

Compliance Document for New Zealand Building Code Clause F3 Hazardous Substances and Processes

Prepared by the Department of Building and Housing

This Compliance Document is prepared by the Department of Building and Housing. The Department of Building and Housing is a Government Department established under the State Sector Act 1988.

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Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Compliance Documents and explains alternative methods of achieving compliance.

Defined words (italicised in the text) and classified uses are explained in Clauses A1 of the Building Code and in the Definitions at the start of this Compliance Document.

F3: Document History		
	Date	Alterations
First published	July 1992	
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Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 1 July 2001 and supersedes all previous versions of this document.

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New Zealand Building Code Clause F3 Hazardous Substances and Processes

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

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FIRST SCHEDULE—continued		
Clause F3—HAZARDOUS SUBSTANCES AND PROCESSES		
Provisions	Limits on application	
OBJECTIVE		
<p>F3.1 The objective of this provision is to safeguard people from injury or illness, and <i>other property</i> from damage, caused by <i>hazardous substances</i> or processes in <i>buildings</i>.</p>		
FUNCTIONAL REQUIREMENT		
<p>F3.2 <i>Buildings</i> where <i>hazardous substances</i> are stored and <i>hazardous processes</i> undertaken, shall be constructed to provide <i>adequate</i> protection to people and to <i>other property</i>.</p>		
PERFORMANCE		
<p>F3.3 Spaces in <i>buildings</i> where <i>hazardous substances</i> are stored, handled or used, or where <i>hazardous processes</i> are undertaken, shall be located and constructed to protect people, and <i>other property</i>, under both normal and reasonably foreseeable abnormal conditions, and shall be provided with:</p>		
<ul style="list-style-type: none"> (a) Means of restricting unauthorised access, (b) Means of preventing <i>hazardous substances</i>, or other materials unacceptable to the <i>network utility operator</i>, from entering <i>sewers</i> or <i>public drains</i>, (c) Means of allowing the harmless release of pressure where there is a significant risk of explosion occurring, (d) Protected ignition sources where flammable or explosive goods are stored, (e) Means of rendering harmless by ventilation, containment, dilution, or chemical or biological action, any radioactive, toxic or flammable vapours, gases or materials which may escape from pipes, vessels or containers, 		

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1992/150

FIRST SCHEDULE—*continued*

Provisions	Limits on application
(f) Impervious, easily cleaned surface finishes on <i>building elements</i> likely to be splashed or become contaminated in the course of the <i>intended use</i> of the <i>building</i> , and	
(g) Signs as required by Clause F8 “Signs”.	

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References

Amend 1
Jul 2001

For the purposes of New Zealand Building Code compliance, acceptable reference documents include only the quoted edition and specific amendments as listed below.

Standards New Zealand

- NZS 4232:- Performance criteria for fire resisting enclosures
 - Part 1: 1988 Internal and external fire doorsets
 - Part 2: 1988 Fire resisting glazing systems
- NZS 5433: 1988 Code of practice for transportation of hazardous substances on land

Where quoted

- AS1 1.3.2, 4.7.12
- AS1 1.4.1
- AS1 App A

Standards Association of Australia

Amend 1
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- AS 1530:- Methods for fire tests on building materials, components and structures
 - Part 1: 1994 Combustibility test for materials
- AS 1768: 1991 Lightning protection (incorporating Amdt. 1)

- Definitions
- AS1 2.1.4 b)

Amend 1
Jul 2001

New Zealand Legislation

- Animal Remedies Act: 1967
- Animal Remedies Regulations: 1980
- Dangerous Goods Act: 1974
- Dangerous Goods Order: 1983
- Dangerous Goods (licensing fees) Regulations: 1976
- Dangerous Goods Regulations
 - Gases: 1980
 - Flammable liquids: 1985
 - Flammable solids: 1985
 - Oxidising substances: 1985
- Explosives Act: 1957
- Explosives Regulations: 1959
- Explosives Authorisation Order: 1983
and amendment No. 1 (1987)
- Pesticides Act: 1979
- Pesticides Regulations: 1983
- Pesticides (Vertibrate Pest Control) Regulations: 1983
- Radiation Protection Act: 1965
- Radiation Protection Regulations: 1982
- Toxic Substances Act: 1979
- Toxic Substances Regulations: 1983

- AS1 App A
- AS1 App A
- AS1 App A
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Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to this Approved Document. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook.

Adequate *Adequate* to achieve the objectives of the *building code*.

Adjacent building A nearby *building*, including an adjoining *building*, whether or not erected on *other property*.

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Combustible See *non-combustible*.

Compound In relation to the storage of liquid dangerous goods, a basin, pit, excavation, hollow or enclosure constructed of concrete, brick, clay, earth, or similar incombustible material which will effectively retain the liquid dangerous goods if they leak from their container(s).

Construct in relation to a *building*, includes to build, erect, prefabricate, and relocate; and **construction** has a corresponding meaning.

Dangerous goods Any materials included in the UN classification, classes 2-5.

Dangerous goods workroom A room reserved primarily for the use of *dangerous goods* of Class 3(a) or Class 3(b) (i.e. flammable liquids).

Depot In relation to *dangerous goods*, a *building*, place, or vessel as may be prescribed, or as may be approved by an Inspector (of *dangerous goods*), as a *depot* for the storage of *dangerous goods*.

Fire door A *doorset*, single or multi-leaf, having a specific *fire resistance rating*, and in certain situations a smoke control capability, and forming part of a *fire separation*. The door, in the event of *fire*, if not already closed, will close automatically and be self latching.

Amend 1
Jul 2001

COMMENT:

Requirements for *fire doors* are given in C/AS1 Paragraph 6.19.1 and 6.19.8 and Appendix C Paragraph C8.1.

