

AS 2243.1:2021



STANDARDS
Australia



Safety in laboratories

Part 1: Planning and operational aspects



AS 2243.1:2021

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- Bureau of Steel Manufacturers of Australia
- CSIRO
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- Institution of Chemical Engineers
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Safety in laboratories

Part 1: Planning and operational aspects

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Preface

This Standard was prepared by the Australian members of Joint Standards Australia/Standards New Zealand Committee, CH-026, Safety in Laboratories, to supersede AS/NZS 2243.1:2005.

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

The objective of this Standard is to provide general information, recommendations and procedures which will promote safe working in laboratories.

Major changes in this edition are as follows:

- (a) Update of existing definitions and addition of new definitions and abbreviated terms.
- (b) Addition of new clauses on electrical installations, as AS 2243.7—1991, *Safety in laboratories, Part 7: Electrical aspects*, is now obsolete.
- (c) Addition of new clauses on nanotechnology and fieldwork.
- (d) Update of existing Appendices. and addition of a new Appendix containing a field trip plan.

This Standard is Part 1 of an 8-part series designed to provide basic coverage of all important aspects of the safety function in laboratories. It deals with the general aspects of safety common to all kinds of laboratories and is intended to be used in conjunction with other Parts of the series, which relate to particular aspects of laboratory operations and to particular kinds of hazards. It emphasizes the importance of preventive measures and sets out safe practices, emergency procedures, and first aid.

The other Parts in the series are as follows:

AS 2243.2, *Safety in laboratories, Part 2: Chemical aspects and storage*

AS/NZS 2243.3, *Safety in laboratories, Part 3: Microbiological safety and containment*

AS/NZS 2243.4, *Safety in laboratories, Part 4: Ionizing radiations*

AS/NZS 2243.5, *Safety in laboratories, Part 5: Non-ionizing radiations — Electromagnetic, sound and ultrasound*

AS/NZS 2243.6, *Safety in laboratories, Part 6: Plant and equipment aspects*

AS/NZS 2243.8, *Safety in laboratories, Part 8: Fume cupboards*

AS/NZS 2243.9, *Safety in laboratories, Part 9: Recirculating fume cabinets*

The term “informative” is used in Standards to define the application of the appendix to which it applies. An “informative” appendix is only for information and guidance.

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Introduction

Safety in laboratories is impacted upon by design and construction. When combined with systems of work that are based on the recognition of hazards and control of risks, and appropriate attitudes and behaviours, we have an integrated approach to achieving a safe workplace.

Everyone has a responsibility to work safely in laboratories. The aim is for every person to be able to make informed decisions based on sound risk management principles.

Top leadership has a duty to provide information, instruction, training and supervision, and to communicate and reinforce safety rules and work practices. Increased alertness is required with personnel who are at greater risk of injury because of their age, inexperience and unfamiliarity with the work surroundings.

It is recommended that a health and safety management system or a quality management system be adopted for the control and review of all laboratory practices and procedures.

Australian Standard®

Safety in laboratories

Part 1: Planning and operational aspects

Section 1 Scope and general

1.1 Scope

This Standard sets out requirements, general procedures, precautions, recommendations and information designed to promote safety of persons and property in laboratory operations. The safety aspects described in this Standard apply to laboratory staff, maintenance staff, contractors, visitors and other authorized personnel, including students, cleaners and security staff who use or enter the laboratory facilities.

This Standard deals specifically with safe practices in laboratories and does not cover the design and construction of laboratories, which is covered in building regulations and is the subject of AS/NZS 2982.

1.2 Application

This Standard should be used in conjunction with the applicable part(s) of AS/NZS 2243 series that is relevant to the types of hazards commonly found in the laboratory and the common types of work being carried out in the laboratory.

For information for areas not covered within the AS/NZS 2243 series, refer to national, state or territory regulations. If the requirements of any part of this Standard conflict with any national, state or territory regulations, the statutory regulations apply.

While this Standard has been developed for laboratories in buildings, it may be used for guidance for laboratories and laboratory activities in other locations, such as in the field.

