



Standard Guide for Selecting Dosimetry Systems for Application in Pulsed X-Ray Sources¹

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1. Scope

1.1 This guide provides assistance in selecting and using dosimetry systems in flash X-ray experiments. Both dose and dose-rate techniques are described.

1.2 Operating characteristics of flash X-ray sources are given, with emphasis on the spectrum of the photon output.

1.3 Assistance is provided to relate the measured dose to the response of a device under test (DUT). The device is assumed to be a semiconductor electronic part or system.

2. Referenced Documents

2.1 ASTM Standards:²

E170 Terminology Relating to Radiation Measurements and Dosimetry

E666 Practice for Calculating Absorbed Dose From Gamma or X Radiation

E668 Practice for Application of Thermoluminescence-Dosimetry (TLD) Systems for Determining Absorbed Dose in Radiation-Hardness Testing of Electronic Devices

E1249 Practice for Minimizing Dosimetry Errors in Radiation Hardness Testing of Silicon Electronic Devices Using Co-60 Sources

2.2 ISO/ASTM Standards:³

ISO/ASTM 51261 Practice for Calibration of Routine Dosimetry Systems for Radiation Processing

ISO/ASTM 51275 Practice for Use of a Radiochromic Film Dosimetry System

ISO/ASTM 51310 Practice for Use of a Radiochromic Optical Waveguide Dosimetry System

¹ This practice is under the jurisdiction of ASTM Committee E10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.07 on Radiation Dosimetry for Radiation Effects on Materials and Devices.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ For referenced ISO/ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

2.3 International Commission on Radiation Units (ICRU) and Measurements Reports:⁴

ICRU Report 14 Radiation Dosimetry: X rays and Gamma Rays with Maximum Photon Energies Between 0.6 and 50 MeV

ICRU Report 17 Radiation Dosimetry: X rays Generated at Potentials of 5 to 150 kV

ICRU Report 34 The Dosimetry of Pulsed Radiation

ICRU Report 51 Quantities and Units in Radiation Protection Dosimetry

ICRU Report 60 Fundamental Quantities and Units for Ionizing Radiation

ICRU Report 76 Measurement Quality Assurance for Ionizing Radiation Dosimetry

ICRU Report 77 Elastic Scattering of Electrons and Positrons

ICRU Report 80 Dosimetry Systems for Use in Radiation Processing

ICRU Report 85a Fundamental Quantities and Units for Ionizing Radiation

3. Terminology

3.1 *absorbed dose*—quotient of $d\bar{\epsilon}/dm$, where $d\bar{\epsilon}$ is the mean energy imparted by ionizing radiation to matter of mass dm :

$$D = \frac{d\bar{\epsilon}}{dm} \quad (1)$$

See ICRU Report 85a. The special name for the unit for absorbed dose is the gray (Gy).

$$1 \text{ Gy} = 1 \text{ J/kg} \quad (2)$$

Formerly, the special unit for absorbed dose was the rad, where $1 \text{ rad} = 100 \text{ erg/g}$.

$$1 \text{ rad} = 0.01 \text{ Gy} \quad (3)$$

Since the absorbed dose due to a given radiation field is material dependent, it is important to include the material composition for which the dose is being reported, e.g., 15.3 Gy(LiF).

⁴ Available from the International Commission on Radiation Units and Measurements, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, U.S.A.