Amend 1
Jul 2001

Fire resistance rating (FRR) The term used to describe the minimum *fire resistance* of *primary* and *secondary elements* as determined in the *standard test* for *fire resistance*, or in accordance with a specific calculation method verified by experimental data from standard *fire resistance* tests. It comprises three numbers giving the time in minutes for which each of the criteria *stability*, *integrity* and *insulation* are satisfied, and is presented always in that order.

Amend 1
Jul 2001

COMMENT:

1. Examples of *FRRs* are:

- a) 30/30/15 indicating *stability* 30 minutes, *integrity* 30 minutes, *insulation* 15 minutes.
- b) 30/-/- indicating *stability* 30 minutes, but no time requirement for *integrity* or *insulation*.
- c) -/15/15 indicating no time requirement for *stability*, but 15 minutes for *integrity* and *insulation*.
- d) 60/30/x indicating *stability* of 60 minutes, *integrity* of 30 minutes, and a requirement for *insulation* from C/AS1 Paragraph 5.6.4.

Amend 1
Jul 2001

2. C/AS1 Part 5 gives more information on *FRRs*.

Amend 1
Jul 2001

Habitable work Any *building* where people live, work or may assemble, but does not include *buildings* associated with the storage or use of *dangerous goods* on the same site.

COMMENT:

The terms "Habitable Work" and "Title Boundary" in this document replace the definition "Protected Work" used in the Dangerous Goods Regulations 1980/46, 1985/188, 1985/170.

Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.

Hazardous Substance Has the meaning ascribed to it by the Fire Service Act 1975.

In bulk In relation to liquid or gaseous *dangerous goods*, product contained in receptacles of a liquid capacity greater than 250 litres. Conversely, **non-bulk** means contained in receptacles of 250 litres capacity or less.

Insulation In the context of *fire* protection, the time in minutes for which a prototype specimen, of a *fire separation* when subjected to the *standard test for fire* resistance, has limited the transmission of heat through the specimen.

Integrity In the context of *fire* protection, the time in minutes for which a prototype specimen, of a *fire separation* when subjected to the *standard test for fire* resistance, has prevented the passage of flame or hot gases.

COMMENT:

The precise meaning of *integrity* depends on the type of *building elements* being treated and how it is defined in the *standard test* being used.

Amend 1
Jul 2001

Isolation distance The minimum physical distance by which an installation, or specified part of an installation, containing *dangerous goods* must be separated from any other specified place, or *building*.

Lower flammable limit (LFL) (also referred to as Lower Explosive Limit (LEL)). The lowest percentage of hydrocarbon or flammable vapour in the air which will readily ignite on introduction of an ignition source.

Non-bulk See *in bulk*.

Non-combustible Materials shall be classified as *non-combustible* or *combustible* when tested to:

AS 1530 – Part 1.

Other property means any land or *buildings* or part thereof which are:

- Not held under the same allotment; or
- Not held under the same ownership – and includes any road.

Public place Any place which is freely open to and frequented by the public, but excludes private property where the access of the public to *dangerous goods* can be controlled by the licensee.

Screen wall Any wall or barrier which effectively diverts flammable vapours by virtue of its width, height and position, or which prevents the spread of *fire* from one place to another.

Stability In the context of *fire* protection, the time in minutes for which a prototype specimen, of a *primary element* when subject to the *standard test for fire* resistance, has continued to carry its *fire* design load without failure.

Amend 1
Jul 2001

COMMENT:

The *fire* design load should be as specified in the limit state loadings code NZS 4203.

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Standard test A test method which is recognised as being appropriate for the *fire* protection properties being assessed.

COMMENT:

A list of *standard test* methods is given in Appendix C of C/AS1.

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Title boundary A boundary with *other property*.

COMMENT:

The terms “Habitable Work” and “Title Boundary” in this document replace the definition “Protected Work” used in the Dangerous Goods Regulations 1980/46, 1985/188, 1985/170.

Vapour path length The travel distance between the vapour source and the point at which the vapour concentration is being considered.

Verification Method F3/VM1

No specific test methods have been adopted for verifying compliance with the Performance of NZBC F3.

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Acceptable Solution F3/AS1

Scope

This document covers substances defined as explosives under the Explosives Act 1957 and substances defined as Classes 2-5 under the Dangerous Goods Order 1983. It is derived from the relevant Dangerous Goods Regulations current as at March 1991.

It is an acceptable solution for *buildings* where explosives are manufactured and where Dangerous Goods of Classes 2-5 are stored or used in quantities requiring a licence under the Dangerous Goods (Licensing fees) Regulations 1976.

1.0 General Provisions

1.1 Protection against electrical ignition

1.1.1 Refer to NZBC G9 for acceptable electrical installations.

1.2 Types of depot construction

Type A. A hardwood or *non-combustible* platform on which to stand containers. It may have a roof constructed of timber or steel framing and clad in a *non-combustible* material.

Type B1. Timber or steel framing, clad and lined with *non-combustible* material such as 0.40 mm thick galvanised steel sheet, galvanised wire mesh or 9.5 mm maximum thickness gypsum plasterboard.

Type B2. Timber or steel framing, clad and lined with *non-combustible* materials such as 0.40 mm thick galvanised steel sheet or 9.5 mm minimum thickness gypsum plasterboard.

Type C1. Concrete, brick or concrete block, with panels of light construction to act as pressure-relief elements which comprise no less than 25% of the internal surface area, and weigh less than 12 kg per m².

COMMENT:

Details for designing pressure-relief elements are given in the Department of Labour booklet "Dust explosions in factories", and are described as 'vents' in that reference.

