COMMITTEE BD-046

DR 09033

(Project ID: 5394)

Draft for Public Comment Australian/New Zealand Standard

LIABLE TO ALTERATION—DO NOT USE AS A STANDARD

BEGINNING DATE FOR COMMENT:	**24 April 2009**
CLOSING DATE FOR COMMENT:	**26 June 2009**

Laboratory design and construction

(Revision of AS/NZS 2982.1:1997)

STANDARDS Australia

STANDARDS NEW ZEALAND PAEREWA AOTEAROA

Draft for Public Comment
Australian/New Zealand Standard

The committee responsible for the issue of this draft comprised representatives of organizations interested in the subject matter of the proposed Standard. These organizations are listed on the inside back cover.

Comments are invited on the technical content, wording and general arrangement of the draft.

The preferred method for submission of comment is to download the MS Word comment form found at http://www.standards.com.au/Catalogue/misc/Public Comment Form.doc. This form also includes instructions and examples of comment submission.

When completing the comment form ensure that the number of this draft, your name and organization (if applicable) is recorded. Please place relevant clause numbers beside each comment.

Editorial matters (i.e. spelling, punctuation, grammar etc.) will be corrected before final publication.

The coordination of the requirements of this draft with those of any related Standards is of particular importance and you are invited to point out any areas where this may be necessary.

Please provide supporting reasons and suggested wording for each comment. Where you consider that specific content is too simplistic, too complex or too detailed please provide an alternative.

If the draft is acceptable without change, an acknowledgment to this effect would be appreciated.

When completed, this form should be returned to the Projects Manager, Celine De Sousa via email to celine.desousa@standards.org.au.

Normally no acknowledgment of comment is sent. All comments received electronically by the due date will be put before the relevant drafting committee. Because Standards committees operate electronically we cannot guarantee that comments submitted in hard copy will be considered along with those submitted electronically. Where appropriate, changes will be incorporated before the Standard is formally approved.

If you know of other persons or organizations that may wish to comment on this draft Standard, could you please advise them of its availability. Further copies of the draft are available from the SAI Global Customer Service Centre listed below and from our website at http://www.saiglobal.com/.

SAI GLOBAL Customer Service Centre

Telephone: 13 12 42

Facsimile: 1300 65 49 49

e-mail: mailto:sales@saiglobal.com

Internet: http://www.saiglobal.com/shop

Draft for Public Comment

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Committee BD-046—Laboratory Design and Construction

DRAFT

Australian/New Zealand Standard

Laboratory design and construction

Part : 1

(Revision of AS/NZS 2982.1:1997)

(To be AS/NZS 2982:200X)

This draft was prepared by Standards Australia Committee BD-046.

Comment on the draft is invited from people and organizations concerned with this subject. It would be appreciated if those submitting comment would follow the guidelines given on the inside front cover.

This document is a draft Australian/New Zealand Standard only and is liable to alteration in the light of comment received. It is not to be regarded as an Australian/New Zealand Standard until finally issued as such by Standards Australia/Standards New Zealand.

PREFACE

This Standard was prepared by the members of the Joint Standards Australia/Standards New Zealand Committee BD-046, Laboratory Design and Construction, to supersede AS/NZS 2982.1:1997, *Laboratory design and construction*, Part 1: *General requirements*. This Standard specifies requirements for the design and construction of laboratories based mainly on maximizing the safety of such facilities.

This Standard supplements the AS/NZS 2243 series, which refers mainly to safe working practices in laboratories. However, the AS/NZS 2243 series also includes some design and construction requirements particularly for specialized components (e.g. fume cupboards) and applications (e.g. physical containment). Reference to both AS/NZS 2982 and the AS/NZS 2243 series is recommended where laboratories are being assessed or planned.

This Standard is designed to help organizations responsible for commissioning and operating laboratories to provide a safe workplace. A laboratory must be designed, constructed, maintained and operated to minimize hazards and reduce risks to personal or public safety to an acceptable level.

While conformity to this Standard will enhance the safety of the workplace, disregard for safe working practices may negate the provisions for safety that are built into a laboratory. It is therefore essential that all personnel, including non-technical staff and visitors, be aware of and follow safe working procedures.

The Committee does not suggest that any of the provisions of this Standard are retrospective. However, users are encouraged to critically reassess their laboratories and adopt and implement those parts of this Standard that are cost effective and practicable and that can improve overall site safety.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

CONTENTS

Page

FOREWORD

The Standard is intended to apply to a wide range of laboratories. It is recognized that certain common design principles apply to laboratories with quite different functions. Separate sections refer to the distinctive needs of biological, radiological, and secondary school laboratories.

A number of different types of hazards may be encountered in laboratories, including—

(a) physical hazards including machinery or equipment in motion, parts under compression or in tension, noise, vibration, high or low pressure;

(b) flammable or explosive materials;

(c) ignition sources;

(c) temperature hazards including high temperature materials, cryogenic fluids;

(d) electrical hazards including high voltages, live equipment, static charge;

(e) chemical hazards including carcinogens, sensitizing agents, corrosives, irritants, genotoxins;

(f) biological hazards including infectious agents, allergens, irritants, genotoxins, zoonoses;

(g) radiation including both ionizing and non-ionizing; and

(h) ergonomic hazards, including repetitive and fixed postures, slips and trips.

Laboratory design and construction plays a fundamental and critical part in ensuring that laboratories are safe places to work. It is therefore necessary to consider in detail the type of hazards that apply to a particular laboratory and clearly define their nature and significance. This information is essential in order to maximize opportunities to eliminate hazards or to reduce risks to an acceptable level at the laboratory design and construction phase.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Laboratory design and construction

S E C T I O N 1 S C O P E A N D G E N E R A L

1.1 SCOPE

This Standard specifies requirements for the design and construction of laboratories. Sections 1 to 7 apply to all laboratories. Sections 8, 9 and 10 contain additional requirements that apply to biological, radiological and secondary school laboratories respectively.

NOTES:

1 This Standard is primarily intended for those aspects of laboratory building design and construction that relate to the safety of the occupants. Various construction requirements that are intended to minimize the hazards associated with laboratories are detailed.

2 This Standard should be used in conjunction with the applicable building regulations and other regulations such as those on occupational health and safety, and the relevant referenced Standards.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1216	Class labels for dangerous goods
1319	Safety signs for the occupational environment
1345	Identification of the contents of pipes, conduits and ducts
1668	The use of mechanical ventilation and airconditioning in buildings
1668.2	Part 2: Ventilation design for indoor air contaminant control
1735	Lifts, escalators and moving walks (series)
1940	The storage and handling of flammable and combustible liquids
2243	Safety in laboratories
2243.4	Part 4: Ionizing radiations
2243.6	Part 6: Mechanical aspects
2243.7	Part 7: Electrical aspects
2252	Biological safety cabinets
2252.2	Part 2: Laminar flow biological safety cabinets (Class II) for personnel, environment and product protection
2567	Laminar flow cytotoxic drug safety cabinets
2639	Laminar flow cytotoxic drug safety cabinets—Installation and use
3780	The storage and handling of corrosive substances
4260	High efficiency particulate air (HEPA) filters—Classification, construction and performance
4775	Emergency eyewash and shower equipment
NHMRC	Australian code of practice for the care and use of animals for scientific purposes

AS/NZS

1596	Storage and handling of LP Gas
1680	Interior and workplace lighting
1680.1	Part 1: General principles and recommendations
2106	Methods for the determination of the flashpoint of flammable liquids (closed cup) (series)
2243	Safety in laboratories
2243.1	Part 1: Planning and operational aspects
2243.2	Part 2: Chemical aspects
2243.3	Part 3: Microbiological aspects and containment facilities
2243.5	Part 5: Non-ionising radiations
2243.8	Part 8: Fume cupboards
2243.9	Part 9: Recirculating fume cabinets
2243.10	Part 10: Storage of chemicals
2430	Classification of hazardous areas
2430.3.6	Part 3.6: Examples of area classification—Laboratories, including fume cupboards and flammable medical agents
2647	Biological safety cabinets—Installation and use
3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
3500	Plumbing and drainage (series)
3816	Management of clinical and related wastes
3833	The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers
4586	Slip resistance classification of new pedestrian surfaces materials
4663	Slip resistance measurement of existing pedestrian surfaces

Road transport reform (Dangerous goods) regulations

NZS

4304	Management of Healthcare Waste
5433	Transport of dangerous goods on lands
5433	Part 1: Technical information
5433	Part 2: List of dangerous goods

ACTDG

ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail (Advisory Committee on the Transport of Dangerous Goods)
No. 19 and No. 39	Radiation Health Series 39 and 19, Code of Practice for the Safe Use of Ionizing Radiations in Secondary Schools (1986) (National Health and Medical Research Council)

National Occupational Health and Safety Commission, Worksafe Australia

NOHSC:1008	Approved criteria for classifying hazardous substances
NOHSC:3009	Guidance Note for Placarding Stores for Dangerous Goods and Specified Hazardous Substances (1990)
NOHSC:1003	Exposure Standards for Atmospheric Contaminants in the Occupational Environment
NOHSC:1015	Storage and Handling of Workplace Dangerous Goods
NOHSC:2005	National code of practice for manual handling

NOHSC:10005 List of designated hazardous substances

NZ
New Zealand Environmental Risk Management Authority (ERMA)
Hazardous Substances and New Organisms (HSNO) Act 1996
Hazardous Substances (Minimum Degrees of Hazard) Regulations 2001
Hazardous Substances (Classification) Regulations 2001
Hazardous Substances (Exempt Laboratories) Regulations 2001
Code of Practice for CRI and University Exempt Laboratories

Code of Practice for School Exempt Laboratories

OSH NZ Department of labour Occupational Safety and Health Service

Approved Code of Practice for Manual Handling

NZCIC New Zealand Chemical Industry Council

HSNO Approved Code of practice, Signage for Premises Storing Hazardous Substances and Dangerous Goods

UN Manual of Tests and Criteria and the UN Recommendations on the Transport of Dangerous Goods—Model Regulations

1.3 DEFINITIONS

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

1.3.1 Air-handling system

A system for the purpose of force ventilating specific enclosures by means of air-handling plant, ducts, plenums, air-distribution devices and automatic controls.

NOTE: See AS 1668.2 for further definitions of types of air and air-handling systems.

1.3.2 Approved, approval

With the approval of, acceptable to, and meeting the prescribed standards of the authority having jurisdiction.

1.3.3 AQIS (Australian Quarantine and Inspection Service)

Inspects and assesses imports for exotic pests and diseases, and provides certification for a range of exports.

1.3.4 Contaminated

Containing harmful or hazardous concentrations of toxic, noxious, pathogenic, flammable, radioactive or other potentially injurious matter, including dusts.

1.3.5 Corrosive

Having the quality of damaging or destroying by direct chemical action. This also includes the effect of caustic substances.

