PHA Big W RDC

Mirvac Group

30 April 2010

Preliminary Hazard Assessment

BIG W Regional Distribution Centre Hoxton Park New South Wales

Preliminary Hazard Assessment

BIG W Regional Distribution Centre Hoxton Park New South Wales

Prepared for

Mirvac Group

Prepared by

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Prepared by Daniel Ward

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Revision	Revision Date	Details	Authorised	
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	19-Mar-2010	Preliminary Hazard Assessment	Kevin Dobson Associate Director - Environment	

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Executive Summary

Development of the subject Big W Regional Distribution Centre at Hoxton Park is considered safe on the basis that the credible risks identified in this report are controlled to a level which is “As Low As Reasonably Practicable” ALARP.

A range of hazards have been identified, the applicable and credible hazards relate to:

- Spillage of flammable liquid
- Development of a flammable atmosphere
- Fire associated with the development of a flammable atmosphere.

Risks associated with these hazards have also been identified in terms of individual risk which has been found to be below the recognised individual risk level for industrial land use.

This PHA is a result of a previous SEPP 33 Assessment which indicated that the Dangerous Goods quantities and associated separation distances were compliant, however, a “large number of transport movements” will be undertaken to and from site and therefore, the Department of Urban Affairs and Planning directed that a PHA would be required.

1.0 Introduction

This proposal involves the redevelopment of the Hoxton Park Aerodrome site for warehouse storage and distribution facilities and associated site infrastructure including access/ /egress roadways. A aerial image of the proposed development is provided in **Figure 1** (see Appendix A.) The proposed warehouse will be occupied by BIG W.

2.0 Site Description

2.1 Location

The site is located approximately 6.5km west of the Liverpool CBD on Cowpasture Road within the new industrial suburb, Len Waters Estate. The site is bound by the M7 Motorway to the west, Cowpasture Road to the south, Hinchinbrook Creek to the east and the proposed residential suburb of Elizabeth Hills to the north (see Figure 1). The site was formerly operated as the Hoxton Park Aerodrome. The site is located wholly within the Liverpool Local Government Area.

2.1.1 Existing Use

The site was most recently used as Hoxton Park Aerodrome, an uncontrolled airfield for light aircraft and helicopters for private flight training and flying. As the aerodrome was never used for commercial flights, the aerodrome does not have a passenger terminal. Several airport hangars and associated buildings, which were occupied by the flying school and other similar companies, were erected to the west of the runway This use ceased in December 2008 and the site is currently unoccupied.

2.1.2 Existing Buildings

The site is generally cleared, and predominantly comprises mown grassed areas.

2.2 Process

The Hoxton Park Big W facility is a Regional Distribution Centre with no hazardous 'processing' occurring onsite. This facility is a storage and transport facility for goods only. As such, operations conducted onsite will include:

- Transport of products via the existing road network to and from the RDC facility
- Movement of products from transport (semi-trailer) to onsite purpose-built storage shelves via the use of forklifts
- Bulk package breakup
- Distribution package sealing
- Movement of products from shelving to road transport vehicles

2.3 Hazardous Materials

A suite of potentially dangerous goods and non-hazardous retail will be stored onsite including but not limited to Class 2.1 aerosols, Class 3 flammable liquids such as cooking oils and quantities of Class 6.1 toxic substances. A brief description of potentially hazardous materials stored onsite is tabulated below.

Table 1 Dangerous goods and forecast quantities to be stored onsite at the Hoxton Park Big W Regional Distribution Facility

Class	Packing Groups	Description	Approximate Total Quantity *
Class 1.4- Explosives		Minor quantities of explosive materials in the form of party poppers and sparklers will be stored	150 kg
Class 2.1 Flammable Gases		Aerosol cans containing deodorants, butane and lighter fluid	13 900 kg
Class 2.2 Oxidising Gases		Minor quantities of oxidising gases including fire extinguishers and shave foam.	300 kg
Class 3 Flammable Liquids	3	Minor quantities of flammable liquids including mouth wash and roll on deodorants will be stored	1215 l
Class 4.1 Flammable Solids	2	Minor quantities of flammable solids including shoe polish will be stored	143 kg
Class 4.1 Flammable Solids	3	Minor quantities of flammable solids including matches and camphor will be stored	170 kg
Class 5.1 Oxidising Substances	3	Very minor quantities of these substances such as hair dye will	60 kg

		be stored	
Class 6.1 Toxic Substances	(b)	Moderate quantities of toxic substances such as herbicide and depilatory creams	1290 kg
Class 7 Radioactive Materials		Very minor quantities of fire alarms will be stored	30 kg
Class 8 Corrosive Substances	2	Quantities of drain cleaners and bleaches will be stored	2040 kg
Class 9 Miscellaneous Dangerous Goods		Moderate quantities of these substances including coolant will be stored	7850 kg
*Refer to Appendix A Section 2.1.2 of "SEPP 33 Assessment for Big W" for method used to calculate these figures			

3.0 Hazard Identification

3.1 Flammable Atmosphere

Discussions with informed user groups during the project definition period and experience from previous design and construction of several large Regional Distribution Centres (RDC) have determined that the most credible hazard scenario associated with dangerous goods is the potential for flammable liquid spills in RDCs is associated with forklift tines piercing primary and secondary packaging materials containing Class 3 dangerous goods within a bunded area. As such, AECOM's "Dangerous Goods Storage - Comparative Study of Proposed Design with Legislative Requirements, Dangerous Goods Segregation and Hazardous Area Classification" document modelled the spill and associated vapour cloud likely to occur given a spill. This modelling (attached as Appendix B) demonstrated that for a commonly stored material (Listerine® Mouth Wash) no significant hazards were identified as a result of modelling undertaken.

3.2 Fire Associated with Flammable Atmosphere

In addition, fire risk associated with the storage of dangerous goods in packages has been mitigated to an acceptable level using automatic foam fire suppression systems in the 'special goods stores' and appropriate sprinkler systems throughout the Distribution Centre.

3.2.1 Fire Safety Engineering

Appendix C details fire fighting Safety Systems Engineering associated with the facility and risk controls incorporated into the design dealing predominately with life safety.

3.2.2 Fire Protection Systems

Appendix C describes the fire protection systems associated with the facility and how these systems provide asset protection.

Table 2 Credible risk scenarios based on storage and transportation of forecast quantities and types of dangerous goods

Area	Event	Cause	Consequence	Measures Prevention / Protection	Information Source
Distribution centre Special Goods Store	AS spill of volatile dangerous goods occurs	Caused by forklift tines piercing packages on a pallet	As a result, flammable vapours are released from the spilled liquid	A range of measures are incorporated including: 1. Staff trained in safe fire fighting and evacuation procedures 2. Staff trained in safe forklift use and lifting procedures 3. Fire fighting equipment available to control fire 4. Foam Fire Fighting equipment available to blanket spill or subsequent fire 5. Design ventilation and spillage control	1. Dangerous Goods Assessment (Appendix B) 2. Fire Safety Engineering Report (Appendix C)
Distribution centre Special Goods Store	Dangerous Goods Spills	Dangerous Goods Container pierced by forklift tines	Impact to Biophysical environment	Building to contain design spill amount	
Distribution centre Special Goods Store	Dangerous Goods Spills	Dangerous Goods Container pierced by forklift tines	Impact to Biophysical environment in event of fire	Building to contain design spill amount	
Delivery Dock	Dangerous Goods	Dangerous Goods	Fire / Explosion /	A range of measures	1. Dangerous

	Spills	Container pierced by forklift tines	Toxic Gas Release	are incorporated including: 1. Staff trained in safe fire fighting and evacuation procedures 2. Staff trained in safe forklift use and lifting procedures 3. Fire fighting equipment available to control fire 4. Foam Fire Fighting equipment available to blanket spill or subsequent fire 5. Design ventilation and spillage control	Goods Assessment (Appendix B) 2. Fire Safety Engineering Report (Appendix C)
Delivery Dock	Dangerous Goods Spills	Dangerous Goods Container pierced by forklift tines	Impact to Biophysical environment	Building to contain design spill amount	
Delivery Dock	Dangerous Goods Spills	Dangerous Goods Container pierced by forklift tines	Impact to Biophysical environment in event of fire	Building to contain design spill amount	
Road transport within RDC site	Dangerous Goods Spills	Road transport vehicle collision / overturns	Fire / Explosion / Toxic Gas Release	A range of measures are incorporated including: 1. Staff trained in safe fire fighting and evacuation	1. Dangerous Goods Assessment (Appendix B) 2. Fire Safety Engineering Report (Appendix C)

				procedures 2. Staff trained in safe forklift use and lifting procedures 3. Fire fighting equipment available to control fire 4. Foam Fire Fighting equipment available to blanket spill or subsequent fire 5. Design ventilation and spillage control	
Road transport within RDC site	Dangerous Goods Spills	Road transport vehicle collision / overturns	Impact to Biophysical environment	Building to contain design spill amount	
Road transport within RDC site	Dangerous Goods Spills	Road transport vehicle collision / overturns	Impact to Biophysical environment in event of fire	Building to contain design spill amount	

3.2.3 External Events

The potential for external events has been investigated as part of the RDC Risk identification process. No external events were considered as being credible given the location, climate and placement of the RDC. The results of this assessment and the issues reviewed are reproduced in Table 3.

Table 3 External risk event assessment for the Hoxton Park Big W Regional Distribution Facility

External Event	Comment	Reference (if applicable)
Cyclone	Risk of cyclones unlikely	
External Flooding	Site levels being revised to be above flood levels	Environmental Assessment Report – Appendix G
Airplane Crash	Site not in flight path	
Earthquake	Area considered low risk	GSHAP
Bushfire	Minor risk – design of structure and suitable fire-separation widths have been identified	Environmental Assessment Report – Appendix E
Lightning	Design complies with relevant standard to minimise risk	
Vehicle Crash	Site is remote from public roads, therefore risk unlikely.	Figure 1

4.0 Risk Assessment

4.1.1 Risk Acceptance Criteria

Quoted acceptability criteria exist in several States of Australia. The value for the commonly referenced acceptance criterion of 'Individual Risk IR' (fatality) for 'Industrial' land use is 50 x 10^{-6} or a 50 in 1 million chance of fatality, whilst involved in 'Industrial' land use. A specific figure is not available for IR whilst involved in Large Retail Distribution land use.

The NSW Department of Planning has published an Advisory Paper No. 4 "Risk Criteria for Land Use Safety Planning" outlining the criteria by which the acceptability of risks associated with potentially hazardous developments is assessed.

For the purposes of this report, a Special Goods Storage Room is considered to be of a similar type 'land use' to an 'Industrial' facility. The potential for exposure of occupants to dangerous goods and other risks in an SGS is similar if not less than, industrial facilities that store and handle dangerous goods.

In the context of the subject land use environment, Individual Risk is the measure of risk that an individual occupant would be exposed to in the Woolworths Big W Special Goods Storage room if they remained in the one position 24 hours a day, for 365.25 days per year.

The Individual Risk value is a frequency of fatality, normally expressed as chance per million per year, and is sometimes shown diagrammatically as a two dimensional plot or layer on a floor or locality plan. The contours are considered to be iso-risk. Examples of iso-risk are not provided in this report.

The Individual Risk values are for fixed targets, and as occupants have the potential to only be present periodically, the Individual Risk evaluation must allow for this condition.

Industrial premises of this nature typically include large retail stores, manufacturer's despatch areas, and the like.

Due to the similarity of land use between SGS and similar industrial premises it is considered that the Individual Risk associated with an SGS should be no worse than the Individual Risk associated with industrial facilities, therefore Individual Risk criterion can be directly used to establish a baseline for risk assessments in SGS.

Table 4 Australian Individual Risk by Land Use

Risk Level	Land Use
0.5×10^{-6}	Hospitals, schools, child care facilities, old age housing
1.0×10^{-6}	Residential, hotels, motels, tourist resorts
5.0×10^{-6}	Commercial developments including retail centres, offices and entertainment centres
10×10^{-6}	Sporting complexes and active open spaces
50×10^{-6}	Industrial

The Individual Risk **upper bound** associated with an SGS on the basis of land use is 50×10^{-6} or 50 people per 1,000,000.

$$\mathbf{IR}_{\text{Fatalities per year}} = \mathbf{50 \times 10^{-6}}$$

The Individual Risk value of 50×10^{-6} is the statistically defined upper bound for Individual Risk criteria as a result of an accidental ignition of combustible liquid substance in SGS facilities and has been adopted in this report.

4.1.2 Risk – Consequence Analysis

In risk analysis, the graphical construct Fault Tree Analysis (FTA) is considered useful for modelling the system conditions using binary variables (0's and 1's) that may result in the occurrence of an unwanted event. The significance of the output event (otherwise known as the 'Top Level Event') is nominally recognised as the 'consequence factor', being a function of risk and therefore, values of probability (random variables) are not normally applied.

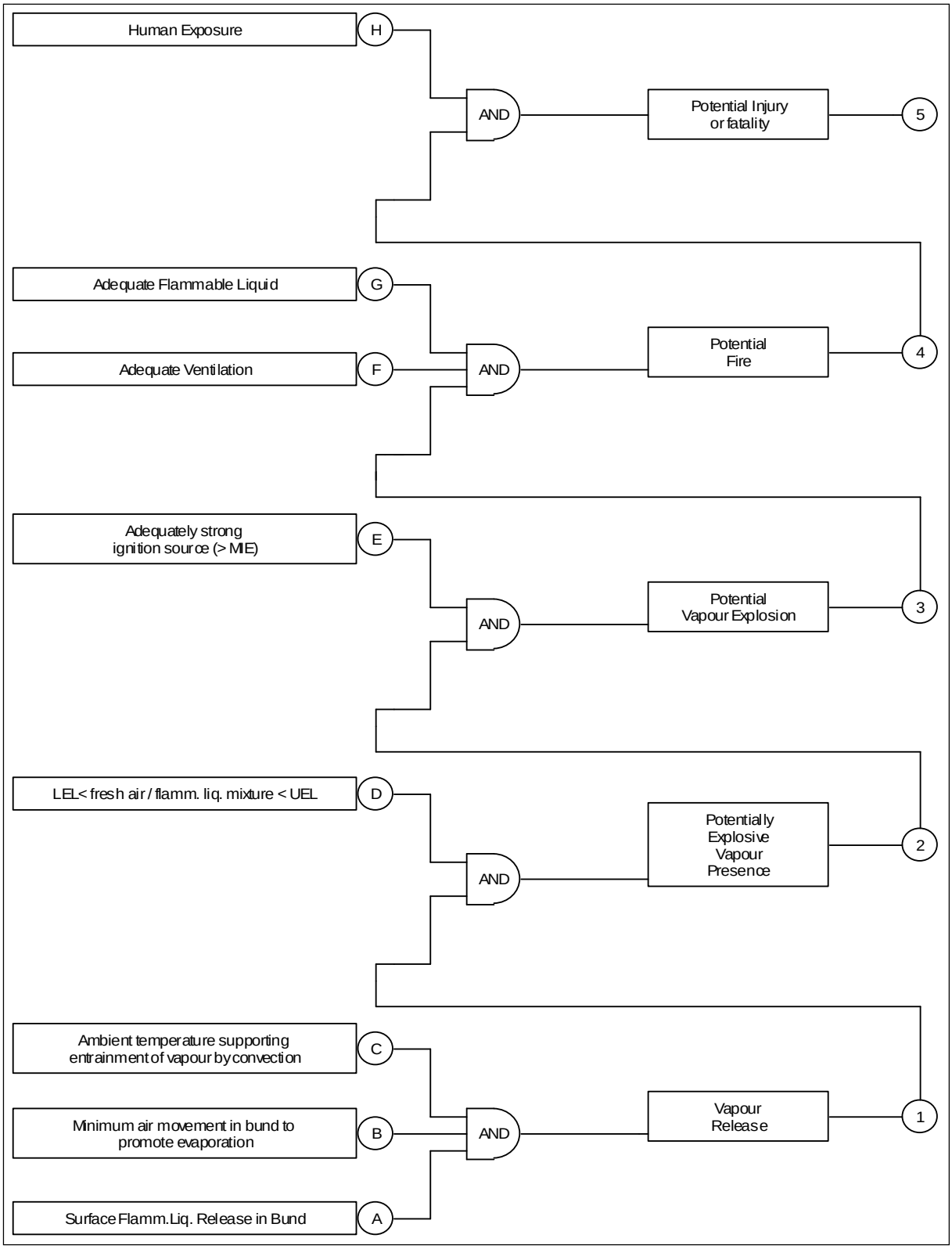
The combination of events in an 'AND' gate configuration or even a single event, as in the case of an 'OR' configuration, is required to trigger the output of the Fault Tree (to achieve a value '1'), so input event probability (or risk likelihood factor) is not associated with Fault Trees.

An overall reduction of Individual Risk $_{\text{FATALITY}}$ may be achieved by preventing Fault Tree outputs from 'triggering'. This is realised through implementing risk mitigation controls that either address the probability of Fault Tree input occurrence (i.e. Reducing the likelihood or probability of achieving a '1' input condition into a logic gate).

The Fault Tree 'Top Level Event' consequence levels can be graded either qualitatively, or quantitatively, however for the purpose of a quantitative assessment in this report, a final random variable value between a range of consequence levels (0< consequence <1) will be used. A useful guide for understanding the consequence factor in this analysis is the 'DSG Risk Assessment Framework' (2005)[1].

The consequence factor for a fatality in this report is assumed to be a maximum level of 0.999, whereas fire event occurrences that would be likely to cause an injury or fatality if human exposure existed are considered to be less than 0.05. Non-fire events are considered to represent a consequence factor of less than 0.01.

Figure 2- Fault Tree Analysis of Individual Risk $_{FATALITY}$ Consequence Factors



The output of Fault Trees is normally used as 'Given Event' inputs to an Event Tree Analysis (ETA), which follows the current FTA analysis shown in Figure 2.

4.1.3 Risk – Likelihood Analysis

Event Tree Analysis (ETA) is also referred to as 'probability tree analysis' and is considered an appropriate graphical analysis tool for the representation of the dependence of events. Sequences of discrete random variables or events are typically associated with random variables, or probabilities.

Deductive logic that starts with an initiating event is used to analyse possible realisations of the variable. The probability of each event is displayed conditional on the occurrence of events that precede it in the Event Tree; these are called 'nodes'. The product probability of each event is shown conditional on the occurrence of events representing the possible subsequent sequences at each node.

The 'Initiating Events' for each Event Tree in the analysis shown in Figure 3 are considered to be the same 'Top Level Events' described in the previous FTA. The summed probability of the branches of any sequence in an Event Tree is '1.00', as the combination of both the possible sequences must equal the total of all possible sequences in the tree (or tree branch).

4.1.4 Analysis of Event 1 – Vapour Release

The probability of vapour release, on the basis of the credible threat scenarios derived from the SGS User Group workshop held in Sydney, 2009, is assumed to be equivalent to the probability of a human handling failure in conjunction with the probability of the co-existence of several environmental factors relating to the formation of a fuel spill and the evaporation of fuel.

The probability of a human handling error by a trained technical worker carrying out non-critical routine activities is in the order of 0.01. Refer Table 5.

Given a reasonable level of ventilation within the SGS room, it is likely that the most significant accidental release, which was assessed as involving a flammable liquid, will proceed to evaporation of the spilled flammable liquid (Listerine®), so the estimated probability of evaporation of an existing spill approximates 1. The overall probability for this event is therefore the product of these probabilities and is effectively the probability of a human error as described.

Table 5 Rates of Error in Human Handling (Source: US Atomic Energy Commission Reactor Safety Study, 1975)

Type of Activity	Probability of Error Per Task
Critical Routine Task	0.001
Non - Critical Routine Task	0.003
Non Routine Operations	0.01
Check List Inspection	0.1

Probability of Vapour Release p(VR) = 0.01.

4.1.5 Analysis of Event 2 – Potentially Explosive Vapour Release

The potential for the vapour present, as described in 'Event 1 – Vapour Release', to become 'explosive' is a function of the released vapour to mix with air and the subsequent vapour-air mixture to exist within the characteristic explosive limits of the compounds comprising spilled 'Listerine®'.

The potential vapour-air mixture has a ready supply of fresh air due to mechanical ventilation in the Special Goods Store (designed to AS/NZS 3833 requirements and validated using Computational Fluid Dynamics modelling). Whilst the quantity of flammable liquid released may be considered a small amount, the likelihood of the fuel vapour-air mixture to be within the flammable range of the substance is quite possible. An assumed probability of 0.9 is considered appropriate for the mixture to be potentially explosive 'somewhere' across the hypothetical volume of vapour produced.

Probability of Potentially Explosive Vapour Release p(PEVR) = 0.9.

4.1.6 Analysis of Event 3 – Potential Vapour Explosion

Ignition sources may be present in the SGS as either 'Fixed' or 'Portable' sources.

Astbury (2005) reports in the "Review of unidentified ignition sources of unplanned flammable releases – Comparison of Offshore and Onshore data" [26] of common categories of general ignition sources from the UK 'Major Hazard Incident DAta Service" MHIDAS, as shown in Table 6.

The MHIDAS information breaks the data down into primary ignition sources and secondary ignition sources. For example, 'Auto Ignition' is a primary source with 'Chemical Reaction' as the secondary source.

'Electric' and 'Flame' ignition sources are shown in Table 7 as significant factors of fire during an unplanned flammable liquid release in land based 'non-process' situations.

Table 6 Common categories of general ignition sources from the UK 'Major Hazard Incident Data Service" MHIDAS

- **Arson**	- **Friction Spark**
- **Auto ignition**	o Non specific
o Non-specific	o Compressor
o Chemical reaction	o Pump
- **Electric Source**	o Sparking Tool
o Non specific	o Welding
o Domestic	- **Hot surface**
o Instrument	o Non specific
o Lightning	o Chemical reaction
o Motor/Generator	o Cigarette
o Static	o Flame
o Vehicle	o Friction surface
o Welding	o Incandescent
- **Flame**	o Lagging
o Non specific	o Steam pipe
o Domestic	o Stove
o Flare	o Vehicle exhausts
o Furnace	o Welding

o Grassfire	- **Non ignition**
o Match	o Non specific
o Welding	o Compressor
	o Chemical reaction

A summary of the MHIDAS UK 'Non Process'[2] ignition sources resulting in fires of unplanned flammable releases is shown in Table 7.

Table 7 - 'Non Process' ignition sources resulting in fires of unplanned flammable releases

Primary Ignition Source	UK Non-Process
Arson	5.5%
Auto Ignition	5.6%
Collision	7.0%
Electric	10.8%
Flame	9.4%
Friction Spark	1.9%
Hot Surface	4.0%
Non Ignition	3.2%
Unknown	53.7%
TOTAL	100%

The credible scenarios developed by the SGS User Group meeting indicated that the most likely sources of ignition of flammable vapour related to hot surface or flames. The probability of ignition of a flammable vapour as a result of 'flame' sources is 0.094. It is likely that the ignition of Listerine® vapour would represent a minor to moderate deflagration.

Probability of Potential Vapour Explosion p(PVER) = 0.094.

4.1.7 Analysis of Event 4 – Potential Fire

'Electric' and 'Flame' ignition sources have been found to be statistically significant in terms of initiating vapour explosions. As the flashpoint of Listerine concentrate is in the order of 13 degrees Celsius and its autoignition temperature is approximately 392 degrees Celsius, a relatively 'strong ignition source' is required to initiate an explosion. This ignition source is likely to be a 'piloted' ignition source above the flashpoint, rather than a temperature above the autoignition temperature. This assumption is supported by the assertions of the recent SGS Risk Workshop findings, which indicated that the 'most credible' ignition sources included 'damaged exit lights and 'hot work'.

Failure mode for each of the identified ignition sources would involve overheating of the equipment or electric arcing. In the case of 'hot work', the ignition source probably would involve hot metal from welding or cutting.

[2] The term 'Non-Process' relates to a situation that is not an industrial process, such as an 'On Shore' petro-chemical refinery or 'Off shore' oil rig.

The ignition source (or pilot) is likely to remain as an ignition source (e.g. the hot metal surface remains hot) after the initial deflagration or explosion, and as such; continuity of burning and spread of fire is likely after the initial detonation, therefore given a vapour explosion, the probability of a subsequent fire and spread of the fire is quite high and estimated to be in the order of 0.1 to 1.0. (Assumed to be 0.5 for this assessment)

In summary, the strength of the ignition source is also significant to the probability of a fire or explosion. The data indicates that a naked flame is 100 times more likely to cause ignition at the hazardous area boundary than weak ignition sources that are designed to be located at the boundary. Table 8 is sourced from [Ref: "A risk-based approach to hazardous area classification", 1998, Energy Institute, London. UK.] and shows the probability of ignition for varying ignition strengths.

Table 8 Probability of ignition for varying ignition strengths

Ignition Source Strength	Description	Probability of ignition source release
Controlled	Where control of ignition sources extends beyond Zone 2	0.003
Weak	Ignition sources within Zone 2	0.010
Medium	Ignition due to road traffic, substations, buildings, unclassified electrical equipment, engines, hot surfaces etc.	0.100
Strong	Continuous strong ignition sources such as fired heaters, Bunsen burners etc	1.00

Probability of Potential Fire p(PF) = 0.5.

4.1.8 Analysis of Event 5 – Potential Fatality or Injury

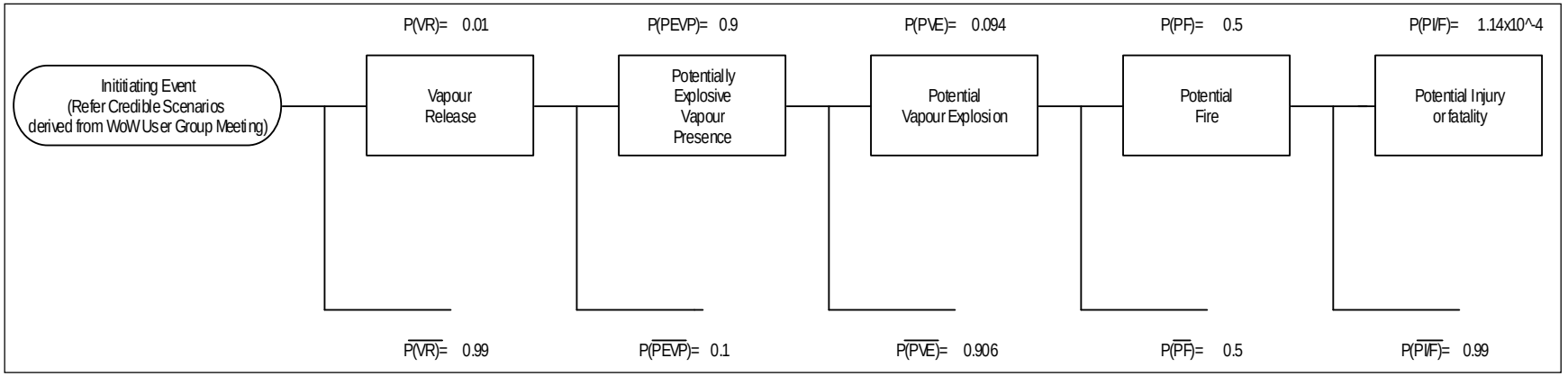
The probability of fatality or injury is directly related to exposure of individuals to the hazard. If an occupant of the SGS is located within the spill area and close to a significant deflagration (e.g. a worker carrying out hot work), it is considered likely that the occupant is vulnerable, but not likely to be killed due to the involvement of small estimated spill quantities.

The exposure of occupants to the hazard is seen as the significant determining factor in this assessment, as the Special Goods Store room is occupied intermittently and when it is occupied, the occurrence of hot work is unlikely.

'Hot Work' within the Special Goods storage room occurs for less than 1 hour in each year (annual maintenance). As the probability of a subsequent fatality or injury is less than the probability of hot work being carried out within the Special Goods Storage room the overall probability of a potential fatality is no greater than $1 / (365.25X24) = 1.14x10^{-4}$.

Probability of Potential Fatality p(PI/F) = $1.14x10^{-4}$.

Figure 3 Event Tree Analysis of CEPS



4.1.9 Individual Risk Assessment

As previously defined, the consequence factor for a fatality in this report is assumed to be a maximum level of 0.999, whereas fire event occurrences that would be likely to cause an injury or fatality if human exposure existed (but does not exist) are considered to be less than 0.05. Non-fire events are considered to represent a consequence factor of less than 0.01.

The consequence factor associated with the Individual Risk of fatality in this assessment is 0.99 (worst case condition) as allocated to the Top Level Event of the previous Fault Tree Analysis.

The likelihood factor (or probability) of a fatality is the product of the sequence of probabilities in the previous Event Tree Analysis. This probability is 4.82×10^{-8}.

The Individual Risk is the product of Consequence and Likelihood, as detailed in the associated SGS FTA and ETA.

Assessed Individual Risk Fatality for the Special Goods storage facility within the bunded area is $0.99 \times 4.82 \times 10^{-8} = 4.77 \times 10^{-8}$ or approximately '5 persons in 100 million'.

This risk level is considerably lower than the Individual Risk Fatality IR' for 'Industrial' land use, which is 50×10^{-6}.

5.0 Conclusions

A range of hazards have been identified, the applicable and credible hazards relate to:

- Spillage of flammable liquid
- Development of a flammable atmosphere
- Fire associated with the development of a flammable atmosphere.

Risk associated with these hazards has also been identified in terms of individual risk which has been found to be below the recognised individual risk level for industrial land use.

Risk associate with offsite incidents are not directly covered however, these have been addressed in the document "*Transport report for proposed distribution centres and warehouse development at Hoxton Park*" attached as Appendix D.

6.0 Recommendation

Development of the subject Big W Regional Distribution Centre at Hoxton Park is considered safe on the basis that the credible risks identified in this report are controlled to a level which is "As Low As Reasonably Practicable" ALARP.

7.0 References

Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (New South Wales Department of Urban Affairs and Planning) 1994.

DSG Risk Assessment Framework Version 2", October 2005, ASEHR

Risk Criteria for Land Use Safety Planning", June 1992, The NSW Department of Planning, Sydney, Australia

Appendix A

SEPP 33 Screening Tests

Mirvac Project Pty Ltd

30 April 2010

Hoxton Park Big W Regional Distribution Centre

SEPP 33 Review

Hoxton Park Big W Regional Distribution Centre

SEPP 33 Review

Prepared for

Mirvac Project Pty Ltd

Prepared by

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1	29-Mar-2010		Kevin Dobson Associate Director	

Table of Contents

Executive Summary

AECOM was commissioned by Mirvac Project Pty Ltd (Mirvac) to undertake a SEPP 33 assessment of the proposed Big W Regional Distribution Centre at Hoxton Park, New South Wales. This facility will be the main transport and storage node for operations within this region.

Based on information supplied to AECOM from Mirvac, which AECOM understands was provided by Woolworths Ltd, and using the "*Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines* (New South Wales Department of Urban Affairs and Planning)" as a basis for assessment, the Department of Urban Affairs and Planning recommends that *Preliminary Hazard Assessment* is required to support any further building applications to local council as transport of dangerous goods to / from site exceeds published threshold levels.

1.0 Introduction

1.1 Background

This proposal involves the redevelopment of the Hoxton Park Aerodrome site for warehouse storage and distribution facilities and associated site infrastructure including access/ /egress roadways. A photomontage of the proposed development is provided in **Figure 1**. The proposed warehouse will be occupied by BIG W, a subsidiary of Woolworths Limited.

1.2 Site Description

1.2.1 Location

The site is located approximately 6.5km west of the Liverpool CBD on Cowpasture Road within the new industrial suburb, Len Waters Estate. The site is bound by the M7 Motorway to the west, Cowpasture Road to the south, Hinchinbrook Creek to the east and the proposed residential suburb of Elizabeth Hills to the north (see Figure 1). The site was formerly operated as the Hoxton Park Aerodrome. The site is located wholly within the Liverpool Local Government Area.

1.2.2 Existing Use

The site was most recently used as Hoxton Park Aerodrome, an uncontrolled airfield for light aircraft and helicopters for private flight training and flying. As the aerodrome was never used for commercial flights, the aerodrome does not have a passenger terminal. Several airport hangars and associated buildings, which were occupied by the flying school and other similar companies, were erected to the west of the runway This use ceased in December 2008 and the site is currently unoccupied.

1.2.3 Existing Buildings

The site is generally cleared, and predominantly comprises mown grassed areas.

1.3 Study Objectives

The objective of this study was to determine if the New South Wales Government's SEPP 33 policy applies to the proposed BIG W Regional Distribution Centre project located at Hoxton Park, New South Wales by determining:

1. The quantity of potentially hazardous materials stored at the BIG W Regional Distribution Centre and the transport frequency of these materials against the threshold levels method as outlined in *Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines* and
2. If, after quantifying both storage and transport components, whether a Preliminary Hazard Assessment (PHA) of this proposed facility is required.