Type C2. A building with walls of brick, concrete block or reinforced concrete without windows, and having a roof of steel or timber framing with lightweight *cladding*.

Type D. Walls as in Type C2 with a reinforced concrete roof, and any skylights constructed of wired glass in a steel frame.

Type E. Walls, floor and ceiling have a *FRR* of no less than 60/60/-.

Type F. Walls, floor and ceiling have a *FRR* of no less than 120/120/-.

Type G. Walls, floor and ceiling have a *FRR* of no less than 180/180/-.

Type H. Walls, floor and ceiling have a *FRR* of no less than 240/240/-.

1.3 Doors

1.3.1 Doors for *dangerous goods* storage and handling facilities shall be constructed with due regard to the class and quantity of the goods, and of the potential hazard. In all cases doors shall be constructed to:

- a) Open outward from the store or workroom, unless specific exemption is made in this document,
- b) Be no wider than 1.0 m except where the use of workroom or storage space necessitates wider doors,
- c) Ensure that no exits from other portions of the *building* are rendered unusable,
- d) Not open directly into portions of the *building* which are not part of the workroom except that the storage space is permitted to open into an adjoining space which is a *dangerous goods workroom* complying with Paragraph 4.7,
- e) Have a *fire resistance rating (FRR)* of no less than the other elements of the room or structure, unless specific exemption is made in this Approved Document, and
- f) Close automatically in the event of *fire*, where the door opens into a *building* or workroom.

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1.3.2 *Fire doors* shall comply with AS/NZS 1905.1, and C/AS1 Appendix C.

1.4 Windows

1.4.1 Window construction

Windows when installed in *dangerous goods workrooms*, shall comply with NZS 4232: Part 2 except that ordinary windows may be installed where:

- a) The exterior walls are of *non-combustible construction*, and
- b) The window is no less than 5 m from any *habitable work*.

1.4.2 Skylights

Skylights and roof ventilators in *dangerous goods workrooms*, when installed in ceilings having a *FRR*, shall be protected by *non-combustible* closures capable of being automatically activated in the event of a *fire*. Alternatively, shutters which automatically close when a fusible link is triggered are acceptable.

1.4.3 Restrictions on use

Walls separating a workroom or storage space from the rest of the *building* shall not contain windows unless they:

- a) Are essential for the operations conducted in the *building*, and
- b) Have the same *FRR* as the walls of the workroom or storage space.

1.5 Ventilation

1.5.1 Ventilation shall be provided to *dangerous goods depots* either:

- a) By natural ventilation having a total open vent area of no less than 0.25% of the storage floor area for every metre of ceiling height up to a maximum of 1%. Vents shall be evenly distributed around the perimeter of the *depot* at both high and low levels. Low level vents must be above the top of any *compound*. Vent openings shall be covered with 0.5 mm brass gauze, where within 1.5 m of the ground, or

- b) By mechanical ventilation providing outside air at a rate of no less than 0.15 litres per second for every m³ of *depot* volume.

1.5.2 Additional specific ventilation requirements are given for flammable gases in Paragraph 3.1, *dangerous goods workrooms* and *depots* in Paragraphs 4.8.2 and 4.8.5, oil storage chambers in Paragraph 4.8.3, and oil burning chambers in Paragraph 4.8.4.

1.6 Related documents

1.6.1 Classification of hazardous substances

Classifications of *hazardous substances* are contained in Appendix A of this acceptable solution.

2.0 Explosives

2.1 Buildings for explosives manufacture

2.1.1 *Buildings* used for the manufacture of explosives shall comply with Paragraphs 2.1.2 to 2.1.5.

2.1.2 Ignition hazard

Interior surfaces of the *buildings*, including the benches, shelves, and fittings, shall be constructed with no exposed iron or steel. Timber linings are acceptable.

2.1.3 Water ingress

The *construction* and the drainage systems installed shall prevent the uncontrolled entry of water into the *building*.

2.1.4 Lightning protection

Buildings shall be protected against lightning strikes by:

- a) The provision of a lightning conductor, consisting of a copper, aluminium or galvanised steel strip no less than 20 x 3.0 mm, or
- b) Complying with the requirements of AS 1768.

2.1.5 Security

Buildings shall be secured against unauthorised access by having lockable doors constructed of either concrete, or steel faced with wood.

3.0 Class 2 Gases

3.1 Ventilation

3.1.1 Ventilation to *buildings* storing Class 2 gases shall comply with Paragraph 1.5 and have ventilators located:

- a) For Classes 2(b), 2(c), 2(d), 2(f) and 2(g): with vent openings, distributed equally at high and low level, and a total combined area complying with Paragraph 1.5.1.
- b) For Class 2(e) (chlorine chambers): with vent openings at low level to allow the escape of gas to the outside air.
- c) For Class 2(b) ethylene (used in fruit ripening chambers) chambers shall be vented to the outside air.

3.1.2 There are no specific requirements for the storage of Class 2(a) gases in relation to *buildings*.

3.1.3 Any subfloor space of a *building* used for storing Class 2(d) LPG shall be completely open to the outside air.

3.2 Class 2(b) gases

3.2.1 Storage facilities

Within *buildings*, storage facilities for tanks or containers shall be Type B1 *depots*.

3.2.2 Fruit ripening chambers (using ethylene)

Chambers which use ethylene to ripen fruit shall be fully sealed to prevent the escape of the gas when gas is being used. Timber framed gas chambers lined with plasterboard and fully stopped are acceptable. Doors shall be sealed around the perimeter.

3.3 Class 2(d) gases

3.3.1 Storage buildings

Where *buildings* are used to store cylinders of Class 2(d) gases they shall be Type B1, C1 or C2. A storage *building* shall not be a part of a *habitable work*.