1.3.6 Cryogenic liquid

Dangerous goods of Class 2, with a boiling point at atmospheric pressure of below minus 150°C, stored in liquid form at or near atmospheric pressure.

1.3.7 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.

(New Zealand) Substances and articles that have properties described in table A of NZS 5433 parts 1 and 2:1999, and includes packaging and empty containers that have not been cleared after containing dangerous goods.

NOTES:

1 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.

2 Dangerous goods also include empty receptacles or packages that have contained dangerous goods, unless such receptacles or packages have been decontaminated.

1.3.8 Designated radiation area (DRA)

An area where the occupational exposure of personnel to radiation or radioactive substances is under the supervision of a radiation protection adviser (RPA).

NOTE: This includes the 'controlled' and 'supervised' areas referred to in publications of the International Commission on Radiological Protection, the International Atomic Energy Agency and the NHMRC.

1.3.9 Environmental Risk Management Authority (ERMA)

The New Zealand Government statutory body responsible for regulating new organisms (including genetically modified organisms), under the *Hazardous Substances and New Organisms (HSNO) Act 1996*. The term includes ERMA New Zealand, the Agency that is the support organization for the Authority.

1.3.10 Flammable

Capable of being readily ignited and burning in air.

1.3.11 Flammable liquid

A liquid that is defined in the Australian Dangerous Goods Code (NZS 5433 for New Zealand) as a Class 3 liquid (also see AS 1940).

1.3.12 Flammable liquid storage cabinet

A cabinet for the indoor storage of flammable liquids complying with Clause 7.2. The liquid capacity of these cabinets relates to flammable liquid contained in separate containers.

1.3.13 Flashpoint

The temperature at which the liquid, when tested according to the method set out in AS/NZS 2106 or other approved specifications, evolves vapour in a sufficient quantity to be ignited by the test flame specified in the method.

1.3.14 Fume (as used in the term 'fume cupboard')

Airborne contaminants in the form of gases, vapours, aerosols or particulate matter.

1.3.15 Fume cupboard

A partially enclosed workplace that—

(a) is designed to prevent the spread of fume to operators and other personnel in the laboratory;

(b) is ventilated by an induced flow of air through a sash opening or working aperture that may be adjusted;

(c) dilutes the fume; and

(d) by means of an exhaust system, provides for the safe and remote discharge of the fume outside the building.

NOTES:

1 A fume hood is a device mounted over a workplace to receive or capture fumes. It may provide little or no enclosure for the workplace and is therefore unable to attain containment as high as a fume cupboard.

2 In American usage, a 'fume hood' means a laboratory fume cupboard.

1.3.16 Gas container

A closed cylinder or vessel used to contain a gas under pressure.

1.3.17 OGTR (Office of the Gene Technology Regulator)

The Australian regulatory agency administering the Gene Technology Act 2000, which regulates genetically modified organisms in Australia.

1.3.18 Hazard

A source or 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 (see AS/NZS 4801).

1.3.19 Hazardous substance

(Australia) A substance that has been classified as hazardous in accordance with NOHSC 1008 or 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*.

1.3.20 HEPA filter

'High-efficiency particulate air' filter complying with AS 4260 with a minimum arrestance efficiency of 99.99% for particles of 0.3 μm diameter.

1.3.21 HSNO

Hazardous Substances and New Organisms.

1.3.22 Ignition source

A source of energy sufficient to ignite a flammable atmosphere or material. An ignition source may include naked flames, exposed incandescent material, electrical welding arcs, mechanical or static sparks and electrical or mechanical equipment not approved for use in locations where hazards exist.

1.3.23 International Commission on Radiological Protection (ICRP)

International advisory body providing expert recommendations and guidelines on all aspects of protection against ionizing radiation.

1.3.24 Laboratory

Any building or part of a building used or intended to be used for scientific and related work that may be hazardous, including research, quality control, testing, teaching or analysis. Such work may involve the use of chemicals, (including dangerous goods, and hazardous substances), pathogens and harmful radiation, or processes including electrical or mechanical research and testing work. The laboratory includes such support areas as instrument and preparation areas, laboratory stores and any offices attached to or adjacent to the laboratory.

NOTES:

1 The term 'laboratory' is commonly used to refer to individual workrooms used for scientific work. It may also refer to the total portion of the building devoted to scientific work.

2 In a multi-occupancy building, the area occupied by the laboratory may be referred to as the laboratory area.

3 Electronic workshops are generally not classed as a laboratory.

1.3.25 Laboratory—biological

A laboratory in which biological materials are handled. Where these materials may be infectious to humans, have the potential to contaminate the environment or where cross-contamination of work may occur, then facilities for microbiological laboratories should be considered.

NOTES:

1 The laboratory may be a biochemical, veterinary, botanical or zoological laboratory. This definition may also apply to teaching and research laboratories.

2 Laboratory animals may be used in biological laboratories.

1.3.26 Laboratory—extreme hazard

A laboratory that presents such potential hazards to humans or the environment that special facilities need to be provided to minimize the risks of those hazards, or special precautions need to be taken by workers in that laboratory. Extreme hazard laboratories include laboratories where there are large quantities of flammable liquids, or laboratories which deal with explosives or highly infectious organisms.

1.3.27 Laboratory—microbiological

A laboratory in which microorganisms are dealt with and includes laboratories used for genetic manipulation work, animal, plant and invertebrate facilities, and laboratories where microbiological work such as research, teaching, diagnosis, quality control and regulatory analysis, e.g., of foodstuffs, water and effluents, pharmaceuticals and cosmetics, is undertaken.

NOTES:

1 The microorganisms involved will determine the level of physical containment required (refer AS/NZS 2243.3).

2 Some microorganisms are pathogenic to human beings.

3 Any biological specimens should be treated as being potentially infectious unless known otherwise.

1.3.28 Laboratory—radiation

A laboratory in which irradiating apparatus or sealed radioactive sources are used or stored. It does not contain any unsealed radioactive material.

1.3.29 Laboratory—radioisotope

A laboratory in which unsealed radioactive material is used or stored. It does not contain any irradiating apparatus.

1.3.30 Laboratory—radiological

A laboratory that incorporates the functions of both a radiation laboratory and a radioisotope laboratory.

1.3.31 Laboratory—secondary

A laboratory used for training in science at secondary schools and secondary colleges.

1.3.32 Laboratory waste

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

1.3.33 MAF Biosecurity New Zealand

Inspects and assesses imports for exotic pests and diseases.

1.3.34 Mechanical ventilation

The distribution of ventilating air by the use of supply or exhaust fans or other physical air-moving devices.

1.3.35 Natural ventilation

Ventilation by natural airflow through fixed ventilators, doors or openable windows due to thermal or pressure gradients.

1.3.36 NHMRC (National Health and Medical Research Council)

The council that advises the Australian community on the achievement and maintenance of the highest practicable standards of individual and public health and fosters research in the interests of improving those standards.

1.3.37 Pathogen

An organism capable of causing disease in people, animals or plants.

1.3.38 Physical containment

Containment that is defined as follows:

(a) *General* The safe methods for managing infectious agents in the laboratory environment where they are being handled or maintained. Physical containment reduces or eliminates the exposure of laboratory workers, other persons, and the outside environment to potentially hazardous agents.

(b) *Primary physical containment* The protection of personnel and the immediate laboratory environment from exposure to infectious agents provided by good microbiological technique and the use of appropriate safety equipment. The use of vaccines may provide an increased level of protection.

(c) *Secondary physical containment* The protection of the environment external to the laboratory, provided by a combination of facility design and operational practices.

NOTE: The risk assessment of the work to be performed with a specific agent will determine the selection of the appropriate combination of primary and secondary physical containment.

1.3.39 Plenum

An air compartment or chamber, intended for the passage of air, to which one or more ducts may be connected and which forms part of an air-handling system.

1.3.40 Radiation protection adviser (RPA)

A person appointed by the management/employer wherever radioactive substances are used in amounts that require licensing, or wherever irradiating apparatus is used.

1.3.41 Recirculating fume cabinet

A partially enclosed workstation that contains the fume to protect operators and other personnel, is ventilated by an induced flow through a working aperture and, by means of a filtration or absorption system, provides for the safe return of the exhaust air to the laboratory.

1.3.42 Reticulated services

Services such as liquids or gases that are distributed through pipes or conduits.

1.3.43 Risk

The probability that—

(a) a hazard may be realized at a specific level in a given span of time; or

(b) an individual may suffer a specified level of injury as a result of a hazard, in a given span of time.

1.3.44 Security sensitive biological agents (SSBA)

The physical security, information management, personnel security, handling, storage, disposal and transport of security sensitive biological agents conforming to applicable regulations.

NOTE: In Australia, the *National Health Security Act 2007* establishes a national scheme for the registration and regulation of entities and facilities handling security sensitive biological agents. National Health Security Regulations and SSBA Standards underpin the NHS Act.

1.3.45 Storage room for hazardous substances

A compartment or store designed or used for keeping any potentially hazardous substances in a laboratory.

1.3.46 Zoonosis

Any disease that is communicable to human beings from another animal species.

SECTION 2 GENERAL LABORATORY CONSTRUCTION REQUIREMENTS

2.1 SCOPE OF SECTION

This Section applies to laboratory areas (including physical containment areas) where there are risks of contamination from hazardous materials and safety issues related to such materials. Segregated areas within the laboratory occupancy that are not at risk of contamination (e.g. office, computer room and paper store) are not constrained by these clauses.

NOTE: For guidance as to design and planning of laboratories, see Appendix A.

2.2 PROTECTION AGAINST SUNLIGHT

If chemicals or instrumentation that are sensitive to direct sunlight are present in the laboratory, the design of the applicable laboratory shall exclude all direct sunlight penetration that exceeds an intensity of 100 W/m^2. The solar intensity limit shall be as measured internally in a plane normal to the solar radiation.

NOTE: See also AS/NZS 2243.1.

2.3 CONSTRUCTION MATERIALS AND FINISHES

Construction materials and finishes shall be chosen to address the risks of contaminant exposure applicable to laboratory areas.

2.4 FLOORS

Floors in laboratories shall comply with the following:

(a) All floors in laboratory work areas shall be finished with materials that are—

(i) easy to clean;

(ii) smooth;

(iii) impervious;

(iv) resistant to chemicals used in the laboratory;

(v) of adequate mechanical and structural strength;

(vi) compatible with the nature of the laboratory operations and operator comfort; and

(vii) slip resistant in accordance with the requirements of AS/NZS 4586 and AS/NZS 4663.

(b) Joints in slabs shall be avoided as far as possible but where used shall be constructed in such a way that they are sealed against penetration by hazardous materials.

(c) Where openings in floors are required they shall be designed to prevent the penetration of liquids.

NOTE: Openings in floors for service pipes can be installed in a raised plinth of the height of the skirting.

(d) Where there is a risk of spillage of hazardous, potentially infectious or unsealed radioactive material, the intersection of floors with walls and exposed plinths shall be coved to facilitate cleaning.