1.4 Scope of the Study

AECOM was commissioned by Mirvac to undertake a SEPP 33 Assessment of the proposed Big W Regional Distribution Centre at Hoxton Park, New South Wales to support the submission of a Development Application to local council. As such, this assessment encompasses all potentially hazardous materials which are forecast to be stored and transported to and from the project site.

2.0 SEPP 33 Review

2.1 Risk Screening

2.1.1 The risk screening process

The *Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines* requires an assessment of both onsite stored goods and goods in/out transportation to be assessed against a threshold level for each class of dangerous goods used. In some cases (for example, Class 2.1 aerosols), if this preliminary test determines that the onsite stored weight or volume is above the threshold level, a secondary assessment against further criteria (for example, in the case of class 2.1 aerosols, a storage distance from the site boundary is prescribed) may be outlined in the guidelines. Therefore, given that the proposed BIG W RDC will both store and transport dangerous goods, the following are assessed:

1. On-site stored dangerous goods – Class and Quantity and
2. Transportation study – Number of vehicle movements of various dangerous goods classes.

2.1.2 AECOM's approach to undertaking this SEPP 33 assessment

During the SEPP 33 screening assessment, AECOM has reviewed all dangerous goods products and the quantities (weights and volumes) which are to be stored at the BIG W RDC facility, as supplied to AECOM by Mirvac and provided by Woolworths Limited. Based on this assessment, a "packaging to dangerous goods ratio" was applied to all dangerous goods classes to enable a realistic estimate of actual dangerous goods stored onsite (excluding packaging) to be calculated (see Appendix A). For example, the dangerous goods component of typical 'insect spray' is 30-60% of contents of container, therefore is less than 50% of the overall retail package which includes can and secondary and tertiary packaging (Refer – MSDS 31587-SDAU "Mortein Barrier Outdoor Surface Spray Aerosol".

Therefore,

$$\text{Actual Dangerous Goods Mass (kg or l)} \approx 0.5 \times \text{Gross Mass}$$

Where Gross Mass = Tertiary packaging + secondary packaging + primary packaging + non-dangerous goods contents + dangerous goods contents

Note: Gross Mass = "Soh_wgt" (stock on hand weight) as shown in Appendix B (Dangerous Goods Manifest).

This approach resulted in a reduction of the overall gross weight of products stored onsite. The benefit of this approach is that gross packaging weights are not included in dangerous goods quantities and therefore acts to reduce the likelihood that trigger values are 'falsely exceeded'. For example, 50% of the total weight of a carton of aerosol cans is contributed to by tertiary and secondary packaging, the cans along with plastic lids and the aerosol delivery systems. Taking this into account, the gross weight of aerosols forecast to be stored onsite at the Hoxton Park RDC (27,800 kg) has been reduced to 13,900 kg, which is a significant reduction in weight and therefore significantly reducing the probability of exceeding trigger values.

Further to the approach described above, given that aerosols are made up of a number of dangerous goods classes, the following scenarios were used during calculations:

a) Where an item was listed as Class 2.1, weight calculations were based on the assumption that the full content of the package (i.e. 50% of gross weight) was Class 2.1 and
b) When an item was listed as a Class 2.1, calculations were based on 30% Class 2.1 goods and 70% Class 3 dangerous goods. Thirty percent was selected after a review of a random selection of MSDS for the products supplied by the proponent suggested that this level was a conservative estimate of propellant contained in each product.

2.1.3 Assumptions made while undertaking this SEPP 33 assessment

In undertaking this SEPP 33 assessment, AECOM has made the following assumptions:

a) Weight / volume / mass conversions are based on:

a. 1 kilogram = 1 litre (eg 1 litre of typical Class 6.1 product, such as weed killer, weighs approximately the same as 1 litre of water)
b. 1000 kilograms = 1 tonne
c. 1 tonne of water = 1 m^3 of water

b) For Class 2.1 (aerosols), we have assumed, based on a random review of available MSDS's, that the component of this dangerous good class is approximately 30%
   a. All Class 2 goods as supplied by the proponent in the manifest are Class 2.1
c) Packaging weight to dangerous goods weights across different DG classes have been based on the assumption that at least 75% of the total product weight is dangerous goods. Different percentages across classes are based on AECOM's experience
d) Information supplied by the proponent about the quantity of dangerous goods forecast to be held onsite is true and accurate

2.2 Findings

2.2.1 Stored Products

2.2.1.1 Results

Based on information supplied to AECOM by Mirvac, the following suite of potentially hazardous materials is forecast to be stored onsite. A brief description of each of these potentially hazardous materials classes and forecast quantities is tabulated below against the SEPP 33 screening threshold for each dangerous goods class. **Note: shaded rows identify forecast quantities which exceed SEPP 33 primary threshold levels.**

Table 1 Comparison of forecast dangerous goods quantities with SEPP 33 screening thresholds for the Hoxton Park Big W Regional Distribution Facility (Refer Appendix B)

Class	Packing Class	Description	Total Quantity (forecast)	Primary SEPP 33 Screening Threshold	Secondary SEPP 33 assessment required
Class 1.4 Explosives		Minor quantities of explosive materials in the form of party poppers and sparklers will be stored	150 kg	Excluded from screening test	
Class 2.1 Flammable Gases		Aerosol cans containing deodorants, butane and lighter fluid	13 900 kg	5000 kg	Yes – assess against Figure 6 in guidelines
Class 2.2 Oxidising Gases		Minor quantities of oxidising gases including fire extinguishers and shave foam.	300 kg	Excluded from screening test	
Class 3 Flammable Liquids	3	Minor quantities of flammable liquids including mouth wash and roll on deodorants will be stored	1215 l	2000 l	No
Class 4.1 Flammable Solids	2	Minor quantities of flammable solids including shoe polish will be stored	143 kg	5000 kg	No
Class 4.1 Flammable Solids	3	Minor quantities of flammable solids including matches and camphor will be stored	170 kg		
Class 5.1 Oxidising Substances	3	Very minor quantities of these substances such as hair dye will be stored	60 l	5000 l	No
Class 6.1 Toxic	(b)	Large quantities of toxic	1290 kg	2500 kg	No

Class	Packing Class	Description	Total Quantity (forecast)	Primary SEPP 33 Screening Threshold	Secondary SEPP 33 assessment required
Substances		substances such as herbicide and depilatory creams			
Class 7 Radioactive Materials		Very minor quantities of fire alarms will be stored	30 kg	Excluded from screening test	
Class 8 Corrosive Substances	2	Quantities of drain cleaners and bleach products will be stored	2040 kg	2500 kg	No
Class 9 Miscellaneous Dangerous Goods		Large quantities of substances including coolant will be stored	7850 kg	Excluded from screening test	No

2.2.1.2 Outcomes

Based on AECOM's approach, Class 2.1 dangerous goods materials exceeded the primary threshold criteria.

Although the forecast quantity of Class 2.1 materials (13,900kg) exceeds the primary threshold level (5000 kg), secondary assessment against SEPP 33 guidelines demonstrated that the storage facility is located far enough away from the site boundary (at 14.8m) not to trigger the requirement for a PHA (prescribe distance of storage facility must be at least 12m from site boundary).

To illustrate, using scenario a) approach as described above¸ the onsite storage quantity triggered the primary SEPP 33 screening threshold level (5000 kg) which requires a secondary assessment against Figure 6 the SEPP 33 guideline. Figure 6 documents how far the storage facility must be located away from the site boundary, which for the current example is approximately 12m. At 14.8m, the current quantity of Class 2.1 products onsite does not warrant further assessment in the form of a PHA. Similarly, using scenario b) Class 3 materials (9,730 kg) exceeds primary threshold levels but, at 14.8m distance from the site boundary, no further assessment in the form of a PHA is required.

The full results of AECOM's assessment are shown in Appendix A.

2.2.2 Transportation

2.2.2.1 Results

Based on information supplied by to AECOM Mirvac, the following suite of potentially hazardous materials is forecast to be transported to and from site. Forecast truck movements and dangerous goods quantities are tabulated in Table 2 below against the SEPP 33 screening threshold for each dangerous goods class. **Note: shaded rows identify forecast truck movements which exceed SEPP 33 primary threshold levels.**

Table 2 Comparison of forecast dangerous goods traffic movements and dangerous goods quantities with SEPP 33 screening thresholds for the Hoxton Park Big W Regional Distribution Facility

Class	SEPP 33 Guideline Threshold		Forecast Data		Does forecast exceed vehicle movement threshold?	Forecast exceed minimum quantity threshold?
	Cumulative annual SEPP 33 threshold	Minimum SEPP 33 quantity (tonnes)	Truck movements	Minimum quantity per load (tonnes)		
1.2	*****		70	0.09		No
2.1	>500	5.00	7228	1.00	Yes	No
3.1	>500	1.00	1137	0.18		No
4.1	>200	2.00	268	0.01	Yes	No
5.1	>500	5.00	148	0.06		No

Class	SEPP 33 Guideline Threshold		Forecast Data		Does forecast exceed vehicle movement threshold?	Forecast exceed minimum quantity threshold?
	Cumulative annual SEPP 33 threshold	Minimum SEPP 33 quantity (tonnes)	Truck movements	Minimum quantity per load (tonnes)		
6.1	all	3.00	337	0.55		No
8	>500	5.00	392	0.23		No
9	>1000		414	0.91		No

2.2.2.2 Outcomes

The results of AECOM's transport assessment indicate that:

1. Class 2.1 and Class 4.1 exceed the cumulative annual SEPP 33 truck movement thresholds (Table 2) for these dangerous goods classes and
2. Neither of these dangerous goods classes is forecast to be transport at dquantities greater than the minimum quantity (tonnes) per load as stated by SEPP 33 guideline thresholds.

Given these outcomes, SEPP 33 guidelines dictate that where minimum transport quantities are below threshold levels, risks are unlikely to be considered significant unless '*large numbers of traffic movements'* are undertaken. There is no quantifying definition in the SEPP 33 guidance documents document in relation to what constitutes a '*large number of movements'*. AECOM has sought advice from the Department of Planning on 28/29 April 2010 in relation to this definition and has been advised that a PHA is required for this facility.

3.0 Conclusions

In conclusion, this assessment has identified that a PHA is required to be undertaken for the BIG W regional distribution centre located at Hoxton Park, NSW. The requirement has been triggered due to the "large" quantity of vehicle movements to and from site.

4.0 Reference

Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (New South Wales Department of Urban Affairs and Planning) 1994.

Appendix A

Calculations

Appendix B Calculations

DG Class	DG : Package ratio	Total DG Weight or Volume onsite	Calculated[a] DG wgt or vol	Guideline Screening Threshold	Exceeds Threshold?	Further compliance requirement
Scenario a) 2.1	50:50	27,800 kg	13900 kg	5000 kg	Yes	Figure 6 – at 14.8m from site boundary, no further assessment required
Scenario b) 2.1 3 (+ calc above)	50:50	27800 kg	4170 kg 9730 (+1215) kg	5000 kg 2000 kg	No Yes	Figure 6 – at 14.8m from site boundary, no further assessment required
3	90:10	1250 l	1215 l	2000 l	No	
4.1 (2)	85:15	168 kg	143 kg	1000 kg	No	
4.1 (3)	85:15	200	170	1000	No	
5.1 (3)	90:10	65 kg	59 kg	5000 kg	No	
6.1 (b)	75:25	1720 kg	1290 kg	2500 kg	No	
8 (2)	85:15	2400 kg	2040 kg	25000 kg	No	

[a] Calculation as (DG ratio*Total weight DG onsite)/100. Therefore for class 3 DG, (90*1250)/100 =1215. For a description of approach, see Section 2.2.1 of this report.

Appendix B

Big W Dangerous Goods Manifest

Appendix B

Data as supplied to AECOM from Mirvac Project Pty Ltd as provided by Woolworths Limited

Indicative Special Goods*Located at Hoxton Park Big W									
area	class	grp	unno	kc	desc	om	om_wgt	soh_oms	soh_wgt
DC	2	II	1993	6226619	TYRE SHINE 4	12	5	198	990
DC	2.1	II	1950	2787367	NIVEA DEOD S	6	0.8	82	65.6
DC	3	II	1950	7539169	VEET SPRAY O	6	1.5	5	7.5
DC	4	II	1325	1564730	SHOE POLISH	6	0.45	33	14.85
DC	4.1	II	1325	316002	SHOE POLISH	6	0.44	38	16.72
DC	4.1	II	1325	316040	SHOE POLISH	6	0.44	40	17.6
DC	4.1	II	3175	2085470	O/SPICE WIDE	6	0.7	100	70
DC	4.1	II	1325	5289011	GOANNA HEAT	6	0.8	61	48.8
DC	8	II	1759	2526256	DRANO CRYST	8	5	41	205
DC	1.4	III	337	1349863	PARTY POPPER	12	1	103	103
DC	3	III	1170	2829340	LISTERINE M/	6	6.5	27	175.5
DC	3	III	1993	3306475	VICKS COUGH	6	1.04	17	17.68
DC	3	III	1993	4000334	GOANNA EUCLY	6	0.5	27	13.5
DC	3	III	1300	4089643	H/D DEGREASE	8	22.14	19	420.66
DC	3	III	1170	4137801	LISTERINE M/	6	9.3	71	660.3
DC	3	III	1266	5836635	LYNX R/ON DE	6	0.5	25	12.5
DC	3	III	1266	6466763	WET ONES HAN	6	0.5	97	48.5
DC	4.1	III	1944	319768	REDHEAD 10PK	12	1.2	16	19.2
DC	4.1	III	1334	1417760	PAS MOTHBALL	12	2	53	106
DC	4.1	III		4959588	HOV CAMPHOR	12	1	77	77
DC	5.1	III		3998106	DECORE BLNDE	3	0.48	31	14.88
DC	5.1	III		3998113	DECORE BLNDE	3	0.48	6	2.88
DC	5.1	III		4558781	NICE N EASY	3	0.7	20	14
DC	5.1	III		4558910	NICE N EASY	3	0.7	19	13.3
DC	5.1	III		4558989	NICE N EASY	3	0.7	4	2.8
DC	5.1	III	2984	4999164	NICE N EASY	3	0.7	24	16.8
DC	6.1	III	2810	1772142	VEET DEPIL 1	6	1	30	30
DC	8	III	3264	6388263	EASY OFF BAM	9	5.5	24	132

DC	8	III		6987633	VEET REMOVAL	5	2	36	72
DC	9	III	2783	2199375	ANTEX GRANUL	6	3	71	213
DC	1.4	NA	113	460286	PARTY SPARKL	36	0.36	164	59.04
DC	1.4	NA		4318149	STAR SPARKLE	12	0.97	149	144.53
DC	2	NA		4216933	REDWIN LOTIO	4	8.4	258	2167.2
DC	2	NA	1950	4721086	IMPULSE GODD	6	0.5	9	4.5
DC	2	NA		6709822	EASY OFF OVE	12	4	33	132
DC	2	NA		6976842	LYNX DRY A/P	6	1	28	28
DC	2	NA		6976934	LYNX DRY A/P	6	1	25	25
DC	2	NA		7001994	L/TAN BRONZE	6	0.9	5	4.5
DC	2	NA		7256806	VO5 HAIRSPRA	6	1	57	57
DC	2	NA		7495991	NEUT USHEER	3	1	30	30
DC	2	NA		7496028	NEUT USHEER	3	0.5	47	23.5
DC	2	NA		7501234	REXONA AP IV	6	0.5	3	1.5
DC	2	NA		7501333	LYNX DEO/CLG	6	1	47	47
DC	2	NA		7501777	4PK BUTANE C	7	10	1487	9000
DC	2.1	NA	1057	100250	TK LIGHTER	12	1.22	43	52.46
DC	2.1	NA	1950	336703	XCARE H/SPRA	4	1	64	64
DC	2.1	NA		336789	EXTRACARE HA	4	2	76	152
DC	2.1	NA	1950	347778	REXONA DEO S	6	0.92	18	16.56
DC	2.1	NA	1950	359719	MR SHEEN REG	12	6.5	31	201.5
DC	2.1	NA	1950	401753	SHVE CRM S/S	4	2	139	278
DC	2.1	NA	1266	413183	REXONA ROLL	6	0.48	59	28.32
DC	2.1	NA	1950	416443	REXONA DEO S	6	1.26	8	10.08
DC	2.1	NA	1950	431705	EXTRACARE LA	4	2	108	216
DC	2.1	NA	1950	469760	WD-40 150G	12	2.85	16	45.6
DC	2.1	NA	1950	914932	REXONA DEO S	6	1.25	27	33.75
DC	2.1	NA		1122022	TAFT MOUSSE	6	1.5	81	121.5
DC	2.1	NA	1950	1295511	BRUT DEODORN	6	1	127	127
DC	2.1	NA	1950	1295528	BRUT A/PERSP	6	1.24	114	141.36
DC	2.1	NA	1950	1417630	MONIQUE HAIR	6	2.5	55	137.5
DC	2.1	NA	1950	1552478	MORTEIN F/KN	12	5.4	45	243
DC	2.1	NA		1579765	TAFTMOUSSE 2	6	1.7	70	119
DC	2.1	NA		1584448	X-CARE STYL/	4	1	71	71

DC	2.1	NA		1584646	X-CARE H/SPR	6	0.8	93	74.4
DC	2.1	NA	1950	2040981	FINAL NET LA	6	0.48	559	268.32
DC	2.1	NA	1950	2040998	FINAL NET LA	4	2	337	674
DC	2.1	NA	1950	2042718	MORTEIN BARR	12	6.4	27	172.8
DC	2.1	NA	1950	2060736	MORTEIN LURE	12	6.2	15	93
DC	2.1	NA		2441948	RID 100ML RO	12	1.6	24	38.4
DC	2.1	NA	1950	2460246	LYNX DEO/CLG	6	0.75	47	35.25
DC	2.1	NA	1950	2644479	MORTEIN CONT	8	3	6	18
DC	2.1	NA		2654393	EXTRACARE MO	4	0.6	45	27
DC	2.1	NA	1950	2675183	REXONA DEO S	6	1.28	61	78.08
DC	2.1	NA	1950	2680644	A/ALL TYREFO	6	3.8	17	64.6
DC	2.1	NA	1950	3004425	MUM ANTIPERS	6	0.96	132	126.72
DC	2.1	NA	1950	3054208	DOVE DEODORA	6	0.86	23	19.78
DC	2.1	NA	1950	3508954	S/SLK HAIRSP	6	1.55	15	23.25
DC	2.1	NA	1950	3643297	NO MORE TOIL	12	1.7	11	18.7
DC	2.1	NA	1057	3818572	TK LIGHTER A	12	1.4	37	51.8
DC	2.1	NA	1950	3895511	BAYGON S/SPR	12	6.2	29	179.8
DC	2.1	NA	1950	3945537	WD-40 425G V	12	7	47	329
DC	2.1	NA	1950	4022039	MUM ANTIPERS	6	0.8	188	150.4
DC	2.1	NA	1950	4159520	VO5 ADV HAIR	4	1.2	80	96
DC	2.1	NA	1950	4159537	VO5 ADV HAIR	4	1	76	76
DC	2.1	NA		4318286	HAIRSPRAY NE	12	1	70	70
DC	2.1	NA		4318309	HAIRSPRAY GL	12	1	74	74
DC	2.1	NA		4406358	RAID PROTECT	12	6	50	300
DC	2.1	NA	1950	4528616	PREEN AERO 3	12	5.1	6	30.6
DC	2.1	NA	1950	4844976	REXONA DEO 2	12	5.2	32	166.4
DC	2.1	NA	1650	4844983	REXONA DEO 2	12	5	6	30
DC	2.1	NA	1950	4844990	REXONA DEO 2	12	5	41	205
DC	2.1	NA	1950	4845003	REXONA DEO 2	12	5	51	255
DC	2.1	NA		4845027	REXONA DEO 2	12	5	27	135
DC	2.1	NA	1950	4845034	REXONA DEO 2	12	5	70	350
DC	2.1	NA	1950	4845041	IMPULSE SPRA	12	2.7	39	105.3
DC	2.1	NA	1950	4845058	IMPULSE SPRA	12	2.7	29	78.3
DC	2.1	NA	1950	4845065	IMPULSE SPRA	12	2.7	21	56.7

DC	2.1	NA	1950	4845089	IMPULSE SPRA	12	2.7	57	153.9
DC	2.1	NA		4909064	BUG&TAR REMO	12	6.3	30	189
DC	2.1	NA	1950	4909071	5STAR WHEEL	12	6.3	109	686.7
DC	2.1	NA	1950	4928157	REXONA AP SP	6	0.9	73	65.7
DC	2.1	NA		4928164	REXONA AP SP	6	0.9	8	7.2
DC	2.1	NA	1950	5298983	AIRWICK FRES	6	2	53	106
DC	2.1	NA		5299041	AIRWICK FRES	6	2	26	52
DC	2.1	NA	1950	5363971	REXONA DEO S	6	1	24	24
DC	2.1	NA	1950	5363988	DOVE DEODORA	6	1	7	7
DC	2.1	NA		5364077	NIVEA DEOD S	6	0.9	120	108
DC	2.1	NA		5456840	SUNSILK HAIR	6	1.53	55	84.15
DC	2.1	NA		5626236	LYNX DEO/CLG	6	0.9	33	29.7
DC	2.1	NA		5637096	PANTENE MOUS	6	0.5	29	14.5
DC	2.1	NA		5649990	PANTENE HAIR	6	2	69	138
DC	2.1	NA	1950	5663736	BRUT A/PERSP	6	1	18	18
DC	2.1	NA		5668298	TK LIGHTER 2	6	4	44	176
DC	2.1	NA		5715213	IMPULSE TEAS	6	1	51	51
DC	2.1	NA	1950	5870530	AUSTRALIS BO	6	9.5	65	617.5
DC	2.1	NA		5870547	AUSTRALIS BO	6	1.6	33	52.8
DC	2.1	NA	1950	5876570	NIVEA DEOD S	6	1	40	40
DC	2.1	NA		5894000	B BOAT SPRY	6	0.5	60	30
DC	2.1	NA		5894017	B BOAT SPRY	6	0.5	55	27.5
DC	2.1	NA		5894024	B BOAT SPRY	6	0.5	64	32
DC	2.1	NA		5929153	LYNX TWIN PK	12	4	134	536
DC	2.1	NA	1950	5929160	LYNX TWIN PK	12	4	28	112
DC	2.1	NA		6103606	CRICKET3+1 L	9	1.1	10	11
DC	2.1	NA		6175559	PREEN CARPET	12	5	9	45
DC	2.1	NA		6181789	CEDAL H/SPRA	4	1.6	126	201.6
DC	2.1	NA		6182076	TRESEMME MIN	5	0.55	21	11.55
DC	2.1	NA		6182090	TRESEMME MIN	5	0.55	4	2.2
DC	2.1	NA		6182670	LYNX DEO/SPR	6	1	28	28
DC	2.1	NA		6183158	FEMFRESH DEO	6	0.75	16	12
DC	2.1	NA		6213565	BOSISTO ECLP	3	1	121	121
DC	2.1	NA	1950	6226633	INTERIOR CLN	12	5	88	440

DC	2.1	NA	1950	6226640	GLASS CLEANE	12	5	74	370
DC	2.1	NA	1950	6226657	3IN1 DEGREAS	12	5	320	1600
DC	2.1	NA	1950	6251772	IMPULSE LOND	6	0.67	57	38.19
DC	2.1	NA		6251789	IMPULSE PARI	6	0.5	34	17
DC	2.1	NA	1950	6251796	IMPULSE NY S	6	0.5	27	13.5
DC	2.1	NA		6251857	DOVE DEODORA	6	0.5	152	76
DC	2.1	NA		6425357	SPRT WHI LTH	6	1	25	25
DC	2.1	NA		6475123	REXONA AP TR	6	1	30	30
DC	2.1	NA		6475147	REXONA AP ME	6	1	2	2
DC	2.1	NA		6487416	LE TAN IN LE	6	1.26	71	89.46
DC	2.1	NA	1950	6487423	LE TAN IN LE	6	1.26	89	112.14
DC	2.1	NA		6514600	REXONA DEO 2	12	4	58	232
DC	2.1	NA		6514648	REXONA DEO 2	12	2	24	48
DC	2.1	NA	1950	6514655	REXONA DEO 2	12	4	28	112
DC	2.1	NA	1950	6514709	LYNX A/PERSP	12	3	31	93
DC	2.1	NA	1950	6514778	LYNX A/PERSP	12	3	3	9
DC	2.1	NA	1950	6557423	LYNX DUO 2PK	12	4	56	224
DC	2.1	NA	1950	6573683	OUST 3 IN 1	12	4.5	32	144
DC	2.1	NA	1950	6573690	OUST 3 IN 1	12	4.5	42	189
DC	2.1	NA		6708078	GLADE AEROSO	12	4.5	86	387
DC	2.1	NA		6708085	GLADE AEROSO	12	4.5	45	202.5
DC	2.1	NA		6709846	AIRWICK 4 IN	12	6	21	126
DC	2.1	NA		6920920	REXONA DEO M	6	0.34	273	92.82
DC	2.1	NA		6925550	DOVE TWIN PA	4	1	24	24
DC	2.1	NA		7256455	S/SILK HAIRS	6	0.35	71	24.85
DC	2.1	NA		7258046	REXONA DEO M	6	0.33	94	31.02
DC	2.1	NA		7258053	LYNX DEO MIN	6	0.34	121	41.14
DC	2.1	NA		7258107	DOVE AP DEO	6	0.3	70	21
DC	2.1	NA		7397424	AIRWICK FRES	3	4	31	124
DC	2.2	NA	1950	305433	SHAVEFOAM LE	4	1.5	97	145.5
DC	2.2	NA	1950	338967	BRUT ULTRA S	6	1.84	142	261.28
DC	2.2	NA		3296769	NIVEA SHAVIN	6	1.5	25	37.5
DC	2.2	NA	1044	4795933	FIRE EXT 1KG	6	4	38	152
DC	2.2	NA	1950	5456864	SUNSILK MOUS	6	1.53	6	9.18

DC	6.1	NA		1086706	CLR 750ML	6	6.43	19	122.17
DC	6.1	NA		1155860	EXIT MOULD 5	9	5.84	7	40.88
DC	6.1	NA		3030295	1.25 LT CLAR	6	6	259	1554
DC	9	NA		3120248	ROUNDUP 1 LI	6	8	161	1288
DC	7	NA		4088080	SMOKE ALARM	6	2.27	25	56.75
DC	8	NA		1155952	WHITE KING B	4	11.5	11	126.5
DC	8	NA		1783452	WHITE KING B	4	11.92	149	1776.08
DC	8	NA		7256790	DRANO ULTRA	6	2	46	92
DC	9	NA		202787	BAR S-BUGS T	12	5.33	71	378.43
DC	9	NA		2840895	ALGI BLOCK 1	6	7.42	176	1305.92
DC	9	NA		2875170	WASH&WAX A/A	6	7	103	721
DC	9	NA		3536759	ROUNDUP RTU	6	6.96	154	1071.84
DC	9	NA		3841655	COOLANT X30	3	15.86	776	12307.36
DC	9	NA		3993712	P/CRAFT S/SO	8	22.3	54	1204.2
DC	9	NA		4395577	CLAIROL FROS	3	0.7	42	29.4
DC	9	NA		4514473	LISTERINE M/	8	4	44	176
DC	9	NA		3998380	HEAD & SHLDR	6	2.7	37	99.9
* These items will be stored in the area designated 'Special Goods Store' on the DC plans									

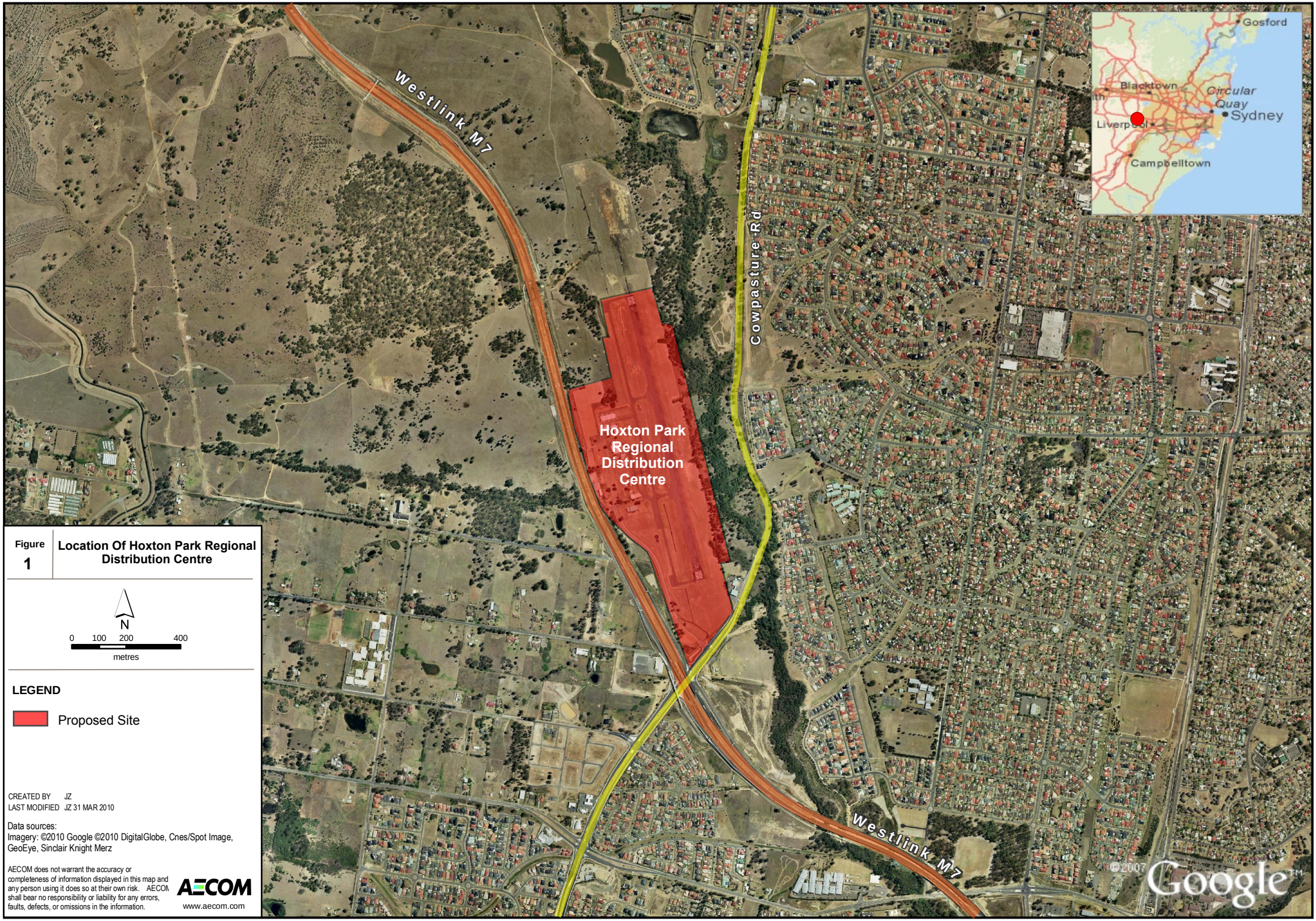

Figure 1 — **Location Of Hoxton Park Regional Distribution Centre**

N

0 100 200 400

metres

LEGEND

Proposed Site

CREATED BY JZ
LAST MODIFIED JZ 31 MAR 2010

Data sources:
Imagery: ©2010 Google ©2010 DigitalGlobe, Cnes/Spot Image, GeoEye, Sinclair Knight Merz

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Appendix B

Dangerous Goods Storage

BASSETT

Dangerous Goods Storage
Comparative Study of Proposed Design with Legislative Requirements, Dangerous Goods Segregation and Hazardous Area Classification

Big W Sydney - Retail Distribution Centre

Big W

28/08/08

Document No.: Q060045489CJKI.09.RP

Comparative Study of Proposed Design with Legislative Requirements, Dangerous Goods Segregation and Hazardous Area Classification

Prepared for

Big W

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Prepared by	Justine Young
Reviewed by	Frank Mendham

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
Rev 1	28/08/2008	Draft	Frank Mendham Manager - Risk Engineering	Signed on Original
Rev 2	23/3/2009	Final Report	Frank Mendham Manager - Risk Engineering	Signed on Original

Table of Contents

Executive Summary

The aim of this report is to provide a comparative study of the prescriptive dangerous goods storage and handling requirements of applicable Dangerous Goods Legislation with the proposed 'Package Store' design, including product handling strategy. A comparison of the proposed design for the Sydney Big W Retail Distribution Centre (SRDC) located within the current structure is carried out against applicable Australian Standard AS/NZS 3833:2007 'The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers' [1]. This report is not in itself a Dangerous Goods storage notification application to the New South Wales (NSW) Government, but potentially, may be used in support of such an application.