3.4 Class 2(c), 2(e) and 2(f) gases

3.4.1 Storage buildings

Buildings used for storage shall be Type B2 where the quantity of gas stored exceeds:

- a) 2500 litres for Class 2(f).
- b) 60 m³ for Class 2(c) acetylene, which must be in a separate room.

3.4.2 Class 2(e) (chlorine) screening

Storage facilities for Class 2(e) gas (chlorine) shall have *screen walls* to prevent the uncontrolled escape of either liquid or gaseous chlorine into a *habitable work*, or a place of public assembly.

3.5 Class 2(g) gas (liquid oxygen)

3.5.1 Protection from spillage

No manhole, channel, drain or sump shall be located within 5.0 m of where liquid oxygen could be accidentally spilt. Storage and filling platforms shall be of concrete.

3.6 Aerosols

3.6.1 Storage facilities for aerosols shall have, for quantities of:

- a) Less than 3,000 litres: no special provision.
- b) Between 3,000 and 10,000 litres: a Type B2 *depot* except that where the *isolation distance* from the *title boundary* or *habitable work* exceeds 3.0 m no special provision is necessary.

An automatic sprinkler system is an acceptable alternative to B2 construction. Refer to C/AS1.

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- c) More than 10,000 litres: a *depot* (but excluding a *compound*) complying with that required for an equivalent amount of Class 3(b) *dangerous goods*.

4.0 Class 3 Flammable Liquids

4.0.1 Storage of flammable liquids not *in bulk*, shall have:

- a) Facilities complying with Paragraphs 4.1 to 4.6.
- b) *Workrooms* complying with Paragraph 4.7.
- c) The ventilation of spaces complying with Paragraph 4.8.

4.1 Security

4.1.1 Open air *depots* shall be protected from unauthorised access by a fence no less than 2.0 m high. Chain link netting and barbed wire is an acceptable *construction*.

4.2 Compounds

4.2.1 Construction

Compounds for containment of spillage of Class 3 flammable liquids shall consist of either:

- a) A *depot* with a perimeter barrier constructed from clay, clean binding earth, or concrete, or
- b) A *depot* constructed with the floor lowered to form a shallow well with impervious *non-combustible* surfaces, and thresholds at all entry points. This type of *compound* is acceptable for *dangerous goods workrooms*.

4.2.2 Capacity of compounds for Class 3 flammable liquids not in bulk

Compounds shall have a minimum storage capacity of:

- a) For containers of 60 litres or less where the total quantity stored is:
 - i) 5,000 litres or less – 1/2 of the quantity stored.

- ii) more than 5,000 litres – 1/4 of the quantity stored but no less than 2,500 litres.

- b) For containers of greater than 60 litres where the total quantity stored is:

- i) 5,000 litres or less – no less than the quantity stored.
- ii) more than 5,000 litres – 1/2 of the quantity stored but no less than 5,000 litres.

4.2.3 Capacity of compounds for storage in bulk

Class 3 bulk storage *compounds* shall have:

- a) A capacity equal to the volume of the largest tank in the *compound* for above ground tanks, except for Class 3(c) where the capacity may be 1/2 of the largest tank.
- b) No more than 75,000,000 litres (75,000m³) of Class 3(a) and 3(b) liquid stored in any single *compound*.
- c) Tanks within a *compound* divided into groups not exceeding 25,000,000 litres (25,000m³) aggregate capacity, with each group separated by an intermediate *compound* wall 250 mm lower than the outer *compound* wall, and with the intermediate *compound* capacity no less than 1/2 the capacity of the largest tank in the group.

COMMENT:

This document does not give a solution for tanks over 25,000,000 litres (25,000 m³).

4.2.4 Drainage

To permit drainage, *compounds* of more than 20,000 litres capacity shall be provided with permanent pumps or a drain pipe with valves operated from outside the *compound*.

4.3 Storage buildings

4.3.1 Types A, B1, B2, C2 and D are acceptable storage structures for *dangerous goods* of Class 3 non-bulk, provided the type of structure used complies with the isolation requirements of Tables 1 and 2 for the dangerous goods stored.

4.4 Depots located within a building

4.4.1 Construction

The *depot* shall be Type G *construction*, except that where the storage capacity is less than 2,000 litres and individual storage containers are less than 60 litres, Type F *construction* may be used.

4.4.2 Doors and windows

a) The storage space must not open to the interior of the *building* except where the adjoining space is a *dangerous goods workroom* complying with Paragraph 4.8.5, and

b) The door between the two spaces is self-closing in the event of a *fire*, and has a *FRR* of 180/180/-, except that:

c) Where the quantity stored is less than 2,000 litres, the storage space may open into the remainder of the *building* if the opening is protected by a door with a *FRR* of 120/120/-, and is self-closing in the event of a *fire*.

4.5 Isolation distances

4.5.1 Storage depots

Generally storage *depots* for Class 3 flammable liquids, not *in bulk*, shall be located so that:

a) They are no less than 15 m from any *fire*, forge, furnace or other source of ignition. The distance may be reduced to 6.0 m where a concrete or concrete masonry *screen wall* is erected between Class 3(b) and 3(c) flammable liquids and any *fire* or furnace.

Table 1: Isolation Distances for Depots Class 3(a) in Drums Over 60 Litre Capacity
Paragraph 4.3.1

Depots Types A & B1 & B2	Quantity stored		Minimum distance between the depot and the title boundary or habitable work (m)
	Depots Type C1 & C2	Depots Type D	
Litres	Litres	Litres	
Up to 250	Up to 500 2,000	Up to 10,000	Nil
			2
			3
1,000	10,000	20,000	4
			6
		100,000	8
		200,000	10
10,000	25,000 40,000	400,000 and over	15
			17
			20
20,000	60,000 200,000 and over		25
			27
40,000			30
60,000			
and over			

Note:
Isolation distances may be interpolated for intermediate quantities.