NOTE: Commercial grade vinyl sheeting with welded joints or similar material laid over a solid impervious base or an approved underlay is acceptable in most laboratories provided the

material is laid strictly in accordance with the manufacturer's specifications. However, liquid nitrogen spills will usually cause welded vinyl to split.

2.5 WALLS

All walls in laboratory work areas shall be finished with materials that are—

(a) easy to clean;

(b) smooth;

(c) impervious; and

(d) resistant to chemicals used in the laboratory.

2.6 CEILINGS

Ceilings in laboratory areas shall be constructed of a rigid material in continuous or tiled systems and may include fibrous plaster, plasterboard, fibrous cement, cement render or other suitable material.

Smooth faced, non-absorbent, washable ceiling surfaces shall be provided where—

(a) contamination of the ceiling can occur;

(b) decontamination is required;

(c) very clean conditions are required; or

(d) fumes, dust or vapours are generated.

If suspended tiles are likely to be displaced by pressure or vibration, they shall be retained in place by an appropriate system.

Access panels shall not reduce the integrity of the ceiling.

2.7 VENTILATION OPENINGS

Refer to Section 5 for door and window opening required for natural and forced ventilation systems.

NOTE: Even mechanically ventilated laboratories may require some openable devices for emergency ventilation.

2.8 BENCHES

Benches in laboratories shall comply with the following:

(a) All benchtops shall be finished with a material that is—

(i) easy to clean;

(ii) smooth (free from irregularities);

(iii) impervious;

(iv) resistant to chemicals used in the laboratory;

(v) scratch-resistant;

(vi) anti-static, where appropriate;

(vii) glare-resistant; and

(viii) free from joints as far as possible but, where unavoidable, joints shall be sealed to prevent seepage of spillages into the space below the benchtops. Where there is a wet area, ends of benchtops shall be sealed to end walls, sinks and similar.

(b) All benches shall be installed in accordance with Clause 2.8.

2.9 AISLES AND ACCESS

The minimum width of working spaces between benches or floor-positioned equipment (see Figure 2.1) shall be as follows:

(a) Workers on one side of aisle, no through traffic..... 1000 mm.

(b) Workers on one side of aisle, plus through traffic ..... 1200 mm.

(c) Workers on both sides of aisle, no through traffic..... 1350 mm.

(d) Workers on both sides of aisle, plus through traffic ..... 1800 mm.

NOTES:

1 Through traffic is that from one laboratory to another.

2 In microbiological and radiation, radioisotope or radiological laboratories through traffic is not encouraged.

3 Internal 90 degree (L-shaped) benches should be avoided as adjacent works may collide.

4 The minimum width of cross aisles or access ways within the laboratory should be 1500 mm to allow 2-way access and for movement of large equipment.

5 Laboratories with egress path exceeding 7 metres should have alternative means of egress. The alternate exit may be to an adjoining laboratory.

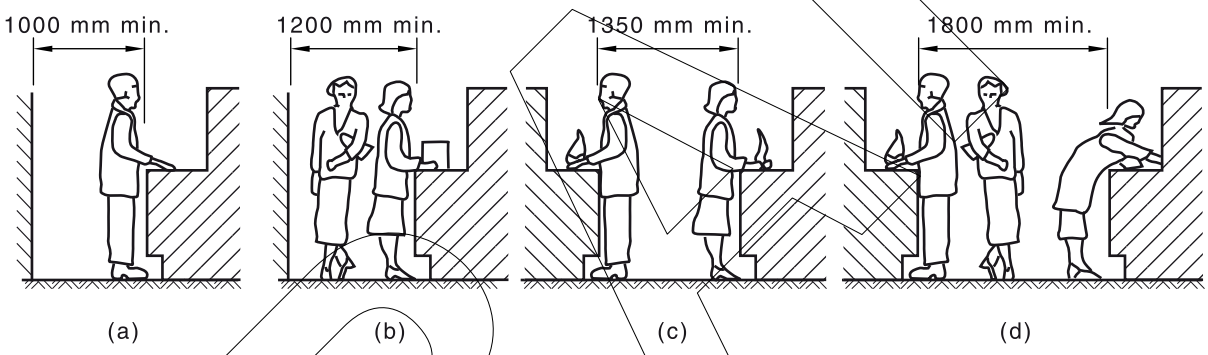

FIGURE 2.1 MINIMUM WIDTH OF WORKING SPACES

2.10 FIXTURES, FITTINGS AND EQUIPMENT

Fixtures, fittings and equipment including under-bench cupboards shall be stable in all applications and facilitate cleaning of the floor surface beneath them.

NOTE: Fixtures, fittings and equipment supported on wheels, plinths, legs, brackets or suitable framework are acceptable.

2.11 SHELVING

All shelving shall be resistant to degradation when exposed to the goods stored.

NOTES:

1 Adjustable height shelving should be securely retained.

2 Shelves, both open or closed, should be installed at a convenient height.

3 The design and location of shelving should take into consideration the risk factors associated with manual handling as provided in the (Australian) National Code of Practice for Manual Handling (NOHSC:2005), (New Zealand) Approved Code of Practice for Manual Handling.

4 In localities exposed to 'moderate' or higher intensity earthquakes, shelving and cabinets should be secured to prevent toppling. Shelves should have lips or some other arrangement to prevent containers from falling off the shelves.

5 Refer also to Paragraph A6 on storage.

2.12 FUME CUPBOARDS AND CABINETS

Localised containment devices such as fume cupboards, biological safety cabinets or cytotoxic drug safety cabinets shall be in accordance with the applicable Australian Standards, as follows:

Containment Device	Australian Standards
Non-recirculating fume cupboard	AS/NZS 2243.8
Recirculating fume cabinet	AS/NZS 2243.9
Biological safety cabinet	AS 2252, AS/NZS 2647
Cytotoxic drug safety cabinet	AS 2567, AS 2639

NOTE: Refer to the listed Australian Standards for constraints and special provisions to accommodate the devices. These requirements are not covered herein.

2.13 LUNCH AND REST ROOMS

Lunch and rest rooms shall not be included in the laboratory area (as defined in Clause 1.3.24, Note 2.

2.14 WRITE UP AREAS

Write up areas shall be separated from areas where hazardous materials are used or harmful processes are undertaken. The separation shall be appropriate for the hazard.

2.15 RESTRICTED ACCESS

Where limited access is required, for whatever purpose or hazard, the relevant area shall be clearly signposted at the entrance(s), stating the hazards or restricted access and those staff authorized to enter.

NOTES:

1 It may be desirable to restrict access to the building. This may be because radiological, microbiological or other hazards are present, or because there is a need to protect the integrity of samples.

2 It is preferable to design these areas so that access is restricted to one normal entrance, although alternative emergency exits may be provided.

2.16 WATER HEATERS

Gas water heaters or other water heaters with open elements shall not be installed in laboratories.

SECTION 3 RETICULATED SERVICES

3.1 SCOPE OF SECTION

This Section applies to permanently installed piping for heating gas (town), other gases, vacuum or hydraulic services and to liquid disposal in all laboratories. It does not apply to hydraulic services associated with firefighting or fire suppression equipment.

3.2 IDENTIFICATION AND COLOUR CODING

Each service, including control valves, shall be clearly labelled or identified at accessible and visible locations over its complete length by permanent means of identification and colour coding in accordance with AS 1345.

3.3 SERVICE ISOLATION

Each reticulated service shall have rational provision for isolation for servicing and maintenance.

3.4 EMERGENCY SHUT OFF

Services that reticulate flammable or hazardous materials shall have provision for emergency shut-off. Each emergency isolating device shall be remote from outlets, prominently labelled and readily accessible on an egress path.

NOTE: It is considered good practice to co-locate emergency shut off devices.

3.5 EXPOSED SERVICE PIPES

Exposed service pipes shall be fixed on brackets so as to provide at least 25 mm clearance between the pipe and the adjacent surfaces to facilitate cleaning.

3.6 PIPING IN CONCEALED SPACES

Confined spaces housing flammable or toxic gas piping (e.g. wall cavities, false ceilings, shafts or ducts) shall have adequate natural or mechanical ventilation to avoid gas accumulation from a small leak

NOTE: AS 5601 provides guidance for reticulation of flammable gases such as LP gas and similar substances.

3.7 RETICULATION FROM GAS CYLINDERS

3.7.1 General

Gas reticulation shall be through piping manufactured from materials which are resistant to attack by the reticulated gas and which are chemically and dimensionally stable under service conditions.

NOTES:

1 Reticulation from gas cylinders is subject to ‘dangerous goods’ regulations.

2 Cylinders from which gases are reticulated to outlets or equipment should be located outside the building.

3 For storage of gas cylinders, see Clause 7.4.

4 For safe working practice when using compressed-gas cylinders, see AS 2243.6.

3.7.2 Control of pressure

The gas reticulation system shall include controls to ensure that gases are reticulated at the lowest practicable pressure. To prevent the flow rate becoming excessive, automatic cut-off or a flow-restrictor shall be provided. Controls shall be fail-safe under all conditions,

including failure of electrical supply. Reticulation within the building shall be through fixed tubing of an appropriate type to gas control outlets or control panels.

3.7.3 Pipes

Pipes conveying gas shall be easily accessible, but protected from physical damage.

3.7.4 Liquefied petroleum gas cylinders

The design, construction and location of cylinders, pipelines, valves, regulators and accessories for liquefied petroleum gas shall comply with the requirements of AS/NZS 1596, except where qualified by Clause 3.5.1.

3.7.5 Asphyxiant gases

Where there is a risk of oxygen displacement or depletion in a laboratory, adequate ventilation shall be provided. Appropriate fail-safe, monitoring and alarm mechanisms shall be provided. Refer to AS/NZS 2243.1.

3.8 VACUUM RETICULATION

Vacuum systems shall incorporate interceptor vessels (traps) in accessible locations. Vacuum systems shall be discharged externally to the building, clear of any outdoor air intakes.

NOTES:

1 Discharge clear of outdoor air intakes is important where there is a risk of sucking back liquids and harmful gases.

2 Pathological or microbiological laboratories may require special types of traps.

3.9 HYDRAULIC SERVICES

3.9.1 General

Hydraulic services shall comply with AS/NZS 3500.

NOTE: Hydraulic installations in laboratories should be installed with particular attention to prevent cross-contamination between different water supplies and liquid wastes.

3.9.2 Materials

Hydraulic reticulation and disposal systems shall be constructed of materials that will not be attacked by the fluid being reticulated, including wastes.

NOTE: The location and other requirements for cryogenic liquid containers should comply with AS/NZS 2243.10 and the ADG Code.

3.9.3 Drinking water

Drinking outlets shall only be installed outside the laboratory in non-hazardous areas.

3.9.4 Safety shower and eyewash

Safety shower and eyewash or eye/face wash equipment shall be supplied with potable water. See Clause 6.2.