This report also addresses the Hazardous Area Classification of the proposed area where dangerous goods will be stored using a risk-based approach, validated using numerical Computational Fluid Dynamics modelling.

Recommendations

Based on the quantities and class of dangerous goods stored in the building under AS/NZS 3833:2007[1], this standard indicates that an option exists involving no requirement for a 'Dangerous Good Storage Facility' (DGSF) based on the implementation of the storage measures outlined in AS/NZS 3833:2007[1] and summarized in Appendix F. Big W, however, has decided to build a DGSF in line with their insurer's requirements.

Bassett advises the following for the proposed area where dangerous goods will be stored :

1 Segregation requirements, operational and personnel safety, emergency management and waste storage and disposal requirements are required to be implemented and maintained by Big W.

2 Ventilation and lighting is assumed to be compliant. Drawings supplied do not provide any quantitative measures for the lighting system, however our expectations is that the final design will comply with the prescriptive requirements of AS/NZS 3833:2007.

3 The separation distance between the dangerous goods storage area and a protected place must be approximately 7m. This distance is to be confirmed once, the site has been selected and the final quantities and range of dangerous goods to be stored are confirmed.

4 The current design is sized to meet the required separation distances outlined in Appendix B and Section 4 of this report.

It is our recommendation to construct a dangerous goods storage area as detailed in Section 5 of AS/NZS 3833:2007[1] and summarized in Section 2.2 of this report. The relevant excerpts and segregation guide from AS/NZS 3833:2007[1] is provided in Appendix A and Appendix B of this report.

In relation to explosive atmosphere safety management, a section of this report addresses hazardous area classification concerns for Big W's Sydney Retail Distribution Centre (SRDC). A review of the SRDC operations revealed opportunities for application of risk based methods to ensure compliance with the New South Wales, *'Occupational Health and Safety Act 2003[24]'* and the requirements of the *'Occupational Health and Safety Regulation, 2001'[25]*.

The proposed area where dangerous goods will be stored at SRDC can be operated safely and effectively with the proposed chemicals, detailed in Appendix F, in conjunction the following conditions:

1 Entry must be restricted to authorised, trained personnel.
2 Appropriate spill kits must be available within the store area, including sealable disposal containers.
3 Load shifting equipment within the dangerous goods store must be limited to one unit at a time.

Bassett recommend that the following engineering controls and procedural measures be undertaken by Big W Pty Ltd:

1. Storage of liquid materials below solid materials, or where this is not possible, installation of solid, chemical resistant 'fire barriers' to separate the goods vertically.
2. Specification of robust, primary packaging for stocked product lines
3. Ongoing review of segregation and separation requirements with regard to new product lines and their Material Safety Data Sheet (MSDS).
4. Rapid and effective response to a spill.
5. Isolation of spark or ignition sources near floor level **as soon as** a spill is detected.
6. Isolation of spark or ignition sources near floor level **until cleanup is completed**.
7. Ongoing review of potential spill scenarios, as practices or product lines change.

The risk based hazardous area classification is based on an 8 litre Listerine spill in the Sydney RDC and is detailed in Table 3.1 of this report. In summary, the extent of the hazardous zones calculated, combined with the nature of the zones is:

1. Zone 2 NE (Negligible Extent) across the floor to a depth of 50 mm.

Opportunities to improve the hazardous zone extent within the dangerous goods store include:

1. Stocking bulk product lines in secondary containers capable of containing potential spillages.
2. Ensuring adequate ventilation, particularly at floor level, possibly installing utilising mechanical ventilation.
3. Development and implementation of robust emergency procedures.
4. Robust forklift training in avoid forklift incidents/accidents.

1.0 Introduction

1.1 Scope of Study

This report is a comparative study of the prescriptive dangerous goods storage and handling requirements of applicable Dangerous Goods legislation and applicable Australian Standards, with the proposed 'Package Store' design, including the product handling strategy. This report is not a Dangerous Goods storage application to NSW Government, however is designed to support such an application.

This report does not address the structural and civil engineering aspects of the proposed design, other than how fundamental significant features of the structure, such as 'Containment Bunding' and 'Fire Rating Levels', are required to meet compliance with applicable Dangerous Goods Standards.

1.2 Drawings Reviewed

Drawings showing the current design of the Dangerous Goods Storage Facility (DGSF) at the Big W Retail Distribution Centre (RDC) in Sydney were reviewed to ascertain whether the current design complied with the requirements of AS/NZS 3833:2007 [1].

The drawings reviewed are listed in the table below and provided in Appendix B for reference:

Table 1 - Drawings reviewed

Drawing Number	Description	Revision
0733 ARSK 215A Part Floor Plan 215.pdf	Part floor plan 215 level 1 site plan	SK 215/A
AR215	Packaging layout Dangerous goods store	Rev B
60045489	Dangerous Goods Store	01

The outcomes of the compliance review with AS 3833:2007 are provided in Appendix C of this report.

2.0 Standards Review

2.1 Review of AS/NZS 3833:2007 Applicability

The following Standards were considered as part of the assessment of the Sydney Retail Distribution Centre (SDRC):

1. AS/NZS 3833:2007 'The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers' [1]
2. AS 1940:2004 'The storage and handling of flammable and combustible liquids' [2],
3. AS/NZS 4681:2000 'The storage and handling of Class 9 (miscellaneous) dangerous goods and Articles' [3].
4. AS 3780:1994 'The storage and handling of corrosive substances' [4].

Of the Australian Standard assessed, AS/NZS 3833:2007 [1] is considered the most appropriate Standard to use for the assessment of the SRDC dangerous goods storage. [1] specifically deals with dangerous goods stores containing mixed classes of dangerous goods. Additionally, [1] also specifically addresses 'Retail Storage' and focuses on the storage requirements for quantities of dangerous goods in retail. AS 1940[2] was considered by Bassett to be less applicable given the low proportion of Class 3 Dangerous Goods in the store compared with the quantity of other dangerous goods classes. Furthermore, AS 1940:2004[2] does not differentiate perceived low risk RDC situations from perceived high risk storages, such as fuel storage facilities.

AS/NZS 46811:2000[3] and AS 3780:1994[4] were also considered not appropriate, based on the variety of mixed classes proposed for placement within the SRDC. The intent of AS/NZS 3833:2007 is to 'set out the requirements and recommendations for the safe storage and handling of dangerous goods... where dangerous goods of more than one class are kept within the same store, without the need for segregating walls[1]'.

AS/NZS 3833:2007[1] is a relatively new Standard that considers 'consumer commodities' in various ways and under various storage scenarios, but most importantly it takes into account recent changes to AS 1940:2004[2]. The significance of this is [2] has a considerable impact on the design requirements for dangerous goods storage, as it can be quite onerous in terms of fire rating levels and separation distances to various locations and to ignition sources. This is why a 'risk-based' approach, is considered a suitable alternative approach to the design of dangerous goods storage facilities where Class 3 Flammable Liquids are proposed.

AS/NZS 3833:2007[1] applies a maximum storage quantity for dangerous goods stored in retail packages for Retail Stores. When the prescribed storage amount is exceeded [1] mandates that a DGSF must be constructed. This requirement is only applicable for Retail Stores. The quantity of dangerous goods stored at a RDC may exceed the quantity prescribed in [1]. AS/NZS 3833:2007[1] does not impose an upper limit on the quantity of dangerous goods stored at a RDC facility. Additionally, [1] has no requirements for the construction of a DGSF for an RDC.

An opportunity exists to eliminate the need for a DGSF provided the measures, as detailed in Section 3 of AS/NZS 3833:2007[1] and summarised in Section 0 of this report, are implemented and actioned for the Big W SRDC.

If the requirements set out in Section 3 of AS/NZS 3833:2007[1] are unable to be achieved or are undesirable, a DGSF should be constructed and managed as detailed in Section 5 of AS/NZS 3833:2007[1] and summarised in Section 2.2 of this report. It is understood that the construction of a dangerous goods storage area based on the DGSF requirements, predominantly for insurance purposes, will be pursued for the Big W RDC and that this is the basis of this study.

2.2 AS/NZS 3833:2007 Requirements with a Dedicated Dangerous Goods Store

It is understood by Bassett that a dangerous goods storage location based on the requirements of a DGSF will be provided for the Big W SRDC facility, even though AS/NZS 3833:2007 may provide the opportunity to eliminate this requirement.

The proposed dangerous goods storage location is intended to meet an equivalent level of risk mitigation as provided in the prescriptive requirements of Section 5 of [1], as summarised below.

2.2.1 Construction

1. A Dangerous Goods store may be either a combination of a room/area within a building, room attached to an external wall of another building, free standing building not attached to others, a storage cabinet, a freight container or an outdoor area with a security fence.
2. A hazard assessment must be carried out for a mixed class Dangerous Goods store.
3. Stores other than storage cabinets must be on a floor that has direct access on at least one side to ground level.
4. Where flammable liquids are kept, the store shall be constructed of fire resistant materials. If flammable liquids are not kept, the store may be constructed of non-combustible materials. Surfaces are to be treated to render them resistant to attack by the substances being kept.
5. All construction materials to be lined with corrosion resistant materials or be constructed of corrosion resistant materials where corrosive substances are stored.
6. Any storage requirements, as specified on material data sheets or MSDS, must be met.
7. Adequate lighting must be provided throughout the centre such that markings on packages and signs are clearly visible. Interior lighting shall be required to comply with AS/NZS 1680.2.4:1994[15] and where flammable goods are stored AS/NZS 2430.3:1986[5] should be referenced.
8. All electrical wiring is to comply with AS/NZS 3000:2007[17]. Where there is a risk of corrosion all electrical wiring is to comply with IP 65 in accordance with AS 60529:2004[16].
9. Where division 2.1, 4.1, 4.2, 4.3 or Class 3 Dangerous goods are stored in large quantities requirements to provide 'Explosion Protected' equipment and wiring of the store in accordance with [5] may be required in accordance with 'Hazardous Area Classification' requirements.
10. Shelves must be designed and constructed such that residues must not be able to build up along ledges and corners, any leaks or spills should be easily noticed. Other than spill trays all shelves should not be able to pool liquid.
11. Large quantities of aerosols stored in the RDC must be in a cage.
12. Exits to be provided as required by the BCA. A -/120/30 fire door must be provided in a fire rated wall separating a Dangerous Goods store from another room.
13. Safety showers, eyewash facilities and water for washing hands must be provided within 10m of but no closer than 2m to areas where packages are opened and contents transferred. The number, location and type of equipment should be based on a risk assessment. Such facilities to comply with ANSI Z358.1:2004[18].
14. Where Dangerous goods may generate combustible dusts or flammable products a 'Hazardous Area Classification' must be conducted in accordance with AS/NZS 2430:1986[5].
15. Forklift trucks used in a Hazardous zone must be in accordance with the requirements of AS 2359.12:1995[19].
16. When forklift trucks are utilised in areas storing oxidising agents they must be in accordance with AS 4326:2008[20].

2.2.2 Spillage Containment

1 Spill containment such as a bund or a means of diverting a spill to a compound must be provided in stores in which liquids are kept. The means of containing the spill must comply with the following:

a) The capacity of the compound used must be no less than 100% of the largest container plus 25% of the storage capacity up to 10 000L, in addition to 10% of the storage capacity beyond 10 000L.

b) The spillage containment compound must also be increased to include 20 minutes of sprinkler discharge.

c) The bund must be constructed of materials which are resistant to attack by the Dangerous goods being kept.

d) Non combustible, chemically resistant shields may be used to deflect leaks into a compound provided that they are positioned so that they do not impede ventilation.

e) A chemical and fire resistant spillage compound must be impervious to the degree necessary to retain spillage and to enable recovery.

f) Incompatible chemicals or substances which might react must not be directed into the same compound.

g) The surfaces of the spillage containment system must be non porous and chemically resistant to the liquids being stored.

h) Drainage of fire water or rainwater to outside the compound should be conducted either via a suitable interceptor or separator or after testing the water.

2.2.3 Storage of Packages

1 Packages must be stored such that they cannot fall or spill outside the compound.

2 Packages should be kept at least 600mm from the inner edge of the bund wall or restraints provided to prevent falls or spills outside the compound.

3 Items that must be considered in stacking packages and pallets are the maximum height based on the load bearing ability, design of the package, method of stacking, design of the stacking and safe working load of the pallet.

2.2.4 Offices within Stores

1 If it is desirable to construct an office inside the Dangerous Goods Store the following requirements must be met:

a) An exit path must be provided which does not require the occupant to traverse through the area where the dangerous goods are stored.

b) Personnel inside the store must not be exposed to vapours emitted from the store.

c) Adequate ventilation must be provided such that the air pressure inside the office does not fall below that of the Dangerous Goods store when flammable or toxic dangerous goods are stored.

d) Access must be restricted to authorised personnel only.

2.2.5 Ventilation

1 Adequate natural or mechanical ventilation must be available to maintain ambient concentrations of vapours or dusts throughout the store below any workplace standard.

2 The ventilation system must be able to ensure the dilution of vapours by the flow of air passing through the store.

3 If flammable liquids are stored, the atmosphere must be kept at a minimum of 10% below the lower explosive limits during normal operation.

4 Vents to be located such that effective air movement to all parts of the store occur.

2.2.5.1 Natural Ventilation

1 If vents are used they must consist of openings immediately above the upper limit of the spillage compound and each vent must have a net free area of $0.1m^2$, or $0.15m^2$ where open packages are present. An equal area of openings must also be provided above the highest package.

2 One low level vent must be provided in each 3m of wall or in each 1.4m of external wall where there is only one external wall. If only one vent is required on a wall it must be located centrally to the length of the wall.

3 Either one of the following may be appropriate depending on the design of the store.

a) Two external sides open to the atmosphere (walls constructed of wire mesh, fixed louvers, lattice, etc whose area is no less than 50% open is considered fully open)

b) One external side open to the atmosphere with no additional vents. The distance to and length of opposite wall must not exceed the length of the open side.

c) One external side open to the atmosphere and vents in the opposite or adjacent wall.

d) Vents in one external wall if the wall is at least 6m long and the opposite wall is not more than 5m away from it.

e) Vents in opposing walls.

f) Under deck ventilation on storage platforms by means of vent openings on opposite sides having an area of not less than $0.1m^2$ for each 1.2m length.

4 Equivalent areas of ventilation are allowed provided the required vent area per unit wall is maintained.

2.2.5.2 Mechanical Ventilation

1 Mechanical ventilation systems must be provided such that:

a) Termination points within the store for fresh air supply and draw-off ducts must be immediately above the upper limit of the spillage compound, on opposing walls and of equal capacity. The distance between any two inlets or any two outlets shall not exceed 5m.

b) In order to optimise their effect, registers are ideally located along the longest side of the building. If a single fan system is utilised the fan should be in the exhaust duct.

c) If the ventilation system incorporates fans on both the supply and exhaust ducts the room is to be maintained under negative pressure.

d) The mechanical ventilation system must be able to exhaust the greater of $0.3m^3$ per square metre of floor area per minute or $5m^3$/min and the air velocity at the entry register must exceed 300 m/min.

e) In the event of airflow failure, a warning device must be provided such that the warning can be identifiable from outside the store.

f) The termination points for any intake or exhaust duct shall either be of the following:

i. Be in the open air at least 2m away from any openings in the building.

ii. 4m from the outlet of any chimney or flue and at least 3m above the ground.

g) External termination points of any inlet duct must be at least 5m from the exhaust duct termination point.

h) The mechanical ventilation system must be designed so that it operates continuously or when occupied or when processes inside the store operate.

i) In locations where flammable substances are stored, where a duct passes through a building other than the store it must be protected by or constructed from material with an FRL of no less than -/180/180. In addition fan blades and nearby components must also be constructed of materials which do not emit sparks when struck.

2.2.6 Housekeeping

1. The site will be maintained in a safe condition.
2. The area will be kept clear of irrelevant items.
3. Adequate clearance distances must be maintained at all times.
4. Exit paths, exits and aisles must be kept clear of packages.
5. Surrounding vegetation must be maintained and kept short to reduce the fire hazard.
6. All stock to be monitored to prevent the accumulation of old material. Stock integrity should be maintained.
7. All stock to be handled with care to prevent package damage and minimise leaks.
8. All packages to be regularly inspected to ensure package leaks are minimised. If signs of spill, leak or deterioration are observed the package is to be examined until rendered safe.
9. Spills or leaks of Dangerous goods must be dealt with according to the Emergency Procedures.
10. Used packages which cannot be recycled must be disposed of by means of an approved method via consultation with the local waste disposal authority, environmental protection authority and health department.
11. Labels to remain on empty containers until decontaminated at which time the labels to be removed.

2.2.7 Security

The RDC shall be restricted to authorised personnel only. Any additional regulatory requirements for dangerous goods stored also apply.

2.2.8 Separation & Segregation

1 Stores must be separated from protected places or other properties by the minimum distances given in the below table. The minimum separation distance from 'On-Site Protected Places' need not exceed 15m where flammable goods are kept, 7.5m where C1 combustible liquids are kept and 3m where C2 combustible liquids or non flammable dangerous goods are kept. Offices inside the store or immediately adjacent to the store used for the direct supervision of the store are not considered to be an 'On-Site Protected Place'.

Table 2 - Separation distances[1]

Aggregate Quantity, kg or L		Minimum Distance
PG I, PG II	PG III, aerosols (UN 1950)	
≤ 4 000	≤ 4 000	3
≤ 7 000	≤ 16 000	5
≤ 10 000	≤ 28 000	6
	≤ 40 000	7
≤ 14 000	≤ 56 000	8
≤ 20 000	≤ 80 000	9
≤ 26 000	≤ 104 000	10
≤ 34 000	≤ 136 000	11
≤ 42 000	≤ 168 000	12
≤ 52 000	≤ 208 000	13
≤ 64 000	≤ 256 000	14
≤ 77 000	≤ 308 000	15
≤ 170 000	≤ 680 000	16
≤ 310 000	≤ 1 240 000	25
≤ 500 000	≤ 2 000 000	30

2 Separation distance to any property boundary must be no less than 3m.

3 If the store contains Dangerous goods of Classes or Divisions 2.1, 3, 4 or 5, a separation distance of no less than 3m must be maintained from ignition sources.

4 Separation distances are generally measured on the horizontal plane. If liquids are stored the separation distance is measured from the inside top edge of the bund. If solids are stored the separation distance is measured from the package nearest to the protected place or boundary.

5 Separation distances may be measured around an intervening screen wall as long as the walls is at least 1m above the highest container in the store and is marked to indicate the maximum allowable storage height. If the store contains flammable liquids the screen must have an FRL no less than 240/240/240. Where other dangerous goods are stored, the screen wall must have an FRL no less than 60/60/60.

2.2.8.1 Segregation within the Store

1 Packages of dangerous goods must be segregated away from incompatible substances, substances which may react and other dangerous goods.

2 Dangerous goods which are incompatible must be either in separate compounds or segregated by a distance of no less than 3m or if both are solids, a distance of 1m.

3 Where dangerous goods may react they must be segregated by no less than 5m measured from the upper interior end of the bund and must not be kept in the same compound or compounds which share the same drainage system.

4 Foodstuffs, products for human or animal consumption, empty food containers, material for the production of foodstuff packaging and medical and veterinary materials can be kept in the same Dangerous Goods store of PGII or PGIII as long as the following are met:

   a) They are no less than 5m away measured horizontally from the dangerous goods

   b) Are not in the same compound unless the foodstuffs are kept above the bund height.

   c) The dangerous goods are kept below other goods,

   d) The packaging for the dangerous goods is not opened.

5 Where Division 5.1 Dangerous Goods (oxidising substances) are kept with other dangerous goods, stacks of Division 5.1 dangerous goods must be no greater than 3m high and a free air space of no less than 1.2m must be maintained between the stacks and any walls.

6 6. Non Dangerous Goods may be kept in segregation spaces provided they do not react with other Dangerous goods being kept. A hazard assessment must be undertaken and any additional fire protection equipment provided if combustible non dangerous goods (excluding combustible liquids) are to be stored in the Dangerous Goods store.

7 Refer to Appendix B for the Segregation Guide.

2.2.9 Operation and Personnel Safety

1 Any restricted area must be locked whenever it is unattended. All visitors, contractors or the like entering into the premises must be accompanied by a trained staff member at all times. If this is not achievable, then before entry induction training must be undertaken or a list of the hazards present and the appropriate precautions to be taken must be provided.

2 At all times the following areas must be kept clear:

   a) Entry and exits

   b) Fire fighting equipment

   c) Personal protective equipment

   d) Clean up materials and equipment

   e) In the aisles and where the manifest is kept.

3 Where dangerous goods present an air inhalation hazard, routine air monitoring should be conducted.

4 A risk assessment and risk management plan must be undertaken before activities such as mixing, blending, degreasing, tinting or package filling or co-storage of other goods are carried out.

5 Packages shall be handled with care to minimise spills and leaks.

6 An appropriate amount of safety equipment must be provided as specified in the MSDS.

7 Where non flameproof fork lift trucks are used in stores containing Class 3 or 4 dangerous goods AS/NZS 3833:2007[1] should be observed for guidance on requirements.

8 Where packages are palletized they must be protected from punctures or tears.

9 Movement of packages of dangerous goods are subject to manual handling risk controls.

10 Sole or inner packages must not be opened inside the store unless for the purposes of sampling, tinting, testing or inspection. All packages to be securely reclosed afterwards.

11 Within a process area no more than two pallets or an aggregate capacity of 3000L of dangerous goods packages are allowed adjacent to the process or not more than a 12 hour supply

whichever is greater. Only exception is when the dangerous goods are stored in a separate area that complies with the relevant Australian Standards.

12 Finished packages must be cleared regularly. The maximum accumulated finished packages must no exceed the output of one working shift.

13 Where a store contains dangerous goods of classes or subsidiary risks 3, 4 or 5, or aerosols all potential ignition and heat sources must be no less than 3m away from any openings to the store.

14 The appropriate first aid measures and MSDS must be readily available.

15 Packages for dangerous goods must be marked in accordance with the applicable legislation.

16 Packaging for dangerous goods being filled must be constructed with sufficient strength and durability for its purpose. All parts of the packaging in contact with contents must not be weakened and must be compatible with the contents being stored.

17 If the packaging is used at other premises other than where it is filled it must meet the requirements of the Australian Dangerous Goods (ADG) Code.

2.2.10 Operation Procedures

1 Safe systems of work must be developed, implemented and maintained. Written procedures must include:

a) Operating procedures which cover all aspects of the day to day operation.
b) Maintenance procedures which cover all inspections, testing and monitoring.
c) Construction and maintenance procedures covering new facilities and modifications.
d) Emergency procedures.

2 All procedures to be updated and documented

3 Operating procedures would include the following:

a) Initial commissioning procedures.
b) Normal handling and transfer/ procedures.
c) Monitoring of essential functions and components.
d) Control of hazards, including ignition sources.
e) Manufacturer's operating procedures for equipment.
f) Housekeeping and site upkeep.
g) Management of leaks, spills and clean ups.
h) Personnel safety and protective equipment.
i) Environmental monitoring.
j) Operation of utilities.
k) Fire protection systems.
l) Check procedures for substances that are incompatible or can react.

1 Construction and maintenance procedures:
   a) Work authorization.
   b) Work in confined spaces.
   c) Testing of instrumentation, protective devices, alarms and monitors.
   d) Isolation and tagging of equipment.
   e) Control of contractors.
   f) Fire fighting equipment.
   g) Bunds.
   h) Electrical equipment.
   i) Ventilation.
   j) Fences and security measures.
   k) Lighting.
   l) Signs and notices.

2 An audit system should be established to determine compliance with procedures established.

3 Placards should be provided to NOHSC: 1015:2001[21] except where conflictions occur between legislative requirements. Legislative requirements will prevail.

4 Restricted Entry and Danger, No Smoking, No Entry - signs should be displayed.

5 Legislative required signs must be provided.

6 All signs to have lettering which contrast the background and comply with AS/NZA 1216.1:2000[9] and AS 1319:1994[22] unless another requirement prevails.

7 The following information and others as requested should be provided to the emergency services and displayed in approved locations.
   a) The location of the emergency plan.
   b) The location of the manifest.
   c) The location of protective equipment and clean up materials.
   d) The locations of controls for essential services and their distribution.
   e) The location and description of the dangerous goods being stored.

2.2.11 Construction and Maintenance Work

1 Written permission must be obtained before work is carried out in a Dangerous Goods store. Before work is undertaken consideration must be given to the safety of the procedures and if necessary the Dangerous goods may be moved to another location.

2 Any routine work, non hazardous work must be supervised such that its safe conduct is ensured.

3 Except for routine non hazardous work all work within the restricted area must be authorised through means of a work permit.

4 The work permit should include:
   a) The nature and extent of the work.
   b) Any conditions to be observed
   c) Any personal protective equipment to be used.
   d) The period for which the permit is valid.
   e) Any necessary regular checking to ensure safety requirements and conditions are maintained.
   f) Any necessary procedures and precautions required to return the area to normal service.
   g) Any fire fighting equipment required at hand.

1 The site or work area must be prepared such that the risk of fire, explosion or exposure to hazardous substances is minimised. Precautionary measures shall include but not limited to:

a) Identification of both the equipment to be worked on the other affected equipment.
b) Depressurization and disconnection of the equipment.
c) Isolation and locking-off of the equipment from other equipment.
d) Purging of the equipment.
e) Removal of hazardous material in the work vicinity if known to impact.
f) Sealing off of drains or pits.
g) Provision of appropriate fire protection equipment.
h) Testing of the work environment for its hazardous vapours and oxygen content.

2 Commissioning shall be conducted on all work after it is completed before returning it to service. A check should be conducted to ensure:

a) The work has been completed.
b) Any temporary arrangements have been removed.
c) All personnel and equipment are accounted for.
d) The work permit has been signed off as being complete.
e) All services and equipment are inspected and tested and have returned back to normal service.

3 No hot work to be conducted unless a work permit has been obtained and any hazardous vapours or residues have been removed. Requirements of AS 1674:1997[23] must be observed in relation to hot work.

2.2.12 Personnel Training

1 All personnel which will come into contact with or handle dangerous goods on the premises must be fully trained in the properties, applicable safety regulations and safe handling procedures. MSDS must be made available to all personnel.

2 All personnel on the premises must be trained in:

a) The nature of the work and safe methods of operation.
b) The properties and hazards of the substances handled.
c) The location of first aid equipment, and first aid measures.
d) The correct use of personal protective equipment, its care and maintenance.
e) Actions to be taken in various emergencies.

3 Evacuation drills and simulated emergencies are to be included in the training.

4 Contractors on the premises must be trained in:

a) Safety rules of the installation, including any restrictions on movement, access, activities and the use of personal protective equipment.
b) Conditions and obligations associated with work permits and confined space entry permits.
c) Hazards likely to be encountered, including any materials stored or handled on site.
d) Procedures to be followed in the event of an incident.

2.2.13 Hygiene

1 The following directions must be adhered to when handling dangerous goods.

a) Where dangerous goods are kept all food and smoking to be prohibited.

b) Wash hands after handling dangerous goods, before eating, drinking or using the toilet and after work.

c) Injuries involving dangerous goods must be addressed immediately.

d) Signs stating the above requirements must be displayed in the work area.

2.2.14 Personal Protective Equipment

1 All personnel must be provided with adequate personal protective equipment in areas where dangerous goods are stored or handled. Personal protective equipment must be ready for use, be regularly maintained and located in designated locations which are well identified.

2 The following types of personal protective equipment must be provided as appropriate to the operational requirements:

a) Protective clothing suitable for the specific dangerous goods complying with AS/NZS 4501.2:2002[7].

b) Eye protection selected in accordance with AS/NZS 1337:1992[8].

c) Protective gloves complying with AS/NZS 2161:2000[9].

d) Safety helmets complying with AS/NZS 1801:1997[10] and selected in accordance with AS/NZS 1800:1998[11].

e) Safety footwear complying AS/NZS 2210:1994[12].

f) Respirators having appropriate filters, complying with AS/NZS 1716:2003[13] and selected, used and maintained in accordance with AS/NZS 1715:1994[14].

3 All personal protective equipment to be kept separate from normal clothing and maintained as follows:

a) After use all protective equipment to be maintained and cleaned in accordance with manufacturer's instructions and specific to material exposed to.

b) Safety helmets to be maintained in accordance with AS/NZS 1800:1998[11].

c) Self contained breathing apparatus to be maintained in accordance with AS/NZS 1715:1994[14].

2.2.15 First Aid

A first aid station must be provided in a clean area. First aid kit and MSDS must be provided. A minimum of one person is to be trained in first aid and a list to be provided identifying personnel trained in first aid to be provided on notice boards.

2.2.16 Emergency Management

1 Design and layout of the facility is to consider the likelihood of accidents occurring due to the proposed layout, items to consider include:

a) Sufficient space between bund walls, storage areas and other structures which will allow access for maintenance staff during emergencies.

b) A means of reducing emission of vapours to the atmosphere.

c) Alarms to be connected to and monitored by the Fire brigade or monitoring services.

d) Water supplies.

e) Fire protection equipment.

f) Means of evacuation and assembly points.

g) Protection of personnel responding to emergency.

h) Access routes for fire brigade appliances.

i) Containment of leaks, spills and 'run off' fire fighting water.

j) Location of emergency plans and safety information.

2 Where required the fire brigade should be consulted regarding the above matters.

a) A detailed emergency plan must be prepared which details the actions to be undertaken for various emergencies that could occur on site. All personnel should be familiar with the procedures via training or the induction process. The relevant authorities and emergency services should be consulted.

3 The emergency plan should consider:

a. The likelihood and potential for emergencies such as fire, explosion, earthquake, reaction or release of dangerous goods.

b. The size and complexity of the installation.

4 The emergency plan should be regularly updated or revised whenever the following situations occur:

a) A new item of dangerous goods is introduced.

b) Quantities of dangerous goods stored on site change.

c) Alterations to the way the dangerous goods are stored.

d) Risk levels change due to changes in processes or procedures.

e) Updated information is provided from manufacturers of hazardous substances and dangerous goods.

f) Issues are found via real incidents or training.

5 Items of information to be provided on an emergency plan should include:

a) Actions to be undertaken in an emergency. These actions should include evacuation procedures, alarm activation, shutdown procedures, etc.

b) List of emergency services contact numbers, when to contact them and the information that they may require such as address, etc.

c) Evacuation procedures and the implementation of a warden system.

d) Location of nominated assembly areas which should be away from the incident area and not obstructing the actions of the emergency services.

e) Training required for personnel carrying out the plan.

f) Locations of MSDS.

6 The fire brigade may require a second emergency plan to be prepared which considers surrounding area emergency services assisting. Advice from the fire brigade should be requested regarding the location of this second plan.

7 A manifest should be provided and maintained in accordance with local regulations.

2.2.17 Management of Leaks and Spills

1 Leaks and spills should be minimised as much as possible. In the event a leak or spill occurs clean up actions should be undertaken immediately.

2 The following clean up procedures must be actioned immediately upon detection of a spill or leak. Consideration should be given to notifying the emergency services.

a) Leaking packages should be positioned in a manner to stop the leak and moved to a safe location.

b) The package should be placed in a suitable container or transferred to a clean packaging with is clearly labelled.

c) Small spills should be collected, absorbed or diluted as necessary. The absorbent shall be disposed of in a suitable waste container.

The following table lists the typical clean up materials and chemicals required in the spill kit which is to be provided at every premise where dangerous goods are kept.

Table 3 - Spill kit contents

Spill Kit
Adequate quantities of absorbent materials
Calcium hydroxide
Sodium bisulphate
Sodium carbonate
Crushed calcium carbonate
Resealable waste recovery containers marked for emergency use only
Portable pumps and decanting equipment.
Non sparking shovel
Yard brooms

2.2.18 Fire Protection

a) The BCA and relevant Fire Brigade requirements must be considered. Other items to consider are total floor area, construction of the store, quantity and classes of dangerous goods being kept, location of the store and fuel load.

b) The Fire Protection equipment shall be designed so the equipment is appropriate to the type and class of dangerous goods stored. The Fire protection measures implemented must be able to quickly control or extinguish a fire and prevent a fire nearby from affecting the store.

c) Fire fighting equipment in addition to BCA requirements must be stored adjacent to exit doors or when in large areas along exit routes. All equipment should be readily visible.

d) Fire fighting equipment shall be labelled as required by the relevant Australian Standard and should be sheltered or enclosed if located in outside or extreme areas.

e) All fixed fire protection and detection systems must be in accordance with relevant Australian Standards and must activate without delay.

f) If a fire alarm system is provided Manual Call Points must be provided in safe locations near work areas, evacuation and alert tones must be clearly distinguishable and a back up electricity supply must be provided.

g) Fire extinguishers shall be provided as per BCA and relevant Fire brigade requirements. Consideration must be given to the dangerous goods being stored and the electrical equipment.

h) Fire hose reels must be provided as per BCA and relevant Fire Brigade requirements. Fire hose reels must be provided to serve every storey of a building where the floor area used to store dangerous goods exceeds 300m^2. The stream from a fire hose reel must be able to reach every part of the floor area including the top of rack storage.

i) If foam fire hose reels are utilised they must be able to produce foam as per manufacturer's specifications.

j) Where monitors are used they must be capable of applying the required water density and quantity at the store. 50% more water must be provided above the calculated quantity to take into account adverse wind conditions. Adjustable monitors must be operable in a safe remote location. Fixed monitors should be provided with adjustable constant flow and fog to straight stream nozzles. Monitors should be 15-30m from the facility being protected. If closer radiant heat protection should be considered.

k) Fire protection systems must be maintained to AS 1851:2005[6].

l) A plan to ensure run off fire fighting water does not enter the surface or ground water should be implemented.

m) The following table specifies the fire protection required for package stores containing classes, divisions or sub risks 3, 4 or 5.1, aerosols or combustible liquids. These requirements are in addition to any BCA requirements.

