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Australia



Safety in laboratories

Part 5: Non-ionizing radiations — Electromagnetic, sound and ultrasound



AS 2243.5:2024

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- Australian Science Teachers Association
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Part 5: Non-ionizing radiations — Electromagnetic, sound and ultrasound

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Preface

This Standard was prepared by the Australian members of the joint Standards Australia/Standards New Zealand Committee CH-026, Safety in Laboratories, to supersede AS/NZS 2243.5:2004.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this document as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this document is to promote safe working practices by providing information on non-ionizing radiations encountered in laboratories and the associated hazards. It also specifies requirements and recommendations in order to prevent injury by non-ionizing sources of radiation, or by other hazards associated with their use.

A list of all parts in the AS (AS/NZS) 2243 series can be found in the Standards Australia online catalogue.

The major changes in this edition are as follows:

- (a) Incorporates specific requirements for LED technology.
- (b) Introduces specific warning signage for non-ionizing radiation sources.
- (c) Revises text on the various types of radiation.
- (d) Applies the Precautionary Principle as a structured approach to the analysis of risk for non-ionizing radiation.

The terms “normative” and “informative” are used in Standards to define the application of the appendices 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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Introduction

This document outlines precautions needed when working with radiations in the ultraviolet (UV), visible, infrared (IR), radiofrequency (RF) and extremely low frequency field (ELF) portions of the electromagnetic spectrum, as well as with acoustic (sound) and ultrasonic radiation.

This document includes information on work health and safety; however, the user of this document needs to refer to relevant regulations for any applicable requirements.

In recognition of the changes made to this document during its revision, it is recommended that existing facilities are assessed for risk and interim control measures are implemented. It is also recommended that current facilities and procedures are updated and improvements made to conform to this document, within a timeframe that takes into account the cost of upgrading and the severity of the associated risk.

NOTES

Australian Standard®

Safety in laboratories

Part 5: Non-ionizing radiations — Electromagnetic, sound and ultrasound

Section 1 Scope and general

1.1 Scope

This document promotes safe working practices by providing information on non-ionizing radiations encountered in laboratories and the associated hazards. It also specifies requirements and provides recommendations to prevent injury by non-ionizing sources of radiation or by other hazards associated with their use.

NOTE 1 This document does not provide an exhaustive treatment of usage and safety requirements for non-ionizing radiations.

This document does not cover—

- (a) field work performed outside the laboratory or exposure of persons to non-ionizing radiations for medical purposes; and
- (b) requirements for medical examinations for laboratory personnel who may be exposed to non-ionizing radiations.

NOTE 2 Refer to Codes of Practice, other Standards or legislation and regulations for any applicable requirements related to these examinations.

NOTE 3 [Appendix B](#) suggests advisory materials that apply to optical fibre systems.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 1319, *Safety signs for the occupational environment*

AS/NZS 1336, *Eye and face protection—Guidelines*

AS/NZS 1337.1, *Personal eye protection, Part 1: Eye and face protectors for occupational applications*

AS/NZS 1338.1, *Filters for eye protectors, Part 1: Filters for protection against radiation generated in welding and allied operations*

AS (AS/NZS) 2243 (all parts), *Safety in laboratories*

AS/NZS ISO 19818-1, *Eye and face protection — Protection against laser radiation, Part 1: Requirements and test methods*

AS/NZS IEC 60825-1, *Safety of laser products, Part 1: Equipment classification and requirements*

AS/NZS IEC 60825-14, *Safety of laser products, Part 14: A user's guide*

ARPANSA. Radiation Protection Series S-1. Standard for Limiting Exposure to Radiofrequency Fields — 100 kHz to 300 GHz

ARPANSA. RPS-12. Radiation Protection Series Publication No. 12: Radiation Protection Standard — Occupational exposure to ultraviolet radiation

1.3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 45001, AS/NZS 4801, AS/NZS IEC 62471, AS/NZS IEC 60825.1, AS/NZS IEC 60825.14, ARPANSA Radiation Protection Series Standard S-1, ICNIRP's *Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz – 100 kHz)* and the following apply.

