

Australian/New Zealand Standard™

Safety in laboratories

Part 1: Planning and operational aspects



AS/NZS 2243.1:2005

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee CH-026, Safety in Laboratories. It was approved on behalf of the Council of Standards Australia on 20 December 2004 and on behalf of the Council of Standards New Zealand on 21 January 2005.
This Standard was published on 11 February 2005.

The following are represented on Committee CH-026:

Australian Industry Group
Australian Institute of Occupational Hygienists
CSIRO
Department of Labour, New Zealand
Department of Primary Industries (Victoria)
Environmental Science and Research, New Zealand
Ministry of Economic Development, New Zealand
National Association of Testing Authorities, Australia
National Measurement Institute, Australia
The New Zealand Chemical Industry Council
New Zealand Microbiological Society
Royal Australian Chemical Institute
Victorian WorkCover Authority
WorkCover New South Wales

Additional Interests:

Fume extraction equipment manufacturing interests
Independent consultant health physicist
Monash University
University of Western Australia

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.standards.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

Alternatively, both organizations publish an annual printed Catalogue with full details of all current Standards. For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

This Standard was issued in draft form for comment as DR 04256.

Australian/New Zealand Standard™

Safety in laboratories

Part 1: Planning and operational aspects

Originated in Australia as AS 2243.1—1979.
Previous edition AS/NZS 2243.1:1997.
Fifth edition 2005.

COPYRIGHT

© Standards Australia/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Jointly published by Standards Australia, GPO Box 5420, Sydney, NSW 2001 and Standards New Zealand, Private Bag 2439, Wellington 6020

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee, CH-026, Safety in Laboratories, to supersede AS/NZS 2243.1:1997, *Safety in laboratories Part 1: General*.

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) Provision of clearer guidance on risk management processes for a laboratory and alignment with AS/NZS 4801, especially for terminology relating to occupational health and safety management.
- (b) Text assigning responsibilities to particular laboratory staff members has been rewritten to a systemic approach to reflect the recommendations of Standardization Guide 17.1, *Drafting of standards that may be referenced under occupational health and safety legislation*, to remove specific assignment of duties.
- (c) Provision of increased guidance on local exhaust ventilation options.
- (d) Removal of the injury report form that had been copied from AS 1885.1 into an Appendix of AS/NZS 2243.1:1997.

The Standard comprises Part 1 of a 10-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 stresses the importance of preventive measures and sets out safe practices, emergency procedures, and first aid.

The other Parts in the series are as follows:

- Part 2: Chemical aspects
- Part 3: Microbiological aspects and containment facilities
- Part 4: Ionizing radiations
- Part 5: Non-ionizing radiations—Electromagnetic, sound and ultrasound
- Part 6: Mechanical aspects
- Part 7: Electrical aspects
- Part 8: Fume cupboards
- Part 9: Recirculating fume cabinets
- Part 10: Storage of chemicals

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.

CONTENTS

	<i>Page</i>
FOREWORD.....	4
 SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	5
1.2 APPLICATION	5
1.3 REFERENCED AND RELATED DOCUMENTS	5
1.4 DEFINITIONS	5
 SECTION 2 PLANNING THE LABORATORY FOR SAFETY	
2.1 GENERAL	9
2.2 DESIGN AND CONSTRUCTION	9
2.3 FIRE DETECTION AND EXPLOSION PROTECTION	10
2.4 EMERGENCY ALARM SYSTEMS AND ASSOCIATED OPERATIONS	11
2.5 INFORMATION ON SUBSTANCES	11
2.6 SAFETY EQUIPMENT	12
2.7 ROOM VENTILATION	13
2.8 LOCAL EXHAUST VENTILATION (INCLUDING FUME CUPBOARDS)	13
2.9 ELECTRICAL INSTALLATIONS	15
 SECTION 3 LABORATORY SAFETY AND EMERGENCY MANAGEMENT	
3.1 LABORATORY SAFETY MANAGEMENT SYSTEMS	16
3.2 FIRE, EMERGENCY AND RESCUE PROCEDURES.....	19
3.3 SAFETY INSPECTIONS	20
 SECTION 4 GENERAL SAFETY PROCEDURES	
4.1 REQUIREMENTS FOR SAFE CONDUCT	21
4.2 USE OF PERSONAL PROTECTIVE EQUIPMENT (PPE).....	22
4.3 CONTAINERS FOR SUBSTANCES.....	24
4.4 USE OF LOCAL EXHAUST VENTILATION (INCLUDING FUME CUPBOARDS)	24
4.5 GENERAL LABORATORY PRACTICES	25
4.6 OPERATION OF INSTRUMENTS	28
4.7 OPERATIONS UNDER VACUUM	28
4.8 OPERATIONS UNDER INTERNAL PRESSURE.....	30
4.9 OPERATIONS USING MICROWAVE EQUIPMENT	30
4.10 HANDLING, LABELLING AND DISPOSAL OF LABORATORY WASTES.....	30
 APPENDICES	
A LIST OF REFERENCED AND RELATED DOCUMENTS	33
B HAZARDOUS AREAS NEEDING AUTOMATIC FIRE DETECTION OR PROTECTION DEVICES.....	38
C HIGH RISK HAZARDS.....	39