Table 4 - Fire Protection for Stores[1]

Store Capacity (kg or L)	Fire Protection Requirements
≤10 000	Portable Fire Extinguishers
> 10 000 ≤ 50 000	Portable Fire Extinguishers Fire Hose Reels
> 50 000 ≤ 100 000	Portable Fire Extinguishers Fire Hose Reels Fire Hydrants
> 100 000 ≤ 250 000	Portable Fire Extinguishers Fire Hose Reels Fire Hydrants Automatic Fire Suppression or equivalent
> 250 000 ≤ 1 000 000	Portable Fire Extinguishers Fire Hose Reels Fire Hydrants Automatic Fire Suppression or equivalent
1 000 000	Portable Fire Extinguishers Fire Hose Reels Fire Hydrants Automatic Fire Suppression or equivalent

2.2.19 Waste Storage & Disposal

1 All waste control shall be in accordance with regulatory requirements.

2 Where dangerous goods are stored a facility must be provided for the storage of wastes and items contaminated with dangerous goods. Requirements applicable to Dangerous Goods store are applicable to the waste storage facility for dangerous goods.

3 Assessments are to be made on the disposal or recycling of the following goods:

a) Goods that have been stored for extended periods of time where the contents may be deteriorated.

b) Wastes and residues from spills and leaks.

c) Unidentifiable goods.

d) Contaminated clothing.

e) Goods that are in excess of possible use or demand.

4 Where goods are to be disposed consultation with the local waste disposal authority, the environment protection authority and the health department must occur to determine the most appropriate method. Advice from manufacturers and other outside sources may be beneficial.

3.0 Legislation Review

3.1 Review of Dangerous Goods Safety Act 2001 Applicability

On 1 September 2005, the Dangerous Goods Act 1975 (NSW) was repealed and the Occupational Health and Safety Act 2000 (NSW) and the Occupational Health and Safety Regulation 2001 were amended to regulate dangerous goods of all quantities at places of work, and certain quantities of dangerous goods at non-workplaces.The applicable Acts Regulations and Codes of Practice under NSW State legislation for the storage, handling and transport of dangerous goods applicable to the SRDC are:

- NSW Occupational Health and Safety Act 2003[24]
- NSW Occupational Health and Safety Regulations 2005[25], and
- Storage and Handling of Dangerous Goods Code of Practice 2005[26].

The NSW Occupational Health and Safety Act 2003[24] issued by the NSW Government details the requirements under NSW law for the safe storage, handling and transport of dangerous goods. All items in relation to dangerous goods storage, handling and transporting in NSW must conform to this Act unless exemptions are specifically granted by the Chief Officer or the appropriate Minister. As the activities in the SRDC will predominately encompass the safe storage, handling and transport of dangerous goods, this Act was considered to be the applicable Act to base this study.

3.2 Review of the Occupational Health and Safety Regulations 2001 Chapter 6A Dangerous Goods

The Occupational Health and Safety Regulation (2001), governs the storage and handling of dangerous goods in NSW. [25] replaces the repealed 'Dangerous Goods Act 1975 (NSW). The fundamental amendments to the OHS Act and the OHS Regulation to the storage and handling of dangerous goods was the introduction of a new 'duty of care' on certain persons dealing with dangerous goods and the establishment of a system of risk identification, assessment and control. [25] applies to all dangerous goods at places of work (regardless of whether or not the premises are places of work or are used for work). A summary of the requirements of [25] for the SRDC is provided below.

3.2.1 Duty of Care

[25] places specific duties on employers, occupiers of premises, manufacturers, importers and people dealing with self-service fuel dispensing units, fuel dispensing units, liquefied flammable gas, the filling of balloons and other containers, and the decommissioning of LPG tanks.

Duties required by [25] are as follows;

1 identifying, assessing and controlling the risk associated with the storage and handling of dangerous goods,
2 retaining records of induction and training,
3 keeping and maintaining registers of dangerous goods,
4 labeling duties, and
5 risk identification, assessment and control procedures.

3.2.2 Definition of 'dangerous goods'

"Dangerous goods" is defined in the OHS Act [25] as:

"a) substances or articles subject to a national standard declared by the NOHSC; and
b) any other substances or articles of risk to public safety."

In addition, section 135A(2) of the OHS Act allows regulations to be made for any substance or article as dangerous goods - irrespective of quantities currently prescribed by the OHS Regulations and regardless of whether they are at a place of work.

3.2.2.1 Obligations of occupies storing and handling dangerous goods

Occupiers of premises must now comply with risk identification procedures set out in Division 2 of Part 6A.2.

3.2.2.2 Duties in relation to dangerous goods [25]:

1 An occupier must ensure that all persons (including members of the public) are not exposed to risks to their health and safety arising from dangerous goods at the occupier's premises.

2 Occupiers have obligations with regard to dangerous goods that relates to risks to property or the environment, both inside and beyond the premises of the occupier.

3.2.2.3 Extension of hazard identification and risk assessment provisions

1 Division 1 (General duties of controllers of premises) of Part 4.2 of Chapter 4 of this Regulation extends to controllers of dangerous goods premises (regardless of whether or not the premises are a place of work or are used for work).

2 A reference in Chapter 2 (Places of work—risk management and other matters) and Division 1 (General duties of controllers of premises) of Part 4.2 of Chapter 4 of this Regulation to occupational health and safety (however expressed) includes, where the hazard concerned is a hazard that arises from dangerous goods, a reference to public health and safety.

3 For the avoidance of doubt:

a) when complying with clause 11 or 36, an occupier, when considering how to control a risk associated with the storage and handling of dangerous goods (where it is not reasonably practicable to eliminate the risk), must control the risk by taking the measures set out in clause 5, and

b) clauses 6 and 8 apply in relation to duties and responsibilities of occupiers and other persons at dangerous goods premises that are not places of work.

3.2.2.4 Risk Assessment

The occupier must,

a) if the occupier is an employer, make a record of each risk assessment and any review of a risk assessment by:
   i) making a notation in the register of dangerous goods kept under clause 174ZW if no specific measure are necessary to control the risks associated with the storage or handling of dangerous goods, or
   ii) preparing a report on the risk assessment of specific measures are necessary to control the risks associated with the storage or handling of the dangerous goods, and

b) the occupiers is not an employer, make a record of each risk assessment and any review of a risk assessment, and

c) keep a copy of that record while the risk assessment is current or being reviewed.

1 An occupier must ensure, so far as is reasonably practicable, that the dangerous goods at the occupier's premises do not inadvertently become unstable, decompose or change so as to:

a) create a hazard that is different from the hazard originally created by the dangerous good, or
b) increase the risk associated with the dangerous goods.

3.2.3 Stability of dangerous goods

The occupier must ensure;

a) if the stability of the dangerous goods is dependent on the maintenance of levels of stabilisers, those levels are maintained as specified by the manufacturer of the dangerous goods, and
b) if the dangerous goods are required to be stored or handled with a particular temperature range specified by the manufacturer, they are stored or handled within that temperature range.
c) In this clause, ***stabiliser*** means any substance (including any diluents, inhibitor, desensitiser, phlegmatizer, solvent, wetting agent or adulterant) added to, or present in, dangerous goods that overcomes the chemical instability inherent in the dangerous goods.

3.2.3.1 Separation of dangerous goods

An occupier must ensure that the risk to other dangerous goods storage or handling areas and to persons and property at or beyond the premises that arises from an incident involving dangerous goods:

a) is eliminated, or
b) if it is not reasonably practicable to eliminate the risk, is controlled so far as is reasonably practicable by separation.

3.2.3.2 Preventing interaction with other substances

An occupier must ensure that dangerous goods on the occupier's premises that are not compatible with other substances (including other dangerous goods) are stored or handled separately from the other substances so that a loss of containment or any other interaction cannot cause a serious incident.

3.2.4 Ignition sources in hazardous areas

1 An occupier must ensure that ignition sources in any hazardous area within the occupier's premises:

a) are eliminated, or
b) if it is not reasonably practicable to eliminate those ignition sources, the risk arising from those sources is controlled.

2 An occupier must identify any hazardous area that is within, or arises as a result of dangerous goods stored or handled at, the occupier's premises.

3.2.5 Atmospheric emissions

An occupier must ensure that any risk produced by atmospheric emissions from dangerous goods that are toxic, corrosive, flammable, explosive or asphyxiant:

a) is eliminated, or
b) if it is not reasonably practicable to eliminate the risk, is reduced so far as is reasonably practicable.

3.2.6 Preventing contamination of feed and personal products

An occupier must ensure that dangerous goods on the occupier's premises cannot contaminate food,

food packaging or personal use products.

3.2.7 Containers for dangerous goods in bulk

An occupier of premises at which dangerous goods in bulk in a container are present must ensure that:

a) the container and any associated pipework are provided with stable foundations and supports, and

b) any pipework or equipment connected to the container is installed so as to prevent excessive stress on the container, pipework or equipment, and

c) the container and any associated pipework are protected from deterioration.

3.2.8 Containment of spills

1 An occupier must ensure that, in each place at the occupier's premises where dangerous goods are stored or handled, provision is made for containment of spills or leaks so as:

a) to eliminate the risk from any spill or leak of dangerous goods, or if it is not reasonably practicable to eliminate the risk, reduce it so far as is reasonably practicable, and

b) so far as is reasonably practicable, to contain safely within the premises the dangerous goods that have been spilled or leaked and any effluent arising from an incident.

2 In the case of dangerous goods containment, any area or receptacle intended to contain spills or leaks must not be shared with any other substances, including other dangerous goods, that are not compatible with the dangerous goods to be contained.

3 In the event of a spill or leak of dangerous goods, the occupier must ensure that:

a) immediate action is taken to reduce any risk associated with the spill or leak so far as is reasonably practicable, and

b) the dangerous goods and any resulting effluent are, as soon as reasonably possible, cleaned up and disposed of or otherwise made safe.

3.2.9 Transfer of dangerous goods

1 An occupier must ensure that any risk associated with the transfer of dangerous goods within, to or from the occupier's premises is eliminated, or if it is not reasonably practicable to eliminate the risk, is controlled so far as is reasonably practicable.

2 In eliminating or controlling a risk in accordance with subclause (1), the occupier must, as relevant, have regard to:

a) the need for measures to:

b) control spills and leaks, and

c) minimise static electricity, and

d) control vapour generation, and

e) the suitability of pipework, attachments and associated safety systems at the premises with the risk elimination or control measures proposed.

3.2.10 Impact protection

An occupier must ensure, as far as is reasonably practicable, that any containers, pipework, attachments, equipment containing, or associated with, of dangerous goods on the occupier's premises are protected from physical damage resulting from activities in or on the premises, including impacts, imposed loads and mechanical stress.

3.2.11 Preparedness for emergencies

3.2.11.1 Fire protection

1. An occupier must ensure that:

   a) The occupier's premises are provided with a fire protection system that:
      i) has been designed and constructed having taken account of any risk assessment of the premises, and
      ii) is designed and constructed to take account of:

         A) the types and quantities of dangerous goods and the conditions under which they are stored and handled, and

         B) other materials and substances that make up the premises or are stored or handled at the premises, and

      iii) is compatible with the dangerous goods and the other materials and substances and is effective in the control of incidents involving the types and quantities of dangerous goods and other materials and substances, and
   b) the fire protection system is:
      i) properly installed, tested and maintained, and
      ii) at all times accessible to persons on the premises and to the relevant emergency services, and
      iii) capable of being used, without adaptation or modification, with the equipment used by the New South Wales Fire Brigades and the NSW Rural Fire Service.

2 The occupier must, if any of the components of the fire protection system are rendered inoperative, ensure that:
   a) the implications of any of the components of the system being unserviceable or inoperative are assessed, and
   b) alternative measures are taken to control, to the same level of effectiveness, those risks that were controlled by the system when functioning fully, and
   c) the fire protection system is returned to full operation as soon as is reasonably practicable.

3 If the implications of the system becoming unserviceable or inoperative, as assessed by the occupier under subclause (2) (a), include a significant reduction in the effectiveness of the fire protection system, the occupier must notify the relevant emergency services of the condition of the fire protection system.

4 In determining the alternative measures required under subclause (2) (b) the occupier must have regard to the need for:
   a) the provision of alternative fire protection measures, and
   b) a reduction of the quantities of dangerous goods stored or handled at the premises, and
   c) stopping or reducing the processes used for the storage and handling of dangerous goods at the premises, and
   d) modifications to systems of work at the premises.

5 In this clause, *fire protection system* includes fixed or portable fire detection, fire suppression and fire fighting equipment.

3.2.11.2 Planning for emergencies

This clause applies in relation to premises where dangerous goods are stored and handled in quantities that exceed the relevant quantities specified in the column headed “Manifest quantity” in the Table to Schedule 5, Appendix E.

1 An occupier of premises to which this clause applies must ensure that a written plan for dealing with any emergency associated with the storage and handling of dangerous goods on those premises (an *emergency plan*) is:

a) developed, implemented and maintained, and

b) communicated to:

i) persons who are engaged by the occupier to work at the premises and who may be exposed to risk as a result of an emergency, and

ii) persons in control of adjacent premises to the extent that the emergency plan applies to those person, if persons or property on the adjacent premises may be exposed to risk as a result of an emergency.

2 In developing or reviewing the emergency plan, the occupier must:

a) provide a draft of the emergency plan to the Commissioner of the New South Wales Fire Brigades, and

b) have regard to any written advice received from the Commissioner of the New South Wales Fire Brigades.

3 The occupier of the premises must provide a copy of the emergency plan to:

a) if the premises to which this clause applies are within a rural fire district within the meaning of the *Rural Fires Act 1997*—the NSW Rural Fire Service, or

b) in any other case—the Commissioner of the New South Wales Fire Brigades.

4 The occupier must review the emergency plan:

a) if there is a change in circumstances at the premises, or any adjacent premises, such as to raise the possibility of an emergency of a kind that is not dealt with by the plan, and

b) at intervals of not more than 5 years from the date on which the plan was developed or last reviewed.

5 The occupier must communicate the revised plan to the persons specified in subclause (2) (b).

3.2.12 Safety equipment and safe access

3.2.12.1 Safety equipment

1 An occupier must ensure that, where safety equipment is required to control an identified risk in relation to the storage or handling of dangerous goods (including personal protective equipment and clean up equipment such as neutralisers, decontaminants and associated equipment), that equipment is provided, maintained and accessible to persons authorised to be on the premises.

2 A person must not wilfully damage or make ineffective any safety equipment referred to in subclause (1).

3.2.12.2 Safe access

An occupier must ensure that safe means of access to and from and within the occupier’s premises are provided and maintained.

3.2.13 Plant, equipment and containers

Cleaning or decommissioning plant, equipment and containers

1 An occupier must ensure that any plant, equipment or container that was used in connection with dangerous goods and:

a) is to be disposed of, or

b) has not had dangerous goods placed in or taken from it for a continuous period of 12 months, is made free from dangerous or otherwise made safe.

2 If a dangerous goods container has been made free from dangerous goods and the container is to be reused for a purpose other than its original purpose, the occupier must ensure that any references, signs, symbols or warning relating to the dangerous goods that it formerly contained are removed or obliterated.

3 If an underground, partially underground or fully mounded tank (other than an LPG tank) has been used to contain dangerous goods and 2 years have elapsed since any dangerous goods were last put in or taken from the tank, the occupier of the premises in which it is situated (or in the case of a LPG tank, the owner of the tank) must:

a) remove any remaining dangerous goods from, and abandon, the tank in compliance with AS 1940, and

b) within 7 days of the abandonment, notify WorkCover in the approved form of the abandonment.

3.2.14 Provision of information

3.2.14.1 Occupier to obtain MSDS

1 For all dangerous goods stored or handled on an occupier's premises, the occupier:

a) must obtain from the supplier of the goods an MSDS before or on the first occasion on which they are supplied, and

b) must ensure that the MSDS is readily accessible to any person at the premises who could store or handle the goods, and

c) must ensure that the MSDS is not altered, otherwise than where it is appropriate that an overseas MSDS be reformatted by the occupier.

2 The provisions of subclause (1) (a) and (b) do not apply to:

a) dangerous goods in transit, and

b) dangerous goods that are supplied to a retailer, retail warehouse operator or transport warehouse operator in a consumer package that:

i) holds less than 30 kg or 30 L of the goods, and

ii) is intended for retail sale, and

iii) is not intended to be opened on the premises of the retailer or operator.

3.2.14.2 Occupier to ensure containers are labelled and enclosed systems are identified

1 An occupier must ensure that packaged dangerous goods at the occupier's premises, including those supplied to or produced within the occupier's premises, are labelled in accordance with the ADG Code, and that the labels are not removed, defaced or altered.

2 Without limiting subclause (1), an occupier must ensure that any such label:

a) clearly identifies the dangerous goods, and

b) provides basic health and safety information about the dangerous goods, including any relevant risk phrases and safety phrases.

3 However:

a) a container into which dangerous goods are transferred for use within the next 12 hours need only be labelled with the product name and the relevant risk phrases and safety phrases, and

b) a container into which dangerous goods are transferred for immediate use need not be labelled, so long as it is cleaned immediately after it has been emptied of the dangerous goods.

4 An occupier must ensure that the identity of any dangerous goods contained in an enclosed system at the occupier's premises (such as a pipe or piping system, or a process or reactor vessel) is notified to a person who could handle the dangerous goods.

3.2.15 Placards

3.2.15.1 Outer warning placards

1 If the quantities of dangerous goods stored and handled at an occupier's premises exceed the relevant quantities specified in the column headed "Placarding quantity" in the Table to Schedule 5, Appendix E, the occupier must ensure that a "HAZCHEM" outer warning placard as specified in Schedule 6 is displayed at the entrances to the premises that emergency services would use or be likely to use in the event of an emergency.

3.2.15.2 Other placarding requirements

1 An occupier must ensure that the following are placarded in accordance with this clause:

a) any container or other form of storage of dangerous goods in bulk,

b) any storage location of packaged dangerous goods.

2 Subclause (1) does not apply to any of the following:

a) dangerous goods in bulk in any container, including an IBC, that is intended for transport and marked in accordance with the ADG Code,

b) C1 combustible liquids in bulk in a quantity not exceeding 10,000 L that are separated from other dangerous goods,

c) dangerous goods of Class 2.1 or 3 or C1 combustible liquids, that are stored in an underground tank at a retail service station where the goods are used to refuel vehicles.

3 The dimensions, design, layout and content of a placard must be in accordance with Schedule 6 or the ADG Code.

4 A placard must be kept clean, in good order and unobstructed.

5 A placard required by subclause (1) must be located:

a) so that it is clearly legible by persons approaching the premises, bulk container or other form of storage or storage location (as appropriate), and

b) so that it is separate from any other sign or writing which contradicts, qualifies or distracts attention from the placard.

6 A placard required by subclause (1) (a) must be located on or adjacent to each bulk container or other form of storage.

7 A placard required by subclause (1) (b) must be located:

a) at the entrance to any building in which the dangerous goods are stored, and

b) within a building referred to in paragraph (a), at the entrance to each room or other closed or walled section of the building in which the dangerous goods are stored, and

c) adjacent to any external storage location where the dangerous goods are stored.

8 If the dangerous goods to which placards apply are permanently removed from the premises, the occupier must remove the placards.

3.2.15.3 Different location permitted

1 An occupier of premises that are required to be placarded may place placards in locations different from those specified in this Part if the relevant emergency services agree with the placards being in those different locations.

2 The occupier must ensure that the agreement of the relevant emergency services is in writing and is readily available for inspection by an inspector.

3.2.16 Revision

An occupier must ensure that all placards required by this Subdivision are revised as soon as reasonably practicable after any change to the type or quantity of dangerous goods stored at the occupier's premises that requires different information to be displayed.

3.2.17 Manifests

3.2.17.1 Manifest to be maintained

1 An occupier of premises where dangerous goods are stored and handled in quantities that exceed the relevant quantities specified in the column headed "Manifest quantity" in the Table to Schedule 5, Appendix E, must keep a manifest of dangerous goods, that contains the information and site plans required by Schedule 7, readily available for use by an inspector or the emergency services.

2 The occupier must ensure that a copy of the manifest is kept, and is readily accessible, at the main entrance to the occupier's premises unless the occupier and the Commissioner of the New South Wales Fire Brigades or the NSW Rural Fire Service, as appropriate, have agreed to a different location for keeping a copy of the manifest.

3 The occupier must ensure that the manifest is revised as soon as possible after a change in any of the information specified in Schedule 7.

4 This clause does not apply in relation to dangerous goods in transit.

3.2.18 Serious incidents and other incidents

3.2.18.1 Response to serious incidents and other incidents

1 An occupier must respond to a serious incident or other incident involving dangerous goods at the occupier's premises by ensuring that:

a) immediate action is taken to assess and control any risk associated with the serious incident or other incident, including making any plant or equipment associated with the serious incident or other incident and the surrounding area safe so far as is reasonably practicable, and

b) only persons essential to carrying out the action referred to in paragraph (a) remain in the vicinity of the serious incident or other incident, and

c) the risk to each person engaged by the occupier at the premises to carry out the action referred to in paragraph (a) is reduced so far as is reasonably practicable.

2 The obligations of the occupier under subclause (1) (b) and (c) do not apply in respect of members of the emergency services responding to the serious incident or other incident.

3.2.18.2 Investigation of serious incidents and other incidents

An occupier must ensure that:

a) any serious incident or other incident involving dangerous goods occurring at the premises is investigated and that the investigation, so far as possible, determines the cause or likely cause of the serious incident or other incident, and

b) a record of the investigation is:
   i) made, and
   ii) kept for at least 5 years, and
   iii) readily available, on request, to an inspector.

3.2.18.3 Risk assessment and control following serious incidents and other incidents

An occupier of premises where a serious incident or other incident involving dangerous goods has occurred must:

a) review the risk assessment carried out in accordance with this Regulation, taking into account the results of the investigation into the serious incident or other incident, and

b) if the review identifies deficiencies in any risk control measures, alter those measures or implement new measures.

3.2.19 Information may be requested

1 WorkCover may request any information from an occupier of premises that are a place of work that is not a mining workplace or a coal workplace in relation to:

   a) the cause or effect of a serious incident or other incident that has occurred on the occupier's premises, and

   b) any action taken by the occupier as a result of the serious incident or other incident.

2 A request for information must:

   a) be in writing, and

   b) specify a reasonable period within which the occupier must respond

3 The occupier must provide the requested information:

   a) in writing, and

   b) within the period specified by WorkCover.

3.2.20 Notification

3.2.20.1 Notification to WorkCover

1 An occupier of premises where dangerous goods are stored and handled in quantities that in total exceed or are likely to exceed the relevant quantities specified in the column headed "Manifest quantity" in the Table to Schedule 5, Appendix E, must ensure that WorkCover is notified of the presence of those dangerous goods.

2 A notification to WorkCover under subclause (1) must:

a) be given within 14 days after the obligation to notify arises, and

b) be accompanied by a fee in such amount as WorkCover may determine as the appropriate amount to cover expenses in connection with the processing and review of notifications required by this clause, and

c) include the following information:

i) the name of the occupier (and any other occupiers of the premises concerned),

ii) the address of the premises where the dangerous goods are stored and handled,

iii) the occupier's contact details,

iv) the nature of the principal activities involving the dangerous goods,

v) the Class, Packing Group and the maximum quantity of the dangerous goods stored and handled in bulk or as packaged dangerous goods,

vi) descriptions and details and the maximum quantity of any C1 combustible liquids stored and handled in bulk or as packaged dangerous goods,

vii) the product name and the maximum quantity of goods too dangerous to be transported,

viii) any other documents or information specifically requested by WorkCover.

3 The occupier must ensure that WorkCover is provided with further notification, containing the information required under subclause (2), every 12 months, or at such longer intervals as are specified by WorkCover.

4 On receiving a notification under this clause, WorkCover must send the occupier a written acknowledgment of the notification.

5 WorkCover may give any information contained in a notification to a relevant local government council and the emergency services.

3.2.21 Miscellaneous

3.2.21.1 Security at premises

An occupier must, so far as is reasonably practicable, prevent:

a) access to dangerous goods on the occupier's premises by unauthorised persons, and

b) unauthorised activities occurring on those premises.

3.2.21.2 Lighting

An occupier must ensure that lighting is provided that:

a) does not create excessive glare or reflection, and

b) is adequate to allow persons to move safely within the occupier's premises, and

c) facilitates safe access to and egress from the premises, including emergency exits.

3.2.22 Obligations of employers

Employer to retain records of induction and training. An employer must retain records in a suitable form of all induction or other training required by clause 13 to be provided to employees who are likely to store or handle dangerous goods at the employer's place of work for at least 5 years after the date of creation of the record.
Maximum penalty: Level 1.

3.2.22.1 Employer to keep register of dangerous goods

1 An employer must ensure that a register is kept and maintained for all dangerous goods stored or handled at the employer's place of work.

2 The employer must ensure that the register includes:
   a) a list of all dangerous goods used at the employer's place of work, and
   b) the relevant MSDS (if any) for each of those dangerous goods, and
   c) any notations required under clause 174ZX.

3 The employer must ensure that the register is readily accessible to all employees who may store or handle dangerous goods while at the employer's place of work.

4 This clause does not apply to the following dangerous goods:
   a) dangerous goods that are supplied to a retailer or retail warehouse operator in a consumer package holding less than 30 kg or 30 L of the dangerous goods, that is intended for retail sale and that is not intended to be opened on the premises of the retailer or operator,
   b) dangerous goods in transit.

5 The employer may keep and maintain a single register both for the purposes of this clause and for the purposes of clause 167 (Employer to keep register of hazardous substances).

3.2.22.2 Employer to record risk assessments

1 An employer must record the results of a risk assessment relating to the storage or handling of dangerous goods by:
   a) making a notation in the register of dangerous goods kept under clause 174ZW if no specific measures are necessary to control the risks associated with the dangerous goods, or
   b) preparing a report on the risk assessment if specific measures are necessary to control the risks associated with the dangerous goods.

2 The employer must ensure that any risk assessment report prepared in relation to dangerous goods that are stored or handled at the employer's place of work is readily accessible to any employee or other person working at the employer's place of work who could store or handle the dangerous goods.

3.2.23 Specific provisions applying to all dangerous goods to which section 135A of Act applies

3.2.23.1 Positioning of liquefied gas cylinders

A person must not keep, convey or use a cylinder containing dangerous goods of Class 2.1, being liquefied flammable gas, unless the cylinder is positioned so that the safety relief device communicates directly with the vapour space in the cylinder.

3.2.23.2 Valves

1 A person who keeps a cylinder or other container containing dangerous goods of Class 2 must, unless it is connected by permanent piping to a consuming device, ensure that its valve is kept securely closed at all times except when the container is being filled or goods are being taken from it.

2 If piping or a pipeline is equipped with one or more excess flow valves, a person must not convey dangerous goods of Class 2 by means of the piping or pipeline unless each valve is set for the minimum diameter of that part of the piping or pipeline that the goods would enter through the valve without first passing through another such valve.

4.0 Dangerous Goods Separation and Segregation

The dangerous goods storage area at the SRDC will be operated as a mixed class storage area, as defined for a Dangerous Goods Package Store by AS/NZS 3833:2007 [1]

Dangerous goods proposed to be in the dangerous goods store are:

Class	Description
1.4	Explosives.
5	Oxidising agents.
6	Toxic.
7	Radioactive goods.
8	Corrosive.
9	Miscellaneous dangerous goods.

A full list of the proposed dangerous goods class and quantities can be found in Appendix F.

4.1 Prescriptive method of dangerous goods storage

Clause 6.3.1 of AS/NZS 3833 [1] gives specific guidance on segregation and separation distances for potentially reactive substances and dangerous goods.

Dangerous goods shall be segregated from incompatible substances, substances with which they might react dangerously and other dangerous goods in accordance with the following requirements:

a) Where the substances being kept are incompatible
   i. they shall be kept in separate compounds, or
   ii. they shall be segregated by a distance of at least 3 m, except that, when both substances are solids, this distance may be reduced to 1 m.

b) Where the substances being kept might react dangerously
   i. they shall be segregated by at least 5 m (measured from the upper interior edge of the bund); and
   ii. they shall not be kept within the same compound, or in compounds that share a common drainage system.

Guidance of the compatibilities and relativities of various compounds are available from the respective Material Safety Data Sheets (MSDS), which can be sourced from the supplier/manufacturer or various online commercial databases. Care should be taken that these documents are set within the Australian legislative framework and have been reviewed within the last five years.

In general terms, guidance is available from Figure 6.1 of AS/NZS 3833[1], reproduced within Appendix B.

Within the storage list proposed by Big W, flammable and combustible liquids must be kept apart from both flammable solids and corrosives. It should be noted that, MSDS need to be consulted to determine if segregation is necessary between the various flammable solid, oxidizing agents and corrosive products.

To achieve compliance with the current stock list supplied by Big W, the following needs to be followed in accordance with [1]:

1 The distance between Class 3 dangerous goods and Class 5 dangerous goods must be 5m. At present there is only a 3.86m, therefore making this section of the Dangerous Goods store non-compliant.
2 The separation distance between Class 3 and Classes 8 &4 must be 3m
3 Class 6 and Class 5.1 dangerous goods must be separated by 1m
4 Any dangerous goods in liquid form should be stored in a manner that prevents them from being able to mix with solid dangerous good.

4.2 Recommendations

The dangerous goods store at the SRDC will be operated as a mixed class store, as defined by AS/NZS 3833:2007 [1]. The separation distance between the Class 3 and Class 5 .1 dangerous goods is currently non-compliant and needs to be increased to 5m. Class 6 and Class 5.1 dangerous goods are non-compliant if stored together. The Class 6 and Class 5.1 dangerous goods must be separated by 1m. Class 4.1 and Class 8must be separated by 3 m. Solids and liquids of the same class should be stored in such a way as to prevent contamination. The appropriate signage and bunding requirements must be put in place and is the responsibility of Big W

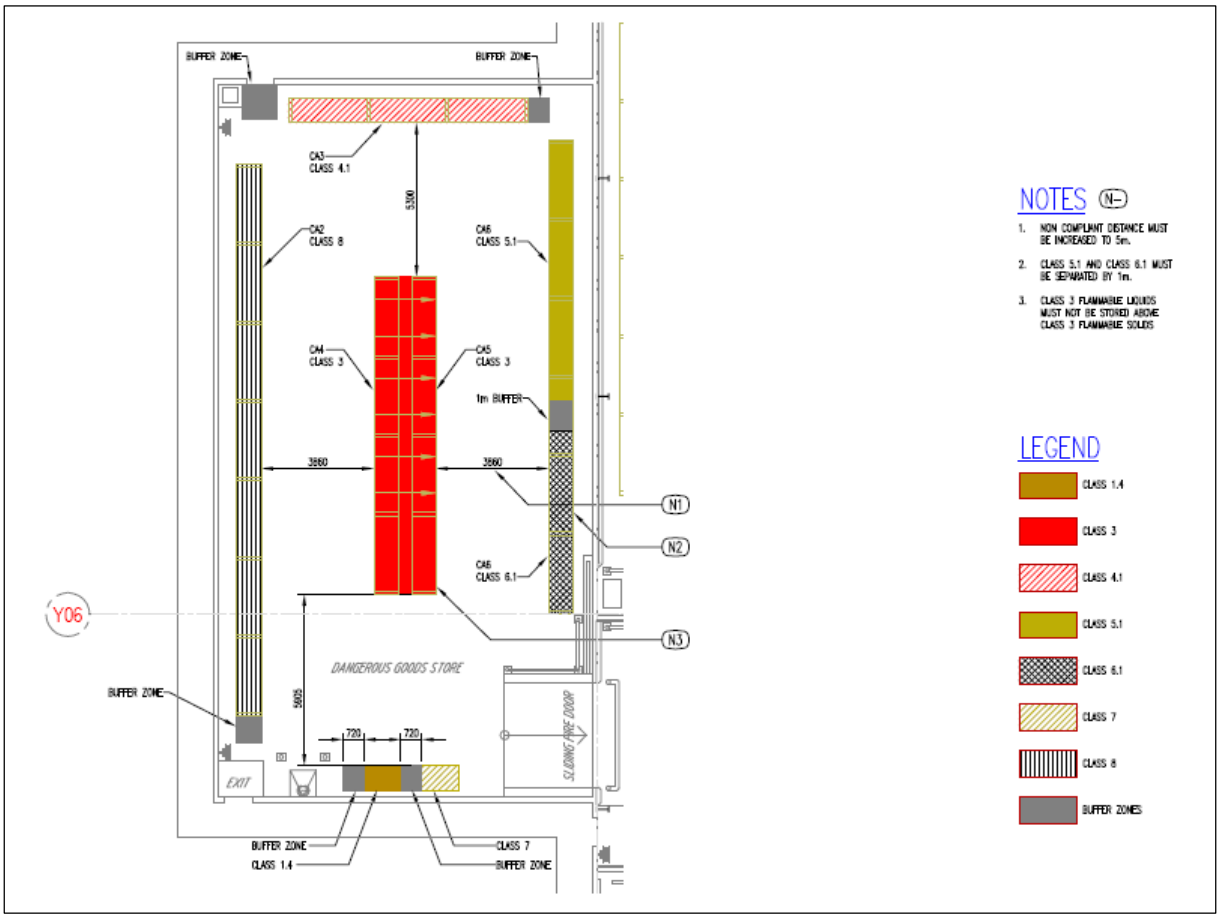

Figure 4.1: Proposed dangerous goods storage within dangerous goods store

5.0 Conclusion

A comparative study of the 'prescriptive requirements of AS/NZS 3833:2007' with the proposed 'Dangerous Goods Package Store design' is provided in this report. A summary of the requirements of AS/NZS 3833:2007 is provided.