3.9.5 Disposal of liquid waste

Dilution pits and vents in the liquid waste disposal system shall be located at least 6 m away from mechanical ventilation outdoor air intakes.

NOTE: Equipment for liquid waste treatment is required to comply with the regulations of the sewerage authority.

SECTION 4 ELECTRICAL SERVICES

4.1 STANDARDS AND REGULATIONS

Electrical wiring and services installations serving all laboratories shall comply with AS/NZS 3000 and the requirements of the relevant authority.

4.2 LABORATORY POWER

Socket-outlets shall be located as required by AS/NZS 3000. Socket-outlets shall be arranged or of such design to avoid ingress of water.

Socket-outlets throughout the laboratory shall be fitted with residual current protection. Selected outlets may be unprotected provided they are prominently labelled 'OUTLET NOT R.C. PROTECTED' and located a minimum of 300 mm above a floor or bench surface.

NOTES:

1 Elimination of residual current protection may be necessary for equipment requiring high reliability power or having intrinsic earth leakage.

2 AS/NZS 2430.3.6 provides information on hazardous zones classification.

3 Specific requirements and recommended practices relating to electrical safety and electrical equipment in laboratories are specified in AS 2243.7.

4.3 LABORATORY LIGHTING

The laboratory shall be provided with a lighting system that achieves the value of maintenance illuminance recommended in AS/NZS 1680.1. Levels of task lighting shall be adequate for the specific tasks involved. Fluorescent light fittings shall be fitted with colour-corrected tubes.

NOTE: Certain tasks may require a higher level of maintenance illuminance.

SECTION 5 VENTILATION AND AIR QUALITY

5.1 GENERAL

The ventilation of laboratories shall comply with applicable building regulations and the additional requirements of this Section. Ventilation shall be provided for the wellbeing of building occupants, to remove airborne contaminants and to ventilate storage rooms in accordance with this Section. Ventilation may be by mechanical or natural means.

5.2 VENTILATION FOR OCCUPANTS

Laboratories shall be mechanically or naturally ventilated in accordance with the requirements of AS 1668.2 and this Standard.

The ventilation systems shall meet or exceed the minimum requirements for air quality as indicated in Clause 5.5.

5.3 NATURAL VENTILATION

Laboratories may be naturally ventilated provided that—

(a) the ventilation systems meet the applicable requirements of AS 1668.2 for natural ventilation;

(b) ventilation openings having an openable area of not less than 10% of the floor area, are provided in each laboratory, located to ensure cross-ventilation to provide adequate air exchange;

(c) laboratory processes and instrumentation do not require temperature and humidity control beyond that achievable by this method;

(d) unfiltered ventilation air will not degrade applicable laboratory processes;

(e) fume cupboards and other devices relying on a uniform face velocity for containment are not exposed to draughts which will degrade their performance;

(f) natural ventilation is not used as a primary method for contaminant dilution or control; and

(g) laboratory ventilation is physically segregated from any adjacent non-laboratory area.

Partitioning between laboratory and non-laboratory areas shall have no ventilation openings other than an openable access door or doors.

Where the above requirements cannot be met, the laboratory shall be mechanically ventilated.

5.4 MECHANICAL VENTILATION

5.4.1 General

Mechanical ventilation systems for laboratories shall be designed to—

(a) provide the minimum outdoor air supply rate as indicated in AS 1668.2;

NOTE: Process and equipment requirements in laboratories may necessitate higher rates of outdoor air ventilation than the minimum set by AS 1668.2.

(b) provide local exhaust ventilation in accordance with AS 1668.2 and the needs of particular processes carried out in the laboratory;

(c) prevent the uncontrolled dispersion or accumulation of hazardous airborne contaminants; and

(d) prevent recirculated air from laboratories mixing with other air for supply to non-laboratory areas.

5.4.2 Natural ventilation as back-up

Unless it is incompatible with functional requirements, each laboratory room with external doors and windows shall have a capacity for naturally ventilation, as a back-up to mechanical ventilation. The back up capability requires an aggregate area to the exterior of at least 2% of the floor area of the room.

The backup ventilation requirement does not apply to—

(a) internal and other rooms without external doors or windows;

(b) rooms with no significant risk of accidental contamination (e.g. rooms with no hazardous substances);

(c) laboratories designed for physical containment or other application where uncontrolled openings are undesirable; or

(d) laboratories with back-up or redundant ventilation systems capable of operating when a primary plant fails and when mains power is interrupted.

NOTE: Laboratories using natural ventilation as the primary ventilation system, require much greater openable area (refer to the preceding clause 5.3.

5.5 AIRBORNE CONTAMINANTS

5.5.1 Exposure limits

Laboratory ventilation shall be designed to limit the concentration of airborne contaminants to safe levels for occupational exposure and shall not exceed the following:

(a) (Australia) the Worksafe Australia (National Occupational Health and Safety Commission) Exposure Standards for Atmospheric Contaminants in the Occupational Environment NOHSC:1003.

(b) (New Zealand) Department of Labour (OSH) Workplace Exposure Standards.

5.5.2 Contaminant control

Wherever practicable, airborne contaminants shall be removed from the laboratory environment at source using local exhaust ventilation.

5.5.3 Control of flammable gases and vapours

Natural or mechanical ventilation shall be provided to prevent the accumulation of flammable gases and vapours in all areas where sources of such gas or vapour are present.

5.6 LOCAL EXHAUST VENTILATION

Local exhaust systems installed for laboratory ventilation shall comply with AS 1668.2, the relevant building regulations and the following:

(a) *Location of exhaust air discharges* Exhaust air discharges shall be located to avoid contaminated air being drawn into outdoor air intakes or ventilation openings.

(b) *Discharge of contaminated air* Where acceptable to the regulatory authorities, exhaust air containing noxious contaminants shall be discharged in a manner which maximizes the safe dispersion of contamination and minimizes entrainment around the building envelope. Where there is insufficient dispersion to avoid hazardous exposure to, or adverse effect on, people, animals, the environment or adjacent properties, the contamination shall be treated before discharge to eliminate such

unsafe exposure. Discharged exhaust air shall not contain contaminants in excess of levels specified by regulatory authorities having jurisdiction over the site.

(c) *Local exhaust recirculation* The discharge air from exhaust systems handling airborne contaminants shall not be recirculated into the laboratory enclosure unless the contamination is removed from the airstream and the discharge air rendered safe for occupational exposure.

(d) *Ducting of contaminated air* Contaminated air, exhausted from a source within the laboratory, shall not pass unducted through other spaces between the intake and discharge of the system. Ductwork exhausting contaminants shall be maintained at negative pressure relative to adjacent laboratory spaces. If positive pressure is necessary within the laboratory area, the ductwork shall be enclosed in a service shaft that is exhausted mechanically. Portions of ductwork outside occupied areas but within the building envelope may operate under positive pressure provided their extent is minimized and precautions are taken to prevent air leakage from positively pressurized ducting.

(e) *Ductwork* Flexible and rigid ductwork handling hazardous contaminants shall not contain pockets where material will accumulate. Duct materials shall be selected to avoid premature deterioration under exposure to the applicable contaminants.

(f) *Location of fan motors and controls* Fan motors and controls shall not be located within the airstream of exhaust systems handling flammable or corrosive contaminants unless these components are specifically designed to avoid deterioration or hazardous operation when exposed to the contaminants.

(g) *Protection of service personnel* Discharge ducts handling hazardous contaminants shall terminate clear of the breathing zone for service personnel standing on roofing or access platforms. Warning signs and access barriers shall be provided where there are special risks.

NOTE: AS 1668.2 defines constraints on acceptable locations for objectionable and non-objectable air discharges.

5.7 VENTILATION FOR HAZARDOUS STORES

Storage rooms for hazardous chemicals shall be naturally or mechanically ventilated in accordance with the requirements of the applicable Standard (see Table 5.1). In the absence of a specific classification, the provisions of AS 1940 shall be taken as the minimum requirements applicable. Ventilation systems shall ensure that workplace exposure limits for the chemicals stored comply with Clause 5.5.1.

Each individual hazardous storage room shall have a dedicated ventilation system not shared by other storage areas. Exhaust air shall discharge outside the building in accordance with Clause 5.6.

TABLE 5.1
APPLICABLE STANDARDS

Material property	Applicable Standard
Anhydrous ammonia	AS/NZS 2022
Batteries	AS 2676
Compressed gas and cryogenic liquids	AS/NZS 2243.10
Corrosive material	AS 3780
Electrical equipment	AS 1482
Flammable liquid	AS 1940
Liquefied chlorine gas	AS/NZS 2927
LP gas	AS/NZS 1596
Organic peroxides	AS 2714
Pesticides	AS 2507

SECTION 6 HEALTH AND SAFETY REQUIREMENTS

6.1 GENERAL

The design and construction of a laboratory shall take into account the health and safety issues associated with the laboratory function and processes. Minimum requirements shall be as set out in Clauses 6.2 to 6.6.

NOTES:

1 Refer to appropriate regulations for first aid facilities.

2 Consideration should be given to the accommodation of safety equipment, e.g. fire-extinguishers, fire blankets, inert absorption material, first aid cabinets and personal protective equipment, as may be required by the regulatory authority.

6.2 SAFETY SHOWERS AND EYEWASHES

6.2.1 Provision of equipment

At least one eyewash or eye/face wash facility and safety shower shall be installed, in each laboratory where hazardous substances are used.

NOTES:

1 Safety showers, eyewashes and eye/face washes may be supported but not replaced with hand-held drench hoses.

2 Safety showers should not normally be used to remove microbiological contamination due to the hazards associated with aerosol creation and possible spread of contamination.

3 Eyewash or eye/face wash facilities in microbiological laboratories should be positioned so waste from their use can be collected in a sink or other facility that minimizes the spread of contaminated liquid and the production of aerosols.

6.2.2 Operation and access

Each safety shower, eyewash or eye/face wash facility shall be capable of operation so that water flow remains constant without requiring the use of the operator's hands.

These devices and their activating mechanisms shall be located so that the approach to them is unobstructed.

NOTES:

1 Personal shower facilities should be within easy access for microbiological laboratories of Physical Containment Levels 1, 2 and 3. Provision of contained showers within an airlock should be considered for a microbiological laboratory of Physical Containment Level 3. The provision of personal showers in airlocks is a mandatory requirement for all Physical Containment Level 4 laboratories (see AS/NZS 2243.3).

2 A travel distance not exceeding 15 m to such devices from any point in the laboratory is considered good practice. Lesser travel distances may be appropriate for high risk applications.

6.2.3 Equipment specifications

Safety shower, eyewash and eye/face wash equipment shall comply with AS 4775.

NOTE: AS 4775 contains design, installation and maintenance provisions for emergency safety shower, eyewash and eye/face wash equipment.