1.3 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 for informative purposes are listed in the Bibliography.

AS 1530.4, *Methods for fire tests on building materials, components and structures, Part 4: Fire-resistance tests of elements of building construction*

AS 1851.1, *Maintenance of fire protection equipment, Part 1: Portable fire extinguishers and fire blankets*

AS 1894, *The storage and handling of non-flammable cryogenic and refrigerated liquids*

AS 2243.2, *Safety in laboratories, Part 2: Chemical aspects and storage*

AS 2252.1, *Biological safety cabinets, Part 1: Biological safety cabinets, (Class I) for personnel and environment protection*

AS 2252.2, *Controlled environments, Part 2: Biological safety cabinets Class II — Design*

AS 2252.5, *Controlled environments, Part 5: Cytotoxic drug safety cabinets (CDSC) — Design, construction, installation, testing and use*

AS 2444, *Portable fire extinguishers and fire blankets — Selection and location*

AS 4332, *The storage and handling of gases in cylinders*

AS 4775, *Emergency eyewash and shower equipment*

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, *Filters for eye protectors (all parts)*

AS/NZS 1715, *Selection, use and maintenance of respiratory protective equipment*

AS/NZS 1716, *Respiratory protective devices*

AS/NZS 1800, *Occupational protective helmets — Selection, care and use*

AS/NZS 1801, *Occupational protective helmets*

AS/NZS 2210, *Occupational protective footwear (all parts)*

AS/NZS 2243.3, *Safety in laboratories, Part 3: Microbiological safety and containment*

AS/NZS 2243.4, *Safety in laboratories, Part 4: Ionizing radiations*

AS/NZS 2243.6, *Safety in laboratories, Part 6: Plant and equipment aspects*

AS/NZS 2243.8, *Safety in laboratories, Part 8: Fume cupboards*

AS/NZS 2243.9, *Safety in laboratories — Recirculating fume cabinets*

AS/NZS 60079, *Explosive atmospheres (all parts)*

AS/NZS 2647, *Biological safety cabinets — Installation and use*

AS/NZS 2982, *Laboratory design and construction*

AS/NZS 3000, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

AS/NZS 3105, *Approval and test specification — Electrical portable outlet devices*

AS/NZS 3504, *Fire blankets*

AS/NZS 3760, *In-service safety inspection and testing of electrical equipment*

UN, *Globally Harmonized System of Classification and Labelling of Chemicals (GHS)*

1.4 Terms and definitions

For the purpose of this Standard, the definitions below apply.

1.4.1

accident

any occurrence which results in personal injury, disease or death, or property damage

1.4.2

ADG Code

Australian code for the transportation of dangerous goods by road or rail

1.4.3

competent person

person who has acquired through training, qualifications or experience, or a combination of these, the knowledge and skills enabling that person to perform a specified task

1.4.4**corrosive**

having the characteristic of damaging or destroying by direct chemical action; this includes the effect of caustic substances

1.4.5**cryogenic liquid**

liquid having a normal boiling point below -90°C at atmospheric pressure (101.3 kPa)

[SOURCE: AS 1894—1997, 1.5.9]

1.4.6**dangerous goods**

substances, mixtures or articles that —

- (a) satisfy the UN tests and criteria for determining whether they are dangerous goods;
- (b) are listed in the ADG Code; or
- (c) are determined to be dangerous goods by relevant legislation.

Note 1 to entry: UN tests and criteria are specified in the *UN Manual of Tests and Criteria* and the *UN Recommendations on the Transport of Dangerous Goods — Model Regulations*.

1.4.7**exposure standard**

airborne concentration of a particular substance in the worker's breathing zone, exposure to which, according to current knowledge, should not cause adverse health effects nor cause undue discomfort to nearly all workers

1.4.8**fieldwork**

working in the field

gathering of information either through passive observation, or the conducting of scientific activities in a natural environment, rather than in a place of study such as a research or teaching laboratory in a building

Note 1 to entry: Fieldwork can be further categorized on the basis of the time or significant distance from essential emergency and required services such that the location presents a significant increase in risk.