Whilst AS/NZS 3833:2007 provides opportunities that might eliminate the need for a dedicated Dangerous Goods Package Store, Big W has advised Bassett that an area referred to as a 'Special Goods Storage Area' will be built to store the following class of chemicals, for reasons primarily related to insurer's requirements:

Class	Description
1.4	Explosives.
5	Oxidising agents
6	Toxic
7	Radioactive goods
8	Corrosive
9	Miscellaneous dangerous goods.

The current proposed design for the 'Special Goods Storage Area' has some non-compliance issues as outlined below and in Appendix C.

AS 3833:2007[1] non compliances:

1 Section 5.4.3, spill contaminant – Incompatible chemicals must not be directed into the same common compound. Class 3 and Class 5 chemicals in the proposed DGSF are not separated by the required distance.

2 Incompatible chemicals must not be directed into the same common compound. Class 4 and Class 8 chemicals in the proposed DGSF are not separated by the required distance.

3 Section 5.4.3, spill contaminant – spillage containment compound must be designed such that substances which may react are not directed into the same compound. Class 5 and Class 6 dangerous goods have been allocated the same compound.

To achieve compliance with the current stock list supplied by Big W, the following is recommended in accordance with [1];

1 The distance between Class 3 dangerous goods and Class 5 dangerous goods must be 5m. At present there is only a 3.86m, therefore making this section of the Dangerous Goods Store non-compliant. Increase separation distance to 5m and ensure chemicals are unable to come into contact with each other.

2 The separation distance between Class 4 and Class 8 must be 3m, ensure distance is met and chemicals are unable to come into contact with each other.

3 Class 6 and Class 5.1 dangerous goods must be separated by 1m. Place a 1 metre buffer between the two chemicals to ensure they are unable to come into contact with each other,

4 Any dangerous goods in liquid form should be stored in a manner that prevents them from being able to mix with solid dangerous good. This can be achieved by placing the liquid chemicals on a chemical bund and storing then away for the powered products.

6.0 Hazardous Area Classification

6.1 Introduction

Certain assumptions have been made regarding the parameters contributing to the potential formation of hazardous zones in the subject locations.

The most important factor contributing to the reduction of unwanted effects associated with flammable substances is effective risk-based storage and handling practices that emphasise safety.

The user identified risk assessment associated with the spillage of flammable liquids is an important aspect of Retail Distribution Centre (RDC) methods of safe work and is critical to ensuring the hazardous area classification and delineation of this report remains appropriate.

Listerine mouthwash was reported to Bassett by Robert Dent on 11th September 2008, as 'the most significant risk' flammable liquid likely to be involved in accidental spills.

This hazardous area classification report is specific and based on the scenario that forklift tines are likely to penetrate the outer layer of packing, piercing a hole in at least 8 Listerine containers, thus spilling the product. The findings and recommendations of this report should not be interpreted as a generic solution applicable to all RDC's.

If at any time the selected compound for the specific spill scenario is no longer considered to be the "most significant risk" substance, then an immediate review of the hazardous areas and storage management arrangements by Bassett Consulting Engineers is recommended.

6.2 Scope

This part of the study was commissioned to address the operational safety risks of the Big W Dangerous Goods Store (DGS) at the SRDC, particularly in relation to the formation of flammable atmosphere and its concurrence with potential ignition sources.

This hazardous area classification applies risk principles to assess the most likely spill scenario, as identified by the client, and determine the likely hazardous atmosphere that develops from the spill.

Computational modelling of the spill scenario as identified by the client, is used to determine with a higher degree of accuracy, the likely fiormation of the vapour cloud and is also used to validate the calculated hazardous zones.

What is not considered in this report are issues related to:

a) Explosives (excluding the small quanitity of Class 4.1)
b) Transit storage.
c) The aerosol store.
d) Environmental requirements for waste from the dangerous goods store.
e) Fire Protection design.

Segregation of dangerous goods is prescribed under legislation and prescriptive standards and in this report; a risk-based approach has been taken to meet the requirements of applicable legislation. Modern legislation, such as the applicable NSW Occupational Health and Safety Regulation 2001[25], is risk based therefore, appropriate alternative risk based solutions have been applied.

Prescriptive requirements of the Australian Standards vary segregation distances of individual dangerous goods classes with each other in accordance with tabulated requirements from the appropriate Standard for a Dangerous Goods Store and for an RDC. In the case of potentially 'more reactive' combinations, separate compounds or bunds are required in Dangerous Goods Stores, but not necessarily in large space RDC's. These distances and requirements are detailed in Australian Standard AS/NZS 3833:2007 *'The Storage and Handling of Mixed Classes of Dangerous Goods, in Packages and Intermediate Bulk Containers'[1]*.

An opportunity within the legislation exists to estimate the distances and separation of various dangerous goods using a 'risk-based' approach, where it can be shown that the level of segregation can be achieved by other methods or approaches that offer equivalent, or even improved levels of safety, that would have been otherwise achieved taking the prescribed requirements path. Current NSW occupational health and saftey legislation is risk-based, therefore supportive of alternative solutions.

The use of standard portable picking equipment and product handling units in Retail Distribution Centres (RDC) and dangerous goods stores is prohibited in situations where the location is 'deemed' as 'Hazardous' given the potential for a vapour explosion. Where it can be shown using scientific methods, that the atmosphere is non-hazardous, the opportunity exists to classify the area as 'Non-Hazardous - NH' rather than 'Zone 0, Zone 1 or Zone 2' allowing the use of non- explosion (Ex) rated equipment.

6.3 Prescriptive hazardous area zoning

The *NSW Occupational Health and Safety Act [1], 2003,* states in section 17 4U:

Ignition sources in hazardous areas:

1 An occupier must ensure that ignition sources in any hazardous area within the occupier's premises:

   a) are eliminated, or

   b) if it is not reasonably practicable to eliminate those ignition sources, the risk arising from those sources is controlled.

2 An occupier must identify any hazardous area that is within, or arises as a result of dangerous goods stored or handled at, the occupier's premises.

The Act [24] does not specify the extent of the hazardous area therefore the hazardous area can be determined by reference to Australian standards.

AS/NZS 3833:2007 [1], clause 6.2.3, recommends a minimum clearance of 3 metres as the separation distance for stores containing flammabe substances from an ignition source. The standard does not specify the classification of the interior of the store, therefore, it may be assumed that spark sources are to be similarly excluded internally.

The principle dangerous goods class affecting the hazardous zoning of the DGS is flammable liquids. Class 3 flammable liquids are the most likely to spill and create a vapour cloud. AS/NZS 2430.3.3:1986, clause 4.3(b)(ii) states, where packages, of volumes greater than minor storage defined by AS 1940, remain closed, the extent of the inadequately ventilated space (e.g. interior of structure), is Zone 2.

6.4 Risk based hazardous area zoning in Sydney dangerous goods store

Risk based assessments, as permitted by both New South Wales legislation and AS/NZS 60079.10:2004 *'Classification of hazardous areas [4]'*, permits consideration of engineering controls and operational procedures to mitigate the extent and likelihood of a flammable atmosphere (hazardous zone).

Discussion with Mr Robert Dent on 11th September 2008 identified that the most likely activity to cause a spill in the SRDC is forklift tines piercing the outer package and puncturing 1.5L Listerine bottles.

The following assumptions were made in relation to the spill scenario:

1. The bulk pallet is held at working height on a pallet fork.
2. The operator stacks the prepacked product for storage.
3. The operator removes the prepacked for distribution.
4. The ambient temperature of the store is 28^{o}C.
5. The pool temperature of the spill pool is 18^{o}C.
6. The area exposed to the spill is 12.42m^{2}.
7. Source of release is an accidental spill.
8. Grade of release is secondary.

Table 6-1summarises the influencing factors and results of the AS/NZS 60079.10 calculation (refer Appendix H for calculation). Complete drawings are located in Appendix I.

Table 6-1 Principal Factors Influencing Type and Extent of EEHA Zone

Process			
Accidental breakage of Listerine via fork tynes			
Ventilation			
Type	Natural		
Degree	Medium		
Availability	Good		
Source of Release		**Grade of Release**	
Punctured Listerine bottles		Secondary	
Product		**Flash Point**	**Vapour Density**
Listerine		33°C	0.967
EEHA Zone	**Extent**	**Class[1]**	**Temp Rating[1]**
Zone 2 NE	6mm across the floor	IIA	T1

Figure 6.1 provides a plan view and a sectional view of the Zone 2 (NE) for the SRDC.

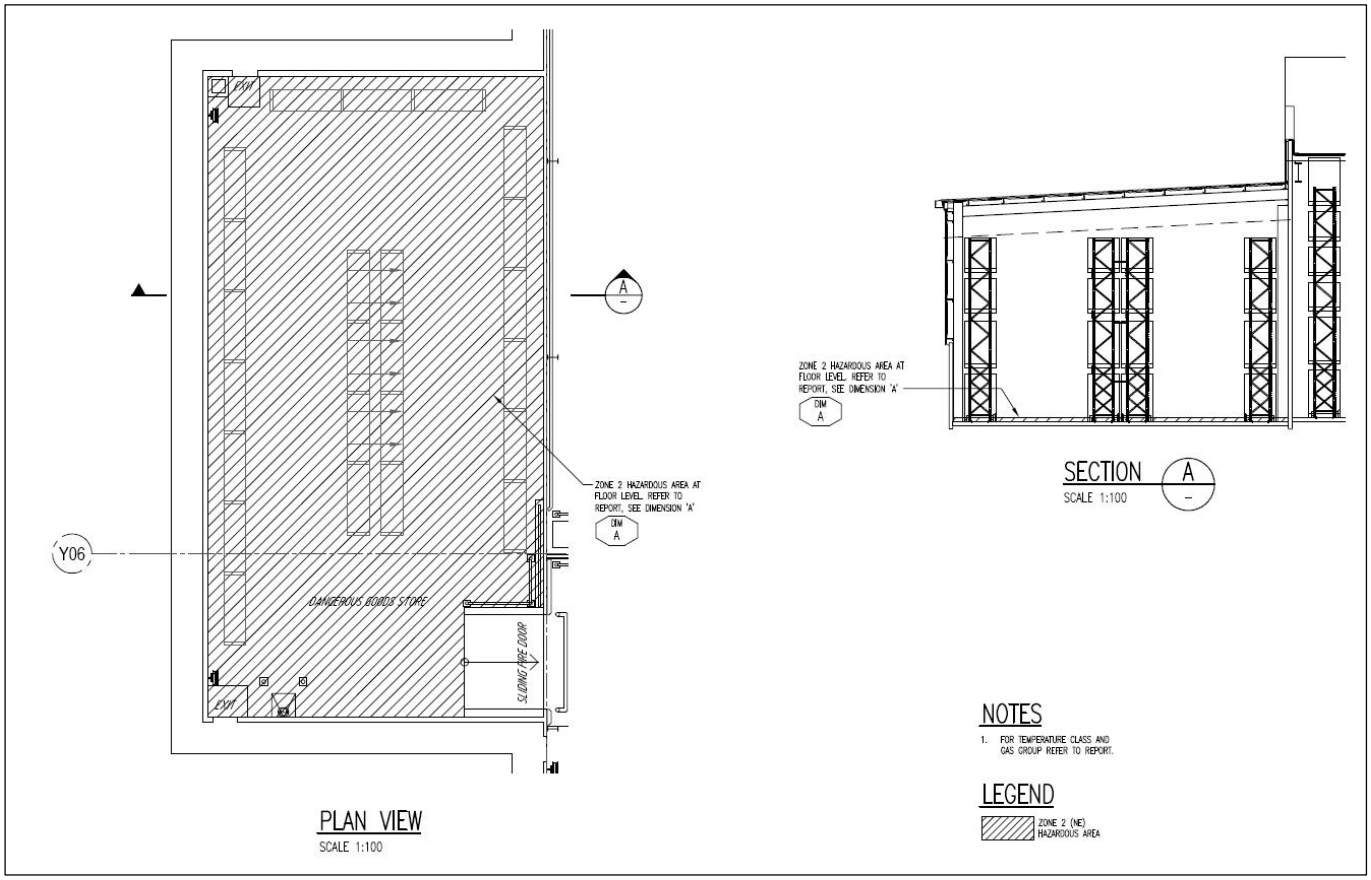

Figure 6-1 Prescriptive hazardous zones associated with the dangerous goods store.

6.5 Recommendations

For the risk scenario studied, the dangerous goods store at the Big W Sydney RDC is zoned:

- Zone 2 (NE) (Negligible Extent) across the floor to a depth of 50 mm.

This classification is subject to the data provided by Big W. If a higher risk product line is stored in the dangerous goods store, or if the operational methods of the store are altered, the assessment will need to be reviewed. **To ensure the Zone 2NE classification within the store, all spills must be attended to immediately and clean up material removed in sealed containers in a timely manner. For the duration of the spill and ensuing clean up, all spark sources at or near floor level must be isolated.**

The dangerous goods store located at Big W SRDC can be operated within the intent of the legislation based on the proposed stock lines detailed in Appendix F and the hazardous area calculations detailed in Appendix H under the following conditions:

1. Entry must be restricted to authorised, trained personnel.
2. Appropriate spill kits must be available within the store area, including sealable disposal containers.
3. Vehicle entry must be limited to one unit at a time.

Effective compliance with the *New South Wales Occupational Health and Safety Act 2003* [24] can be achieved through:

1. Installation of solid, chemical resistant 'fire barriers' between adjacent racking of incompatible goods.
2. Storage of liquid materials below solid materials, or where this is not possible, installation of solid, chemical resistant 'fire barriers' to separate the goods vertically.
3. Robust, break resistant, primary packaging for stocked product lines.
4. Ongoing review of segregation and separation requirements with regard to new product lines and their MSDS.

Hazardous zones have been assessed and are delineated in Appendix I.

1. Rapid and effective response to a spill.
2. Isolation of spark or ignition sources near floor level as soon as a spill is detected.
3. Isolation of spark or ignition sources near floor level until cleanup is completed.
4. Ongoing review of potential spill scenarios as practices or product lines change.

Hazardous zone extents can be reduced and possibly eliminated within the dangerous goods store by:

1. Stocking product lines with break resistant primary packaging.
2. Stocking bulk product lines in secondary containers that will contain potential spillages.

7.0 Computational modelling of vapour dispersion

7.1 Overview

Big W has requested that a risk-based hazardous area classification be performed of the proposed dangerous goods storage area associated with its SRDC. A computational fluid dynamics (CFD) analysis has been performed to determine the effectiveness of the proposed ventilation system in the dangerous goods storage area.

Listerine was considered to be by Big W, the highest risk compound that might be involved in a spill situation and as such was simulated to evaporate from the floor, and the constituent species of ethanol, was tracked. It was found that under the proposed ventilation system, the ethanol vapour did not disperse throughout the room after 7.5 minutes of simulation, but rather had reached a stable time-averaged volume which was in good agreement with analytical methods.

The following report details the assumptions, model setup and the results obtained.

7.2 Geometry

The basis of the model is a dangerous goods storage area which is a fire-rated room with limited access. The dangerous goods storage area was modelled based on the architectural drawings provided, as shown in Figure 7-1.

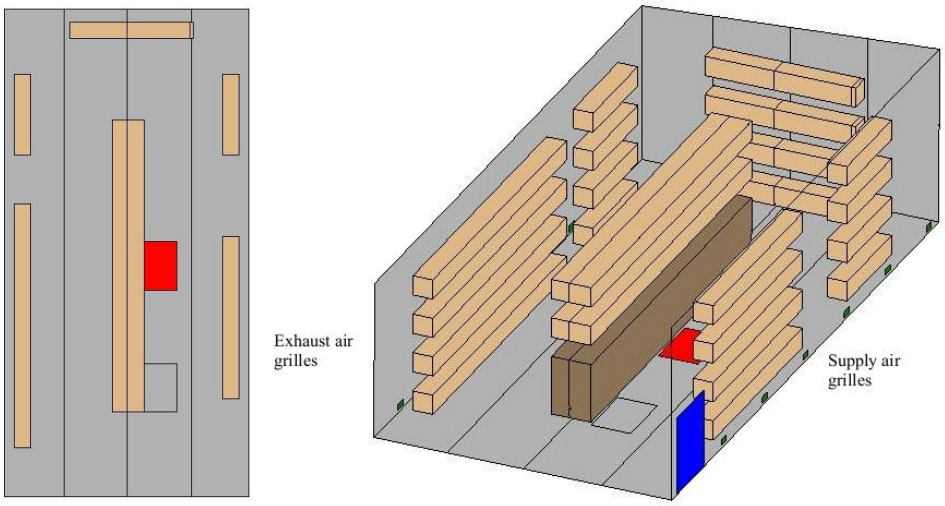

Figure 7-1: Geometry of Woolworths dangerous goods store (DGS). (a) top view and (b) angled view.

Referring to Figure 7-1, the room is rectangular in shape with slope ceiling. The dangerous goods storage area consists of a door (blue), inlets and outlets (green) and a spill area of Listerine (red). Bulk stock racks (light brown) are provided down each side and through the centre. Stock levels in the bulk stock racks were assumed to be at 50% on all pallets under advice from Big W. “Flow racking” (darker brown) is provided in the lower portion of the centre aisle shelf units; stock is on rollers in this portion. The flow racks were considered to be a more dense obstruction to air flow and therefore assumed to be a solid element.

All stock on ground level against walls was elevated 100 mm above floor level to account for air flow along the floor due to the fork lift access provided by wooden risers in the stock pallets. Stock on flow racks in the centre aisle shelving was elevated 150 mm.

Mechanical ventilation is positioned along each of the long walls. Six supply air grilles are located on one side and six exhaust air grilles on the opposite wall. The grilles are staggered such that any supply and exhaust grilles is not directly opposite each other.

Overhead ceiling lights were not included as they were deemed to have negligible impact on flow field temperatures.

7.3 Boundary Conditions

A thermal model was used to determine the wall, floor, roof and ambient air temperatures for use in the fluid dynamics model. These temperatures listed below were derived from a set of conditions that yielded the greatest value of evaporative mass flow rate from the spill, which represents the worst case scenario.

The wall and spill temperature conditions were set as follows, based on results from the thermal model at an ambient air temperature of 28°C:

- exterior walls – 24.6°C
- interior walls – 24.6°C
- ceiling – 25.7°C
- floor - 22.6°C
- spill – 22.6°C

It was assumed that the liquid temperature of the spill would equalise to the floor temperature in a short amount of time. The spill area was represented by a rectangular area, based on an 8L spill. The spill properties are outlined in Table 7-1.

Table 7-1 – Spill boundary conditions.

Spill Type	Dimension (m)	Constant Mass Flow Rate
C_2H_5OH main constituent of Listerine	2 x 3	1.92 x 10^{-4} kg/s

The inlets and outlets were constructed and properties defined as outlined in Table 7-2.

Table 7-2 – Inlet/outlet boundary conditions.

Grill Type	Number of Grilles	Free area Dimension (mm)	Flow Rate (L/s)	Temperature	Height above floor (mm)
Supply air	6	600 x 300	1,200	28°C	150
Exhaust air	6	630 x 300	1,330	-	150
Door (supply air)	1	3,000 x 4,000	Make up air	28°C	0

A negative pressure exists due to the supply and exhaust flow rates provided by the mechanical ventilation system. This air flow is made up from air drawn in through the access door connecting the main storeroom to the DGS.

7.4 Results

The results of the CFD simulation were analysed to determine what volume of the room had a vapour concentration of ethanol, the main constituent of Listerine, greater than its lower explosive limit (LEL_m) of 6.3%. The results are summarized in Figure 7-2.

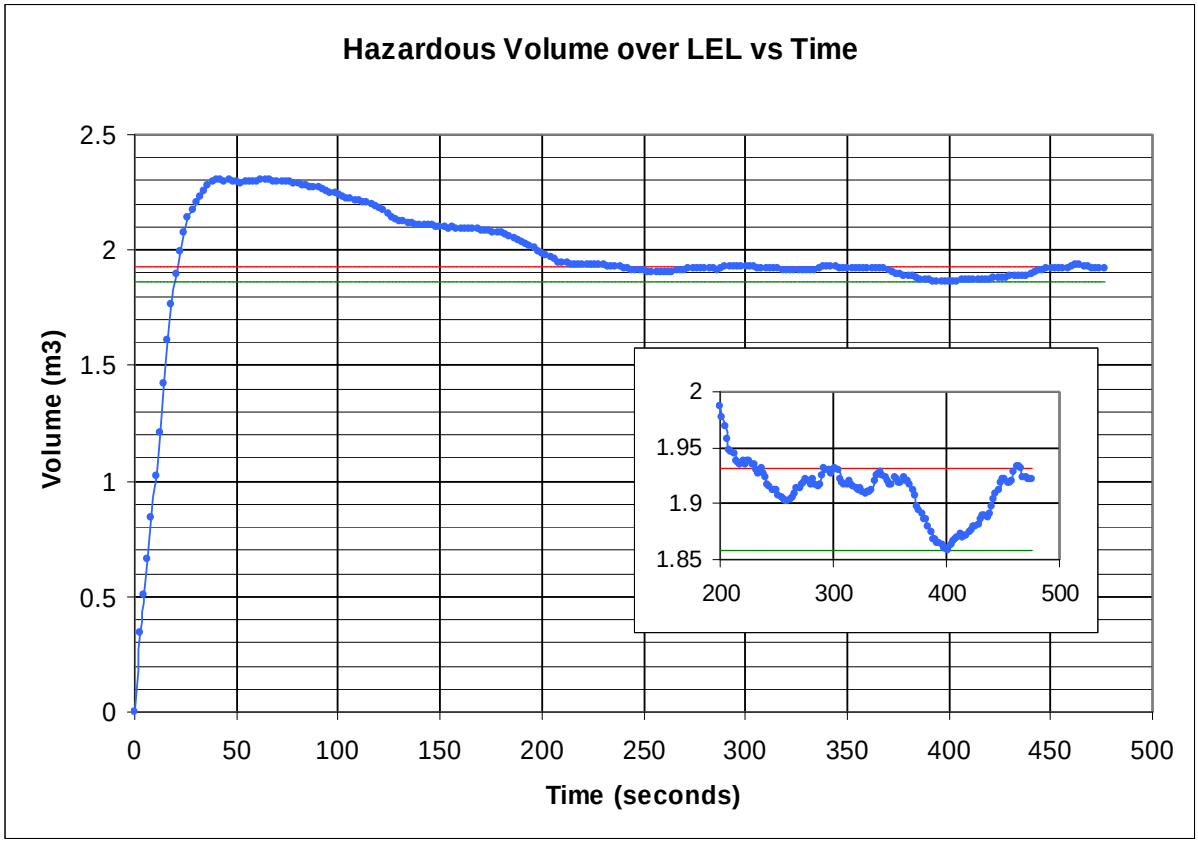

Figure 7-2: Graphical representation of the volume of vapour greater than LEL_m over time. The red and green horizontal marks represent the upper and lower limits of the steady-state volume of hazardous vapour.

From Figure 7-2 it can be seen that initially, the volume of ethanol above the LEL_m increases rapidly after the spill occurs. The volume peaks at a value of 2.3 m^3 and stabilises to a final time-averaged value of 1.9 m^3.

Figure 7-3 shows a surface plot which encompasses the volume of ethanol vapour which is above the LEL_m after 7.5 minutes.

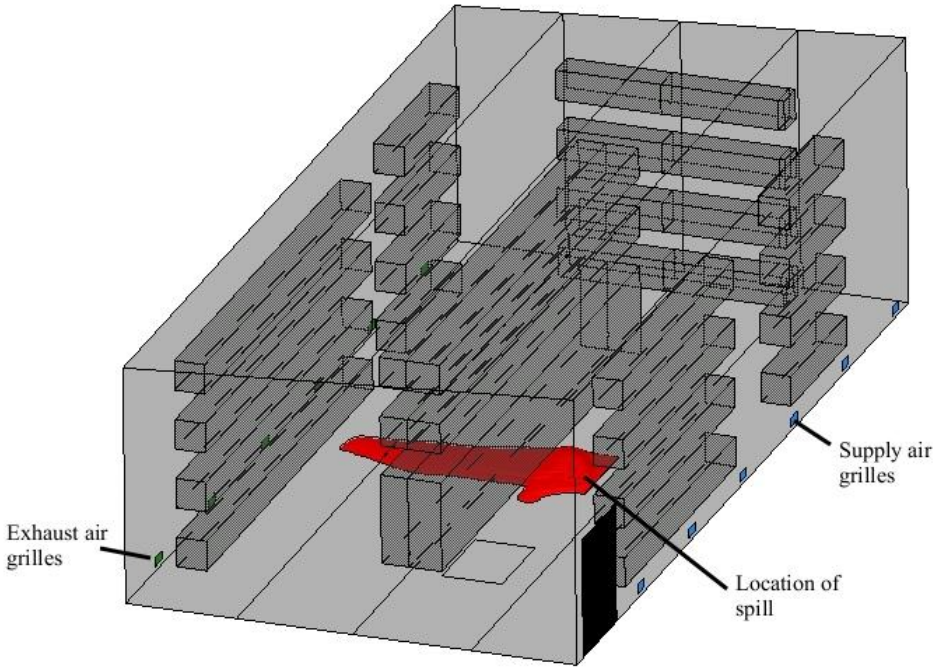

Figure 7-3: A surface plot of the ethanol vapour which is above the LEL_m after 7.5 minutes.

From Figure 7-3 it can be seen that the vapour volume moves from the location of the spill towards the exhaust grilles, staying close to the floor and moving under the sliding shelves. Thus, the plume of hazardous vapour does not rise very far above ground level, or disperse rapidly throughout the room.

The average height of this volume is 50 mm. The peak height of the vapour is 200 mm which occurs directly above the spill pool.

The resultant hazardous area classification of the dangerous goods storage area is Zone 2 (NE) (Negligible Extent) across the floor to a depth of 50 mm. The Gas Group is IIA and the Temperature Class is T2.

(This dimension is shown on Drawing 60045489 R102 "Risk Engineering – Dangerous Goods Store Hazardous Area Classification" as Dimension 'A')

8.0 References

1. AS/NZS 3833:2007: The Storage and Handling of Dangerous Goods, in Packages and Intermediate Bulk Containers, Australian Standards.
2. AS 1940:2004: The Storage and Handling of Flammable and Combustible Liquids', Australian Standards.
3. AS/NZS 4681:2000: The Storage and Handling of Class 9 (miscellaneous) Dangerous Goods and Articles, Australian Standards.
4. AS 3780:1994: The Storage and Handling of Corrosive Substances, Australian Standards.
5. AS/NZS 2430.3:1986 Classification of hazardous areas – Combustible dusts, Australian Standards.
6. AS 1851:2005: Maintenance of fire protection systems and equipment, Australian Standards.
7. AS/NZS 4501.2:2006: Occupational protective clothing – General, Australian Standards.
8. AS/NZS 1337:1993: Eye protection for industrial applications, Australian Standards.
9. AS/NZS 2116.1:2000: Occupational protective glasses – Selection, use and maintenance, Australian Standards.
10. AS/NZS 1801:1997: Occupational protective helmets, Australian Standards.
11. AS/NZS 1800:1998: Occupational protective helmets – Selection, use and care, Australian Standards.
12. AS/NZS 2210:1994: Occupational protective footwear – Guide to selection, care and use, Australian Standards.
13. AS/NZS 1716:2003: Respiratory protection devices, Australian Standards.
14. AS/NZS 1715: 1994: Selection, use and maintenance of respiratory protective devices, Australian Standards.
15. AS/NZS 1680.2.4: 1994: Interior lighting – Industrial tasks and processes, Australian Standards.
16. AS 60529:2004 Degrees of protection provided by enclosures (IP Code), Australian Standards.
17. AS/NZS 3000:2007: Electrical installations (also known as the Australian and New Zealand Wiring Rules), Australian Standards.
18. ANSI Z358.1:2004: American National Standard for emergency eyewash and shower equipment, American National Standards Institute.
19. AS 2359.12:1995: Powered industrial truck – Hazardous areas, Australian Standards
20. AS 4326:2008: The storage and handling of oxidising agents, Australian Standards
21. NOHSC1015:2001, National Standards for the storage and handling of workplace dangerous goods, Australian Safety and Compensation Council.
22. AS 1319:1994: Plumbing and drainage – Water services, Australian Standards.
23. AS 1674.1:1997 Safety in welding and allied processes- Fire precautions, Australian Standards.
24. New South Wales Occupational Health and Safety Act 2003, www.legislation.nsw.gov.au.
25. New South Wales Occupational Health and Safety Regulation 2001, www.legislation.nsw.gov.au.
26. The storage and handling of dangerous goods code of practice, www.legislation.nsw.gov.au.

9.0 Glossary of Terms

Term	Description
Retail Shop	A retail shop can be defined as either of the following: a) A place where the general public or end user are able to purchase displayed goods. b) A place or space behind the sales counter such as a back of house or store where goods can be kept so that they can be sold to the general public or end user. Retail shops include areas where goods are received and stored prior to being displayed for sale.
Retail Distribution Centre	A warehouse or storage area whose primary use is for the storage of goods and for the packing of deliveries to be delivered to retail shops. Access is limited to personnel and restricted from the general public. Goods in retail distribution centres are generally contained in outer packages.
Packing Group (PG)	Three hazard groups to which Dangerous Groups are assigned in the Australian Dangerous Goods (ADG) code are 'I' (High Danger), 'II" (Medium Danger) and 'III' (Low Danger).
Combustible Liquid	Any liquid that has a flash point and a fire point less than its boiling point except for a flammable liquid. Class C1 are combustible liquids having a flash point of 150°C or less. Class C2 are combustible liquids having a flash point greater than 150°C.
Protected Place	A protected place can be defined as any other of the following: a) Any building or open area such as a dwelling or public building where people will assemble. Can be within or outside the property boundary of the installation. b) Any factory, workshop, office, store shop or building where people are employed which is outside the boundary of the installation. c) Any DGSF outside the property boundary of the installation (excludes areas with only minor storage). d) An environmentally sensitive area.
Flammable atmosphere	Is a mixture of flammable vapour or gases with air that will burn if ignited without additional mixture?
Explosive atmosphere	Is a mixture of flammable vapours, gas/es, mists, or dust/s with air in which combustion rapidly spreads to the entire unburned mixture after ignition occurs?
Laboratory hazardous area classification	Is the assessment of the laboratory facility into hazardous and non-hazardous areas and includes the further sub-division of the hazardous areas into zones.
Hazardous area and zone classification	The three dimensional space in which a flammable atmosphere may exist at frequencies requiring special precautions in relation to the control of ignition sources to be designed and constructed.
Hazardous zones	Hazardous areas are delineated into hazardous zones based on the likelihood of occurrence and duration of a flammable atmosphere.

These zones are as follows for flammable liquids and gases:-

Zone 0 – That part of a hazardous area in which a flammable atmosphere is continuously present or present for long periods.