6.3 HANDWASHING FACILITIES

Laboratories in which hazardous substances are used and all biological laboratory work areas shall have basins for handwashing purposes with potable hot and cold water provided

through an approved mixing device. Handbasins shall be located near the main exit from the laboratory.

6.4 SAFETY NOTICEBOARDS

A safety noticeboard in a prominent place in each working area shall be provided. The noticeboard shall—

(a) list emergency procedures; and

(b) highlight any particular hazards.

NOTE: The noticeboard may also be used to report accidents.

6.5 SAFETY SIGNS

Safety signs shall comply with AS 1319.

6.6 HAZARD SIGNS AND PLACARDS

Laboratories shall be placarded in accordance with:

(a) (Australia) NOHSC:3009;

(b) (Australia) NOHSC:1015 or with the requirements of the relevant regulatory authority.

(c) (New Zealand) Approved Code of Practice for Signage for Premises Storing Hazardous Substances and Dangerous Goods.

Containment laboratories shall be placarded in accordance with AS/NZS 2243.3.

NOTE: Hazchem placarding provides relevant information on emergency procedures for employee and emergency service personnel responding to fire, spillage or other incidents involving dangerous goods.

6.7 ADDITIONAL REQUIREMENTS

Suitable coat hooks for laboratory gowns shall be provided within the laboratory, adjacent to the laboratory access door.

If personal protective equipment (PPE) is used then suitable storage shall be provided.

SECTION 7 STORAGE OF HAZARDOUS SUBSTANCES

7.1 GENERAL

The storage of hazardous substances shall be in accordance with the requirements of AS 1940, AS/NZS 2243.10, (Australia) NOHSC:1015 and with the following:

NOTE: New Zealand Laboratories electing to operate under the HSNO exempt laboratories regulations should refer to the relevant Exempt Laboratories Code of Practice

(a) Where flammable liquids are used in a laboratory, flammable liquids cabinets or stores shall be provided in accordance with Clauses 7.2 and 7.3.

(b) Stores for flammable liquids, compressed-gas cylinders, corrosive materials and other hazardous substances shall be separated from property boundaries, ignition sources and protected works as required by the applicable Standard or the requirements of the regulatory authority.

7.2 FLAMMABLE LIQUIDS CABINETS

7.2.1 General

Where flammable liquids are stored within storage cabinets in laboratories, they shall be stored according to AS 1940.

NOTE: Flammable liquids cabinets are primarily for the use of liquids on a day-to-day basis. It is desirable to limit the amount of flammable liquids in a laboratory. For larger quantities, separate storage is encouraged.

7.2.2 Segregation

Incompatible goods shall be segregated from one another as required by AS/NZS 2243.10.

7.2.3 Maximum capacity

Not more than 250 L aggregate of flammable and combustible liquid shall be stored in any individual storage cabinet. Cabinets under benches shall have a maximum capacity of 30 L per cabinet or as required by AS/NZS 2243.10.

NOTE: Quantities may differ for New Zealand Laboratories electing to operate under the HSNO exempt laboratories legislation. Refer to the relevant Exempt Laboratories Code of Practice.

7.2.4 Cabinet venting

Where ventilation of cabinets is required it shall be provided in accordance with AS 1940 and AS/NZS 2243.10.

7.3 FLAMMABLE LIQUIDS STORES

The general design, construction, security and signage of flammable liquids stores shall comply with AS 1940 and AS/NZS 2243.10.

The storage of flammable liquids is subject to the requirements of the regulatory authority for dangerous goods.

A flammable liquids store within a laboratory building shall be designed solely for the storage and decanting of flammable liquids and, in addition to the provisions of AS 1940, shall be designed to store not more than 500 L of flammable liquids.

7.4 COMPRESSED-GAS CYLINDERS

If compressed-gas cylinders are used within a laboratory they shall be accommodated according to AS/NZS 2243.10.

NOTES:

1 For reticulation from gas cylinders, see Clause 3.7.

2 For segregation of cylinders containing flammable gases from cylinders containing other gases, see AS/NZS 2243.10.

3 For Liquefied Petroleum Gas storage and handling, see AS/NZS 1596. Refer to the requirements of the regulatory authority for dangerous goods.

7.5 STORAGE AREAS FOR CORROSIVE MATERIAL

7.5.1 General construction

A separate storage area shall be provided for the storage of corrosive liquids (e.g. acids) or corrosive or caustic solids exceeding the permissible quantities in AS/NZS 2243.10. The storage area shall comply with the requirements of AS 3780 and AS/NZS 2243.10. In addition, the following shall be observed:

(a) No shelves shall be more than 1 m from the floor.

(b) The walls shall be constructed of a suitable material such as concrete or masonry with a corrosion-resistant coating which is resistant to chemical attack.

NOTE: It is desirable that the storage area contains a hose cock connected to the water supply.

7.5.2 Floors

The floor shall be of concrete and painted or coated with corrosion-resistant material. The floor in this storage area shall be bunded so that spillage cannot flow into other areas.

7.6 CHEMICAL STORAGE CABINETS

Where hazardous chemical vapours cannot be eliminated by storing materials in well sealed containers and other good house keeping measures, there shall be at least one cabinet for the storage of such chemicals, segregated from the general storage area. It shall be ventilated to comply with the requirements of AS/NZS 2243.10. (See also Section 9 and AS/NZS 2243.2.)

NOTE: Where extremely hazardous vapours are emitted the ventilation should be independent of any other mechanical ventilation system. In this event, an emergency electrical supply should also be considered.

7.7 STORAGE FOR SOLID AND LIQUID WASTES

Suitable areas shall be provided for the safe temporary storage of solid or liquid wastes collected from laboratories until they are removed by a waste collection agency or disposed of by other approved means.

Suitable sterilization and storage facilities for biological waste shall be provided in accordance with AS/NZS 2243.3.

SECTION 8 BIOLOGICAL LABORATORIES

8.1 SCOPE OF SECTION

The requirements of this Section apply to the design and construction of biological laboratories, including microbiological laboratories, and are additional to requirements of Sections 1 to 7.

NOTES:

1 Microbiological laboratories have specific requirements additional to those commonly encountered in other biological laboratories. Particular attention needs to be given to the degree of containment necessary for microorganisms likely to be encountered (refer to the classification of microorganisms as given in AS/NZS 2243.3 Section 3.

2 Requirements for genetic manipulation work are administered by: (Australia) the Office of the Gene Technology Regulator (OGTR). (New Zealand) Environmental Risk Management Authority (ERMA).

3 The Australian Quarantine and Inspection Service (AQIS) and MAF Biosecurity New Zealand has special requirements for the handling and disposal of imported materials of biological origin or materials that have come into contact with them.

8.2 LABORATORY LAYOUT

8.2.1 Separation of work areas

Laboratory work areas and animal accommodation areas shall be physically separated by means of walls from non-technical areas, e.g., administrative and clerical work areas, and those areas to which patients and other members of the public have access.

8.2.2 Microbiological work areas

Microbiological work areas, including associated sterilization and media preparation facilities, shall be physically separated by means of walls from other laboratory work areas. See also Clauses 8.7, 8.8 and 8.9.

NOTES:

1 The layout should provide for work flow arrangements whereby sterile materials are stored separately from contaminated and waste materials. The area where specimens are received, and clerical facilities, should be separated from the laboratory work area.

2 For experimental animal areas, see Clauses 8.7, 8.8 and 8.9.

8.3 SECURITY

Laboratory work areas that handle security sensitive biological agents shall incorporate appropriate security arrangements.

8.4 VENTILATION

Ventilation of laboratory areas shall comply with the general requirements of Section 5. For microbiological laboratories, refer to Clause 8.7.9 and AS/NZS 2243.3.

8.5 STERILIZATION

Refer to AS/NZS 2243.3.

NOTE: Requirements of OGTR, AQIS or MAF Biosecurity New Zealand may need to be considered where relevant.

8.6 BIOLOGICAL WASTE DISPOSAL

8.6.1 General

Facilities shall be provided for the appropriate handling, sterilization and disposal of biological waste materials. See also AS/NZS 3816 and NZS 4304 for clinical and healthcare waste and AS/NZS 2243.3.

8.6.2 Incinerators

Where a laboratory needs to dispose of material in an incinerator, it shall have convenient access to, or facilities to safely transport waste material to, that incinerator, which shall be of suitable capacity and performance to safely burn the material and produce a biologically inert ash.

NOTE: The incinerator will need to comply with environmental protection requirements.

8.7 ANIMAL ACCOMMODATION FACILITIES

8.7.1 Application

Clauses 8.7.2 to 8.7.11 relate to laboratories in which a limited number of experiments requiring the use of small laboratory animals are carried out. This Standard does not include requirements for specialized clean breeding (e.g. germ free, SPF etc.) or biological containment facilities.

NOTES:

1 Experiments and breeding programs involving large numbers of animals have additional specialized requirements which are beyond the scope of this Standard.

2 Consideration should be given to adequate security for animal accommodation facilities.

8.7.2 Separation of animal accommodation

Laboratory animals shall be housed in an area which is physically separated from the general laboratory area. Where required, separate quarantine and acclimatization areas shall be provided.

NOTES:

1 For advice in Australia, refer to the Australian Quarantine and Inspection Service.

2 For advice in New Zealand, refer to MAF Biosecurity New Zealand.

8.7.3 Prevention of vermin

The animal accommodation shall be effectively screened to prevent access by insects and vermin.

8.7.4 Separation of infected animals

The layout of the animal accommodation shall provide for infected or experimental animals to be securely separated from non-infected animals.

8.7.5 Clean stores

Areas within the building shall be provided for animal food and clean stores.

8.7.6 Autopsy and experimental areas

A separate area shall be provided for carrying out autopsies and experiments on animals.

NOTE: For guidance on appropriate segregation and treatment of animals see the Australian code of practice for care and use of animals for scientific purposes, or the New Zealand *Animal Welfare Act 1999*, as appropriate.

8.7.7 Waste handling and storage

Where concentrations of dust and allergenic material may become unsafe, local exhaust ventilation shall be installed.

NOTE: The main source of allergenic material in animal accommodation is dirty bedding.

8.7.8 Cage wash area

An area shall be provided for the cleaning of cages.

8.7.9 Ventilation

Animal houses require relatively high rates of fresh air ventilation to control odours and contaminants such as animal detritus and ammonia (from waste products). The fresh air ventilation rate shall be sufficient to keep odour and contaminant levels below acceptable threshold limits for the long-term exposure of animal house personnel.

NOTES:

1 The required fresh air ventilation rate depends on a number of factors, including:
   (a) The type of animal caging.
   (b) The nature of animals to be accommodated.
   (c) The stocking density in relation to room volume.
   (d) The animal husbandry, particularly the frequency of bedding changes.
   (e) Temperature, humidity and air movement in the animal environment.
   (f) The ventilation effectiveness.