1.4.9**fire-isolated compartment**

portion of a building separated from another portion or portions by fire-resisting construction

1.4.10**fire-resisting (as applied to a structural member or other part of a building)**

having resistance rating, determined in accordance with the fire-resistance test set out in AS 1530.4, required for that structural member or other part

1.4.11**flammable**

capable of being ignited and of burning in air

1.4.12**flammable liquid**

liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc., but not including substances otherwise classified on account of their dangerous characteristics) which give off a flammable vapour at temperatures of not more than 60°C , closed cup test, normally referred to as the flash point

[SOURCE: AS 1940:2017, 1.4.28]

1.4.13**flash point**

lowest temperature, corrected to a barometric pressure of 101.3 kPa, at which application of a test flame causes the vapour of the test portion to ignite under the specified conditions of a test

Note 1 to entry: Closed-cup flash point methods are given in the AS/NZS 2106 series.

1.4.14**Globally Harmonized System of Classification and Labelling of Chemicals****GHS**

international system of classification and labelling of chemicals, published by the United Nations

1.4.15**harmful processes**

processes in which energy or harmful substances are used or produced and which, upon uncontrolled release, can cause injury or illness to persons or can damage property

1.4.16**hazard**

source or a situation with a potential for harm in terms of human injury or ill-health, damage to property, damage to the environment, or a combination of these

[SOURCE: AS/NZS 4801—2001, 3.5]

1.4.17**hazardous chemical**

<Australia> any substance, mixture or material that satisfies the criteria of one or more Globally Harmonized System of Classification and Labelling of Chemicals (GHS) hazard classes, including a classification in Schedule 6 of the WHS Regulations

1.4.18**hazardous substance**

<New Zealand> any substance that triggers any one of the threshold levels defined in the Hazardous Substances (Minimum Degrees of Hazard) Regulations 2017

1.4.19**incident**

any unplanned event resulting in, or having a potential for injury, ill-health, damage or other loss

[SOURCE: AS/NZS 4801—2001, 3.9]

1.4.20**laboratory**

any building or part of a building used, or intended to be used, for scientific or technical work, including research, quality control, testing, teaching or analysis

Note 1 to entry: Such work may involve the use of chemicals and gases, pathogens and radiation, or processes including electrical or mechanical work. The laboratory includes such support areas as instrument and preparation areas, laboratory stores and any offices attached or adjacent to the laboratory.

Note 2 to entry: AS/NZS 2982 contains definitions of various types of laboratories.

1.4.21**laboratory compartment**

fire-isolated compartment in a laboratory, being either the whole laboratory or a subdivision of the laboratory

Note 1 to entry: A laboratory compartment may be divided into subcompartments such as workrooms, stores or offices, or may be an open-plan area.

1.4.22**laboratory waste**

all liquid, solid or gaseous material that results from laboratory operations and is for disposal

1.4.23**may**

indicates the existence of an option

1.4.24**nanotechnology**

application of scientific knowledge to manipulate and control matter predominantly in the nanoscale (length range approximately from 1 nm to 100 nm) to make use of size- and structure-dependent properties and phenomena distinct from those associated with individual atoms or molecules, or extrapolation from large sizes of the same material

Note 1 to entry: Manipulation and control includes material synthesis.

[SOURCE: SA/TS 80004-1:2015, 2.1 and 2.3]

1.4.25**plant**

any machinery, equipment (including scaffolding), appliance, implement or tool and any component or fitting thereof or accessory thereto

1.4.26**residual current device****RCD**

device intended to isolate supply to protected circuits, socket-outlets or electrical equipment in the event of a current flow to earth that exceeds a predetermined value

[SOURCE: AS/NZS 3000:2018, 1.4.102]

1.4.27**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]

1.4.28**risk assessment**

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

[SOURCE: AS/NZS 4801—2001, 3.7]

1.4.29**safety data sheet****SDS**

document which provides information on the identification, hazards, precautions for use and safe handling of a specific chemical product

Note 1 to entry: Refer also to Safe Work Australia, *Model Code of Practice: Preparation of Safety Data Sheets for Hazardous Chemicals*.