Zone 1 – That part of a hazardous area in which a flammable atmosphere is likely to occur in normal operation

Zone 2 – That part of a hazardous area in which a flammable atmosphere is not likely to occur in normal operation and, if it occurs, will exist only for a short period.

For flammable dusts these zones are as follows:

Zone 20 – an area in which an explosive atmosphere, in the form of a cloud of combustible dust in air, is present continuously, or for long periods or frequently for short periods.

Zone 21 – an area in which an explosive atmosphere, in the form of a cloud of combustible dust in air, is likely to occur occasionally in normal operation.

Zone 22 – an area in which an explosive atmosphere, in the form of a cloud of combustible dust in air, is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

NE — Negligible Extent, a theoretical zone of negligible extent under normal conditions.

NH — Non Hazardous, areas that do not fall into any of the above.

Source of Release Is the point or location from which a flammable gas, vapour or liquid mabe released into the atmosphere.

Grade of Release There are three grades of release:-

A 'Continuous' grade release is continuous or approximately continuous, or one that occurs frequently and for short periods.

A 'Primary' grade release is likely to occur periodically or occasionally in normal operation i.e. a release which, in operating procedures, is anticipated to occur.

A 'Secondary' grade release is one that is unlikely to occur in normal operation. That is, one that is unlikely to occur, such as from an accidental spill of flammable liquid.

Hazard radius (radii) The horizontal extent, independent of ground effects, of the hazardous area that is generated by the source when situated in an open area. The concentration of flammable vapour in air has fallen to the lower flammable limit at this distance.

Ventilation Natural ventilation is caused by wind. It applies to open areas and is not normally associated with laboratories. (This definition is provided for completeness.)

Artificial ventilation is caused by air purge or by assisted mechanical means normally involving fans and extraction and is applied throughout either the enclosure (eg the laboratory) or locally (eg flammable liquid storage cabinet local exhaust).

Adequate ventilation Ventilation that is natural, artificial or a combination of both sufficient to avoid the persistence of flammable atmospheres within a sheltered or enclosed area, but insufficient to avoid the initial formation and spread throughout the area.

Point Source approach Due to possible variability in temperature, pressure and equipment, the prescriptive approach to hazardous area classification using examples may not suitable. The Point Source approach uses the

	extent of vaporisation based on the release rate of flammable liquid to determine hazardous zoning.
Risk-based Approach	The risk-based approach to hazardous zoning for laboratory situations assesses the likelihood and consequence of the expected flammable liquid spill area occurring based on an event scenario analysis.
Adequate ventilation	This includes ventilation that is natural, artificial or a combination of both, sufficient to prevent persistence of flammable atmospheres within enclosed areas, but insufficient to avoid their initial formation and spread throughout the area.
Dilution Ventilation	Ventilation that is sufficient to maintain an non-hazardous zone in an enclosed area containing a source of release
Enclosed area	Is a building, room or enclosed space where the ventilation does not meet the requirements for adequate ventilation should the absence or failure of artificial ventilation exist.
Flash point	The lowest temperature, corrected to a barometric pressure of 101.3 kPa, at which the application of a source of ignition causes the vapour of the test portion to ignite and the flame propagate across the surface of the liquid under the specified conditions of test.
Hazardous atmosphere	An atmosphere containing flammable gas or vapour in a concentration capable of ignition.
Local artificial ventilation	Air movement and replacement with fresh air by artificial means applied to a particular source of release or local area within a more general area.
Lower Explosive Limit (LEL)	The lowest concentration of a flammable gas or vapour in air at atmospheric pressure capable of being ignited. The figure is expressed as percentage by volume. (Synonymous with Lower Flammable Limit (LFL))
Mobile equipment	Equipment mounted on its own wheels or tracks or similar having the feature of mobility.
Upper Explosive Limit (UEL)	The highest concentration of a flammable gas or vapour in air at atmospheric pressure capable of being ignited. The figure is expressed as percentage by volume. (Synonymous with Upper Flammable Limit (UFL))
Flammable Liquid Storage Cabinet (FLSC)	A metal enclosure constructed in accordance with the requirements of AS1940 and used for the storage of independently and internally contained flammable liquids. An FLSC may have local ventilation facility (exhaust) or not.
Dust	Small solid particles including fibres and flyings in the atmosphere which settle out under their own weight, but which may remain

	suspended in air for some time (includes dust and grit as defined in ISO 4225).
Explosive Dust Atmosphere	Mixture with air, under atmospheric conditions, of flammable substances in the form of dust, fibres or flyings in which, after ignition, combustion spreads throughout the unconsumed mixture.
Source of Dust Release	Point or location from which combustible dust can be released into the atmosphere.

Housekeeping

Three levels of housekeeping can be described:

Good: Dust layers are kept to negligible thickness, or are non-existent, irrespective of the grade of release. In this case the risk of the occurrence of explosive dust clouds from layers and the risk of fire due to layers has been removed.

Fair: Dust layers are not negligible but are short lived (less than one shift). Depending on the thermal stability of the dust, and the surface temperature of the equipment, the dust may be removed before and fire can start. In this case, equipment selected according to rule 1 in Annex B of AS/NZS 61241.10:2005 is likely to be suitable.

Poor: Dust layers are not negligible and persist for more than one shift. The fire risk may be significant and this should be controlled by selecting equipment according to advice given in Annex B of AS/NZS 61241.10:2005.

Appendix A: Applicable excerpts from AS 3833

SECTION 5 STORAGE AND HANDLING OF PACKAGES AND INTERMEDIATE BULK CONTAINERS

5.1 SCOPE OF SECTION

This Section sets out requirements and recommendations for the storage and handling of sealed packages and sealed IBCs of dangerous goods, in quantities greater than those given for minor storage in Section 2 and in storages other than retail storage (as described in Section 3) or transit storage (as described in Section 4).

5.2 APPLICATION OF SECTION

This Section does not apply where Sections 2, 3 or 4 are applicable.

Except where Sections 2, 3 or 4 apply, Clauses 5.3, 5.4, 5.5 and 5.6 apply to all mixed class stores. Clause 5.9 specifically applies to storage in freight containers. Clause 5.10 applies specifically to storage cabinets. Clause 5.11 applies to offices within stores.

5.3 PLANNING

5.3.1 General

A store for mixed classes of dangerous goods may be one or a combination of the following:

(a) A room, enclosure or area within a building.

(b) A roofed structure or room, attached to an external wall of another building.

(c) A free-standing, roofed structure or building, not attached to any other building.

(d) A storage cabinet (see Clause 5.10).

(e) A freight container that has been modified in accordance with Clause 5.9.

(f) An outdoor storage area with a security fence.

5.3.2 Hazard assessment

When evaluating the type of store required, a list of the classes of dangerous goods intended to be kept shall be prepared. The requirements for a store containing different classes of dangerous goods depend on the compatibility of the different goods within the store, the nature of each type of goods and the type of packaging used for the goods.

A hazard assessment shall be carried out for each mixed class dangerous goods store on the site. Such an assessment shall take into account the factors specified above and shall include appropriate spillage control and segregation requirements for the store.

The requirements so determined shall be formally documented. A plan of the store, detailing the locations of the different goods kept, shall be prepared and displayed within the store.

NOTE: Appendix D outlines provisions to be made when implementing a risk assessment for a dangerous goods store.

5.3.3 Location

Stores shall be located in accordance with the requirements of Section 6 of this Standard.

Except for cabinets, the store's location shall not jeopardize the safety of any areas on other levels of the building in which it is situated, or impede firefighting operations.

The location of any cabinets shall be as given in Clause 5.10.4.

5.4 DESIGN AND CONSTRUCTION OF STORES

5.4.1 General

The following requirements shall apply to the design and construction of stores for mixed classes of dangerous goods:

(a) Except for storage cabinets, stores shall be on a floor that has direct access from ground level on at least one side.

(b) Stores shall be designed, constructed and operated in a manner that will allow the housekeeping requirements of Clause 7.5 to be carried out effectively.

(c) Unless required to be fire-resistant (e.g. where flammable liquids are to be kept), stores shall be constructed of non-combustible materials that are compatible with the dangerous goods being kept. Where appropriate, surfaces shall be treated in such manner as to render them resistant to attack by the substances being kept.

NOTE: Some corrosive substances and some oxidizing agents can attack surfaces.

(d) Where corrosive substances are to stored, all materials of construction shall have corrosion resistance appropriate to the substances being kept, or shall be lined with corrosion-resistant materials.

(e) Any special storage requirements (e.g. those given on MSDS, labels and other product information) shall be met.

(f) Lighting shall comply with Clause 5.4.4.

(g) Electrical wiring shall comply with AS/NZS 3000. In stores where there is a risk of corrosion, all electrical wiring and lighting shall comply with IP 65 in accordance with AS 60529.

NOTE: Examples of oxidizing agents that cause corrosion are calcium hypochlorite and ammonium nitrate.

(h) Where flammable dangerous goods are to be stored, and a Hazardous Zone could be present, the relevant requirements of the AS/NZS 2430.3 series shall apply.

NOTE: Where dangerous goods of Divisions 2.1, 4.1, 4.2 or 4.3, or Class 3, are stored in quantities greater than those given for minor storage in Section 2, it may be necessary to 'flameproof' the store in accordance with the relevant part of AS/NZS 2430.3. This includes any materials handling equipment (e.g. forklift trucks) to be used in the store. Consideration should be given to building and operating the store to AS 1940.

(i) Stores shall be provided with ventilation complying with Clause 5.4.5.

(j) Where shelving is fitted, it shall be designed and installed so that residues cannot build up along ledges or in corners, and any spillage can be readily noticed and cleaned up.

Except where designed as spill trays or compounds, any racks or shelves shall be designed so as to prevent any accumulation or pooling of liquid.

(k) Cages shall be provided in stores for any quantities of aerosols greater than those given for minor storage being kept.

5.4.2 Exits

Exits shall be provided in accordance with BCA/NZBC. Any door in a fire rated wall separating a dangerous goods store from another room shall have an FRL/FRR of at least –/120/30.

SECTION 6 SEPARATION AND SEGREGATION

6.1 SCOPE OF SECTION

This Section sets out requirements for the separation of, and segregation within, stores containing more than one class of dangerous goods, in quantities exceeding those given for minor storage.

NOTE: The requirements of this Section do not apply to minor storage (see Section 2) or retail storage (see Section 3).

6.2 SEPARATION DISTANCES FOR STORES

6.2.1 General

Stores shall be separated from protected places by the minimum distances given in Table 6.1, with the additional requirements and qualifications as set out in this Clause (6.2).

This Clause does not apply to storage cabinets, which are addressed in Clause 5.10.4.

Where alterations to the installation or adjoining site result in a breach of the required separation distances, the installation shall be assessed and brought into compliance or decommissioned.

6.2.2 Separation to protected places on adjoining properties

The separation distance to a protected place on another property shall be at least that specified in Table 6.1. This distance may be measured across the boundary, provided that, if alterations on the adjacent property result in a breach of the separation distance, the installation shall be modified or relocated to restore compliance, or taken out of service.

Where the future installation of a protected place on the adjoining property is possible, the installation may be located in accordance with boundary separation distances, provided that the provisions stated in the above paragraph are satisfied.

NOTES:

1 The use of the protected place distance measured to the boundary of the adjacent property is recommended to eliminate future problems, although it is a commercial decision.

2 A formal agreement or covenant may be used.

6.2.3 Separation to property boundary and ignition sources

The separation distance to any property boundary shall be at least 3 m.

Where the store contains dangerous goods of Classes or Divisions 2.1, 3, 4 or 5, it shall be separated from any ignition sources by at least 3 m.

6.2.4 Separation to on-site protected places

The minimum separation distance to any on-site protected place shall be as given in Table 6.1, but need not exceed—

(a) 15 m where flammable dangerous goods are kept;

(b) 7.5 m where C1 combustible liquids are kept;

(c) 3 m where C2 combustible liquids, or non-flammable dangerous goods, are kept.

Any office within or immediately adjacent to the store, and that is used for the direct supervision of the store, is not considered an on-site protected place.

6.2.5 Measurement of separation distances

6.2.5.1 *General*

Separation distances shall be measured in a horizontal plane.

Where liquids are stored, the separation distance shall be measured from the top inside edge of the bund.

Where solids are stored, the separation distance shall be measured from the package nearest to the protected place or boundary.

6.2.5.2 *Measurement around a screen wall*

Separation distances may be measured around an intervening screen wall (as defined in Clause 1.4.59), provided that the wall extends at least 1 m above the highest container in the store, and is marked to indicate the maximum allowable storage height.

Where the store contains flammable liquids, the screen wall shall have an FRL/FRR of at least 240/240/240.

Where other dangerous goods are stored, the screen wall shall have an FRL/FRR of at least 60/60/60.

A wall on an adjacent property shall not be used as a screen wall unless an agreement similar to that described in Clause 6.2.2, Note 2, is in place.

6.3 SEGREGATION WITHIN THE STORE

6.3.1 General

Packages and IBCs of dangerous goods shall be located within the store in a manner that minimizes the likelihood of dangerous interaction. Without limiting this, dangerous goods shall be segregated from incompatible substances, substances with which they might react dangerously and other dangerous goods in accordance with the following requirements:

(a) Where the substances being kept are incompatible—

  (i) they shall be kept in separate compounds; or

  (ii) they shall be segregated by a distance of at least 3 m, except that, when both substances are solids, this distance may be reduced to 1 m.

(b) Where the substances being kept might react dangerously—

  (i) they shall be segregated by at least 5 m (measured from the upper interior edge of the bund); and

  (ii) they shall not be kept within the same compound, or in compounds that share a common drainage system.

The MSDS is the primary source of information on any incompatibility of the dangerous goods being stored. Further expert advice should be sought from the supplier of the goods.

Figure 6.1 provides guidance on the segregation of dangerous goods within the store.

6.3.2 Segregation of dangerous goods from foodstuffs

Foodstuffs, products for human or animal consumption, empty foodstuff containers, material for the production of foodstuff packagings, and medical and veterinary material may be kept in the same store as dangerous goods of Packing Groups II or III, provided that—

(a) they are kept at least 5 m (measured horizontally) from the dangerous goods;

(b) they are not kept in the same compound as the dangerous goods, unless the foodstuffs are kept above bund height (e.g. on pallets, shelves or racking);

(c) the dangerous goods are not kept above the other goods; and

(d) the dangerous goods are in packages that are not opened.

NOTE: Greater separation distances from chemicals having strong odours may be necessary.

TABLE 6.1

SEPARATION DISTANCES FROM MIXED CLASS STORES TO PROTECTED PLACES

Aggregate quantity, kg or L		Minimum distance
PG I*, PG II	PG III, aerosols (UN 1950) or combustible liquids (C1, C2)	m
	≤4 000	3
≤4 000	≤16 000	5
≤7 000	≤28 000	6
≤10 000	≤40 000	7
≤14 000	≤56 000	8
≤20 000	≤80 000	9
≤26 000	≤104 000	10
≤34 000	≤136 000	11
≤42 000	≤168 000	12
≤52 000	≤208 000	13
≤64 000	≤256 000	14
≤77 000	≤308 000	15
≤170 000	≤680 000	20
≤310 000	≤1 240 000	25
≤500 000	≤2 000 000	30

* Compatible PG I dangerous goods only (see Clause 1.2.1(b)).

NOTES:

1 The distances apply to stores where packages remain closed at all times (see also Clause 7.2.7).

2 Units of kilograms apply for solids and units of litres to liquids. For the purpose of this Table, it is assumed that 1 kg = 1 L.

3 For any intermediate quantity, the distances may be obtained by linear extrapolation.

4 Where manufactured products are kept, 50% of their volume may be used when calculating the total quantity to be considered when using this Table.

5 Where quantities exceed those given above, separation distances shall be determined by risk assessment and fire protection studies.

6.3.3 Storage of dangerous goods of Division 5.1

The following requirements apply where the mixed class store contains Division 5.1 dangerous goods:

(a) Stacks of packaged dangerous goods of Division 5.1 shall be limited to 3 m in height.

(b) A free air space of at least 1.2 m shall be maintained between the stack and any walls.

6.3.4 Storage of non-dangerous goods in segregation spaces

Non-dangerous goods may be kept in segregation spaces, provided that they will not react dangerously with any of the dangerous goods being kept. Non-dangerous goods that are combustible (excluding combustible liquids) may be kept in such spaces, provided that—

(a) a hazard assessment, including an assessment of the additional fire load, has been carried out; and

(b) any necessary additional fire protection is provided.

NOTE: The volume of any non-dangerous goods kept in the segregation spaces needs to be considered when calculating the volume of the spillage containment for the store.

Appendix B: Typical Incompatibility Table

CLASS		2		3	4			5		6	8
											
COMPRESSED GASES 2.1 Flammable	2	Compatible	KEEP APART	Segregate from	Segregate from	Segregate from	Segregate from	Segregate from	ISOLATE	KEEP APART	KEEP APART
2.2 Non-flammable/ non-toxic	2	KEEP APART	Compatible	KEEP APART	Segregation may be necessary	Segregate from	Segregation may be necessary	Segregation may be necessary	Segregate from	Segregation may be necessary	KEEP APART
FLAMMABLE LIQUIDS (and Combustible liquids)	3	Segregate from	KEEP APART	Compatible	KEEP APART	Segregate from	Segregate from	Segregate from	ISOLATE	KEEP APART	KEEP APART
FLAMMABLE SOLIDS 4.1 Flammable solids	4	Segregate from	Segregation may be necessary	KEEP APART	Compatible	KEEP APART	Segregate from	Segregate from	Segregate from	KEEP APART	Segregation may be necessary
4.2 Spontaneously combustable	4	Segregate from	Segregate from	Segregate from	KEEP APART	Compatible	KEEP APART	Segregate from	ISOLATE	KEEP APART	KEEP APART
4.3 Dangerous when wet	4	Segregate from	Segregation may be necessary	Segregate from	Segregate from	KEEP APART	Compatible	KEEP APART	Segregate from	Segregation may be necessary	Segregation may be necessary
OXIDIZING SUBSTANCES 5.1 Oxidizing agents	5	Segregate from	Segregation may be necessary	Segregate from	Segregate from	Segregate from	KEEP APART	*	Segregate from	KEEP APART	KEEP APART
5.2 Organic peroxides	5	ISOLATE	Segregate from	ISOLATE	Segregate from	ISOLATE	Segregate from	Segregate from	Compatible	KEEP APART	KEEP APART
TOXIC SUBSTANCES	6	KEEP APART	Segregation may be necessary	KEEP APART	KEEP APART	KEEP APART	Segregation may be necessary	KEEP APART	KEEP APART	Compatible	Segregation may be necessary
CORROSIVE SUBSTANCES	8	KEEP APART	KEEP APART	KEEP APART	Segregation may be necessary	KEEP APART	Segregation may be necessary	KEEP APART	KEEP APART	Segregation may be necessary	*

LEGEND:

Compatible	Dangerous goods of the same Class should be compatible; consult MSDS or suppliers about requirements for individual substances.
*	Dangerous goods of the same Class could be incompatible or react dangerously. Consult the MSDS or suppliers about requirements for individual substances.
Segregation may be necessary	Segregation of these Classes may be necessary. Consult the MSDS or supplier.
KEEP APART	Dangerous goods of these Classes should be kept apart by at least 3 m. Consult the MSDS or supplier.
Segregate from	These combinations of dangerous goods should segregated by at least 5 m and kept in separate compounds or building compartments.
ISOLATE	This requirement applies to organic peroxides, for which dedicated stores or storage cabinets are recommended. Adequate separation from other buildings and boundaries is required.

Appendix C: Compliance Report Table

The drawings as identified in Section 1.2 were reviewed to ascertain wether or not the design of the current Dangerous Goods Store which would be replicated in the new Dangerous Goods store would comply with the requirements of AS 3833:2007[1]. The outcomes of this review are provided in the table below.

Table 3 - Compliance with AS 3833:2007

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant NC = Non Compliant or Unassessable N/A = Not Applicable					
SECTION 5 – Storage and Handling of Bulk Packages and Intermediate Bulk Containers					
5.3 Planning					
5.3.1 General	A store for a mixed classes of dangerous goods may be one or a combination of the following:				
	(a) A room, enclosure or area within a building.	☐	☐	☒	
	(b) A roofed structure or room, attached to an external wall of another building.	☐	☐	☒	
	(c) A free-standing, roofed structure or building, not attached to any other building.	☒	☐	☐	
	(d) A storage cabinet (see Clause 5.10)	☐	☐	☒	
	(e) A freight container that has been modified in accordance with Clause 5.9.	☐	☐	☒	
	(f) An outdoor storage facility with a security fence,	☐	☐	☒	

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant NC = Non Compliant or Unassessable N/A = Not Applicable					
5.3.2 Hazard Assessment	When evaluating the type of store required, a list of the classes of dangerous goods intended to be kept shall be prepared. The requirements for a store containing different classes of dangerous goods depend on the compatibility of the different goods within the store, the nature of each type of goods and the type of packaging used for the goods. A hazard assessment shall be carried out for each mixed class dangerous goods store on site. Such an assessment shall take into account the factors specified above and shall include appropriate spillage control and segregation requirements for the store. The requirements so determined shall be formally documented. A plan of the store, detailing the locations of the different goods kept, shall be prepared and displayed within the store.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology,
5.3.3 Location	Stores shall be located in accordance with requirements of Section 6 of this Standard. Except for cabinets, the store's location shall not jeopardize the safety of any areas on other levels of the building in which it is situated, or impede firefighting operations. The location of any cabinets shall be as given in clause 5.10.4	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology, .
5.4 Design and construction of stores					
5.4.1 General	The following requirements shall apply to the design and construction of stores for mixed classes of dangerous goods:				
	(a) Except for storage of cabinets, stores shall be on a floor that has direct access from ground level on at least one side	☒	☐	☐	

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(b) Stores shall be designed, constructed and operated in a manner that will allow the housekeeping requirements of Clause 7.5 to be carried out effectively.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Unless required to be fire resistant (e.g. where flammable liquids are to be kept), stores shall be constructed of non combustible materials that are compatible with the dangerous goods being kept. Where appropriate, surfaces shall be treated in such manner as to render them resistant to attack by the substances being kept.	☒	☐	☐	
	(d) Where corrosive substances are stored, all materials of construction shall have corrosion resistance appropriate to the substances being kept, or shall be lined with corrosion resistant materials.	☒	☐	☐	
	(e) Any special storage requirements (e.g. those given on MSDS, labels and other product information) shall be met.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Lighting is to comply with Clause 5.4.4	☒	☐	☐	
	(g) All electrical wiring to comply with AS/NZS 3000. Where there is a risk of corrosion all electrical wiring to comply with IP 65 in accordance with AS 60529 NOTE: Calcium hypochlorite and ammonium nitrate are examples of oxidising agents causing corrosion.	☒	☐	☐	

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(h) Hazardous zones may be present where flammable dangerous goods are kept. The relevant requirements of AS/NZS 2430.3 series will apply. NOTE: It may be necessary to "flameproof" the store in accordance with AS/NZS 2430.3 if dangerous goods of divisions 2.1, 4.1, 4.2 or 4.3 or Class 3 are stored in quantities greater than those for minor storage. Consideration should be given to building and operating the store to AS 1940.	☒	☐	☐	
	(i) Ventilation complying with Clause 5.4.5 shall be provided in stores.	☒	☐	☐	This will only be compliant provided the new store's natural ventilation meets the requirements of AS 3833 [1]There is insufficient information on the drawings to assess if adequate ventilation is proposed.
	(j) Shelves fitted shall be designed to and installed such that residues cannot build up along edges or in corners. This will allow spillage to be readily noticed and cleaned up. NOTE: Other than spill trays or compounds racks and shelves to be designed to prevent pooling of liquid.	☒	☐	☐	
	(k) Where storage of aerosols exceed minor storage, stores to be provided with cages.	☒	☐	☐	Aerosols currently located in another location.
5.4.2 Exits	Exits to be provided in accordance with BCA. Doors in fire rated walls separating a dangerous goods store from another room shall have an FRL of no less than -/120/30.	☒	☐	☐	

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
5.4.3 Spillage containment	A means of diverting any spill to a compound within the premises such as a bund shall be provided in stores where liquids are kept. Spillage containment shall comply with the following requirements:				
	(a) For all liquid dangerous goods the capacity of the compound is required to be no less than 100% of the larges container plus 25% of the storage capacity up to 10000L, together with 10% of the storage capacity beyond 10000L.	☒	☐	☐	
	(b) The capacity of the spillage containment compound must be increased to include 20 minutes of any fire sprinkler discharge.	☒	☐	☐	
	(c) Construction material of the bund must be resistant to attack by the dangerous goods being stored.	☒	☐	☐	
	(d) Shields may be used to deflect leaks into compounds. Where used they are required to be:				
	(i) Non-combustible	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(ii) Chemically resistant to the goods being stored; and	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(iii) Positioned such that they do not impede ventilation	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(e) Spillage containment compound shall be impervious to retain spillage to allow recovery of spillage. The compound shall be chemically resistant and fire resistant to the degree necessary to perform its containment function.	☒	☐	☐	
	(f) Incompatible chemicals must not be directed into the same common compound. NOTE: This includes the possible combination of ammonium nitrate and flammable or combustible liquids.	☐	☒	☐	Class 3 and Class 5 chemicals need to be separated as per the AS 3833 segregation requirements.
	(g) Spillage containment compound must be designed such that substances which may react are not directed into the same compound. NOTE: Environmental legislative requirements also apply	☐	☒	☐	
	(h) Spillage containment system shall have surfaces which are non-porous and chemically resistant to all stored liquids.	☒	☐	☐	
	(i) The drainage of any fire water or rainwater to outside the compound shall be -				
	(i) Via a suitable interceptor or separator such as a molecular sieve; or	☐	☐	☐	Insufficient information provided
	(ii) After sampling and testing of the water.	☐	☐	☐	Insufficient information provided
5.4.4 Lighting	Lighting shall be provided in accordance with the following requirements:				

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant NC = Non Compliant or Unassessable N/A = Not Applicable					
	(a) Lighting shall be sufficient during the hours of operation to provide safe working conditions that include but are not limited to, clear visibility of all markings on packages, signs, instruments and other necessary items.	☒	☐	☐	
	(b) Interior lighting shall be at least the luminance specified in AS/NZS 1680.2.4.	☒	☐	☐	
	(c) When internal roads are used on the installation by personnel sufficient lighting shall be available.	☐	☐	☐	Insufficient information provided
	(d) The appropriate part of AS/NZS 2430.3 series shall be referenced where flammable goods are stored.	☒	☐	☐	
5.4.5 Ventilation					
5.4.5.1 General	Adequate natural or mechanical ventilation shall be provided to each store depending on the materials being stored and any vehicle exhaust fumes which may be emitted. Ventilation shall be sufficient to maintain the ambient concentration of any vapours and or dusts throughout the store below any recommended workplace exposure standards. The following requirements also apply:				
	(a) The store ventilation system must be able to ensure that any vapours that are generated are diluted with and removed by the flow of air passing through the store.	☐	☐	☐	Insufficient information provided

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(b) Where flammable substances are stored, the atmosphere shall be maintained below 10% of the lower explosive limits during normal operation.	☐	☐	☐	Insufficient information provided
	(c) A natural ventilation system that complies with the requirements of Clause 5.4.5.2 shall be deemed to comply with item (a).	☒	☐	☐	
	(d) A mechanical ventilation system that complies with the requirements of Clause 5.4.5.3 shall be deemed to comply with item (a).	☐	☐	☒	
	(e) Location of vents will be chosen so as to ensure effective air movement to all parts of the store.	☒	☐	☐	
5.4.5.2 Natural ventilation	A natural ventilation system in the store shall comprise one of the following:				
	(a) At least two external sides completely open to the outside. NOTE: A wall of wire mesh, or of fixed louvres, lattice or the like having a minimum of 50% of it areas as openings is considered to be completely open.	☐	☐	☒	
	(b) One external side open to the atmosphere with no additional vents. The distance to and length of opposite wall must not exceed the length of the open side.	☐	☐	☒	
	(c) One external side open to the atmosphere and vents in the opposite or adjacent wall.	☐	☐	☒	
	(d) Vents in one external wall if the wall is at least 6m long and the opposite wall is not more than 5m away from it.	☐	☐	☒	

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(e) Vents in opposing walls.	☒	☐	☐	
	(f) Under deck ventilation on storage platforms by means of vent openings on opposite sides having an area of not less than 0.1m^2 for each 1.2m length. NOTE: Additional ventilation, dependent on the size of the store and its storage density, may be required.	☐	☐	☒	
	If vents are used they must consist of openings immediately above the upper limit of the spillage compound and each vent must have a net free area of 0.1m^2, or 0.15m^2 where open packages are present. An equal area of openings must also be provided above the highest package. One low level vent must be provided in each 3m of wall or in each 1.4m of external wall where there is only one external wall. If only one vent is required on a wall it must be located centrally to the length of the wall. Equivalent areas of ventilation are allowed provided the required vent area per unit wall is maintained.	☒	☐	☐	
5.4.5.3 Mechanical ventilation	Mechanical ventilation systems must be provided such that:				
	(a) Termination points within the store for fresh air supply and draw-off ducts must be:				
	(i) Immediately above the upper limit of the spillage compound.	☐	☐	☒	
	(ii) On opposing walls; and	☐	☐	☒	
	(iii) Of equal capacity.	☐	☐	☒	

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	The distance between any two inlets or any two outlets shall not exceed 5m. NOTE: The registers should be located along the longest side of the building, in order to optimize their effect. If a single-fan system is adopted, the fan should be in the exhaust duct. The supply duct may be in the form of natural ventilation in an external wall at low level, meeting the requirements of Clause 5.4.5.	☐	☐	☒	
	(b) If the ventilation system incorporates fans on both the supply and exhaust ducts the room is to be maintained under negative pressure.	☐	☐	☒	
	(c) The mechanical ventilation system must be able to exhaust the greater of 0.3m^3 per square metre of floor area per minute or 5m^3/min and the air velocity at the entry register must exceed 300 m/min.	☐	☐	☒	
	(d) In the event of airflow failure, a warning device must be provided such that the warning can be identifiable from outside the store.	☐	☐	☒	
	(e) The termination points for any intake or exhaust duct shall be either in the open air at least 2m away from any openings in the building or 4m from the outlet of any chimney of flue and at least 3m above the ground. External termination points of any inlet duct must be at least 5m from the exhaust duct termination point.	☐	☐	☒	
	(f) The mechanical ventilation system must be designed so that it operates -				
	(i) Continuously; or	☐	☐	☒	

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(ii) Whenever work is being carried out in the store; or	☐	☐	☒	
	(iii) Whenever a person is in the store.	☐	☐	☒	
	(g) Where flammable substances are stored-				
	(i) Any duct passes through a building other than the store it must be protected by or constructed from material with an FRL of no less than -/180/180.	☐	☐	☒	
	(ii) Fan blades and nearby components must also be constructed of materials which do not emit sparks when struck. NOTES: A common enclosure may be used for both intake and exhaust ducts. Unsatisfactory materials include steel, or steel withy aluminium-magnesium alloys.	☐	☐	☒	
5.5 General Requirements	Except for storage cabinets (as described in Clause 5.10), stores for packages of dangerous goods shall comply with the following requirements and recommendations as appropriate:				
	(a) Packages must be stored such that they cannot fall or spill outside the compound. Packages should be kept at least 600mm from the inner edge of the bund wall or restraints provided to prevent falls or spills outside the compound.	☐	☐	☐	This risk need to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Clear access shall be available within the store.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(c) Safety showers, eyewash facilities and water for washing hands must be provided within 10m of but no closer than 2m to areas where packages are opened and contents transferred. The number, location and type of equipment should be based on a risk assessment. Such facilities to comply with ANSI Z358.	☐	☒	☐	Insufficient information provided
	(d) All relevant requirements of Clause 7.2 shall apply.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Where Dangerous Goods may generate combustible dusts or flammable products a Hazardous zone assessment must be conducted in accordance with AS/NZS 2430.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Forklift trucks used in a Hazardous zone must be in accordance with the requirements of AS 2359.12.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(g) When forklift trucks are utilised in areas storing oxidising agents they must be in accordance with AS 4326.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology..
5.6 Security of storage areas	The RDC shall be restricted to authorised personnel only. Any additional regulatory requirements for Dangerous Goods stored also apply.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
5.7 Storage in stacks	For safe stacking, block stacks of packages on pallets shall be restricted in height, having regard to the load bearing ability, design and quality of the package, e.g. sole or combination packaging. Other considerations include-				

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant NC = Non Compliant or Unassessable N/A = Not Applicable					
	(a) The method of stacking;	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) The design of the stacking; and	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) The safe working load of the pallets.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
5.8 Storage of IBCs		☐	☐	☒	
5.9 Storage in freight containers		☐	☐	☒	
5.10 Storage in cabinets		☐	☐	☒	
5.11 Offices within stores	If it is desirable to construct an office inside the Dangerous Store the following requirements must be met:				
	(a) An exit path must be provided which does not require the occupant to traverse through the area where the Dangerous Goods are stored.	☐	☐	☒	
	(b) Personnel inside the store must not be exposed to vapours emitted from the store.	☐	☐	☒	

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(c) Adequate ventilation must be provided such that the air pressure inside the office does not fall below that of the Dangerous Goods store when flammable or toxic Dangerous Goods are stored.	☐	☐	☒	
	(d) Access must be restricted to authorised personnel only.	☐	☐	☒	
Section 6 – Separation and Segregation					
6.2 Separation distances for stores					
6.2.1 General	Stores must be separated from protected places or other properties by the minimum distances given in the Table 6.1 of the Standard. Where alterations to the installation or adjoining site result in a breach of the required separation distances, the installation shall be assessed and brought into compliance or decommissioned.	☐	☐	☐	Depending on final quantity and range of Dangerous Goods stored. Separation distance is required to be 7m.
6.2.2 Separation to protected places on adjoining properties	The separation distance to a protected place on another property shall be at least that specified in Table 6.1 of the Standard. This distance may be measured across the boundary, provided that, if alterations on the adjacent property result in a breach of the separation distance, the installation shall be modified or relocated to restore compliance, or taken out of service. Where the future installation of a protected place on the adjoining property is possible, the installation may be located in accordance with boundary separation distances, provided that the provisions stated in the above paragraph are satisfied.	☐	☐	☐	Depending on final quantity and range of Dangerous Goods stored. Separation distance is required to be 7m.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
6.2.3 Separation to property boundary and ignition sources	The separation distance to any property boundary shall be at least 3m. Where the store contains dangerous goods of classes or divisions 2.1, 3, 4 or 5 is it shall be separated from any ignition sources by at least 3m.	☐	☐	☐	To be confirmed, site not yet selected.
6.2.4 Separation to on-site protected places	The minimum separation distance from on site protected places are given in Table 6.1 of this Standard but need not exceed:				
	(a) 15m where flammable goods are kept	☐	☐	☐	To be confirmed.
	(b) 7.5m where C1 combustible liquids are kept	☐	☐	☐	To be confirmed.
	(c) 3m where C2 combustible liquids or non flammable Dangerous Goods are kept	☐	☐	☐	To be confirmed.
	Offices inside the store or immediately adjacent to the store used for the direct supervision of the store are not considered to be an on-site protected place.	☐	☐	☒	
6.2.5 Measurement of separation distances					
6.2.5.1 General	Separation distances are generally measured on the horizontal plane. If liquids are stored the separation distance is measured from the inside top edge of the bund. If solids are stored the separation distance is measured from the package nearest to the protected place or boundary.				

