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**Practice for dosimetry in electron beam  
and X-ray (bremsstrahlung) irradiation  
facilities for food processing**

*Pratique de la dosimétrie dans les installations de traitement des  
produits alimentaires irradiés par faisceau d'électrons et de  
rayons X (bremsstrahlung)*



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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

ASTM International is one of the world's largest voluntary standards development organizations with global participation from affected stakeholders. ASTM technical committees follow rigorous due process balloting procedures.

A project between ISO and ASTM International has been formed to develop and maintain a group of ISO/ASTM radiation processing dosimetry standards. Under this project, ASTM Subcommittee E10.01, Dosimetry for Radiation Processing, is responsible for the development and maintenance of these dosimetry standards with unrestricted participation and input from appropriate ISO member bodies.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. Neither ISO nor ASTM International shall be held responsible for identifying any or all such patent rights.

International Standard ISO/ASTM 51431 was developed by ASTM Committee E10, Nuclear Technology and Applications, through Subcommittee E10.01, and by Technical Committee ISO/TC 85, Nuclear energy.

This second edition cancels and replaces the first edition (ISO/ASTM 51431:2002), which has been technically revised.



## Standard Practice for Dosimetry in Electron Beam and X-Ray (Bremsstrahlung) Irradiation Facilities for Food Processing<sup>1</sup>

This standard is issued under the fixed designation ISO/ASTM 51431; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision.

### 1. Scope

1.1 This practice outlines the installation qualification program for an irradiator and the dosimetric procedures to be followed during operational qualification, performance qualification and routine processing in facilities that process food with high-energy electrons and X-rays (bremsstrahlung) to ensure that product has been treated within a predetermined range of absorbed dose. Other procedures related to operational qualification, performance qualification and routine processing that may influence absorbed dose in the product are also discussed. Information about effective or regulatory dose limits for food products, and appropriate energy limits for electron beams used directly or to generate X-rays is not within the scope of this practice (see ASTM Guides F 1355, F 1356, F 1736, and F 1885).

NOTE 1—Dosimetry is only one component of a total quality assurance program for adherence to good manufacturing practices used in the production of safe and wholesome food.

NOTE 2—ISO/ASTM Practice 51204 describes dosimetric procedures for gamma irradiation facilities for food processing.

1.2 For guidance in the selection and calibration of dosimetry systems, and interpretation of measured absorbed dose in the product, see ISO/ASTM Guide 51261 and ASTM Practice E 666. For the use of specific dosimetry systems, see ASTM Practices E 1026 and E 2304, and ISO/ASTM Practices 51205, 51275, 51276, 51310, 51401, 51538, 51540, 51607, 51650 and 51956. For discussion of radiation dosimetry for electrons and X-rays also see ICRU Reports 35 and 14. For discussion of radiation dosimetry for pulsed radiation, see ICRU Report 34.

1.3 While gamma radiation from radioactive nuclides has discrete energies, X-rays (bremsstrahlung) from machine sources cover a wide range of energies, from low values (about 35 keV) to the energy of the incident electron beam. For information concerning electron beam irradiation technology and dosimetry, see ISO/ASTM Practice 51649. For information concerning X-ray irradiation technology and dosimetry, see ISO/ASTM Practice 51608.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced documents

#### 2.1 ASTM Standards:<sup>2</sup>

- E 170 Terminology Relating to Radiation Measurements and Dosimetry
- E 666 Practice for Calculating Absorbed Dose from Gamma or X Radiation
- E 1026 Practice for Using the Fricke Reference Standard Dosimetry System
- E 2232 Guide for Selection and Use of Mathematical Models for Calculating Absorbed Dose in Radiation Processing Applications
- E 2303 Guide for Absorbed-dose Mapping in Radiation Processing Facilities
- E 2304 Practice for Use of a LiF Photo-Fluorescent Film Dosimetry System
- F 1355 Guide for Irradiation of Fresh Fruits as a Phytosanitary Treatment
- F 1356 Guide for Irradiation of Fresh and Frozen Red Meat and Poultry to Control Pathogens and Other Microorganisms
- F 1736 Guide for Irradiation of Finfish and Shellfish to Control Pathogens and Spoilage Microorganisms
- F 1885 Guide for Irradiation of Dried Spices, Herbs, and Vegetable Seasonings to Control Pathogens and Other Microorganisms

#### 2.2 ISO/ASTM Standards:<sup>2</sup>

- 51204 Practice for Dosimetry in Gamma Irradiation Facilities for Food Processing
- 51205 Practice for Use of a Ceric-Cerous Sulfate Dosimetry System
- 51261 Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing
- 51275 Practice for Use of a Radiochromic Film Dosimetry System
- 51276 Practice for Use of a Polymethylmethacrylate Dosimetry System

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.01 on Dosimetry for Radiation Processing, and is also under the jurisdiction of ISO/TC 85/WG 3.

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<sup>2</sup> For referenced ASTM and ISO/ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.