1.4.30**shall**

indicates that a statement is mandatory

1.4.31**should**

indicates a recommendation

1.4.32**toxic substance**

substances liable either to cause death or serious injury, or to harm human health, if swallowed or inhaled, or following eye or skin contact

Note 1 to entry: Such substances —

- (a) are listed in the *ADG Code* or NZS 5433; or
- (b) meet the classification criteria set out in the *UN Manual of Tests and Criteria* or NZS 5433; or
- (c) in New Zealand, meet the criteria of the *Hazardous Substances (Health and Safety Reform Revocations) Regulations 2017*

1.4.33**working in isolation**

work carried out in an area where normal means of contact (e.g. verbal, sight) with other staff are not available, so that the potential risk of existing hazards is increased to the extent that extra precautions are needed

Note 1 to entry: This includes working in isolated areas on or off-site, either during or outside normal working hours.

Section 2 Planning the laboratory for safety

2.1 General

Aspects of laboratory operations pertaining to particular kinds of hazards are covered in other Parts of the AS/NZS 2243 series as follows:

- (a) For chemical aspects, refer to AS 2243.2.
- (b) For microbiological safety and containment, refer to AS/NZS 2243.3.
- (c) For ionizing radiation, refer to AS/NZS 2243.4.
- (d) For non-ionizing radiation, refer to AS/NZS 2243.5.
- (e) For plant and equipment aspects, refer to AS/NZS 2243.6.
- (f) For fume cupboards, refer to AS/NZS 2243.8.
- (g) For recirculating fume cabinets, refer to AS/NZS 2243.9.

NOTE 1 For other aspects, including manual handling, electrical aspects, confined spaces and noise, reference should be made to relevant national, state and territory legislation, codes of practice or other standards.

NOTE 2 For any particular operation, hazards are likely to be identified in more than one aspect and each aspect may require a different document to be consulted.

2.2 Design and construction

2.2.1 General

Laboratory design and construction shall be in accordance with AS/NZS 2982, the requirements of which apply to the design of both new laboratories and existing buildings which have been converted to a laboratory or to a different type of laboratory use. At the planning stage, risk assessment and hazard and operability (HAZOP) studies (refer to AS IEC 61822) shall be carried out. Special consideration shall be given to access, egress and security, as well as to the design and construction of laboratories and of their facilities.

2.2.2 Laboratory layout

In the process of designing the laboratory, attention shall be given to manual handling and work flow issues, including traffic routes, traffic volumes and the carrying out of repetitive operations.

The minimum spacing for benches shall be as specified in AS/NZS 2982. The minimum spacing for biological safety cabinets shall be as specified in AS/NZS 2647 and the minimum spacing for fume cupboards shall be as specified in AS/NZS 2243.8. Benches and large items of equipment should be arranged so that employees can work without being impeded or subjected to danger by others working in the laboratory. Benches and large items of equipment shall not be moved after the final layout has been established, without a risk assessment of the consequences (see [Clause 3.1.2](#)). Bench heights and widths should be designed taking into account the type of work to be performed. Guidance should be sought from AS/NZS 2982.

NOTE Consideration should be given to ergonomics and available lighting, particularly where computer and other screen-based equipment is to be used. The height of screen-based equipment should be adjusted to minimize the potential for overuse strain injury.

2.2.3 Protection against sunlight

Direct sunlight should be prevented from entering the interior of the laboratory where it can affect the work being carried out (also refer to AS 2243.2 and AS/NZS 2982).

NOTE 1 An important aspect of laboratory safety is that volatile chemicals and liquids should not be subjected to heat from sunlight.

NOTE 2 Sunlight can also cause formation of unstable by-products in certain chemicals, and degrade certain plastic containers.

2.2.4 Eating facilities

Facilities for storage, preparation and consumption of food and drink shall be provided outside the laboratory and be readily accessible by laboratory staff.

2.2.5 Amenities

Hand washing facilities shall be provided within laboratories (refer to AS/NZS 2982).