Table 2: Isolation Distances for Depots
Class 3(b) (all capacities)
Class 3(a) in Drums over 60 Litre Capacity
Paragraphs 4.3.1 and 4.5.3 e)

Depots Types A & B1 & B2	Quantity stored		Minimum distance between the depot and the title boundary or habitable work (m)
	Depots Type C1 & C2	Depots Type D	
Litres	Litres	Litres	
Up to 250	Up to 1,000	Up to 20,000	Nil
500			1
750	2,000		2
2,000		30,000	3
		100,000	4
	10,000	200,000	5
		400,000	6
		and over	
10,000	100,000		10
25,000	400,000 and over		15
40,000			17
60,000			20
and over			

Note:
Isolation distances may be interpolated for intermediate quantities.

- b) Type A and B *depots*, and openings in Type C2 and D *depots*, are not within 3.0 m of any *building*, except that this need not apply if portions of the *building* within 3.0 m of the *depot* are constructed of *non-combustible* materials.
- c) Type A and B *depots* are not within 4.0 m of any similar *depot*, or within 8.0 m of any *depot* if the quantity of stored material exceeds 10,000 litres.

4.5.2 When the *depot* is isolated from the *title boundary* or a *habitable work* by a reinforced concrete or concrete masonry *screen wall*, and the *depot* is at least 3.0 m from the *screen wall*, the allowable storage capacity may be doubled.

4.5.3 Class 3(b) and 3(c)

Class 3(b) and 3(c) flammable liquids need not be stored in a *depot* provided that:

- a) The goods are in steel containers of no more than 250 litres capacity,

- b) The total capacity stored is no greater than 250 litres,
- c) The floor of the storage place is concrete, coated with an inert sealant, and the walls and ceiling are lined with *non-combustible* materials,
- d) No other *dangerous goods*, highly *combustible* materials or sources of ignition, are stored within 6.0 m of the storage place unless a *screen wall* intervenes, and
- e) Isolation distances comply with Table 2.

4.5.4 Flammable liquids used in spray painting

For spray painting premises, if the Class 3 flammable liquids are held in containers each of no more than 20 litres capacity, and the total quantity stored does not exceed 450 litres, an acceptable *depot* is:

- a) A room of Type E *construction* with a self closing door having a *FRR* of 60/60/-, or

- b) A Type B *depot* isolated from workshops and other occupied *buildings* by no less than 6.0 m.

COMMENT:

The use of metal cabinets constructed specifically to store these substances is an acceptable alternative.

4.5.5 Class 3(c) (fuel oil)

Class 3(c) flammable liquids (fuel oil) not *in bulk*, need not be stored in a *depot* provided the storage place is:

- a) A minimum of 8.0 m from any above-ground storage site for Classes 3(a) and 3(b) flammable liquids,
- b) No less than 15 m from any *fire*, forge, furnace or other source of ignition, and
- c) A room of Type E *construction* when forming part of a *habitable work* and the quantity does not exceed 500 litres.

4.6 Storage tanks for oil-burning equipment within a building

4.6.1 "Oil" means *dangerous goods* of Class 3(b) having a flash point of 50°C or greater and all *dangerous goods* of Class 3(c).

4.6.2 Construction

A storage tank to supply oil-burning equipment may be located within a *building* provided that the tank is installed in a chamber which:

- a) Is Type D *construction* with walls bonded to floor to give a leak proof chamber,

- b) Has walls extending above floor level without openings, for sufficient height to form a *compound* capable of containing the total volume of the oil storage tank,
- c) Has wall, floor and ceiling thicknesses complying with Table 3,
- d) Has all access openings into the chamber complying with Paragraph 1.3 except that doors shall have a *FRR* of 60/60/-,
- e) Has sufficient size to allow a minimum clearance of 400 mm between the tank, and walls and ceiling of the chamber, if the chamber has to be entered for servicing, and
- f) Is ventilated in accordance with Paragraphs 1.5 and 4.8.

4.6.3 Storage on upper floors

If the storage tank is located on a floor above any other floor, then this upper floor shall be constructed with:

- a) A reinforced concrete slab no less than 150 mm thick, and
- b) The tank chamber *compounded* to contain the full contents should leakage occur.

4.6.4 Capacity

The maximum acceptable storage capacity is:

- a) 50,000 litres in any *building*.
- b) 25,000 litres in a building which has a *FRR* of less than 120/120/-.

Table 3: Depot Wall Thickness Paragraph 4.6.2 c)			
Total capacity of tank or tanks		Thickness of in-situ concrete	Thickness of masonry (Note 1)
	Litres	(mm)	(mm)
Up to	1,200	100	150
Up to	4,000	125	200
Over	4,000	150	NOT AN OPTION
Note:			
1. Masonry to have all cells filled.			

4.7 Flammable liquid workrooms

4.7.1 Construction

Flammable liquid workrooms shall be of Types E, F or H *construction*, as appropriate for the flammable liquid being used, and shall have *isolation distances* complying with Table 4.

4.7.2 If there is no occupied floor above the workroom, and the ceiling is of *non-combustible* material, the ceiling *FRR* may be reduced to 60/60/- provided a parapet is constructed. The parapet must rise no less than 450 mm above the roof line to protect adjacent or adjoining rooms or *buildings*.