2 Guideline fresh-air ventilation rates for animal houses are as follows:

Animal housing	Fresh airflow (air changes per hour)
Open cages or enclosed, naturally ventilated filtertop cages	15 – 20
Force ventilated cages with HEPA filters and activated carbon or other effective odour removal on animal cage exhausts discharging into room.	9 – 12
Exhaust ventilated cages (discharging externally)	6 – 10

3 For exhaust ventilated cages, the fresh airflow also needs to be sufficient for ventilation make-up purposes.

8.7.10 Animal containment

Provision shall be made to prevent the escape of animals through all openings, e.g. floor wastes, ventilation openings, doorways and windows.

8.7.11 Cleaning

Hot and cold water shall be provided for cleaning. The intersection of floors with walls and exposed plinths shall be coved to facilitate cleaning.

8.8 ADDITIONAL REQUIREMENTS FOR ANIMAL ACCOMMODATION

For additional requirements for animal accommodation associated with microbiological work, see AS/NZS 2243.3 Section 6.

8.9 REQUIREMENTS FOR PLANT HOUSES

For requirements for plant houses associated with microbiological work, see AS/NZS 2243.3 Section 7.

8.10 REQUIREMENTS FOR INVERTEBRATE FACILITIES

For requirements for invertebrate facilities associated with microbiological work, see AS/NZS 2243.3 Section 8.

SECTION 9 LABORATORIES IN WHICH RADIOACTIVE MATERIALS AND IONIZING RADIATIONS ARE USED

9.1 SCOPE OF SECTION

This Section applies to the design and construction of radiation, radioisotope and radiological laboratories. Radioisotope laboratories require additional design features to minimize the potential for spread of radioactive contamination and its inhalation or ingestion by persons working in these laboratories. For radiological laboratories the requirements for both radiation and radioisotope laboratories apply. Each laboratory in which unsealed radioactive materials, sealed radioactive sources or irradiating apparatus is used, shall be provided with all the required radiation safety features.

The requirements of this Section are additional to those of Sections 1 to 7.

This Section does not deal with laboratories in which sources of non-ionizing radiation are to be used. Such laboratories are covered by AS/NZS 2243.5.

NOTES:

1 Ionizing radiation emitted by irradiating apparatus or radioactive sources (sealed or unsealed) may cause radiation exposure of personnel.

2 Additional hazards to be considered when using unsealed radioactive materials are—

(a) airborne radioactive contaminants that may be inhaled or ingested; and

(b) radioactive surface contamination that may—

(i) cause a radiation hazard if it emits penetrating ionizing radiation and is present in sufficient amounts;

(ii) cause personnel contamination if transferred to the skin; and

(iii) be inhaled if disturbed so that it becomes airborne.

3 In the planning of a new or refurbished laboratory in which irradiating apparatus is to be used or radioactive materials are to be stored, the advice of the relevant statutory authorities and the local radiation protection adviser (RPA) should be sought.

4 AS 2243.4 should be consulted for additional information on laboratory requirements.

9.2 GENERAL

9.2.1 Radiation warning signs

Radiation warning signs shall be displayed at the entrance to each designated radiation area. (See AS 2243.4.) These signs may be incorporated into the general hazard laboratory sign. Statutory regulations may require the use of specific wording.

9.2.2 Shielding

Radiation, radioisotope and radiological laboratories may require shielding. The purpose of shielding is to ensure that the dose received by any person is below the dose limits specified in AS 2243.4 and is as low as reasonably achievable (ALARA).

Sealed and unsealed sources and apparatus that emit penetrating ionizing radiation (e.g. X-, gamma, beta or neutron radiation) may need to be shielded. The level and type of shielding required depends on the type and energy of the radiation emitted and its intensity.

9.2.3 Limitation on access

Provisions shall be made to limit unauthorized access to radiation, radioisotope and radiological laboratories.

9.2.4 General requirements for radiation laboratories

9.2.4.1 *Separation*

Laboratories in which X-ray machines, other radiation producing equipment or sealed radioactive sources are used, shall be dedicated solely to that purpose.

Associated clerical, administrative and other functions shall be in areas separated from the radiation laboratory so that workers in these areas will not receive radiation doses in excess of those applicable to members of the public (see AS 2243.4). The information needed to design radiation shielding for such areas is contained in various publications of the International Commission on Radiological Protection (ICRP) (see Refs 1, 2 and 3).

9.2.4.2 *Planning*

In working through the planning brief, special attention shall be given to such aspects as—

(a) radiation shielding and beam area limitations permanently built into the equipment;

(b) directions of radiation beams and scatter which are not inherently shielded;

(c) occupancy and use of adjoining areas, including above and below, where applicable;

(d) operation and access to equipment;

(e) structural shielding requirements;

(f) floor loadings for heavy shielding, and access ways to move it into the laboratory;

(g) electrical power and cooling requirements;

(h) interlocks on doors to prevent access, apart from occasions when the equipment is switched off or the sealed radioactive source is shielded in its storage position; and emergency OFF features operated from within the shielded enclosure for large radiation sources such as gamma sterilization plants;

(i) warning signs advising of designated radiation areas (DRAs) (see AS 2243.4); and

(j) provision of appropriately designed storage facilities for laboratories in which sealed radioactive sources are used.

NOTE: When the source is a fixed and integral part of an apparatus, duly licensed by the relevant statutory authorities and not likely to be involved in maintenance procedures, then special handling or storage precautions may not be necessary. See also AS 2243.4.

9.2.5 General requirements for radioisotope laboratories

9.2.5.1 *Separation*

To reduce contamination risks, laboratories in which unsealed radioisotopes are used shall be separated from other facilities. Radionuclide counting rooms shall be separated from operational areas and from radionuclide storage areas. Office accommodation shall be separate from laboratories.

9.2.5.2 *Planning*

In working through the planning brief, special attention shall be given to such aspects as—

(a) provision of services, airconditioning, ventilation and the design of drains;

(b) accessibility for emergency services and emergency egress from the laboratory;

(c) provisions for the disposal of solid, liquid and gaseous wastes;

(d) provision of storage areas for stock radioactive substances and waste; and

(e) radiation shielding requirements.

9.2.5.3 *Building expansion joints*

Building expansion joints shall not pass through the floor area of radioisotope laboratories or laboratory store rooms as the finished flooring needs to be smooth and watertight.

9.2.5.4 *Cleaning*

Suitable storage space shall be provided in medium-level laboratories (see Clause 9.3.5) and high-level laboratories (see Clause 9.3.6) for cleaning equipments which shall be reserved for use only in these laboratories. Similar facilities may be provided for low-level laboratories (see Clause 9.3.4) on the advice of the RPA and the regulatory authority.

9.2.5.5 *Sealed systems*

All sealed systems that may become internally contaminated (e.g., ducts and pipes) shall be clearly marked at access locations to warn maintenance personnel of the presence of radioactive material.

9.2.5.6 *Working space*

Working space shall be allocated on a generous scale compared with normal laboratory standards; 10 m^2 overall room area per worker shall be regarded as a desirable objective.

9.2.5.7 *Cleanliness*

The detailed design shall aim at providing an area that can be readily kept in a very clean condition.

9.2.5.8 *Laboratory identification*

Each entrance to a laboratory room (or suite of rooms for medium-level laboratories) shall have an identification placard on the door, or immediately adjacent to it—

(a) identifying the laboratory;

(b) indicating the main potential hazards within;

(c) advising the nature of personal protective equipment to be worn, especially by emergency services personnel; and

(d) advising the names and telephone numbers of the persons to be contacted in the event of after-hours emergencies.

9.2.5.9 *Wastes*

Drains into which radioactive aqueous wastes are discharged shall be segregated from other drainage systems within the building handling non-radioactive liquid waste (e.g. non-radioisotope laboratories, toilets and stormwater).

9.3 MINIMUM CRITERIA FOR RADIOISOTOPE LABORATORIES

9.3.1 Laboratory grading

Radioisotope laboratories in which unsealed radioactive isotopes are used shall be graded in accordance with AS 2243.4 as low level, medium level or high level.

9.3.2 General

Toilets, lunch rooms or drinking water facilities shall not open directly from a radioisotope laboratory and, where a barrier is provided, they shall not be on the radioactive side.

NOTE: A barrier is a device which physically separates a radioactive area from a non-radioactive area and provides a facility for persons to change their footwear at the barrier.

Minimum criteria for low-level and medium-level laboratories are listed in Clauses 9.3.4 and 9.3.5. High-level laboratory requirements are given in Clause 9.3.6.

Wall cupboards and open shelves shall not be provided in high-level laboratories.

9.3.3 Floor penetrations

Floor penetrations shall be minimized as they impair the integrity of the floor covering. Services and drains (except floor drains) shall enter and leave the laboratory through sealed wall penetrations.

9.3.4 Low-level laboratories

In low-level laboratories, fittings and finish shall be chosen so that they may be readily cleaned and shall incorporate features as follows:

(a) Joints shall be sealed and made waterproof and be located away from sources of contamination (e.g. not near sinks or under edges of benches).

Seamless PVC flooring is recommended. Painted or carpeted surfaces are not acceptable.

(b) Walls shall be smooth and reasonably free of exposed electrical conduits, and water and gas pipes. These surfaces shall be finished with a washable high gloss or semi-gloss paint.

(c) Benchtops shall have a smooth, waterproof, chemically resistant covering that is easy to clean. Melamine, seamless vinyl, cast epoxy resin and stainless steel are recommended. Painted surfaces are not acceptable.

(d) Drainage shall be arranged so that other building areas cannot become contaminated if the drainage system becomes blocked.

(e) Secure storage facilities shall be provided for stocks of radionuclides. Shielding shall be provided if recommended by the RPA. Refrigerator storage or freezer storage, or both, may be required in medical and biological radioisotope laboratories.

(f) The advice of the RPA shall be sought to determine if a fume cupboard is necessary for handling small quantities of non-volatile radionuclides that are of low radiotoxicity class (see AS 2243.4).

(g) A recirculating fume cabinet that complies with AS/NZS 2243.9 may have limited applications when small quantities of radionuclides of low radiotoxicity class are being handled. Advice shall be sought from the RPA before any recirculating fume cabinet is used for radioactive materials.

Stainless steel sinks are recommended. A flushing sink, preferably with knee operated or automatic actuator, shall be provided for the sewer disposal of aqueous liquid waste to permit rapid dilution of the effluent within the laboratory drainage system and to help keep this drainage system clean.

A hand washbasin with automated action, or knee- or foot-operated taps shall be provided, preferably immediately adjacent to the entrance doorway. A hand-held shower on a flexible hose and an eye wash facility shall be provided at each hand wash basin to assist decontamination of personnel.

9.3.5 Medium-level laboratories

A high degree of cleanliness is essential in medium-level laboratories, and finishes and fittings shall be chosen to assist its achievement. In addition to meeting the requirements of Clause 9.3.4, the laboratory shall comply with the following:

(a) The floor shall be strong enough to support the weight of any shielding while maintaining its smooth decontaminable continuous surface.