1.4.1

accident

occurrence resulting in personal injury, disease, death, or property damage through exposure to non-ionizing radiation

1.4.2

Actinic radiation

photochemically active radiation

1.4.3

incident

any occurrence involving exposure to non-ionizing radiation that has the potential to cause personal injury, disease, death, or property damage

1.4.4

luminous

emitting a steady glowing light

1.4.5

may

indicates the existence of an option

1.4.6

non-ionizing radiation

any electromagnetic radiation of greater wavelength than 100 nm in air or vacuum, sound or ultrasound

1.4.7

radiation

emission or transfer of energy in the form of waves

1.4.8

risk

<in relation to any potential injury or harm> combination of the likelihood of occurrence of a work-related hazardous event(s) or exposure(s) and the severity of injury and ill health that can be caused by the event(s) or exposure(s)

[SOURCE: AS/NZS ISO 45001:2018, 3.21]

1.4.9

risk assessment

overall process of estimating the magnitude of risk and deciding what actions will be taken

[SOURCE: AS/NZS 4801:2001, 3.7]

1.4.10

shall

indicates that a statement is mandatory

1.4.11

should

indicates a recommendation

1.4.12**specular reflection**

reflection from a surface which maintains angular correlation between incident and reflected beams of radiation

Note 1 to entry: An example of this is a reflection from a mirror.

1.4 Wavelength bands

The wavelength band designations given in this document are approximate and reflect the conventions used within the referenced literature.

Section 2 General principles of protection

2.1 Hazard identification, risk assessment and control process

2.1.1 General

This process should, at a minimum, include the following:

- (a) Identification of the hazards associated with the operation of non-ionizing radiation sources.
NOTE [Appendix C](#) specifies the signage requirements of non-ionizing radiation sources.
- (b) Assessment of the nature of the risks associated with such identified hazards.
- (c) Evaluation of the required type of non-ionizing radiation, the degree of exposure of persons to the identified risks and the potential of those risks to cause injuries and illness.
- (d) Selection of controls, based on their effectiveness and the hierarchy of controls, to either eliminate or minimize risks.
- (e) Assessment of the level of training required for personnel who either operate the radiation emitting equipment or may be exposed to its radiation.

2.1.2 Risk assessment

Risk assessments of all non-ionizing radiation operations in the laboratory shall be conducted.

NOTE Refer to the relevant federal, state and territory regulations and codes of practice for any applicable requirements.

The AS/NZS 2243 series shall be taken into account as part of the risk assessment.

Tasks shall be assessed for risk —

- (a) during typical working hours;
- (b) outside of typical working hours; and
- (c) while working in isolation.

Risk associated with common and foreseeable deviations in operations shall be included in the assessment.

2.2 Hierarchy of controls

Control of risk shall be achieved by selecting one or more of the measures from the hierarchy of controls that, individually or in combination, achieve the required risk reduction. The measures selected shall be appropriate to the risks they are applied to. Controls are listed in the following order of priority:

- (a) Elimination of the hazard. If this is not practical, exposure to the risk should be prevented or minimised by one or a combination of the control measures listed below.
- (b) Substitution with a less hazardous process or less hazardous device.
- (c) Isolation and containment of the hazard. Examples include enclosing the source in a dedicated room or in an embedded system (housing).
- (d) Engineering controls, including redesign of equipment or work processes, and/or isolation and containment of the hazard. Examples include installing shielding, fail-safe interlocks, radiation detectors and alarms.

- (e) Administrative controls such as signage restricting access, hazard signs or warning lights.
- (f) Personal protective equipment (PPE). All users of radiation equipment shall be provided with the necessary PPE, as well as trained and supervised in its use in order to ensure that they have a clear understanding of its correct usage and limitations. In addition, the PPE shall be maintained and replaced as specified by the manufacturer so that its effectiveness is not compromised.