Non-emergency showering facilities, readily accessible but external to the laboratory, may be required, depending upon the tasks being carried out and the quantity of chemicals being used.

Changing facilities, including clothing storage facilities, may also be required.

NOTE Other Parts in the AS/NZS 2243 series may contain more specific requirements for the positioning of amenities.

2.2.6 Write-up areas

Precautions shall be taken to ensure that reading and writing materials do not become contaminated or damaged.

Write up areas shall be separated from areas where hazardous materials are used or harmful processes are undertaken (refer to AS/NZS 2982).

NOTE Write up areas in laboratories should only be used on a temporary basis and should not be used as a substitute for office areas/activities.

2.2.7 Storage place

Provision shall be made for the housing of laboratory records, stores and equipment which are currently not in use.

2.2.8 Access for disabled persons

Where a disabled person uses the laboratory, special facilities may be required to ensure a safe system of work. A review of the risk assessment program for the laboratory procedures shall be undertaken to confirm that no additional risks are present for the disabled person or their work colleagues.

In designing the laboratory, provision shall be made for safe access and egress for disabled persons during any emergency.

NOTE There are statutory requirements that address discrimination against persons on the grounds of disability that include work, education and access to premises.

2.3 Fire detection and fire protection

Fire protection equipment or automatic fire detection equipment shall be installed in a laboratory where there is a foreseeable risk of fire or explosion.

If substances that can pose a fire or explosion risk are used in a laboratory, risk control measures shall be applied. Electrical equipment that is a source of ignition in normal operation, e.g. switches, socket outlets, contactors, relays and circuit breakers, shall not be installed less than 300 mm above floor level in a laboratory where flammable liquids or heavier-than-air flammable gases are handled.

Storage and handling of flammable and combustible liquids shall be in accordance with AS 1940.

NOTE 1 Examples of risk control measures include procedural controls that minimize the quantity of materials handled, use of containers that are not likely to break if dropped, maintaining segregation of reactive chemicals and having response procedures in case of an accident such as spillage.

NOTE 2 Electrical equipment that is selected and installed with increased safety measures in accordance with AS/NZS 60079.14 is not considered an ignition source.

NOTE 3 Examples of areas where protection equipment or automatic fire detection equipment may be required are given in [Appendix A](#).

2.4 Emergency alarm systems and associated operations

Because of the distinctive nature of the operations being carried out within a laboratory, the need may arise to evacuate the building for emergencies other than fire. An independent intercommunication system in accordance with AS 1670.4 should be installed.

The following emergency equipment shall be provided for a laboratory occupancy:

- (a) An emergency evacuation alarm system which is audible in all parts of the building and is accompanied by a visual alarm where the specific circumstances can prevent the identification of the audible alarm, e.g. background noise levels.

Remote signalling systems connecting the emergency alarm and any automatic detection or protection devices to an attended location.

- (b) Where remote signalling systems are impracticable, alternative means of direct communication shall be provided.

- (c) Annunciator (indicator) panels for all automatic detection, extinguishing and manual alarm systems, in locations easily accessible to the attending emergency service, to indicate the location of any detection, extinguishing or manual alarm device which has operated. Annunciator panels shall be clearly and conspicuously marked.

NOTE 1 Refer to relevant national, state and territory regulations regarding information to be provided alongside panels.

- (d) When actuated, by any automatic or manual fire or gas detection, protection or alarm device, mechanical ventilation systems shall exhaust air so that there is no recirculation.

- (e) The laboratory exhaust system and fume cupboards shall continue to operate unless manually shut down.

NOTE 2 Guidance on flammable gas detection equipment is provided in AS/NZS 60079.29.2 and guidance on toxic gas detection equipment is provided in IEC 62990-2.

2.5 Information on substances

2.5.1 Safety data sheets and inventory

An inventory of hazardous chemicals used in the laboratory and safety information in the form of safety data sheets shall be readily accessible and understandable to all personnel. This information shall also be available external to the laboratory in an accessible place known to the emergency services.

NOTE Refer to relevant national, state and territory regulations for the preparation of safety data sheets.