Where welded PVC floor covering is used, a polyvinyl chloride content in excess of 76% by weight is recommended for ease of decontamination.

The floor covering shall be coved up to and be sealed to walls and vertical surfaces to aid cleaning.

(b) Benches shall be strong enough to support the weight of any shielding likely to be used. The front and side edges of the benchtop shall be slightly raised and the back coved up to the wall or reagent shelf, so that the benchtop acts as a shallow tray to help contain spills.

(c) Joins between bench surfaces shall be designed and constructed so that they do not leak or trap contamination.

(d) A hand washbasin shall be provided and the taps shall be operated automatically, or be operated by knee or foot.

(e) Drainage systems shall be continuous and be appropriately labelled at accessible locations. Polyethylene and PVC pipes and fittings are recommended because they are resistant to most chemicals and are less likely than metal pipes to become internally contaminated.

(f) If glove boxes are to be used, each shall have its own exhaust air filter. Discharge of the exhaust air shall comply with the requirements of AS/NZS 2243.8.

(g) Laboratory ventilation requires careful design with outdoor fresh air quantities increasing as the quantity of radioactivity proposed for use increases. Table 9.1 provides a practical guide to the supply of outdoor air requirements for laboratories assuming a floor area of 10 m^2 per person and a ceiling height of 2.4 m. The RPA shall advise on recirculation of laboratory air within radioisotope laboratories. Fume cupboard exhaust air shall not be recirculated. Radioisotope laboratories shall be maintained at a negative pressure with respect to adjacent spaces. An alarm system that is automatically activated in the event of failure of the ventilation system shall be installed.

TABLE 9.1

MINIMUM OUTDOOR AIR FLOW FOR RADIOISOTOPE LABORATORIES

Type of laboratory	Minimum outdoor fresh air flow per unit of total floor area, L/s.m^2
Biological and chemical	3 to 6
Animal rooms	10
Radionuclide counting rooms	3
Low-level radioisotope laboratories	3 to 6
Medium-level radioisotope laboratories	6 to 9
High-level radioisotope laboratories	>9 (see Clause 9.3.6)

NOTE: Heat loads will in many cases increase the total supply air requirements well above these figures.

(h) The RPA shall determine whether overshoes and barriers are required.

(i) Laboratories of a medical or biological nature, where sterility of products also has to be maintained, will present special design difficulties. In such cases the RPA will need to resolve the different requirements of the radioisotope codes and standards, the sterility standards for cleanrooms and the Australian Code of Good Manufacturing Practice for Therapeutic Goods. In addition, for product and operator protection, laminar flow biological safety cabinets complying with AS 2252.2 may be required.

Ceilings shall be smooth and decontaminable as for walls. Flush light fittings shall be used in preference to suspended fittings which will trap dust.

Laboratories, in the upper part of the medium-level classification or above, shall have ceilings coved to the walls to aid cleaning.

For medium-level laboratories in which higher levels of radioactivity are used, consideration shall be given to the provision of delay tanks for collection of the effluent before discharge to the sewer. Several tanks may be necessary for holding during decay and dilution of the aqueous liquid effluent before discharge. These tanks shall be surrounded with a bund of sufficient size to retain the tank contents in the event of mishap. Holding tanks shall be emptied by pumps rather than by gravity discharge. The advice of the RPA, regulatory authority and waste water authority shall be sought when considering the need for, and design of, such a system.

At least one fume cupboard in accordance with AS/NZS 2243.8 shall be provided. Appropriate exhaust air filters are desirable and provision shall be made to fit them at a later date even if they are not required in the first instance. Provision shall be made for exhaust air sampling. The base of the fume cupboard shall be capable of carrying 0.5 kg/cm^2 (0.5 MPa) averaged over the whole area of the base.

9.3.6 High-level laboratories

High-level laboratories need special detailed design and planning before construction. An existing laboratory can rarely be modified for use as a high-level laboratory. The RPA and the relevant regulatory authority shall always be consulted at an early planning stage. Such laboratories shall contain the features listed in Clauses 9.3.4 and 9.3.5 and shall also provide the following:

(a) A ventilating system capable of supplying at least 9 L/s.m^2 of floor area of fresh filtered air. Atmospheric discharge of airborne radioactive waste shall be minimized at source where possible, by filtration of aerosols or airborne particulates or other appropriate collection or treatment methods. The quantity and rate of discharge shall not exceed that permitted by the regulatory authority or authorizations permitting the discharge of waste materials.

Arrangements shall be made to demonstrate compliance with the foregoing, by appropriate monitoring or other means acceptable to the regulatory authority.

Trapped contaminants arising from the treatment of laboratory or fume cupboard exhaust air shall be disposed of safely in a manner approved by the RPA and the regulatory authority.

A negative pressure shall be maintained at all times in any glove boxes and hot cells. An evacuation alarm system shall be automatically activated when the ventilation system fails. Windows in the laboratory shall be of fixed glass and non-openable.

(b) Extensive shielding and remote handling equipment for large quantities of gamma emitters. Consideration shall be given to permissible floor loadings and the provision of cranes.

(c) Facilities for the decontamination of apparatus.

(d) Warning signs, lights and interlocks, as necessary, in accordance with AS 1216 and AS 1319.

(e) A change room located at the entrance to the laboratory. The layout shall be such that the correct route through it is obvious and difficult to bypass. Depending upon the type of laboratory served, the change room shall provide—

(i) a clear barrier or demarcation between the ‘radioactive’ and the ‘non-radioactive’ areas, with adequate space on each side;

(ii) storage for clothing on each side of the barrier and containers for used clothing beside the barrier on the active side;

(iii) washing facilities on each side of the barrier with automatic or knee- or foot-operated taps;

(iv) personnel monitoring facilities;

(v) a ventilation system to ensure that airflows are directed from the change room to the active area;

(vi) a shower; and

(vii) provision for the mounting of written instructions.

9.4 SUMMARY OF DESIGN REQUIREMENTS

Table 9.2 provides a summary of requirements and recommendations for various grades of radioisotope laboratories.

9.5 STORAGE OF RADIOACTIVE MATERIALS

9.5.1 General

Radioactive substances shall be stored separately from non-radioactive substances.

9.5.2 Security

Radioactive materials shall be stored so that they do not present a hazard to persons in the vicinity and are secure against theft or unauthorized tampering.

9.5.3 Shielding

Radiation levels outside the store at locations that are accessible to non-occupationally exposed persons, shall not exceed the levels specified in AS 2243.4.

9.5.4 Ventilation

Where radioactive material is likely to emit a radioactive gas or vapour, the store shall have separate and mechanical ventilation to the outside air. The fan shall be designed such that it can be operated for at least two minutes before any person opens or enters the store.

9.5.5 Signage

A radiation warning sign (see AS 2243.4) shall be displayed at the entrance to each radioactive store.

Ducting, fans, air cleaning systems and discharge outlets for airborne wastes shall be clearly and permanently labelled.

9.6 REFERENCES

1 INTERNATIONAL BASIC SAFETY STANDARDS FOR PROTECTION AGAINST IONIZING RADIATION and for the Safety of Radiation Sources, Vienna, 1994.

2 INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION. Protection against ionizing radiation from external sources used in medicine. ICRP Publication 33, Annals of the ICRP. Oxford: Pergamon Press, 1982, Vol. 9, No. 1.

3 INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION. Data for use in protection against external radiation. ICRP Publication 51, Annals of the ICRP. Oxford: Pergamon Press, 1987.

TABLE 9.2

SUMMARY OF RADIOISOTOPE LABORATORY REQUIREMENTS AND RECOMMENDATIONS

Laboratory grade	Typical examples	Description	Control of other aspects
Low-level	Radio-immunoassay area within a small medical diagnostic laboratory using only pre-labelled non-volatile kits. Typically uses no more than 400 kBq of Iodine-125 per week in predispensed kits.	Continuous floor covering but not coved up to walls. Melamine, PVC, stainless steel or similar flat topped benches without raised edges. Semigloss washable paint. No particular effort to conceal exposed pipes and conduits. Window exhaust fan may provide sufficient air change. Fume cupboard not necessary. A handbasin shall be provided. However, a lever action tap over a laboratory sink may be acceptable to the regulatory authority. Flushing sink may or may not be needed; depends upon type of work.	Access limited to laboratory workers. Normal laboratory coats satisfactory. No requirement for overshoes. Radioisotope area often occupies a small section of bench space within a larger laboratory in which non-radioactive work is also carried out. Work area delineated by radioactive marking tape holding down absorbent paper on which work shall be carried out in trays.
	Larger radio-immunoassay laboratories in pathology practices and hospitals.	Criteria as itemized in Clause 9.3.4.	Access limited to laboratory workers.
	Teaching, medical and research laboratories in medical schools, hospitals, universities, CSIRO and similar institutions.	A fume cupboard in accordance with AS/NZS 2243.8 will be required in most of these laboratories.	Wrap-over type laboratory coats shall be provided with 'velcro' fastening, colour identified for radioisotope work.
	Typical usage up to 20 MBq of radiotoxicity hazard group 2, up to 2 GBq of group 3 and up to 200 GBq of group 4.	Advice shall be sought from the RPA as some of the medical and biological/ molecular biology/pathology laboratories will need to meet additional criteria for small- scale genetic manipulation work.	Laboratory shall be dedicated to radioisotope work only.
Medium-level	Radio-iodination procedures in research laboratories and institutions with typical I-125 activity up to 200 MBq. Radiochemistry research with typical usage up to 20 MBq of Co-60, up to 400 MBq of Sn-113 and Zn-65.	Criteria as itemized in Clauses 9.3.4 and 9.3.5. RPA advice as above if genetic manipulation involved.	Laboratory shall be dedicated solely to radioisotope work. Overshoes may be required to RPA advice. Colour coded 'velcro' fastening laboratory coats essential. Access restricted to radioisotope workers.
	Preparation of nuclear medicine diagnostic doses.	Criteria itemized in Clauses 9.3.4 and 9.3.5.	As above.

(*continued*)

TABLE 9.2 (*continued*)

Laboratory grade	Typical examples	Description	Control of other aspects
	Preparation of radioisotope therapy doses.	Compliance with appropriate parts of Australian Code of good manufacturing practice for therapeutic goods.	As above. Overshoes required.
	Small-scale production of commercial radioisotope products.		
High-level	Refer Clause 9.3.6.		

SECTION 10 SECONDARY SCHOOL LABORATORIES

10.1 SCOPE OF SECTION

The requirements of this Section apply to the design and construction of secondary school laboratories and are additional to, or variations to, those of Sections 1 to 7. In New Zealand reference should also be made to the Code of Practice for School Exempt Laboratories.

NOTES:

1 When designing secondary school laboratories, the tendency for young students to panic in an emergency should be kept in mind.

