



Designation: F1736 – 21

Standard Guide for Irradiation of Finfish and Aquatic Invertebrates Used as Food to Control Pathogens and Spoilage Microorganisms¹

This standard is issued under the fixed designation F1736; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

The purpose of this guide is to present information on the use of ionizing radiation for eliminating or reducing the number of pathogenic microorganisms and parasites and for reducing the number of spoilage microorganisms on finfish and aquatic invertebrates. Information on the handling of finfish and aquatic invertebrates before receipt by the irradiation facility and after shipment from the facility is also provided.

The food commodities covered by this standard can include, but are not limited to: molluscan shellfish, crustacean shellfish, fin fish, and flat fish, including those that are saltwater, fresh water, wild caught and farm-raised.

This guide is intended to serve as a set of recommendations to be followed when using irradiation technology where approved by an appropriate regulatory control authority. It is not to be construed as setting forth rigid requirements for the use of irradiation. While the use of irradiation involves certain essential requirements to attain the objective of the treatment, some parameters can be varied in optimizing the process.

This guide is based on a guideline published by the International Consultative Group on Food Irradiation (ICGFI) at the initiation of the Joint Food and Agriculture Organization/International Atomic Energy Agency Division of Nuclear Techniques in Food and Agriculture, which serves as the Secretariat to the ICGFI.

1. Scope

1.1 This guide outlines procedures and operations for the irradiation of raw, untreated, fresh (chilled), or frozen finfish and aquatic invertebrates, while ensuring that the irradiated product is safe and wholesome.

1.1.1 Aquatic invertebrates include mollusks, crustacea, echinoderms, etc.

1.1.1.1 Mollusks include bivalve shellfish, such as clams, mussels, and oysters; snails; and cephalopods, such as squid and octopus.

1.1.1.2 Crustacea include shellfish such as shrimp, lobster, crabs, prawns and crayfish.

1.1.1.3 Echinoderms include sea urchins and sea cucumbers.

1.2 This guide covers absorbed doses used to reduce the microbial and parasite populations in aquatic invertebrates and finfish. Such doses typically are below 10 kGy (**1**).²

1.2.1 This guide covers gamma, electron beam, and X-radiation treatment.

1.3 The use of reduced-oxygen packaging (vacuum or modified atmosphere, and including products packed in oil) with irradiated, raw product is not covered by this guide. The anaerobic environment created by reduced-oxygen packaging provides the potential for outgrowth of, and toxin production from, *Clostridium botulinum* spores.

1.4 This guide does not cover the irradiation of smoked or dried fish to reduce microbial load or to control insect infestation.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 This document is one of a set of standards that provides recommendations for properly implementing and utilizing

¹ This guide is under the jurisdiction of ASTM Committee E61 on Radiation Processing and is the direct responsibility of Subcommittee E61.05 on Food Irradiation.

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² The boldface numbers in parentheses refer to the list of references at the end of this standard.

radiation processing. It is intended to be read in conjunction with ISO/ASTM Practice 52628.

1.7 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:³

E3083 Terminology Relating to Radiation Processing: Dosimetry and Applications

F1416 Guide for Selection of Time-Temperature Indicators

F1640 Guide for Selection and Use of Contact Materials for Foods to Be Irradiated

2.2 ISO/ASTM Standards:³

51261 Practice for Calibration of Routine Dosimetry Systems for Radiation Processing

51539 Guide for Use of Radiation-Sensitive Indicators

51608 Practice for Dosimetry in an X-Ray (Bremsstrahlung) Facility for Radiation Processing at Energies between 50 keV and 7.5 MeV

51649 Practice for Dosimetry in an Electron Beam Facility for Radiation Processing at Energies Between 300 keV and 25 MeV

51702 Practice for Dosimetry in a Gamma Facility for Radiation Processing

52303 Guide for Absorbed-Dose Mapping in Radiation Processing Facilities

52628 Practice for Dosimetry in Radiation Processing

52701 Guide for Performance Characterization of Dosimeters and Dosimetry Systems for Use in Radiation Processing

2.3 Codex Alimentarius Commission Recommended International Codes and Standards:⁴

CAC/RCP 1-1985, Rev. 1991, and 2001 General Standard for the Labelling of Prepackaged Foods

CAC/RCP 19-1979, Rev. 2003 Recommended International Code of Practice for the Operation of Irradiation Facilities for the Treatment of Foods

CAC/RCP 106-1983, Rev. 2003 General Standard for Irradiated Foods

CAC/RCP 9 Recommended International Code of Practice for Fresh Fish

CAC/RCP 16 Recommended International Code of Practice for Frozen Fish

CAC/RCP 17 Recommended International Code of Practice for Shrimps and Prawns

CAC/RCP 18 Recommended International Code of Hygienic Practice for Molluscan Shellfish

CAC/RCP 24 Recommended International Code of Practice for Lobsters

CAC/RCP 27 Recommended International Code of Practice for Minced Fish Prepared by Mechanical Separation

CAC/RCP 28 Recommended International Code of Practice for Crabs

CAC/RCP 37 Recommended International Code of Practice for Cephalopods

CAC/RCP 20 Code of Ethics for International Trade in Food

CAC/RCP 42 Sampling Plans for Prepackaged Foods (AQL 6.5)

2.4 ISO Standards:⁵

ISO 12749-4 Nuclear energy – Vocabulary – Part 4: Dosimetry for radiation processing

2.5 International Commission on Radiation Units and Measurements (ICRU) Reports:⁶

ICRU Report 80 Dosimetry Systems for Use in Radiation Processing

ICRU Report 85a Fundamental Quantities and Units for Ionizing Radiation

2.6 Joint Committee for Guides in Metrology (JCGM) Reports:

JCGM 100:2008, GUM 1995, with minor corrections Evaluation of measurement data – Guide to the Expression of Uncertainty in Measurement⁷

JCGM 200:2012, VIM International Vocabulary of Metrology – Basic and General Concepts and Associated Terms⁸

3. Terminology

3.1 Definitions:

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

$$D = d\bar{\epsilon}/dm$$

3.1.1.1 *Discussion*—The SI unit of absorbed dose is the gray (Gy), where 1 gray is equivalent to the absorption of 1 joule per kilogram of the specified material (1 Gy = 1 J / kg).

3.1.2 *absorbed dose mapping*—measurement of absorbed dose within an irradiated product to produce a one-, two-, or three-dimensional distribution of absorbed dose, thus rendering a map of absorbed dose values.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁶ Available from International Commission on Radiation Units and Measurements (ICRU), 7910 Woodmont Ave., Suite 400, Bethesda, MD 20841-3095, <http://www.icru.org>.

⁷ Document produced by Working Group 1 of the Joint Committee for Guides in Metrology (JCGM WG1). Available free of charge at the BIPM website (<http://www.bipm.org>).

⁸ Document produced by Working Group 2 of the Joint Committee for Guides in Metrology (JCGM WG2). Available free of charge at the BIPM website (<http://www.bipm.org>).

³ 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.

⁴ Available from Joint FAO/WHO Food Standards Program, Joint Office, Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, 00100 Rome, Italy.