4.7.3 Isolation distances

The isolation of *dangerous goods workrooms* shall provide for:

- a) Distances from the title *boundary* which comply with Table 4 for the *construction* type, except that distances may be halved if:
 - i) a *fire* extinguishing system is installed, or
 - ii) a system is provided to automatically dump the *dangerous goods* into

underground holding tanks in the event of a *fire*.

- b) Any *dangerous goods workroom* or other *building*, where Class 3(a) flammable liquids are used, to be located no closer than 15 m from any *fire*, forge, furnace, highly *combustible* goods or other source of danger, except that the *isolation distance* may be reduced where a *screen wall* is erected which ensures the *vapour path length* is no less than 15 m.
- c) Any *dangerous goods workroom* or other *building*, where Class 3(b) flammable liquids are used, to be located no closer than:
 - i) 6.0 m from any *fire* or furnace, and
 - ii) 15 m from any other source of ignition.

4.7.4 Workroom storage capacity

When the maximum permitted *dangerous goods* storage capacity of a *dangerous goods workroom* exceeds 60 litres for Class 3(a) and 100 litres for Class 3(b), the workroom shall be at or about ground level unless the *building* containing the workroom has a *FRR* of 120/120/-.

Table 4: Isolation Distances for Dangerous Goods Workrooms
Paragraphs 4.7.1 and 4.7.3 a)

Quantity stored	Distance from nearest title boundary or habitable work for workrooms of:			
	(litre)	Type E (m)	Type F (m)	Type H (m)
Class 3(a)				
Up to 500		Nil	Nil	Nil
1,750		5	Nil	Nil
3,000		8	5	Nil
7,500		15	8	5
Class 3(b)				
Up to 750		Nil	Nil	Nil
2,500		5	Nil	Nil
4,000		8	5	Nil
10,000		15	8	5

Note:
Isolation distances may be interpolated for intermediate quantities, but shall not be less than 3 m.

4.7.5 Doors

Doors in or connected with *dangerous goods workrooms* shall comply with Paragraph 1.3 and:

- a) Be constructed to provide a *FRR* equal to that of the workroom walls except that:
 - i) where a door opens directly to the outside and provides no hazard to other *buildings*, the door may have a *FRR* of 30/30/-,
 - ii) doors in a Type 3 workroom which open into part of the *building* used for activities associated with the workroom, may have a *FRR* of half that required for the walls, and
- b) Provide no access to any other room unless there is an *adequate* means of escape from that room, other than through a workroom.

4.7.6 Number of exits

When more than 3 people are employed in a *dangerous goods workroom* there shall be 2 *escape routes* complying with C/AS1 which:

- a) Are placed as far apart as possible, and
- b) One of which provides direct access to the open air.

COMMENT:

Paragraph 4.7.6 satisfies the performance requirements of NZBC C2 "Means of Escape".

4.7.7 Windows

Windows and skylights in *dangerous goods workrooms* shall comply with Paragraph 1.4.

4.7.8 Containers inside a workroom

Containers with a maximum capacity of 15,000 litres of Class 3(a) and 25,000 litres of Class 3(b), are permitted inside a *dangerous goods workroom* forming part of a larger *building* where:

- a) The containers are located on the ground floor,
- b) The *building* is constructed of concrete or similar *non-combustible* material, and the storage space is Type H,
- c) Any opening between the room where the

containers are located, and the remainder of the *building*, is fitted with a door having a *FRR* of 60/60/-, and which closes automatically in the event of *fire*, and

- d) Windows and skylights in the container room have wired glass in *non-combustible* frames.

COMMENT:

The use of a single storage container to achieve the maximum permitted storage capacity is acceptable.

4.7.9 Storage outside a workroom

Small dip-tanks, machines and other process containers which use Classes 3(a) and 3(b) flammable liquids may be located outside of a *dangerous goods workroom*, where all the following requirements are met:

- a) No more than 30 litres of Class 3(a) and 50 litres of Class 3(b) are used or stored at any point in time, and
- b) Any part of the storage room within 3.0 m of the storage container is of *non-combustible* construction.

4.7.10 When no other dangerous goods are used, the use of up to 50 litres of Class 3(a) or up to 200 litres of Class 3(b) flammable liquids outside of a *dangerous goods workroom* is permitted, provided that:

- a) The space where exposure of the flammable liquid to the atmosphere takes place has any walls, ceiling, or floor within 6.0 m of the storage container constructed of *non-combustible* materials, and
- b) The *building* is under the sole occupancy of the user of the flammable materials.

4.7.11 Drying rooms

Drying rooms for flammable liquids shall be constructed:

- a) To comply with Type E *construction*, and
- b) With doors and windows complying with Paragraphs 1.3.1 a), b), c), e) and f), and 1.3.2 and 1.4.1.

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4.7.12 Buildings housing stationary internal combustion engines

Stationary internal combustion engines using Class 3(a) fuels in *buildings* which are *habitable works*, shall be located within a Type E enclosure which has a self-closing door complying with NZS 4232: Part 1, and having a *FRR* of 60/60/-.

4.8 Ventilation

4.8.1 Ventilation of storage *depots* and workrooms shall comply with the requirements of Paragraphs 1.5, and 4.8.2 to 4.8.5.

4.8.2 Storage depots

Ventilation shall comply with Paragraph 1.5.1 and have the lower openings less than 1.5 m above the ground level. The lower openings shall be covered with 0.5 mm nominal aperture brass-wire gauze.

4.8.3 Oil storage chambers

Oil storage chambers shall be vented to the open air by vents having a minimum area of 0.4 m². Ducting serving the vent shall be concrete or metal.

4.8.4 Oil burning chambers

Rooms containing oil burners are to be provided with vents having a minimum aggregate area of 3 times the cross-sectional area of the furnace flue.