2 There are restrictions on radiation doses to students. In Australia refer to NHMRC Radiation Health Series 39 and 19 which states that, in relation to conditions for young persons—

(a) no person under the age of 16 years is to be subjected to occupational exposure; and

(b) no person under the age of 18 years is to be allowed to work in a controlled area unless supervised and then only for the purpose of training.

3 In New Zealand refer to the Ministry of Education Safety in Science 2000 publication.

10.2 RETICULATED SERVICES

10.2.1 Gas isolating valves

Outlets shall be provided with a lockable isolating valve located on or adjacent to the teacher's bench.

10.2.2 Controls labelling

All controls for laboratory services shall be provided with a legible and durable label indicating the service.

10.3 ELECTRICAL SERVICES

All power to general purpose outlets for student use shall be supplied through an emergency/master control circuit operated by a suitably labelled push-button, with key operated manual reset, located near the teacher's bench adjacent to the main gas isolating valves.

10.4 HAZARDOUS MATERIALS

10.4.1 Flammable liquids

Flammable liquids shall not be stored in any secondary school laboratory. All flammable liquids shall be stored in a separate compartment cabinet or preparation area in accordance with AS 1940.

NOTE: For specific New Zealand requirements refer to the Code of Practice for School Exempt Laboratories.

10.4.2 Chemicals emitting hazardous vapours

Chemicals emitting hazardous vapours shall not be stored in any secondary school laboratory. All chemicals emitting hazardous vapours shall be stored in a separate compartment cabinet or preparation area in accordance with AS 3780 or another appropriate Standard.

APPENDIX A

PLANNING, DESIGN AND CONSTRUCTION

(Informative)

A1 THE PLANNING BRIEF

During the stages of planning a laboratory a written brief should be provided by the building owner to the building designer containing the following information:

(a) Type and function of the laboratory.

(b) A detailed description of the work in so far as it may affect building requirements, including its layout and containment levels.

(c) Details of hazards associated with the work.

(d) Any proposed operations which may give rise to air contaminants, including—

  (i) chemical, biological or radioactive operations; and

  (ii) operations where flammable liquids, hazardous or infectious materials or objectionable odours can contaminate ventilation air, particularly in the event of accidental spillage.

(e) The types of gases and flammable vapours likely to be produced by particular laboratory processes or to arise from flammable liquid stores or cabinets and the tendency of those gases or vapours to ascend or descend.

(f) Equipment and apparatus to be installed.

(g) Degree of flexibility required.

(h) Staff complement (present and projected).

(i) Conditions that might necessitate special structural requirements (e.g. heavy loads).

(j) Additional loading, anti-vibration or insulation requirements which may result from the location of the laboratory or from the nature of the work to be carried out in it, or other special hazards such as fire, explosion or radiation.

(k) Types and amount of waste.

(l) Future extension needs.

(m) Any other relevant matters.

Through the design, planning and implementation process programmed risk assessments should be undertaken.

A2 SITING OF BUILDINGS

Laboratories should be preferably located separately in an environment appropriate to the required facilities, services and possible effluents, i.e. not mixed with non-laboratory functions located on adjacent floors. In the siting of laboratory buildings, consideration should be given to all matters affecting the safety of persons engaged in the laboratory and of persons in the vicinity, including the following:

(a) The need to isolate or remove hazards of the work or otherwise reduce the risk.

(b) Security of personnel and protection of the public.

(c) Control of access, including security.

(d) Access and facilities for handling hazardous substances and heavy goods.

(e) Access and facilities for firefighting, ambulance and rescue services.

(f) Availability of water for firefighting.

(g) Proximity and use of adjacent premises or properties.

(h) Safe areas for occupants after evacuation.

(i) Any increased risk of fire.

(j) Disposal of hazardous or infectious laboratory wastes.

(k) Degree of protection from or exposure to sun and wind (see also Clause 2.2).

(l) Exhaust-air discharge locations, considering—

  (i) effects on people;

  (ii) effects on the building (corrosion);

  (iii) effects of wind;

  (iv) proximity to air intakes; and

  (v) effects on the environment.

(m) Isolation of noise—

  (i) from other areas; and

  (ii) to other areas.

(n) Effect of airborne particulates.

A3 ENVIRONMENTAL CONDITIONS WITHIN LABORATORIES

Temperature, humidity and air cleanliness within laboratory spaces should be designed to suit the requirements of the laboratory processes and instrumentation, or, in the absence of any special requirements, to provide acceptable occupant comfort and safety.

No space heating equipment installed in a laboratory should contain any source of ignition in contact with the laboratory air flow.

A4 LABORATORY ACCESS AND EGRESS

A4.1 Laboratory egress

Laboratories with an egress path length exceeding 7 m should have alternative means of egress. The alternate exit may be to an adjoining laboratory.

A4.2 Control of access

Laboratories should be designed to allow control of all access points.

A4.3 Access for materials and equipment

If a lift is used, it should comply with AS 1735.

NOTE: Use of lifts rather than stairs will facilitate the safe movement and distribution of chemicals, materials and equipment.

Factors that should be taken into account include the following:

(a) Sizes of openings adequate for access to equipment.

(b) Avoidance of steps in paths used for access, especially where hazardous substances are carried.

(c) Ready access to associated areas and stores—

(i) to facilitate sampling and access to stores; and

(ii) to avoid unnecessary storage of hazardous substances within the laboratory.

(d) Control of access for hazardous materials including security sensitive biological agents.

(e) Facilities to ensure the safe distribution of hazardous substances and stores from storerooms.

A5 WORK SURFACE HEIGHTS

Most laboratory work takes place in the space immediately above the work surface. In order to maximize this space, the work surface should be set at the lowest height convenient to the user. For working when seated, the work surface height should be 700 mm to 750 mm.

A height of 900 mm is suggested for bench surfaces for work when standing.

The height adopted for different work surfaces and writing surfaces should be standardized throughout the laboratory area.

NOTE: The space available above the bench should be considered. For example, tall apparatus may require a lower bench to enable safe easy access to the full height of the rig.

A6 STORAGE

A6.1 Storage heights

The heights at which items are to be stored shall be related to convenient reach and the frequency of use.

NOTES:

1 The height of the top shelf should not exceed 1700 mm and the top of the cupboard should not exceed 2200 mm.

2 Refer to AS/NZS 2243.10 for chemical storage height limits.

3 Reference in New Zealand should also be made to the requirements in the relevant Exempt Laboratories Code of Practice.

A6.2 Storage depths and access

Depth of storage cupboards should not normally exceed 500 mm.

NOTE: Access to the rear of shelves deeper than 500 mm is difficult, particularly in the case of under-bench units.

A7 FUME CUPBOARDS, SAFETY CABINETS ETC.

A7.1 Containment devices

Localised containment devices such as fume cupboards and biological safety cabinets enhance safety by capturing contaminants at source and either retaining them for disposal or exhausting them to atmosphere. Some devices have other important functions such as protecting products or service personnel from exposure to contaminants. The range of standardised devices includes recirculating and non-recirculating fume cabinets, class I and II biological safety cabinets and cytotoxic drug safety cabinets. These devices are covered by specific Australian Standards as listed in Clause 2.10. In addition, other less standardized devices e.g. class III biological safety cabinets, glove boxes and specialized exhaust hoods, may have application to particular laboratories.

These devices all have a range of planning and design impacts that need to be carefully assessed to maximise safety and utility. A number of planning and design constraints can be found by reference to the Australian Standard for each device under consideration. Important considerations that may apply include:

(a) Providing a suitable location and space to fully accommodate each device and any associated ductwork with acceptable access and clearances.

(b) Assessing the risk and impact of an accident associated with the device (e.g. fire, explosion, fume or aerosol release), particularly in relation to safe egress from the area.

(c) Avoiding disturbance to airflow around the face of the device (e.g. by excessive draughts or personnel movement).

(d) Treatment of airborne, waterborne and other contaminant and waste products.

(e) Safe dispersion of exhaust air and residual contaminants.

(f) Maintaining fire separation where exhaust ducts traverse more than a single fire compartment.

(g) Providing for decontamination, cleaning and servicing.

(h) Selecting device materials to suit the application and level of exposure to degradation.

(i) Providing reticulated services for the application.

(j) Making provision for device relocation or replacement.

A7.2 Laminar flow cabinets

Simple cross-flow type laminar flow cabinets provide ultra-clean or aeseptic work spaces and are commonly used in conjunction with cleanrooms. These laminar flow cabinets are not containment devices. They are designed to exclude airborne contaminants from the work space. However, the planning and design issues with these cabinets may be quite similar to those for localised containment devices. Note, in particular, items (a), (b), (c), (g), (i) and (j) listed in the preceding clause. In general, these cabinets are easier to accommodate than most of the containment devices.

*** END OF DRAFT ***

PREPARATION OF JOINT AUSTRALIAN/NEW ZEALAND STANDARDS

Joint Australian/New Zealand Standards are prepared by a consensus process involving representatives nominated by organizations in both countries drawn from all major interests associated with the subject. Australian/New Zealand Standards may be derived from existing industry Standards, from established international Standards and practices or may be developed within a Standards Australia, Standards New Zealand or joint technical committee.

During the development process, Australian/New Zealand Standards are made available in draft form at all sales offices and through affiliated overseas bodies in order that all interests concerned with the application of a proposed Standard are given the opportunity to submit views on the requirements to be included.

The following interests are represented on the committee responsible for this draft Australian/ New Zealand Standard:

Australasian Fire Authorities Council

Australian Chamber of Commerce and Industry

Australian Universities of Australia

CSIRO Land and Water

Commonwealth Department of Health and Ageing

Commonwealth Scientific and Industrial Research Organization

Engineers Australia

Environmental Science and Research New Zealand

National Measurement Institute

Plumbing Products Industry Group

Standards New Zealand

The Royal Australian Chemical Institute

The Royal Australian Institute of Architects

Standards Australia

Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. These standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth government, Standards Australia is recognized as Australia's peak national standards body.

Standards New Zealand

The first national Standards organization was created in New Zealand in 1932. The Standards Council of New Zealand is the national authority responsible for the production of Standards. Standards New Zealand is the trading arm of the Standards Council established under the Standards Act 1988.

Australian/New Zealand Standards

Under a Memorandum of Understanding between Standards Australia and Standards New Zealand, Australian/New Zealand Standards are prepared by committees of experts from industry, governments, consumers and other sectors. The requirements or recommendations contained in published Standards are a consensus of the views of representative interests and also take account of comments received from other sources. They reflect the latest scientific and industry experience. Australian/New Zealand Standards are kept under continuous review after publication and are updated regularly to take account of changing technology.

International Involvement

Standards Australia and Standards New Zealand are responsible for ensuring that the Australian and New Zealand viewpoints are considered in the formulation of international Standards and that the latest international experience is incorporated in national and Joint Standards. This role is vital in assisting local industry to compete in international markets. Both organizations are the national members of ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission).

Visit our web sites

www.standards.org.au www.standards.co.nz

www.standards.com.au