2.3 Controls

2.3.1 General

Use of non-ionizing radiation shall cease where direct exposure on skin, ears or eyes is expected to be greater than the exposure limits or levels specified in the referenced standards in each section.

Potentially hazardous areas shall be indicated by signs and barriers as specified in [Appendix C](#) and AS 1319, commensurate with the degree of risk.

There are numerous effective safeguards against the hazards of non-ionizing radiation. Some of these safeguards are generally applicable to all forms of non-ionizing radiation whereas others, which are specific, are detailed in the relevant section.

General safeguards include the following:

- (a) Shielding the source in order to protect individuals from direct or indirect exposure to the radiation.
- (b) Maximizing the distance between the source and the operator in order to limit exposure.
- (c) Minimizing the exposure time.
- (d) Providing individuals with PPE, such as laboratory clothing and suitable eye-shields.
- (e) Restricting the access of unauthorized persons.

Protocols for the application of these controls shall be developed, documented and implemented to ensure their effectiveness. The effectiveness should be checked by measurements or model calculation. It is important to consider the relevant ranges of parameters, for example the variation of irradiance with the type of source, the wavelengths of the emitted radiation and the unit of measurement encountered.

2.3.2 Training

All persons working in areas where potentially hazardous non-ionizing radiation sources are used should be trained in the following:

- (a) The nature of any associated hazard.
- (b) Minimization of the hazard.
- (c) Methods of protecting against injury and or illness.
- (d) Awareness of the potential for exposure and measures that can be taken to control the exposure, including possible treatment for any effect from over exposure.
- (e) Reporting suspected or confirmed incidents of over exposure to radiation which is to be medically assessed as soon as practical.
- (f) Regulatory requirements relating to the particular form of non-ionizing radiation.

NOTE Refer to Safe Work Australia's Code of Practice for guidance on health and safety in the workforce. Refer to the relevant standards for recommendations for radiation safety training.

2.3.3 Signage

For the safety of persons entering the laboratory, unambiguous warning signs shall be displayed at the entrance and in close proximity (e.g. 2 m) to the source of any hazardous non-ionizing radiation. The type of radiation shall be identified on the warning signs. Signs shall also be displayed indicating any PPE that needs to be used in the laboratory as well as any access restrictions and authorizations for entry.

NOTE See [Appendix C](#) for examples of signage.

2.3.4 Maintenance and service

Equipment shall be switched off during any maintenance and service on the device, particularly if the safety shielding is removed. Administrative controls may be used in combination with PPE. Instruction for service and/or maintenance adjustments and procedures may include:

- (a) Clear warning signage during service/maintenance.
- (b) Procedures to be used by persons other than a qualified agent.

2.4 Radiation incident and accident reporting

2.4.1 Reporting

Whenever a radiation incident or an accident occurs resulting in exposure to a potential or actual hazardous level of non-ionizing radiation, a report regarding the circumstances shall be prepared and provided to the relevant person.

NOTE 1 Refer to AS 1885.1 Sup 1 for a report format.

NOTE 2 Refer to the relevant regulatory authority for any requirements applicable to the reporting of radiation incidents and accidents.

2.4.2 Composition of the report

Unless otherwise specified in regulations, the report should contain the following:

- (a) A summary of the circumstances of the incident specifying the following:
 - (i) the nature of the incident and an estimate of the amount (dose) of radiation received by all persons involved.
 - (ii) The date, location and time of the incident.
 - (iii) Details of the level of training of persons directly involved and their experience with the equipment.
 - (iv) The cause of the incident or accident.
 - (v) The RPA or RSO's recommendations to prevent a recurrence.
 - (vi) The suspected nature of the injury sustained by each person.
- (b) Full statements from all persons (including, if practicable, the operator) who were engaged in the relevant operation, as well as from the RPA or RSO, who can detail any relevant information pertinent to the occurrence of the incident.