FOREWORD

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, 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. Management has a duty to provide information, instruction, training and supervision. Management should communicate and reinforce safety rules and work practices. They should show leadership and foster appropriate attitudes and behaviours in all personnel who work in laboratories. Increased alertness is required with regard to personnel who are at greater risk of injury because of their age, inexperience and unfamiliarity with the work surroundings.

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

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand 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.

NOTE: This Standard does not cover field work performed outside the laboratory.

1.2 APPLICATION

This Standard should be used in conjunction with the appropriate part(s) of AS/NZS 2243 that are relevant to the type of work being carried out in the laboratory. If the requirements of any part of this Standard conflict with any National, State or Territory regulations, the appropriate statutory regulations shall 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 vehicles or vessels.

1.3 REFERENCED AND RELATED DOCUMENTS

A list of referenced and related documents is given in Appendix A.

1.4 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 Competent person

A 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.

1.4.3 Corrosive

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

1.4.4 Cryogenic liquid

A liquid having a normal boiling point below -90°C at atmospheric pressure (101.3 kPa). [AS 1894]

1.4.5 Dangerous goods

(Australia) Substances and 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 the competent authority under Regulation 2.2 of the *Road Transport Reform (Dangerous Goods) Regulations*. [AS/NZS 3833]

(New Zealand) Substances having properties described in Table A of NZS 5433:1999, and includes packaging and empty containers that have not been cleaned after containing dangerous goods.

NOTE: 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*.

1.4.6 Exposure standard

An 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. The exposure standard can be of three forms: time-weighted average (TWA), peak, or short-term exposure limit (STEL) (see NOHSC:1003 or NZ Department of Labour (OSH) Workplace Exposure Standards), all of which are defined as follows:

- (a) *Time-weighted average (TWA)* The average airborne concentration of a particular substance when calculated over a normal eight-hour work day, for a five-day working week.
- (b) *Peak* A maximum or peak airborne concentration of a particular substance determined over the shortest analytically practicable period of time, which does not exceed 15 min.
- (c) *Short-term exposure limit (STEL)* A 15 min TWA exposure which should not be exceeded at any time during a work day even if the eight-hour TWA average is within the TWA exposure standard. Exposures at the STEL should not be longer than 15 min and should not be repeated more than four times per day. There should be at least 60 min between successive exposures at the STEL.

1.4.7 Fire-isolated compartment

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

1.4.8 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.

1.4.9 Flammable

Capable of being ignited and of burning in air.

1.4.10 Flammable liquid

A liquid which is defined in the ADG Code/NZS 5433 as a Class 3 liquid (see AS 1940).

1.4.11 Flash point

The minimum temperature at which, under specified test conditions, a substance emits sufficient flammable gas to ignite momentarily on application of an ignition source.

NOTE: AS/NZS 2106 provides appropriate test methods.

1.4.12 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.

1.4.13 Hazard

A 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. [AS/NZS 4801]

1.4.14 Hazardous substance

(Australia) A substance which has been classified as hazardous in accordance with NOHSC:1008 or is listed in NOHSC:10005.

