Australian Standard™

Safety in laboratories

Part 4: Ionizing radiations

This Australian Standard was prepared by Committee, CH/26—Safety in Laboratories. It was approved on behalf of the Council of Standards Australia on 1 May 1998 and published on 5 July 1998.

The following interests are represented on Committee CH/26:

Agriculture Victoria

Australian Council of Trade Unions

CSIRO Manufacturing Science and Technology

Department of Defence, Australia

Department of Labour, New Zealand

Environmental Science and Research, New Zealand

ESR Kenepuru Science Centre, New Zealand

Ministry of Commerce, New Zealand

National Association of Testing Authorities, Australia

New Zealand Chemical Industry Council

New Zealand Microbiological Society

Victorian WorkCover Authority

WorkCover New South Wales

This Standard was prepared by the following participants:

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PREFACE

This Standard was prepared by Subcommittee CH/26/4, Ionizing Radiation, on behalf of the Joint Standards Australia/Standards New Zealand Committee CH/26, Safety in Laboratories, to supersede AS 2243.4(Int)—1994.

This Standard is the result of a consensus among representatives on the Joint Committee to produce it as an Australian Standard.

The objective of this Standard is to promote safe working practices and to prevent unnecessary exposure of persons working in laboratories containing sources of ionizing radiation.

This Standard was prepared after consideration of the *Recommendations for limiting exposure to ionizing radiation* (1995) [NOHSC:3022] and *National standard for limiting occupational exposure to ionizing radiation* [NOHSC:1013 (1995)] (Radiation Health Series No. 39) issued by the National Health and Medical Research Council (NHMRC) and Worksafe Australia, and the most recent recommendations of the International Commission on Radiological Protection (ICRP). Where necessary, future relevant publications of the NHMRC and ICRP should be consulted as they become available.

The sections of this Standard dealing with dose limits, accident and emergency procedures and the requirements for radiological laboratories have been further refined since the superseded interim edition. Where there is a choice of data, the most restrictive data is presented. For more detailed information, the referenced source documents should be consulted. The previous edition contained some design information for laboratories which has been omitted from this Standard and may now be found in AS/NZS 2982.1, *Laboratory design and construction*, Part 1: *General requirements*.

This Standard is Part 4 in a series aimed at promoting safety in laboratories. The series is as follows:

Part 1: General
Part 2: Chemical aspects
Part 3: Microbiology
Part 4: Ionizing radiations (this Standard)
Part 5: Non-ionizing radiations
Part 6: Mechanical aspects
Part 7: Electrical aspects
Part 8: Fume cupboards
Part 9: Recirculating fume cabinets
Part 10: Storage of chemicals

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this Standard.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

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FOREWORD

Radiation is the emission of energy, in the form of rays, wave motion or particles, from a source. The various kinds of radiation can be subdivided broadly as follows:

(a) *Ionizing radiations*—radiations that by reason of their nature and energy, interact with matter causing ionization by removing or adding electrons from or to the atoms of substances through which the radiations pass, including those that comprise the human organism. Sufficiently energetic radiation may also cause changes in the nuclei of the atoms in the substance. Ionizing radiation comprises X-rays, gamma rays, alpha particles, beta particles (i.e. high energy electrons), neutrons, protons and other nuclear particles. Ultraviolet radiation of wavelength less than 100 nm will also cause ionization in air.

(b) *Non-ionizing radiations*—radiations that do not cause ionization or nuclear changes, but can harm the human body in other ways. Potentially harmful non-ionizing radiations are propagated as electromagnetic waves (in particular, when the wavelength is between about 100 nm and 1 km), and acoustic noise (i.e. unwanted sound).

This Standard does not deal with non-ionizing radiation, which is covered in AS 2243.5, *Safety in laboratories*, Part 5: *Non-ionizing radiations*.

NOTES:

1 Although referred to in Item (a), ultraviolet radiation is generally classified as non-ionizing radiation and is therefore considered in AS 2243.5.

2 Radiation protection is concerned with the protection of individuals, their progeny, the human race as a whole and the environment, while still allowing necessary activities from which radiation exposure might result.

3 It should be noted that various forms of high voltage apparatus may produce ionizing radiations. Various chemicals and minerals may be radioactive by virtue of the fact that they contain traces of naturally occurring radioactive elements.

STANDARDS AUSTRALIA

Australian Standard

Safety in laboratories

Part 4: Ionizing radiations

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard sets out the precautions needed to prevent unnecessary exposure of persons using sources of ionizing radiation in laboratories and other persons who could be harmed by accidental or planned releases of radioactive substances or external beams of radiation. It also describes the important characteristics of ionizing radiation-producing substances and apparatus, the nature of the hazards, laboratory design requirements, and other essential radiation protection information.

It is recommended that the requirements of this Standard be implemented in all laboratories in which—

(a) radioactive substances are used or stored; or

(b) irradiating apparatus is operated.

As a guide to good practice, persons operating with radioactive substances in less than licensable quantities are invited to follow the principles contained in this Standard.

NOTE: The exposure of members of the public is considered in Appendix A.

1.2 REFERENCED DOCUMENTS A list of referenced documents and other related publications is provided in Appendix B.

1.3 DEFINITIONS For the purposes of this Standard, the definitions below apply.

1.3.1 Absorbed dose—the energy absorbed by matter from ionizing radiation per unit mass of irradiated substance. The SI unit of absorbed dose is the joule per kilogram, with the special name gray (Gy). For radiation protection purposes, the absorbed dose is averaged over a tissue or organ.

1.3.2 Activity—the average number of spontaneous nuclear transformations of a radionuclide occurring in unit time. The SI unit of activity is the becquerel (Bq), which is equal to one nuclear transformation per second.

1.3.3 Activity median aerodynamic diameter (AMAD)—The aerodynamic diameter (see Clause 1.3.5) of particles having the median activity of the aerosol of interest. That is, 50% of the aerosol activity is associated with larger particles. For dosimetry purposes, the AMAD can be taken to represent the aerosol.

1.3.4 Adequate protection—protection against ionizing radiations so that the radiation doses received by any person from external or internal sources, or both, are as low as is reasonably achievable (the ALARA principle), are below any constraints recommended for those sources by the National Health and Medical Research Council (NHMRC) and, in any event, do not exceed the maxima referred to in Section 4.

1.3.5 Aerodynamic diameter—the diameter, in μm, of a unit density sphere having the same aerodynamic characteristics as the particle of interest.