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
6.2.5.2 Measurement around a screen wall	Separation distances may be measured around an intervening screen wall as long as the walls is at least 1m above the highest container in the store and is marked to indicate the maximum allowable storage height. If the store contains flammable liquids the screen must have an FRL no less than 240/240/240. Where other Dangerous Goods are stored, the screen wall must have an FRL no less than 60/60/60.				
6.3 Segregation within the store					
6.3.1 General	Packages of Dangerous Goods must be segregated away from incompatible substances, substances, which may react and other Dangerous Goods in accordance with the following requirements:				
	(a) Where the dangerous goods are incompatible-				
	(i) must be either in separate compounds; or	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(ii) segregated by a distance of no less than 3m or if both are solids a distance of 1m.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) where the substance being kept might react dangerously-				
	(i) must be segregated by no less than 5m measured from the upper interior end of the bund	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(ii) Must not be kept in the same compound or compounds which share the same drainage system.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	The MSDS is the primary source of information on any incompatibility of the dangerous goods being stored. Further expert advice should be sought from the supplier of the goods. The segregation guide provides guidance.				
6.3.2 Segregation of dangerous goods from foodstuffs	Foodstuffs, products for human or animal consumption, empty food containers, material for the production of foodstuff packaging and medical and veterinary materials can be kept in the same Dangerous Goods store of PGII or PGIII as long as the following are met -				
	(a) They are no less than 5m away measured horizontally from the Dangerous Goods	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Are not in the same compound unless the foodstuffs are kept above the bund height.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) The Dangerous Goods are kept below other goods,	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Packagings for the Dangerous Goods are not opened.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
6.3.3 Storage of dangerous goods of Division 5.1	Where Division 5.1 Dangerous Goods (oxidising substances) are kept with other Dangerous Goods the following apply -				
	(a) Stacks of Division 5.1 Dangerous Goods must be no greater than 3m high.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) A free air space of no less than 1.2m must be maintained between the stacks and any walls.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
6.3.4 Storage of non-dangerous goods in segregation spaces	Non Dangerous Goods may be kept in segregation spaces provided they do not react with other Dangerous Goods being kept. Non-dangerous goods that are combustible (excluding combustible liquids) may be kept in such spaces provided that-				
	(a) A hazard assessment is undertaken including an assessment of the additional fire load; and	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Any additional fire protection equipment provided. NOTE: The volume of any non-dangerous goods kept in the segregation spaces needs to be considered when calculating the volume of the spillage containment for the store.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
Section 7 – Operational and personnel Safety					
7.2 General Precautions					

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
7.2.1 Control of entry	Any restricted area must be locked whenever it is unattended. All visitors, contractors or the like entering into the premises must be accompanied by a trained staff member at all times. If this is not achievable, then before entry induction training must be undertaken or a list of the hazards present and the appropriate precautions to be taken must be provided.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.2.2 Clear access	The means of entry into and exit from areas, rooms or buildings where dangerous goods are kept or handled shall be kept clear at all times. At all times the following areas must be kept clear and free access shall be available:	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(a) Entry and exits	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Where Fire fighting equipment are located.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Where Personal protective equipment are located.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Where clean up materials and equipment is located.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) In the aisles and where the manifest is kept.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
7.2.3 Lighting	Whenever people are in an area where dangerous goods are kept, lighting shall be provided in accordance with Clause 5.4.4.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.2.4 Ventilation	Whenever people are in an area where dangerous goods are kept, the requirements of Clause 5.4.5 shall apply. Where Dangerous Goods present an air inhalation hazard, routine air monitoring should be conducted.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.2.5 Activities within stores	A risk assessment and risk management plan must be undertaken before activities such as mixing, blending, degreasing, tinting or package filling or co-storage of other goods are carried out. Appendix D of the Standard outlines items to be considered when implementing a hazards assessment. Where non flameproof fork lift trucks and vehicles are used in a store containing dangerous goods of Classes or subsidiary risks 3 or 4, Appendix E of the Standard must be applied in full.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.2.6 Handling precautions	The following precautions shall be observed when handling packaged dangerous goods:				
	(a) Packages shall be handled with care to minimise spills and leaks.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) An appropriate amount of safety equipment must be provided as specified in the MSDS.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(c) Where packages are palletized they must be protected from punctures or tears.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Movement of packages of Dangerous Goods are subject to manual handling risk controls.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.2.7 Opening of packages	Sole or inner packages must not be opened inside the store unless for the purposes of sampling, tinting, testing or inspection. All packages to be securely reclosed afterwards.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.2.8 Process feedstock's and products	The storage of dangerous goods within a process area shall be limited to-				
	(a) No more than two pallets or an aggregate capacity of 3000L of Dangerous Goods packages are allowed adjacent to the process; or	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Not more than a 12 hour supply whichever is greater. Only exception is when the Dangerous Goods are stored in a separate area that complies with the relevant Australian Standards.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Finished packages must be cleared regularly. The maximum accumulated finished packages must no exceed the output of one working shift.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
7.2.9 Sources of ignition and heat	Where a store contains Dangerous Goods of Classes or subsidiary risks 3, 4 or 5, or aerosols all potential ignition and heat sources must be no less than 3m away from any openings to the store. NOTE: Reference should be made to the appropriate part of the AS/NZS 2430 series.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.2.10 Safety information	The appropriate first aid measures and MSDS must be readily available.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology..
7.2.11 Packages for dangerous goods	The following requirements apply to the packaging of dangerous goods:				
	(a) Packaging for Dangerous Goods being filled must be constructed with sufficient strength and durability for its purpose. All parts of the packaging in contact with contents must not be weakened and must be compatible with the contents being stored.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) If the packaging is used at other premises other than where it is filled it must meet the requirements of the ADG Code.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.2.12 Markings of packages	Packages for Dangerous Goods must be marked in accordance with the applicable legislation. NOTE: Labelling in compliance with ADG Code/NZS 5433, NOHSC:2012, and the SUSDP may be required.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.3 Operating Procedures					

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
7.3.1 General Requirements	Safe systems of work must be developed, implemented and maintained. Written procedures must include:				
	(a) Operating procedures which cover all aspects of the day to day operation.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Maintenance procedures which cover all inspections, testing and monitoring.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Construction and maintenance procedures covering new facilities and modifications of plant.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Emergency procedures. See Clause 7.3.4 and Section 8. NOTE: Many states have OHS legislation which provides for consultative mechanisms at workplaces, to enable management and workers to be jointly involved in the development of the procedures and work practices.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	All procedures to be updated and documented/	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.3.2 Operating Procedures	Operating procedures would include the following:				
	(a) Initial commissioning procedures.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(b) Normal handling and transfer/ procedures.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Monitoring of essential functions and components.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Control of hazards, including ignition sources.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Manufacturer's operating procedures for equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Housekeeping and site upkeep.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(g) Management of leaks, spills and clean ups.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(h) Personnel safety and protective equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(i) Environmental monitoring.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(j) Operation of utilities.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(k) Fire protection systems.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(l) Check procedures for substances that are incompatible or can react.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.3.3 Construction and maintenance of procedures	Construction and maintenance procedures:				
	(a) Work authorization.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Work in confined spaces.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Testing of instrumentation, protective devices, alarms and monitors.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Isolation and tagging of equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(e) Control of contractors.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Fire fighting equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(g) Bunds.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(h) Electrical equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(i) Ventilation.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(j) Fences and security measures.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(k) Lighting.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(l) Signs and notices.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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7.3.4 Emergency procedures	Documented emergency procedures and first aid procedures shall be prepared in accordance with Section 8 and Clause 7.10.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.3.5 Compliance with procedures	An audit system should be established to determine compliance with procedures established.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.4 Placarding					
7.4.1 Placarding or stores	Placards should be provided to NOHSC:1015 except where conflictions occur between legislative requirements. Legislative requirements will prevail. The following additional signs shall be displayed as appropriate:	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(a) A warning sign to prohibit smoking and to exclude ignition sources, e.g. DANGER: NO SMOKING, NO IGNITION SOURCES. (b) A warning sign to restrict entry, e.g. RESTRICTED AREA, AUTHORISED PERSONNEL ONLY. (c) Any other notices or warnings that may be required by authorities and any Legislative required signs must be provided. All signs to have lettering which contrast the background and comply with AS 1216 and AS 1319 unless another requirement prevails.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.4.2 Safety information	The following information and others as requested should be provided to the emergency services and displayed in approved locations.				

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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	(a) The location of the emergency plan.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) The location of the manifest.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) The location of protective equipment and clean up materials.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) The locations of controls for essential services and their distribution.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) The location and description of the Dangerous Goods being stored. NOTE: A pictorial layout of the site or building may also be required on the safety information board.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.5 Housekeeping					
7.5.1 Site upkeep	The area within any compound or in or around storage and handling facilities shall be maintained in a safe condition. In particular-				
	(a) The area will be kept clear of irrelevant items.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Adequate clearance distances must be maintained at all times.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(c) Exit paths, exits and aisles must be kept clear of packages.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Surrounding vegetation must be maintained and kept short to reduce the fire hazard.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.5.2 Housekeeping procedures	The following housekeeping procedures shall be established and maintained:				
	(a) Aisles of store to be kept clear.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) All stock to be monitored to prevent the accumulation of old material. Stock integrity should be maintained	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) All stock to be handled with care to prevent package damage and minimise leaks.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) All packages to be regularly inspected to ensure package leaks are minimised. If signs of spill, leak or deterioration are observed the package is to be examined until rendered safe.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Spills or leaks of Dangerous Goods must be dealt with in accordance with Clause 8.5.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Used packages which cannot be recycled must be treated in accordance with Section 10.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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	(g) Labels to remain on empty containers until decontaminated at which time the labels to be removed.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.6 Effluent control	All waste control shall be in accordance with regulatory requirements.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.7 Construction and Maintenance work					
7.7.1 General	Written permission must be obtained before work is carried out in a Dangerous Goods store. Before work is undertaken consideration must be given to the safety of the procedures and if necessary the Dangerous Goods may be moved to another location.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.7.2 Routine work	Any routine work, non hazardous work must be supervised such that its safe conduct is ensured.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.7.3 Work permit	Except for routine non hazardous work all work within the restricted area must be authorised through means of a work permit. The work permit should include:	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(a) The nature and extent of the work.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Any conditions to be observed	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Any personal protective equipment to be used.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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	(d) The period for which the permit is valid.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Any necessary regular checking to ensure safety requirements and conditions are maintained.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Any necessary procedures and precautions required to return the area to normal service.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(g) Any fire fighting equipment required at hand.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	A work permit may identify, within any restricted are, an open area in which major maintenance or construction work may be performed without further permission. The physical limit of such an area shall be clearly marked.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.7.4 Preparation of work site	The site or work area must be prepared such that the risk of fire, explosion or exposure to hazardous substances is minimised. Precautionary measure shall include but not limited too:	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(a) Identification of both the equipment to be worked on the other affected equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Depressurization and disconnection of the equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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	(c) Isolation and locking-off of the equipment from other equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Purging of the equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Removal of hazardous material in the work vicinity if known to impact.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Sealing off of drains or pits.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(g) Provision of appropriate fire protection equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(h) Testing of the work environment for its hazardous vapours and oxygen content.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.7.5 Completion of work and commissioning	Commissioning shall be conducted on all work after it is completed before returning it to service. A check should be conducted to ensure:				
	(a) The work has been completed.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Any temporary arrangements have been removed.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) All personnel and equipment are accounted for.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(d) The work permit has been signed off as being complete.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) All services and equipments are inspected and tested and have returned back to normal service.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.7.6 Hot work	Any work involving cutting or welding by gas or electric arc or any non-welding work of equivalent risk shall not be undertaken within a restricted area where dangerous goods are stored unless-				
	(a) A work permit has first been obtained; and	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Any hazardous residues or vapours have been removed. The requirements of AS1674 series shall be observed in relation to any hot work undertaken.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.8 Personnel training					
7.8.1 Job knowledge	All personnel which will come into contact with or handle Dangerous Goods on the premises must be fully trained in:				
	(a) The properties and safe handling procedures. MSDS must be made available to all personnel; and	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Applicable safety regulations and safe handling procedures.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.8.2 Training	All personnel on the premises must be trained in:				
	(a) The nature of the work and safe methods of operation.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(b) The properties and hazards of the substances handled.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) The location of first aid equipment, and first aid measures.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) The correct use of personal protective equipment, its care and maintenance.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Actions to be taken in various emergencies.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Evacuation drills and simulated emergencies are to be comprised in the training.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.8.3 Contractors	Contractors on the premises must be trained in:				
	(a) Safety rules of the installation, including any restrictions on movement, access, activities and the use of personal protective equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Conditions and obligations associated with work permits and confined space entry permits.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Hazards likely to be encountered, including any materials stored or handled on site.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Procedures to be followed in the event of an incident.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.8.4 Hygiene	The following directions must be adhered to when handling Dangerous Goods.				

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	(a) Where Dangerous Goods are kept all food and smoking to be prohibited.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Wash hands after handling Dangerous Goods, before eating, drinking or using the toilet and after work.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Injuries involving Dangerous Goods must be addressed immediately.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Signs stating the above requirements must be displayed in the work area.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.9 Personal Protective Equipment					
7.9.1 General	In areas where packaged dangerous goods are kept or handled-				
	(a) All personnel must be provided with adequate personal protective equipment;	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Personal protective equipment must be ready for use and located in designated locations which are readily identified;	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Personal protective equipment must be regularly maintained.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.9.2 Type of personal protective equipment	The following types of personal protective equipment must be provided as appropriate to the operational requirements:				
	(a) Protective clothing suitable for the specific Dangerous Good complying with AS/NZS 4501.2.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(b) Eye protection selected in accordance with AS/NZS 1337.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Protective gloves complying with AS/NZS 2161.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Safety helmets complying with AS/NZS 1801 and selected in accordance with AS/NZS 1800.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Safety footwear complying AS/NZS 2210.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Respirators having appropriate filters, complying with AS/NZS 1716 and selected, used and maintained in accordance with AS/NZS 1715. NOTE: MSDSs may provide further information on suitable protective equipment	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.9.3 Care and maintenance of personal protective equipment	All personal protective equipment to be kept separate from normal clothing and maintained as follows:				
	(a) After use all protective equipment to be maintained and cleaned in accordance with manufacturer's instructions and specific to material exposed to.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Safety helmets to be maintained in accordance with AS/NZS 1800.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(c) Self contained breathing apparatus to be maintained in accordance with AS/NZS 1715.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
7.10 First Aid	First aid station must be provided in a clean area. First aid kit and MSDS must be provided. It is recommended that:				
	(a) A minimum of one person is to be trained in first aid; and	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) A list to be provided identifying personnel trained in first aid to be provided on notice boards.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
Section 8 Emergency Management					
8.2 Planning for emergencies					
8.2.1 Consideration in designing premises	Design and layout of the facility is to consider the likelihood of accidents occurring due to the proposed layout, items to consider include:				
	(a) Sufficient space between bund walls, storage areas and other structures which will allow access for maintenance staff during emergencies.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) A means of reducing emission of vapours to the atmosphere.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Alarms to be connected to and monitored by the Fire brigade or monitoring services.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Water supplies.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(e) Fire protection equipment.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Means of evacuation and assembly points.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(g) Protection of personnel responding to emergency.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(h) Access routes for fire brigade appliances.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(i) Containment of leaks, spills and run off fire fighting water.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(j) Location of emergency plans and safety information.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Where required the fire brigade should be consulted regarding the above matters.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
8.2.2 Emergency plan					
8.2.2.1 General	A detailed emergency plan must be prepared which details the actions to be undertaken for various emergencies that could occur on site. The relevant authorities and emergency services should be consulted. The emergency plan should consider:	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(a) The likelihood and potential for emergencies such as fire, explosion, earthquake, reaction or release of dangerous goods;	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(b) The size and complexity of the installation; and	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Be regularly appraised and updated (see Clause 8.2.2.4)	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	All personnel should be familiar with the procedures via training or the induction process.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	The emergency services may require a copy of the emergency plan to be kept at the site entrance. NOTE: Recommended documents containing guidelines on the preparation of emergency plans are listed in Appendix F of the Standard.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
8.2.2.2 Premises emergency plan	Items of information to be provided on a premise emergency plan should include:				
	(a) Actions to be undertaken in an emergency. These actions should include evacuation procedures, alarm activation, shutdown procedures, etc.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) List of emergency services contact numbers, when to contact them and the information that they may require such as address, etc.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Evacuation procedures and the implementation of a warden system.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(d) Location of nominated assembly areas which should be away from the incident area and not obstructing the actions of the emergency services.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Training required for personnel carrying out the plan.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Locations of MSDS.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	The emergency plan shall be reviewed and updated regularly.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
8.2.2.3 Plan for use by emergency services	The fire brigade may require a second emergency plan to be prepared which considers surrounding area emergency services assisting. Advice from the fire brigade should be requested regarding the location of this second plan. NOTE: The information to be provided for the emergency services in this emergency plan is described in Appendix G of the Standard.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
8.2.2.4 Review of emergency plan	The emergency plan should be regularly updated or revised whenever the following situations occur:				
	(a) A new item of Dangerous Goods is introduced.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(b) Quantities of Dangerous Goods stored on site change.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Alterations to the way the Dangerous Goods are stored.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Risk levels change due to changes in processes or procedures.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Updated information is provided from manufacturers of hazardous substances and Dangerous Goods.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Issues are found via real incidents or training.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	The plan shall be reviewed and revised periodically.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
8.3 Manifest	A manifest should be provided and maintained in accordance with local regulations.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
8.4 Placarding	Stores shall be placarded in accordance with Clause 7.4.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
8.5 Management of Leaks and Spills					

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant NC = Non Compliant or Unassessable N/A = Not Applicable					
8.5.1 General	Leaks and spills should be minimised as much as possible. In the event a leak or spill occurs clean up actions should be undertaken immediately. Leaked or spilled dangerous goods shall be kept and disposed of in accordance with Section 10	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
8.5.2 Clean up materials and equipment	In order to deals with leaks and spills, clean up equipment, chemicals for neutralising or decontaminating spills, and absorbent materials shall be maintained at every premises on which dangerous goods are kept or handled. Sufficient neutraliser should be available to treat the contents of the largest container stored. The following is a typical list of such materials and equipment:	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Adequate quantities of absorbent material, e.g. sand, fuller's earth or suitable proprietary substances.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Calcium hydroxide (hydrated lime), for use on acidic spills.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Sodium bisulphate, for use with alkaline spills.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Sodium carbonate (soda ash), for use on acidic spills.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Crushed calcium carbonate (limestone), for use on acidic spills.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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	A sufficient number of resealable waste recovery containers, e.g. drums, made of materials compatible with the substance being kept and appropriately marked for emergency use only. NOTE: A means of labelling the recovery containers should also be provided.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Portable pumps and decanting equipment. NOTE: Petrol-powered pumps are unsuitable for use with flammable liquids,	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Non sparking shovel where flammable liquids are stored.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Yard brooms	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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8.5.3 Actions for dealing with leaks and spills	At every occurrence of a leak or spill the emergency plan shall be implemented and consideration shall be given to notifying the emergency services. NOTE: Emergency services should be notified when – (a) The dangerous goods have spread, or have the potential to spread, beyond the boundary of the installation; (b) It is beyond the resources of the occupier to clean up the spill or leak effectively and safely; (c) The protective equipment is inadequate for dealing with the situation; (d) Staff are not experienced in dealing with the situation; or (e) Staff and the public are; or could be placed at risk. Leaking packages should be positioned in a manner to stop the leak and moved to a safe location. The package should be placed in a suitable container or transferred to a clean packaging with is clearly labelled. Small spills should be collected, absorbed or diluted as necessary. The absorbent shall be disposed of in a suitable waste container.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
Section 9 Fire protection					
9.2 Fire hazards	Dangerous goods can present the following hazards in a fire:				
	Can give off flammable, toxic or corrosive vapours, fumes or smoke. Flammables mixtures in the air can also be resulted.				
	Flammable or oxidising dangerous goods can intensify or spread the fire.				
	Spilled substances and contaminated debris could be toxic to the environment.				

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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	Containers can rupture violently, or become projectiles when heated.				
	Some substances react violently with water or other chemicals causing the substances to be sprayed over a wide area.				
	The mixing of spilt or fire affected substances have unknown properties and consequences.				
	Contaminated water run off from fire can present a hazard to persons and the environment.				
9.3 Fire protection measures					
9.3.1 General	Fire protection requirements shall be obtained from, and implemented in conjunction with the fire authority and other regulatory authorities wherever possible. The fire protection system in a dangerous goods store should provide firefighting equipment with the capacity to-				
	(a) Quickly control and extinguish any fire that might occur in the store; and				
	(b) Provide fire protection, to prevent the dangerous goods from being affected by any nearby fire.				
9.3.2 Design	The BCA and relevant Fire Brigade requirements must be considered. In addition to the BCA requirements other items to consider are:				
	(a) total floor area and type of construction of the store	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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	(b) Quantity, classes and packing groups of dangerous goods being kept	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Storage and configuration, height and density.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Location and type of the store; and	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Goods or activities which may increase the fuel load.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	Where high rack storage is provided, the firefighting system shall be designed to provide adequate protection for all dangerous goods at all racks of storage.	☐	☒	☐	Insufficient information provided
	The fire protections systems specified in this Section may be either independent or where permitted integrated with other fire protection systems on the premises.	☐	☒	☐	Insufficient information provided
	Any other fire protection facilities that are already available on site in respect to BCA, or for other reasons not related to the dangerous goods store, may be taken into account when determining equipment requirements, provided that such equipment complies with the requirements of this Section and the relevant Australian Standards.	☐	☒	☐	Insufficient information provided
9.3.3 Heat Protection	Stores of dangerous goods shall be adequately protected from adjacent potential fire exposures, examples are:	☐	☐	☐	Insufficient information provided
	(a) Sufficient separation from the potential heat source to render thermal protection unnecessary.	☐	☐	☐	Insufficient information provided

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(b) The use of radiation barriers.	☐	☐	☐	Insufficient information provided
	(c) The use of cooling water, which may be by means of	☐	☐	☐	Insufficient information provided
	(i) Fixed or traversing monitors;	☐	☐	☐	Insufficient information provided
	(ii) Fixed sprinklers or deluge systems;	☐	☐	☐	Insufficient information provided
	(iii) Fire hydrants equipped with hoses; or	☐	☐	☐	Insufficient information provided
	(iv) Fire hose reels.	☐	☐	☐	Insufficient information provided
9.3.4 Compatibility	The Fire Protection equipment shall be designed so the equipment is appropriate to the type and class of Dangerous Goods stored. All firefighting materials and equipment shall be compatible with that of the local fire authority at all essential interfaces. Appropriate extinguishing media needs to be selected in consultation with the local fire authority. NOTE: Australia is signatory to an international agreement under which halon extinguishers are being progressively taken out of service. Portable halon fire extinguishers for general purposes were prohibited after 1995 and fixed halon suppression systems are subject to controls administered by state environmental authorities.	☐	☐	☐	Insufficient information provided
9.3.5 Location	Fire fighting equipment in addition to BCA requirements must be stored adjacent to exit doors or when in large areas along exit routes. All equipment should be readily visible.	☐	☐	☐	Insufficient information provided

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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9.3.6 Weather protection	Fire fighting equipment should be sheltered or enclosed if located in outside or extreme areas.	☐	☐	☒	
9.3.7 Labelling of firefighting equipment	Fire fighting equipment shall be labelled as required by the relevant Australian Standard.	☒	☐	☐	Insufficient information provided
9.3.8 Fixed fire protection and detection systems	All fixed fire protection and detection systems must be: NOTE: Reliance on intermittent or external observation e.g. by security guards is unsatisfactory.				
	(a) In accordance with relevant Australian Standards listed in Table 9.1 of the Standard; and	☐	☐	☐	Insufficient information provided
	(b) Must activate without delay.	☐	☐	☐	Insufficient information provided
9.3.9 Fire alarm systems	If a fire alarm system is provided it is to comply with the AS 1670 series and AS 1603.5 as well are the following requirements-				
	(a) Manual Call Points must be provided in safe locations near work areas	☐	☐	☐	Insufficient information provided
	(b) Evacuation and alert tones must be clearly distinguishable; and	☐	☐	☐	Insufficient information provided
	(c) A back up electricity supply must be provided to the alarm system.	☐	☐	☐	Insufficient information provided
9.4 Portable fire extinguishers					
9.4.1 General	Fire extinguishers shall be provided as per AS 2444, adjacent to any relevant risk (see clause 9.3.5) and relevant Fire brigade requirements. Fire extinguishers shall comply with appropriate Australian Standard as listed in Table 9.2 of this Standard.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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9.4.2 Special risks	Consideration must be given to the Dangerous Goods being stored and the electrical equipment.				
9.4.3 Maintenance	All fire extinguishers to be maintained in accordance with AS 1851.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
9.4.4 Limitations	Fire extinguishers shall be selected with the following criteria in mind:				
	(a) Its suitability for use with the class of dangerous goods on which it is intended to be used on.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) With regard to indoor electrical equipment such as electrical equipment, dry powder type fire extinguishers are preferred.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Where powder type and foam extinguishers are liable to be used together in an emergency they shall be compatible.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(d) Alcohol compatible foam shall be used for alcohol and other polar liquids.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
9.5 Fire Hose Reels	Where required fire hose reels shall comply with AS/NZS 1221, AS 2441 and the following requirements:				
	(a) Fire hose reels must be provided as per BCA and relevant Fire Brigade requirements.	☒	☐	☐	
	(b) Fire hose reels must be provided to serve every storey of a building where the floor area used to store dangerous goods exceeds 300m^2.	☒	☐	☐	
	(c) The stream from a fire hose reel must be able to reach every part of the floor area including the top of rack storage.	☒	☐	☐	

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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	(d) Sufficient fire hose reels shall be provided so that no point is beyond an arc formed by a radius of two thirds of the length of hose, measured from the hose concerned.	☒	☐	☐	
	(e) If foam fire hose reels are utilised they must be able to produce foam as per manufacturer's specifications.	☒	☐	☐	
	(f) Hose reel shall be maintained to AS/NZS 1221 NOTE: Hose reels systems should take into consideration tenancy layouts and non penetrable barriers.	☒	☐	☐	
	In some instances hydrant hose systems may be substituted for fire hose reels if there is trained staff capable of using the equipment.				
9.6 Fire hydrants	Where fire hydrants are installed they are to comply with AS 2419.1 and be compatible with requirements of the local fire services. Hydrants may be equipped with hose, branch and nozzle at the discretion of the relevant fire authority.	☐	☐	☐	Insufficient information provided
9.7 Monitors	Where monitors are used they shall be installed and maintained in accordance with the manufacturers specifications. The following also applies:	☐	☐	☒	
	Monitors must be capable of applying the required water density and quantity at the store. 50% more water must be provided above the calculated quantity to take into account adverse wind conditions	☐	☐	☒	
	Adjustable monitors must be operable in a safe remote location.	☐	☐	☒	
	Fixed monitors should be provided with adjustable constant flow and fog to straight stream nozzles so that the facility is suitably protected, but not damaged by a solid stream at shorter ranges.	☐	☐	☒	

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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	Monitors should be 15-30m from the facility being protected. If closer radiant heat protection should be considered.	☐	☐	☒	
	Monitors may be required to have foam making capabilities. NOTE: In still air and at a nozzle pressure of approx 690kPa, the maximum horizontal straight stream range of a 1900 L/min monitor is about 45m and the horizontal reach to the centre of the pattern is approximately 3m.	☐	☐	☒	
9.8 Automatic sprinkler systems	Where fire sprinkler systems are required, they shall be installed in accordance with AS 2118 and maintained in accordance with AS 1851. Such systems to comprise-				
	Individual-actuation sprinklers;				
	Deluge sprinklers;				
	Foam sprinklers; or				
	A combination of any of the above.				
9.9 Water supply	Where a fire service water supply is required, it shall comply with the requirements of the relevant Australian Standards for the fire protection equipment installed.	☐	☐	☐	Insufficient information provided
9.10 Retention of fire water	A plan to ensure run off fire fighting water does not enter the surface or ground water should be implemented. Where liquids are the principal firefighting and cooling media, the provision of fire water retention facilities, with such capacity as to contain any water that may be generated, shall be determined in consultation with emergency services (in terms of quantity) and regulatory requirements.	☐	☐	☐	Insufficient information provided

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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9.11 Fire protection requirements	Fire protection equipment and systems shall be provided in accordance with the requirements of the Fire Authority, any relevant Australian Standard and Table 9.3 and 9.4 of this Standard as appropriate to the dangerous goods being stored. Fire protection equipment shall be tested and maintained in accordance with the relevant Australian Standard and records of testing shall be kept.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
Section 10 Waste Storage and Disposal					
10.2 Storage of wastes	Where Dangerous Goods are stored, a facility must be provided for the storage of wastes and items contaminated with Dangerous Goods. Wastes that still meet the definition of dangerous goods shall, pending their disposal, be kept in accordance with all of the relevant requirements of this Standard.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
10.3 Waste management	Assessments are to be made on the disposal or recycling of the following goods:				
	(a) Goods that have been stored for extended periods of time where the contents may be deteriorated.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Wastes and residues from spills and leaks.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Unidentifiable goods.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

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	(d) Contaminated clothing.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Goods that are in excess of possible use or demand.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
10.4 Methods of disposal	Where goods are to be disposed consultation with the local waste disposal authority, the environment protection authority and the health department must occur to determine the most appropriate method. Advice from manufacturers and other outside sources may be beneficial.				
Section 4 – Transit Storage (Australia Only)					
4.2 Delineation of transit storage areas	Areas used for transit storage of dangerous goods of mixed classes shall be deemed to be separate areas if apart from each other from other storage areas by at least 15m				
4.3 Requirements for transit storage	The following requirements apply to transit storage of packages of mixed classes:				
	(a) The aggregate quantity of dangerous goods held in each transit storage area shall not exceed 200t.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(b) Except when in freight containers, the maximum quantity of each pallet bank or store in a transit storage area shall not exceed 25t. Such pallets or stores shall be at least 5m apart.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(c) Parked road vehicles loaded with dangerous goods shall be separated from any other loaded vehicles by at least 3m, and from any other dangerous goods stores by at least 5m.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
C = Compliant	NC = Non Compliant or Unassessable				N/A = Not Applicable
	(d) Where dangerous goods of Class 5 are in transit storage, any other class of dangerous goods shall be separated from them by a minimum of 5m.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(e) Where dangerous goods of Classes, Divisions or subsidiary risks 6.1 or 8 are in transit storage, all foodstuffs shall be separated from them by a minimum distance of 3m, unless an approved segregation device is used.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(f) Where dangerous goods of Classes, Divisions or Subsidiary Risks 2.1, 3, 4.1, 4.2, 4.3, 5.1 or 5.2 are in transit storage, there shall be no fixed ignition sources within 1m of the store (see Clause 7.2.9).	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(g) At least one portable fire extinguisher, suitable for use with the dangerous goods being stored and having a rating of not less than 60 B(E), shall be provided in each 150m^2 of the store of thereof. For fire protection of dangerous goods in freight containers, Section 9 applies.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(h) Freight containers or tank containers containing dangerous goods in transit storage area shall-				
	(i) Not be stacked more than two containers high and two containers deep;	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(ii) Where stacked two containers deep, be provided with access to both sides of each stack;	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(iii) Not be in the same vertical stack as any container of other Classes of dangerous goods; and	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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	(iv) Be separated from containers of incompatible goods by at least 3m.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(i) Access and escape routes shall be clearly identified and kept clear at all times	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(j) The spillage catchment and clean-up facilities of the site shall be capable of handling at least 100% of the capacity of the largest container or package in the area. NOTE: In order to facilitate the management of emergencies, it is recommended that compound capacities be about 10% greater than the minimum volumes specified above.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(k) Specific facilities, which may include a designated area, shall be provided at the site for dealing with containers that are-				
	(i) Leaking;	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(ii) Damaged and likely to leak as a result of such damage; or	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(iii) Awaiting disposal NOTE: Packages of dangerous goods that are leaking, or are impaired may spill or leak, should not be loaded on a vehicle unless a waste-recovery container as described in Clause 8.5.2(f).	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(l) Except in emergencies, dangerous goods shall not be transferred between containers or be decanted when in transit storage area.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.

