 60846:2002. Where such instruments are also to be used for emergency measurements, they shall also meet the requirements of this part of the IEC 60846 series.

Although this part of the IEC 60846 series specifies the requirements for instruments primarily for emergency use, such instruments may also be used for on-site measurements at other times. If the instrument has a remote detector and if an additional detector is provided in the measuring assembly to measure dose equivalent rate at the location of the operator, the requirements shall apply to both of the detectors.

2 Normative references

This clause of IEC 60846:2002 applies, with the following additional references:

IEC 60325:2002, *Radiation protection instrumentation – Alpha, beta and alpha/beta (beta energy >60 keV) contamination meters and monitors*

IEC 60846:2002, *Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation*

Withdrawn

3 Terms and definitions

For the purposes of this document, the terms and definitions given in 3.1 to 3.4 of IEC 60846:2002 apply, without modification.

An additional definition applies:

3.2.15
extracameral
response to radiation of all the parts of the instrument except the detector itself

4 General characteristics of ambient dose equivalent (rate) meters for emergency purposes

4.1 General

4.1.1 Indication

The indications of the ambient dose equivalent (rate) meter shall be in units of dose equivalent (rate), for example, Sievert or Sievert per hour, respectively.

4.1.2 Read-out

Single scale is preferred. If multiple scales are used, the changing of measuring range and read-out scale shall be simultaneous and shall be clearly displayed. All scales shall be readable under normal lighting conditions.

4.1.3 Dose equivalent (rate) meter labels and markings

This subclause of IEC 60846:2002 applies, without modification.

4.1.4 Dose equivalent and dose equivalent rate range

The implementation of the ICRP recommendations requires the determination of dose equivalent rate over a wide range of values. Under some circumstances, dose equivalent rates as high as 10 Sv/h require measurement. For application as an emergency instrument, the dose equivalent rates of interest are within the range from approximately 1 mSv/h to 10 Sv/h. If integrating capability is provided, the range between 1 mSv to 10 Sv is usually of interest.

4.1.5 Effective range of measurement

This subclause of IEC 60846:2002 applies, without modification.

4.1.6 Minimum range of measurement

The minimum effective range of measurement of dose equivalent rate shall cover at least four orders of magnitude and shall include the range from 1 mSv/h to 10 Sv/h. The minimum effective range of dose equivalent shall cover at least four orders of magnitude and shall include 10 Sv.

4.1.7 Alarm levels

This subclause of IEC 60846:2002 applies, without modification.

4.1.8 Additional indication

This subclause of IEC 60846:2002 applies, without modification.

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4.1.9 Failure operation of indication

This subclause of IEC 60846:2002 applies, without modification.

4.1.10 Ease of decontamination

This subclause of IEC 60846:2002 applies, without modification.

4.1.11 Portability

In the case of survey meters, the complete instrument should not exceed 4 kg in weight and shall be equipped with handles, straps or other means to facilitate operation while being carried. It is recognized that an extension probe or some other means may be required to reduce the dose to the operator.

4.1.12 Protection of switches

Switches and other controls shall be protected to prevent inadvertent de-activation or mal-operation of the instrument.

4.1.13 Use of extension probe

If an extension probe is to be used, the instrument shall be tested with the probe in place. The manufacturer shall provide the method to be used to perform the test together with the results of the test.

4.2 Classification of the performance characteristics

This subclause of IEC 60846:2002 applies, without modification.

4.3 General test procedures

This subclause of IEC 60846:2002 applies, without modification.

4.4 Contamination probe

Emergency dose rate monitors are frequently provided with a surface contamination probe. This probe shall meet the requirements of IEC 60325.

5 Radiation characteristics – Directional dose equivalent (rate) meters

5.1 Relative intrinsic error

This subclause of IEC 60846:2002 applies, without modification.

5.2 Variation of response with beta radiation energy and angle of incidence

5.2.1 Requirements

The response of the directional dose equivalent (rate) meter to beta radiation produced by the reference radiation of $^{90}Sr/^{90}Y$ in the calibration direction shall not differ by more than ±50 % from unity. In addition, the response to the reference radiation of ^{85}Kr or ^{204}Tl shall be given by the manufacturer.

5.2.2 Test method

For the beta radiation of $^{90}Sr/^{90}Y$, the response shall be measured for zero angle of incidence.

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5.3 to 5.6

These subclauses of IEC 60846:2002 apply, without modification.

5.7 Statistical fluctuations

5.7.1 Requirements

The coefficient of variation of the indication due to random fluctuations shall be less than the values given in Table 2 of IEC 60846-2.

5.7.2 Test method

This subclause of IEC 60846:2002 applies, without modification.

5.8 and 5.9

These subclauses of IEC 60846:2002 apply, without modification.

6 Radiation characteristics – Ambient dose equivalent (rate) meters

6.1 Relative intrinsic error

This subclause of IEC 60846:2002 applies, without modification.

6.2 Variation of response with photon radiation energy and angle of incidence

6.2.1 General

Where telescopic or remote cylindrical probes are used for emergency instrumentation, the following subclauses replace 6.2.1 and 6.2.2 of IEC 60846:2002. In all other cases, 6.2 of IEC 60846:2002 applies, without modification.

6.2.2 Requirements

The relative response due to a change of the radiation energy and angle of incidence shall not exceed the following values:

- 0,71 to 1,67 for 80 keV to 1,5 MeV and 0° to ±60° and 180° to (180°±60°).
- 0,625 to 2,50 for 80 keV to 1,5 MeV and ±60° to ±120°; however, at 90°±10° a lower response of 0,50 is allowed.
- 0,625 to 2,50 for 1,5 MeV to 7 MeV and 0° to ±60° and 180° to (180°±60°).

All indicated dose values shall be corrected for non-linear response and, if necessary, for the effect of the influence quantity dose rate.

Where more than one detector is utilized, then these requirements shall apply to each detector.

NOTE 1 The calibration direction for cylindrical probes is typically normal to the axis of symmetry.

NOTE 2 The range of the response 0,71 to 1,67 corresponds to the range of the correction factor 1,00 ±0,40. The range of the response 0,625 to 2,50 corresponds to the range of the correction factor 1,00 ±0,60.

6.2.3 Test method

The tests should be performed using the narrow-spectrum series of radiation qualities of ISO 4037-1, however if very high dose rates are required, the wide-spectrum series or high air kerma rate series may be required.

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