(New Zealand) Any substance that triggers any one of the threshold levels defined in the *Hazardous Substances (Minimum Degrees of Hazard) Regulations 2001* for any of the hazard properties listed in the *Hazardous Substances and New Organisms Act 1996*.

1.4.15 Incident

Any unplanned event resulting in, or having a potential for injury, ill-health, damage or other loss. [AS/NZS 4801]

1.4.16 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. Such work may involve the use of chemicals (including dangerous goods and hazardous substances), 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.

NOTES:

- 1 In a multi-occupancy building, the area occupied by the laboratory may be referred to as the laboratory area.
- 2 AS/NZS 2982.1 contains definitions of various types of laboratories.

1.4.17 Laboratory compartment

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

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

1.4.18 Laboratory waste

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

1.4.19 Material safety data sheet (MSDS)

A document that describes the properties and uses of a material, that is, identity, chemical and physical properties, health hazard information, precautions for use and safe handling information.

NOTE: MSDSs are also known as safety data sheets (SDSs) in New Zealand.

1.4.20 May

Indicates the existence of an option.

1.4.21 Plant

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

1.4.22 Risk

(In relation to any potential injury or harm.) The likelihood and consequence of that injury or harm occurring. [AS/NZS 4801]

1.4.23 Risk assessment

The overall process of estimating the magnitude of risk and deciding what actions will be taken. [AS/NZS 4801]

1.4.24 Safety

A state in which the risk of harm (to persons) or damage is limited to an acceptable level. [AS/NZS 4801]

1.4.25 Shall

Indicates that a statement is mandatory.

1.4.26 Should

Indicates a recommendation.

1.4.27 Toxic substance

A substance which, when introduced in sufficient quantity by methods such as ingestion, inhalation or absorption, destroys or threatens to destroy life, or injures health.

NOTES:

- 1 The word 'toxic' has the same meaning as 'poisonous'.
- 2 The effects of toxicity can also occur due to cumulative or long-term exposure to the toxic substance.

1.4.28 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. 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, see AS/NZS 2243.2.
- (b) For microbiological aspects and containment facilities, see AS/NZS 2243.3.
- (c) For ionizing radiation, see AS 2243.4.
- (d) For non-ionizing radiation, see AS/NZS 2243.5.
- (e) For mechanical aspects, see AS 2243.6.
- (f) For electrical aspects, see AS 2243.7.
- (g) For fume cupboards, see AS/NZS 2243.8.
- (h) For recirculating fume cabinets, see AS/NZS 2243.9.
- (i) For storage of chemicals, see AS/NZS 2243.10.

For other aspects, including manual handling, plant, confined spaces and noise, reference should be made to relevant National, State and Territory legislation, codes of practice or other standards.

NOTE: 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 comply with AS/NZS 2982.1, 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, the risks in the laboratory shall be eliminated or reduced and 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 2982.1. 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.

Consideration should be given to appropriate 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 (see AS 3590.2).

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 (see also AS/NZS 2243.10 and AS/NZS 2982.1).

NOTES:

- 1 An important aspect of laboratory safety is that volatile chemicals and liquids should not be subjected to heat from sunlight.
- 2 Sunlight can also cause formation of unstable by-products in certain chemicals, and degrade certain plastic containers.

2.2.4 Eating facilities

Adequate facilities for storage, preparation and consumption of food and drink shall be provided outside the laboratory and readily accessible by laboratory staff (see also AS/NZS 2982.1).

2.2.5 Amenities

Hand washing facilities, sufficient for the number of staff and the tasks being undertaken, should be provided within laboratories (see AS/NZS 2982.1).

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.

2.2.7 Storage place

Provision should 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 is required to use 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 should be undertaken to confirm that no additional risks are present for the disabled person or their work colleagues.

In designing the laboratory, provision should 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 EXPLOSION 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.

For a laboratory where substances that can pose a fire or explosion risk are used, hazardous areas shall be classified in accordance with AS/NZS 2430.3.6.