4.8.5 Dangerous goods workrooms

The ventilation of *dangerous goods workrooms* and spaces in *buildings* where Class 3 *dangerous goods* are used, shall provide:

- a) A system which withdraws, at its source, any accumulation of flammable vapour from the room, and discharges it safely into the open air,
- b) Air change rates which ensure that the concentration of flammable vapour in the workroom air does not exceed 25% of the *lower flammable limit* of that vapour, and in no case are less than:

- i) 12 per hour where Class 3(a) flammable liquids are used, and
- ii) 6 per hour where Class 3(b) flammable liquids are used, and
- c) A positive airflow, into the workroom through any door or opening linking the workroom to another part of the *building*.

COMMENT:

Positive airflow into the workroom prevents the spread of flammable vapours to other parts of the *building*.

4.8.6 Where flammable liquids are used inside the *building* but outside a *dangerous goods workroom* as permitted by Paragraphs 4.7.9 and 4.7.10, a mechanical air extraction system shall be installed alongside the tanks, machines, or process vessels, venting to outside the *building*.

5.0 Class 4 Flammable Solids

5.1 Storage depot construction

5.1.1 *Depot constructions* for Class 4 flammable solids shall be:

Class 4.1A: a Type H *depot* with a door complying with Paragraph 1.3 and which has a *FRR* of 120/120/-, and floors covered with a non-sparking (e.g. elastomeric) finish.

Class 4.1B: a Type A *depot* with a roof structure wide enough to ensure the goods stored are protected from the direct rays of the sun.

Class 4.1C: if stored in quantities exceeding 250 kg, a Type B, C or D *depot*.

Class 4.2A:

- a) For an isolated *depot*, a Type D.
- b) For storage areas contained within a *building*, Type H *construction* which has doors complying with Paragraph 1.3, except that the door may have a minimum *FRR* of 120/120/-.

Class 4.2B: a Type B, C or D *depot*.

Class 4.3: in quantities exceeding 50 kg, a Type B, C or D *depot* constructed to prevent the entry of water by having raised door sills, and a floor higher than the surrounding ground level.

5.2 Ventilation requirements

5.2.1 Ventilation of Classes 4.1A and 4.3 is to comply with Paragraph 1.5, provided that water is prevented from entering ventilation openings in class 4.3 storage facilities. Cowls or awnings may be used to achieve this.

6.0 Class 5 Oxidising Substances

6.1 Sources of heat

6.1.1 Class 5(a) *dangerous goods* shall be protected from overheating by locating any heating equipment so that:

- a) The heating device cannot come into direct contact with the *dangerous goods*, and
- b) The *dangerous goods* cannot be heated above 50°C or within 15°C of their decomposition temperature, whichever is the lower.

6.2 Construction

6.2.1 Storage facilities for Class 5 oxidising substances shall comply with the appropriate Paragraphs 6.2.2 and 6.2.3 for the particular substance.

6.2.2 Class 5(a):

- a) Where the quantity stored is more than 500 kg, a *depot* of either:
 - i) Type C2 having a *FRR* of 120/120/-, or
 - ii) Type B1 for *depots* isolated from the *title boundary* or any *habitable work* by no less than 3.0 m.
- b) *Depots* shall be located at ground level with the floor constructed of concrete.
- c) *Depots* containing ammonium nitrate shall be isolated in accordance with Table 5.

d) *Depots* containing more than 10 tonnes, except of ammonium nitrate in quantities of more than 20 tonnes, shall be isolated from all *combustible* materials, explosives, zinc, magnesium, powdered metals, any other *dangerous goods* and any material that could oxidise or catalyse the decomposition of the Class 5(a) *dangerous goods*. Isolation shall be by:

- i) a distance of no less than 5.0 m, or 10 m in the case of ammonium nitrate of more than 20 tonnes.
 - ii) a wall of reinforced concrete no less than 100 mm thick, or concrete masonry 150 mm thick with all cavities filled.
- e) *Depots*, containing quantities exceeding 1000 kg, shall be surrounded with kerbing and channelling arranged to direct, in the event of a *fire*, the flow of molten Class 5(a) *dangerous goods* away from other *depots* and *buildings*.

Table 5: Isolation Distances for Ammonium Nitrate Class 5(a)
Paragraph 6.2.2 c)

Quantity (Tonnes)	Distance from title boundary or habitable work (m)
0 - 50	Nil
50 - 100	15
100 - 200	30

6.2.3 Class 5(b) (organic peroxides):

- a) A Type C2 *depot* with shelves and internal fittings constructed of *non-combustible* materials compatible with organic peroxides. There shall be no exposed timber surfaces.
- b) *Isolation distances* shall comply with Table 6.
- c) Kerbs shall be provided around the storage bays to retain any spillage within the *building*.

6.3 Ventilation

6.3.1 Ventilation of Class 5 storage areas shall comply with Paragraph 1.5 except that vents in Class 5(b) storage facilities shall be protected with 3.0 mm maximum gauge stainless steel mesh.

Table 6: Isolation Distances for Class 5(b) (organic peroxides)
Paragraph 6.2.3 b)

Quality of organic peroxides	Minimum distance from a public place	Minimum distance from the title boundary or habitable work
(kg)	(m)	(m)
25	5	10
50	7	15
100	10	20
200	12	25
500	15	35
1000	20	45
2000	25	55
3000	35	80

Note:
Isolation distances may be interpolated for intermediate quantities.

Appendix A: Classification of Hazardous Substances

Introduction

New Zealand legislation which controls the use of *hazardous substances*, bases its categorisation of materials deemed to be *hazardous*, on the classification system developed by the United Nations. This system categorises *hazardous substances* in terms of the type of risk involved. The following notes explain how this system is used in New Zealand to place *hazardous substances* into various defined classes, labelled Classes 1-8.