In some situations, more than one type of protection should be provided. For example, flammable liquid stores should have automatic detection, automatic extinguishing and, where necessary, explosion-venting equipment.

NOTE: Examples of areas where protection equipment or automatic fire detection equipment would be required are given in Appendix B.

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. Accordingly, consideration should be given to installing an independent intercommunication system which complies with AS 1670.4 and relevant regulations. 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.
- (b) Remote signalling systems connecting the emergency alarm and any automatic detection or protection devices to an attended location.

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: Reference should be made to statutory 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.

NOTE: The laboratory exhaust system and fume cupboards should continue to operate unless manually shut down by the personnel in charge of the laboratory.

2.5 INFORMATION ON SUBSTANCES

2.5.1 Material safety data sheets and inventory

An inventory of hazardous substances and dangerous goods used in the laboratory and safety information in the form of material 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. (Refer also to NOHSC:2011 in Australia and NZ Department of Labour (OSH) *Guidelines for the preparation of MSDSs in New Zealand* (1995).)

In New Zealand, the *Hazardous Substances (Tracking) Regulations 2001* and the *Hazardous Substances (Exempt Laboratories) Regulations 2001* shall be consulted.

2.5.2 Storage and use of substances

The storage, handling and use of substances in laboratories shall be in accordance with the requirements of AS/NZS 2243.2, AS/NZS 2243.10, AS 4332 and AS/NZS 2982.1.

2.5.3 Labelling

Substances shall be adequately labelled and personnel using the substances shall be made familiar with the relevant hazardous properties.

NOTE: Relevant National, State or Territory regulations should be consulted in addition to NOHSC:2012 in Australia.

2.5.4 Warnings

Appropriate warning placards shall be placed in internal locations and on the external wall of the building, as required by National, State, and Territory regulations (see also AS/NZS 2982.1 in Australia and NZCIC *Hazardous Substances and New Organisms (HSNO) Approved Code of Practice, Signage for premises storing hazardous substances and dangerous goods* in New Zealand).

2.5.5 Change in laboratory tasks

Before a change is made in the tasks performed within a laboratory compartment that involves the storage or use of substances, that compartment shall be assessed for its suitability for the new task.

2.5.6 Liaison with emergency services

A regular liaison should be maintained with emergency services to inform them of the nature of hazards in the laboratory and of the emergency requirements.

2.6 SAFETY EQUIPMENT

Fixed safety equipment shall be as specified in AS/NZS 2982.1. Each eyewash and safety shower shall be tested and maintained in accordance with ANSI Z358.1.

NOTE: Other Parts in the AS/NZS 2243 series, may contain more specific requirements for the positioning of safety equipment.

The following additional safety equipment shall be available and accessible to all staff within the laboratory area:

- (a) Fire extinguishers, installed in each laboratory in accordance with AS 2444, which shall be maintained in accordance with AS 1851.1.
- (b) Fire blankets, manufactured in accordance with AS/NZS 3504.
NOTE: Asbestos blankets should be replaced with fire blankets that comply with AS/NZS 3504.
- (c) Adequate first aid facilities and supplies (see appropriate National, State or Territory regulations).
- (d) Suitable spill kits (see AS/NZS 2243.2).
- (e) A manual containing safety procedures.

NOTE: If there is a risk of damage by grease, chemicals, or humidity, the pages of the manual should have a protective coating or be sealed in suitable transparent envelopes.

Where outside support is not relied upon for self-contained breathing apparatus (SCBA), a minimum of two sets of SCBA should be accessible to personnel competent in its use within the laboratory area. The decision on whether to provide SCBA, for use in operations, spillages of hazardous substances, dangerous operations and emergency rescue operations, should be based on a risk assessment of the potential for exposure to hazardous atmospheres if responding to emergency situations. The assessment should take account of the ability of local emergency services to respond. Where provided, self-contained breathing apparatus shall be maintained in accordance with AS/NZS 1715.

In addition to the safety equipment held in the laboratory, an area at the entrance to each main laboratory or laboratory occupancy (complex) should be a safety station containing safety equipment compatible with the work being performed, such as the following:

- (i) Safety glasses and face shields.