Class 1: Explosives

Explosives are described in the Schedule to the Explosives Act 1957 by seven individual classes. "Authorised explosives" in terms of the Act are further specifically described by the Explosives Authorisation Order 1983 (and its Amendment No. 1 (1987)) wherein, under the Classes of explosives in the Schedule to the Act, authorised explosives are further defined.

COMMENT:

Pertinent legislation:
Explosives Act 1957,
Explosives Regulations 1958.

Class 2: Gases

Are described in the Schedule to the Dangerous Goods Act 1974 as:

Gases being –

- a) Gases (other than those included under any other paragraph of this Class) when compressed, liquefied, or dissolved under pressure.
- b) Ethane, ethylene, hydrogen, methane, and any other flammable gas (other than that included under any succeeding paragraph of this Class).
- c) Acetylene, compressed or dissolved, and contained within a porous substance.
- d) Liquefied petroleum gas, and any other liquefied flammable gas.

- e) Chlorine.
- f) Anhydrous ammonia.
- g) Liquid oxygen.

COMMENT:

Pertinent legislation:
Dangerous Goods Regulations, Gases: 1980.

Class 3: Flammable Liquids

Are described in the Dangerous Goods Order 1983 (which amends the description in the Schedule to the Dangerous Goods Act 1974) as:

Flammable liquids, being –

- a) Liquids, mixtures of liquids, and liquids containing solids in solution or suspension, which in each case has a flash point lower than 23 degrees, and nitrocellulose with, by mass, a nitrogen content not exceeding 12.6 percent wetted with, by mass, not less than 45 percent flammable liquids with a flashpoint less than 23 degrees Celsius:
- b) Liquids, mixtures of liquids, and liquids containing solids in solution or suspension, which in each case has a flash point of 61 degrees Celsius or lower, but not lower than 23 degrees Celsius, and nitrocellulose with, by mass, a nitrogen content not exceeding 12.6 percent wetted with, by mass, not less than 45 percent flammable liquids with a flashpoint of 61 degrees Celsius or lower but not less than 23 degrees Celsius.
- c) Fuel oil.

COMMENT:

Pertinent legislation:
Dangerous Goods Regulations, Flammable Liquids: 1985.

Class 4: Flammable Solids and Substances

Defined by listings of 118 substances or types of substances in the Dangerous Goods Order 1983. In summary this covers:

Flammable solids, being substances liable to spontaneous combustion or substances which, on contact with water, emit flammable gases, and which consist of the following divisions and categories.

Division 4.1 – Flammable solids, being solids, other than those classed as explosives, possessing the common property of being easily ignited by external sources.

Division 4.2 – Substances liable to spontaneous combustion, being solids or liquids possessing the common property of being liable spontaneously to heat and to ignite.

Division 4.3 – Substances which, in contact with water, emit flammable gases, being substances which, by interaction with water, are liable to become spontaneously flammable or to emit flammable gases in dangerous quantities.

Class 4 is further divided into categories A, B & C. These categories are defined by the Dangerous Goods Order 1983.

COMMENT:

Pertinent legislation:
 Dangerous Goods Regulations
 Flammable solids: 1985.
 Oxidising substances: 1985.

Class 5: Oxidising Substances

Defined in the Dangerous Goods Order 1983 as:

Oxidising substances being –

- a) Bromates, chromates and dichromates, chlorates, chlorites, chromium trioxide (anhydrous), hypochlorites (with more than 39 percent available chlorine), inorganic peroxides, nitrates, perborates, perchlorates, permanganates, persulphates, potassium nitrite, sodium nitrite, tetranitromethane,

urea hydrogen peroxide, hydrogen peroxide, zirconium picramate wetted with not less than 20 percent water.

- b) Organic peroxides.

COMMENT:

Pertinent legislation:
 Dangerous Goods Regulations
 Flammable solids: 1985.
 Oxidising substances: 1985.

Class 6: Toxic Substances

Defined in the Toxic Substances Act 1979 and in Schedules to the Toxic Substances Regulations 1983. Pesticides as defined in the Pesticides Act 1979, and animal remedies as defined in the Animal Remedies Act 1967 are specific types of Class 6 toxic substances. There is however no type-of-risk internal classification of Class 6 constituents.

COMMENT:

Pertinent legislation:
 Toxic Substances Regulations 1983.
 Pesticides Regulations 1983.
 Pesticides (Vertebrate Pest Control) Regulations 1983.
 Animal Remedies Regulations 1980.

Class 7: Radioactive Substances

Defined in the Radiation Protection Act 1965. No scheduled listing of substances is given although the First Schedule to the Radiation Protection Regulations 1982 has a listing of activities and concentrations of radioactive materials.

COMMENT:

Pertinent legislation:
 Radiation Protection Regulations: 1982.

Class 8: Corrosives

Corrosives are covered by the Toxic Substances Regulations 1983, and are included within the general definition of a toxic substance in those Regulations. Corrosives are not listed by name in the regulation themselves but are covered by various listings in NZS 5433: 1988 "Code of practice for

transportation of hazardous substances on land”, which is the document to which the Toxic Substances Regulations refer as “the Transport Recommendations”.

COMMENT:

Pertinent legislation:

Toxic Substances Regulations 1983.

NZS 5433: 1988 “Code of practice for transportation of hazardous substances on land”.

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Electrical installations see NZBC G9 Electricity

Explosives see Class 1 Explosives

Fruit ripening chambers **AS1** 3.2.2

Gases see Class 2 Gases

Oil burning chambers **AS1** 1.5.2, 4.8.4

Oil storage chambers **AS1** 1.5.2, 4.8.3

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