Clause	3833:2007 Requirements	C	NC	N/A	Comments/Notes
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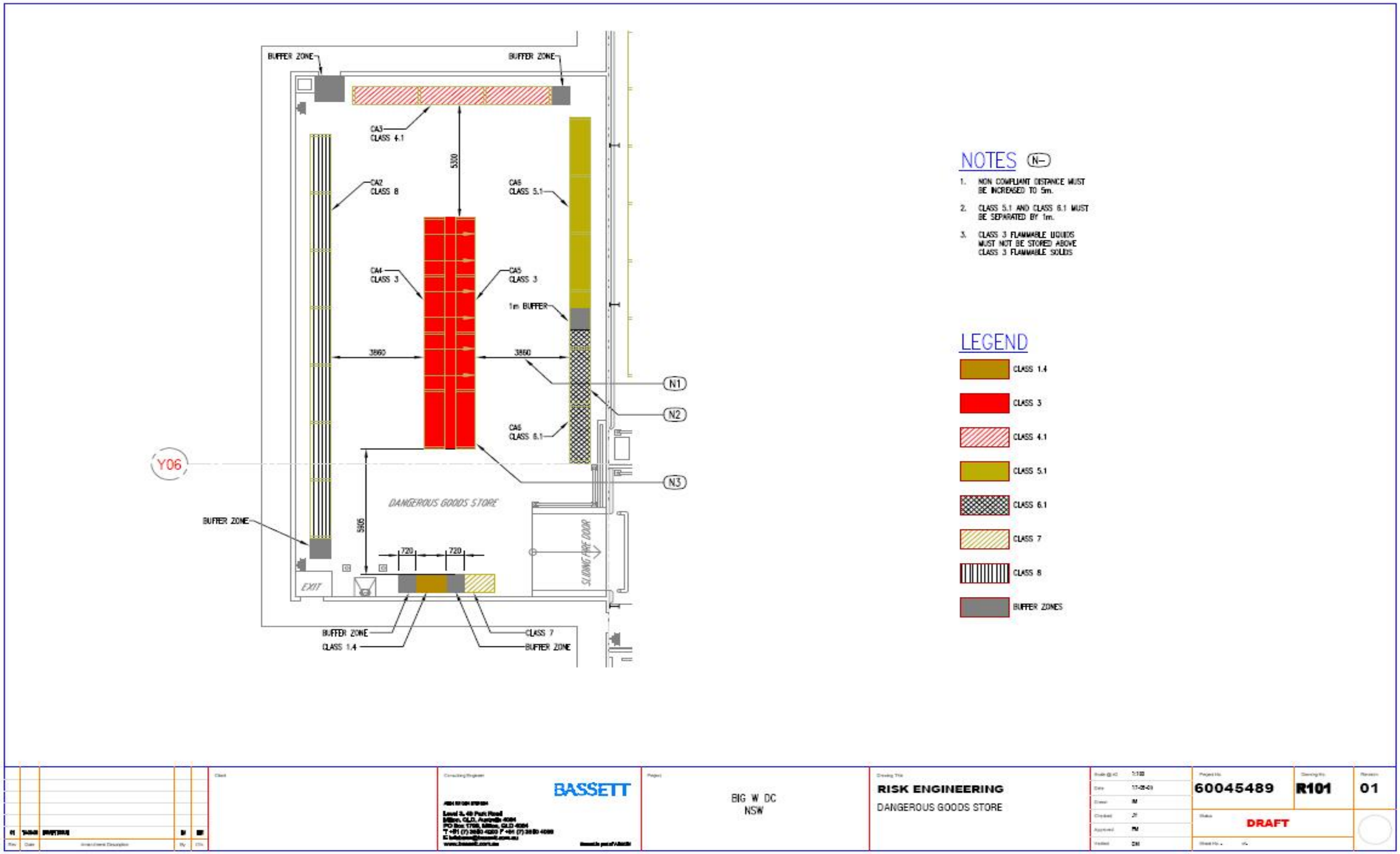
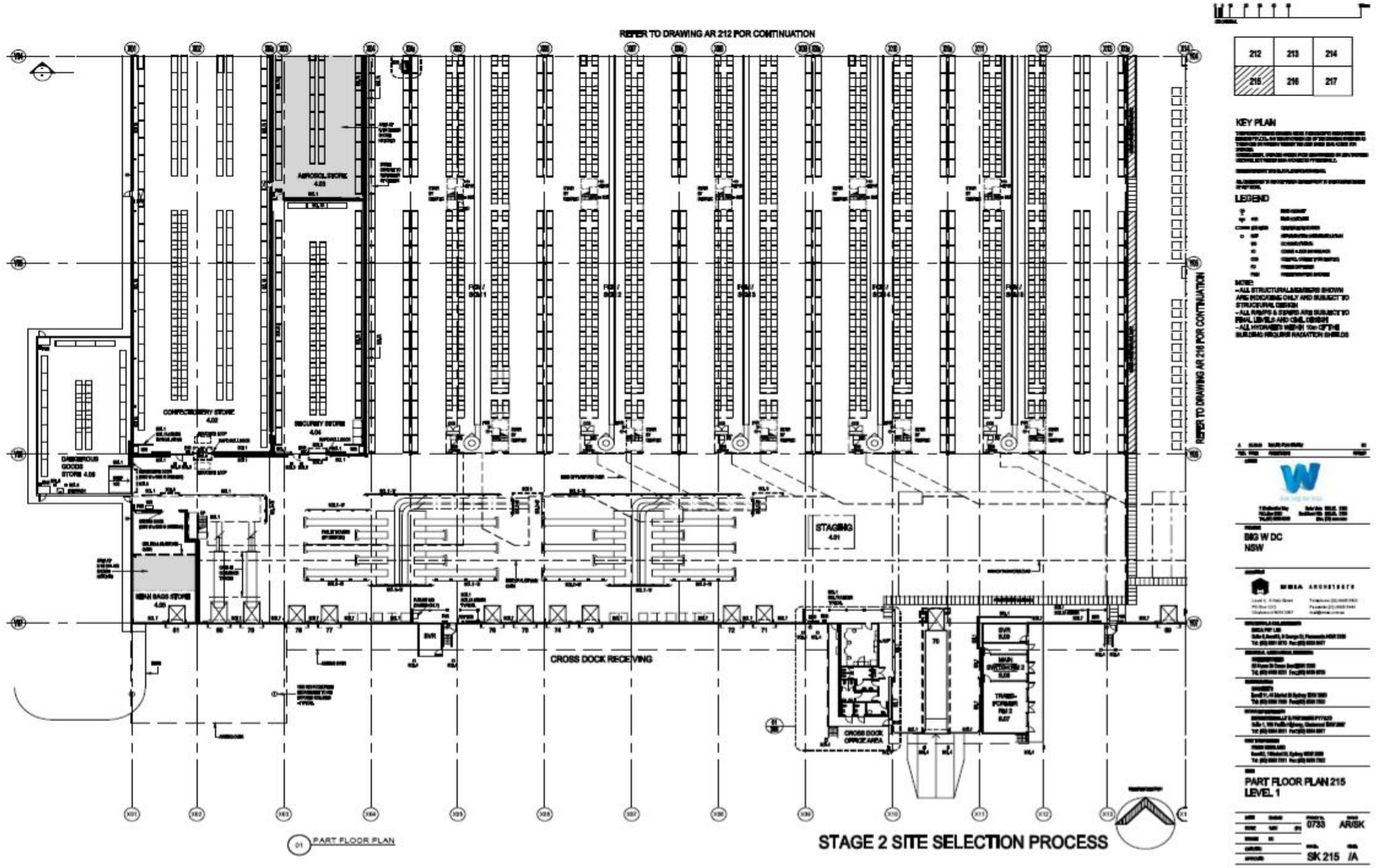
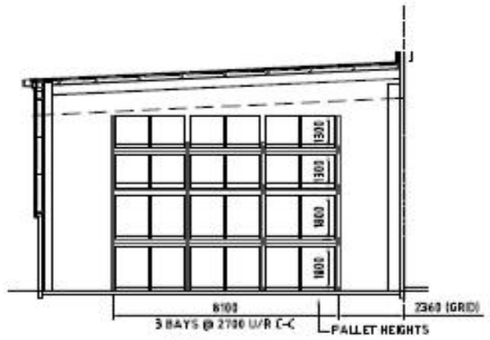
	(m) Where relevant, and in emergencies, appropriate protective equipment (see Clause 7.9) shall be provided and used.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
	(n) All dangerous goods and freight containers shall be labelled in accordance with the ADG Code.	☐	☐	☐	This risk needs to be addressed by Woolworths prior to use as it forms part of the site specific Safe Work Methodology.
4.4 Separation distances for transit storage	Areas for the transit storage of dangerous goods of mixed classes shall be separated from protected places, boundaries, public places and public roads by the distances given in Clause 6.2				

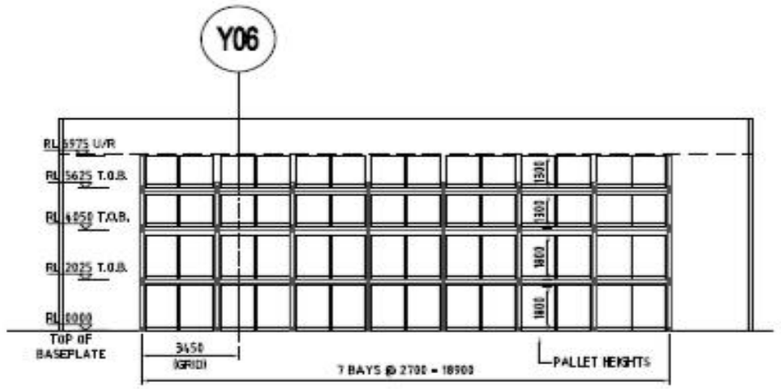
Appendix D Dangerous Goods Drawings



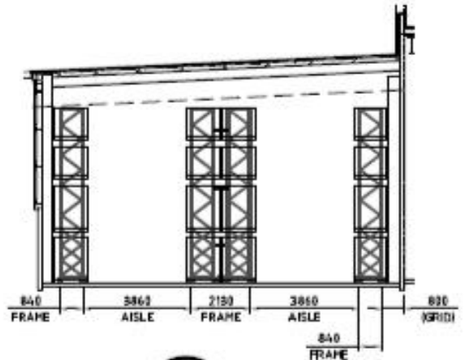

REFER TO DRAWING AR 212 FOR CONTINUATION
REFER TO DRAWING AR 216 FOR CONTINUATION
CROSS DOCK RECEIVING
STAGING
CROSS DOCK OFFICE AREA
212
213
214
215
216
217
KEY PLAN
LEGEND
BIG W DC
NSW
PART FLOOR PLAN 215
LEVEL 1
0733
ARISK
SK 215
/A
01 PART FLOOR PLAN
STAGE 2 SITE SELECTION PROCESS



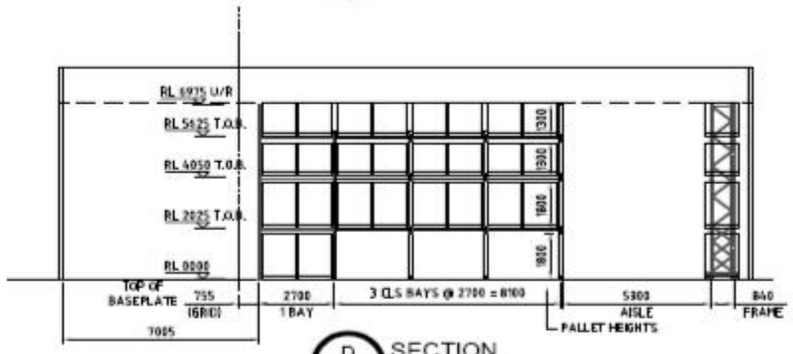
A SECTION



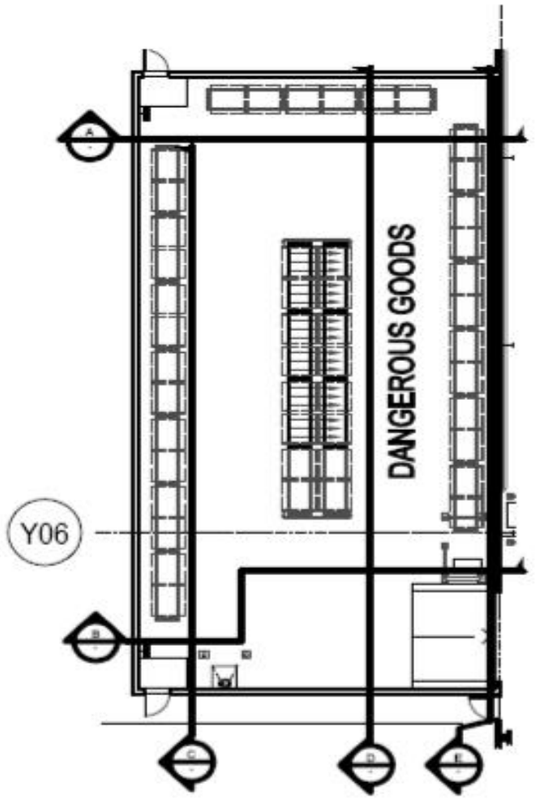
C SECTION



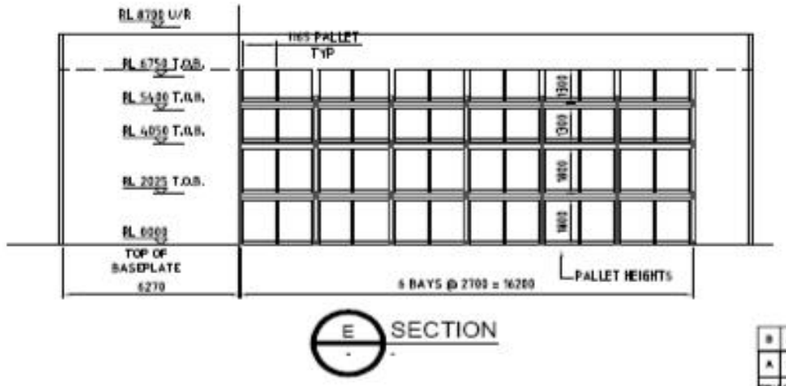
B SECTION



D SECTION



PLAN VIEW
L010



E SECTION

REFERENCE DRAWINGS:
L010 – ELEVATION INDICATIONS

APPROVAL PRINT

APPROVED ☐
APPROVED AS NOTED ☐
NOT APPROVED-RESUBMIT ☐

SIGNED..... / /
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APPROVAL CONSTITUTES CLIENT AGREEMENT THAT OVERALL DIMENSIONS & CLEARANCES MEET OPERATIONAL REQUIREMENTS. DETAIL DIMENSIONS MAY CHANGE AS THEY ARE SUBJECT TO BUILDING DESIGN CO-ORDINATION & DEMATIC FINAL ENGINEERING.

REV	DRN	APP'D	DESCRIPTION	DATE	DRAWN
B	MPE	MHA	FACP REVISED - ISSUED FOR PPR PATH CAD XCAN - 19/06/08	19/06/08	DYE
A	MPE	MHA	ISSUED FOR APPROVAL	18/06/08	MPE

DEMATIC
BIG W – NSW DC
RACKING LAYOUT
DANGEROUS GOODS

DRAWN	MPE	07/05/2008
CHKD	MPE	19/06/08
APPD	MHA	19/06/08

SIZE A1 SCALE 1:100
DRAWING P00887L205
REV B

Appendix E: Schedule 5

1 1 or the purposes of the Table below, the placarding quantity or manifest quantity is equal to the total of the quantities determined in accordance with items 2 and 3.

2 In relation to:

(a) packaged dangerous goods in a container that are:
(i) non-liquid dangerous goods (other than Class 2 dangerous goods)—the quantity is to be determined by the net mass in kilograms of the goods in the container, and
(ii) liquid dangerous goods (other than Class 2 dangerous goods)—the quantity is to be determined by the net capacity of the container, and
(iii) Class 2 dangerous goods—the quantity is to be determined by the water capacity of the container, and

(b) dangerous goods in bulk that are:
(i) non-liquid dangerous goods (other than Class 2 dangerous goods)—the quantity is to be determined by the mass in kilograms that the container is designed to hold, and
(ii) liquid dangerous goods (other than Class 2 dangerous goods)—the quantity is to be determined by the design capacity of the container in litres, and
(iii) Class 2 dangerous goods—the quantity is to be determined by the water capacity of the container, and
(iv) solid dangerous goods not in a container—the quantity is to be determined by the undivided mass in kilograms, and

(c) dangerous goods that are articles or things—the quantity is to be determined by the net quantity of that part of the article or thing that is in itself dangerous goods.

3 In the Table below, *kg or L* means, where this combination of letters immediately follows numbers, the combined total of:

(a) the number of kilograms of non-liquid dangerous goods (other than Class 2 dangerous goods), and
(b) the number of litres of liquid dangerous goods (other than Class 2 dangerous goods), and
(c) the water capacity of containers of Class 2 dangerous goods,
in accordance with item 2.

4 For the purposes of the Table below, *separately*, in relation to the storage or handling of dangerous goods separately from other dangerous goods, means the physical separation of the dangerous goods from other dangerous goods, by either distance or a physical barrier

Table 7 Dangerous goods quantities

Group	Description of dangerous goods	Packing Group	Placarding quantity	Manifest quantity
1	Class 2			
	Class 2.1	Not Applicable	500 L	5,000 L
	Class 2.2 Subsidiary Risk 5.1	Not Applicable	2,000 L	10,000 L
	Other Class 2.2	Not Applicable	5,000 L	10,000 L
	Class 2.3	Not Applicable	50 L	500 L
	Aerosols	Not Applicable	5,000 L	10,000 L
	Cryogenic Fluids	Not Applicable	1,000 L	10,000 L

Group	Description of dangerous goods	Packing Group	Placarding quantity	Manifest quantity
2	Class 3, 4.1, 4.2, 4.3, 5.1, 5.2, 6.1 or 8	I	50 kg or L	500 kg or L
		II	250 kg or L	2,500 kg or L
		III	1,000 kg or L	10,000 kg or L
		Mixed Packing Groups in a single Class with the quantity of each Packing Group below the specified quantity for the Packing Group.	1,000 kg or L	10,000 kg or L
3	Class 9	II	1,000 kg or L	10,000 kg or L
		III	5,000 kg or L	10,000 kg or L
		Mixed Packing Groups in Class 9 with the quantity of each Packing Group below the specified quantity for the Packing Group.	5,000 kg or L	10,000 kg or L
4	Mixed Classes of dangerous goods where none of the Classes, types or Packing Groups (if any) present exceeds the quantities specified for the relevant quantity in Item 1, 2 or 3 of this Table.	Not Applicable	5,000 kg or L—The quantity applies only if the placarding quantity for an individual Class that is present is 5,000 kg or L. 2,000 kg or L—The quantity applies only if the placarding quantity for all of the Classes present is 2,000 kg or L or less.	10,000 kg or L
5	C1 combustible liquids stored and handled with fire risk dangerous goods where none of the Classes, types or Packing Groups (if any) present exceeds the relevant quantities in Item 1, 2 or 3 of this Table.	Not Applicable	1,000 kg or L	10,000 kg or L
6	Goods too dangerous to be transported that are not kept in a laboratory.	Not Applicable	Any quantity	Any quantity
7	C1 combustible liquids in bulk stored and handled separately from other dangerous goods.	Not Applicable	10,000 L	100,000 L
	C1 combustible liquids stored and handled in packages separately from other dangerous goods.	Not Applicable	50,000 L	100,000 L
	C1 combustible liquids in bulk and in packages stored and handled separately from other dangerous goods provided the quantity in bulk is 10,000 L or less.	Not Applicable	50,000 L	100,000 L

Note.
For the purposes of item 3 in the Table, where Class 9 dangerous goods do not have a Packing Group assigned to them, they are deemed to be assigned to Packing Group III.

Appendix F Quantities of Dangerous Goods Inventory Store

Item Code	Product Description	Class	Packaging Group	Un number	Order Multiplier (No. of product)	Order Multiplier weight	Stock on hand	Total weight of stock on hand
460286	PARTY SPARKL	1.4		337	36	0.36	42	15.12
1349863	PARTY POPPER	1.4	III	337	12	1	2	2
4216933	REDWIN LOTIO	2			4	8.4	424	3561.6
739184	BRUT A/SHV L	3	II	1266	6	1.5	56	84
739191	BRUT SPLASH-	3	II	1266	6	1.13	50	56.5
2258416	AEROGARD LOW	3	II	1170	12	1.9	27	51.3
2509969	MENTHOLATUM	3	III	1170	6	0.78	149	116.22
2829340	LISTERINE M/	3	III	1170	6	6.5	75	487.5
2866239	LISTERINE M/	3			6	6.8	126	856.8
3306475	VICKS COUGH	3	III	1993	6	1.04	18	18.72
3824290	HEAD & SHLDR	3		1940	6	2.4	48	115.2
4000334	GOANNA EUCLY	3	III	1993	6	0.5	109	54.5
4014966	NIVEA A/SHAV	3	II	1266	6	1.5	13	19.5
4089643	H/D DEGREASE	3	III	1300	8	22.14	63	1394.82
4137801	LISTERINE M/	3	III	1170	6	9.3	88	818.4
4159575	VO5/ADV H/SP	3	II	1170	4	0.8	117	93.6
4159605	VO5/ADV GEL	3	II	1170	4	0.5	96	48
4189763	AUSCREEN SPF	3	II	1993	6	0.62	30	18.6
4388869	DOVE MOISTUR	3		1170	6	2	44	88
4790945	CLEAN&CLEAR	3			6	1	53	53
5205523	VOLTAREN EMU	3		1987	8	0.35	14	4.9
5219810	NIVEA AQUACO	3			6	0.95	90	85.5
5274512	TRESEMME HAI	3	III	1170	4	2	95	190
5836635	LYNX R/ON DE	3	III	1266	6	0.5	103	51.5
5836659	LYNX R/ON DE	3	III	1266	6	0.5	61	30.5
5836666	LYNX R/ON DE	3	III	1266	6	0.5	65	32.5
6182694	LYNX R/ON DE	3		1268	6	0.5	20	10
6183332	BOSISTO ECLY	3		1993	4	1	127	127
6226619	TYRE SHINE 4	3	II	1993	12	5	111	555
6311179	WITEOUT SHK	3		1268	6	0.2	12	2.4
6374020	L/PAPER BTLR	3		1993	12	0.5	39	19.5
6460587	NEUTR SPOT G	3			6	0.2	34	6.8
6466749	WET ONES HAN	3		1170	6	1	56	56
6466763	WET ONES HAN	3	III	1266	6	0.5	123	61.5
6477226	DETTOL HAND	3			12	1	32	32
6477233	DETTOL HAND	3		1170	6	1.5	17	25.5
6713300	SCHL PERFECT	3			6	0.5	20	10
6713409	EUREKA ECLYP	3			4	1.3	190	247
6713416	EUREKA T/TRE	3			6	1.8	59	106.2
406376	AEROGUARD TR	3.1	II	1170	12	0.78	27	21.06
1564730	SHOE POLISH	4	II	1325	6	0.45	19	8.55
316002	SHOE POLISH	4.1	II	1325	6	0.44	29	12.76
316040	SHOE POLISH	4.1	II	1325	6	0.44	39	17.16
319768	REDHEAD 10PK	4.1	III	1944	12	1.2	17	20.4
1417760	MOTHBALLS PK	4.1	III	1334	12	2	83	166
2085470	O/SPICE WIDE	4.1	II	3175	6	0.7	36	25.2

5289011	GOANNA HEAT	4.1	II	1325	6	0.8	133	106.4
3998106	DECORE BLNDE	5.1			3	0.48	120	57.6
3998113	DECORE BLNDE	5.1			3	0.48	56	26.88
3998137	DECORE BLNDE	5.1			3	0.54	67	36.18
4558781	NICE N EASY	5.1			3	0.7	14	9.8
4558910	NICE N EASY	5.1			3	0.7	20	14
4558989	NICE N EASY	5.1			3	0.7	61	42.7
4999164	NICE N EASY	5.1	III	2984	3	0.7	70	49
5251926	NICE N EASY	5.1			3	0.7	5	3.5
5420476	NICE N EASY	5.1	III	2984	2	1.5	36	54
5420513	NICE N EASY	5.1	III	2984	2	1.5	73	109.5
388610	WINDEX TRIGR	6.1			9	7.7	63	485.1
1086706	CLR 750ML	6.1			6	6.43	59	379.37
1155860	EXIT MOULD 5	6.1			9	5.84	107	624.88
1978988	ROUNDUP RTU	6.1			4	13.73	137	1881.01
2199375	ANTEX GRANUL	6.1		2783	6	3	68	204
3030295	1.25 LT CLAR	6.1			6	6	37	222
3120248	ROUNDUP 1 LI	6.1			6	8	183	1464
4051374	SMOKE ALARM	7			6	1	105	105
4088080	SMOKE ALARM	7			6	2.27	90	204.3
1155952	WHITE KING B	8			4	11.5	118	1357
1772142	VEET DEPIL 1	8	III	2810	6	1	75	75
1783452	WHITE KING B	8			4	11.92	206	2455.52
2526256	DRANO CRYST	8	II	1759	8	5	37	185
3089026	FINISH D/WAS	8			12	3.9	55	214.5
5987054	VEET HAIR RE	8	III	1719	5	1	36	36
6175528	HARPIC WHT &	8		3266	12	6.5	61	396.5
6175535	HARPIC WHT &	8			12	5	100	500
6205362	AJAX PROF BA	8			8	4.9	118	578.2
6206345	EASY OFF BAM	8		3266	6	5	106	530
6388263	EASY OFF BAM	8		3264	9	5.5	46	253
202787	BAR'S-BUGS T	9			12	5.22	55	287.1
2258515	MORTEIN SUPE	9			12	1.5	13	19.5
2840895	ALGI BLOCK 1	9			6	7.42	77	571.34
2875170	WASH&WAX A/A	9			6	7	209	1463
3536759	ROUNDUP RTU	9			6	7.5	183	1372.5
3993712	P/CRAFT S/SO	9			8	22.3	39	869.7
4395577	CLAIROL FROS	9			6	1.8	34	61.2
4514473	LISTERINE M/	9			8	4	187	748

Appendix G AS/NZS 3833:2007 Requirements without Dedicated Dangerous Goods Store

AS/NZS 3833:2007[1] does not apply a maximum storage quantity for dangerous goods stored in retail packages in RDC with or without a dedicated Dangerous Goods Storage facility. The following outlines the requirements as detailed in Section 3 of AS/NZS 3833:2007[1] for RDC not provided with a dedicated Dangerous Goods Store. Compliance with these requirements provides an opportunity to eliminate the need for a dedicated Dangerous Goods Storage facility.

9.1.1 Racks and Shelving

1 Structurally sound racks and shelves which do not absorb liquids and are compatible with the dangerous goods being kept shall be provided. Racks and shelves are to be positioned such that they permit ready access to all stock and provide a clear passage. Clear exit paths are to be provided where dangerous goods are kept.

2 Provisions inside the centre must be provided to confine any spill of dangerous goods. This may include the implementation of barriers on shelves which store dangerous goods to ensure that the spill does not spread beyond the shelf of origin.

9.1.2 Segregation

1 Goods which may undergo reaction from contact must be separated

2 Incompatible goods must not be stored horizontally or vertically on the same shelf.

3 Class 6.1 and Class 8 dangerous goods must be stored away from foodstuff, food containers or items for direct human application if not provided in liquid tight containers. If not provided in liquid tight containers, a lateral distance of no less than 1m must be maintained if located on the same shelf or else must be located on separate shelves.

4 Aerosols stored in the RDC must either be stored in a cage or dispersed throughout the centre. All aerosols must be stored undercover and protected from exposure to, direct sunlight and the effects of the weather. Aerosols must be kept a minimum of 3m away from any heat or ignition source. In addition, aerosols must be located on a stable shelf which reduces the likelihood of a stack collapse and damage to containers.

9.1.3 Security

1 The RDC shall be restricted to authorised personnel only. Any additional regulatory requirements for Dangerous Goods stored also apply.

9.1.4 Housekeeping

1 A high level of housekeeping must be maintained in the RDC.

2 Stock integrity should be monitored. Old material which could deteriorate and become a hazard must be disposed of.

3 Aisles must be kept clear at all times.

4 Liquids and powders must not to be stored together. Liquids in glass bottles are to be stored at lower levels below powders and solids.

5 Packages should be stored such that a package leak will not affect other substances. To minimize the risk of leaks, packages must be handled with care at all times.

6 All packages to be regularly inspected to ensure package leaks are minimised. If signs of spill, leak or deterioration are observed the package is to be rendered safe.

7 Leaks or spills should be dealt with in accordance with the Emergency Procedures.

8 Labels to remain on empty containers until decontaminated at which time the labels to be

removed.

9 Packages must not be kept in direct contact with the floor. Pallets or low shelves to be used.

10 Used packages which cannot be recycled must be disposed of by means of an approved method via consultation with the local waste disposal authority, environmental protection authority and health department. Waste storage and disposal requirements are specified later in this report.

9.1.5 Lighting and Ventilation

1 Adequate natural ventilation or mechanical ventilation must be provided[1].

2 Adequate lighting must be provided through out the RDC, in addition where flammable goods are stored AS/NZS 2430.3:1986[5] should be referenced.

9.1.6 Construction of facility

1 The RDC should be constructed in accordance with the Building Code of Australia (BCA).

2 Where large quantities of Class 2.1 Dangerous Goods are kept, any common walls shared between areas where Class 2.1 flammable liquids, solids or aerosols are stored and other adjoining protected areas are required to achieve a fire rating of at least 120/120/120. If the common wall is between the RDC and another block a fire rating of at least 60/60/60 is required.

3 Where vehicles such as forklifts traverse bollards and crash barriers are to be provided on shelves to reduce the risk of goods and shelves being damaged.

4 A dedicated area inside the RDC but isolated from the remaining areas must be provided for the products of any solid and/or liquid dangerous goods spill.

9.1.7 Fire Protection

1 The BCA and relevant Fire Brigade requirements must be considered. Other items to consider are total floor area, construction of the store, quantity and classes of dangerous goods being kept, location of the store and fuel load.

2 The Fire Protection equipment shall be designed so it is appropriate to the type and class of dangerous goods stored. The Fire protection measures implemented must be able to quickly control or extinguish a fire and prevent a fire nearby from affecting the store.

3 Fire fighting equipment, in addition to BCA requirements, must be stored adjacent to exit doors or when in large areas, along exit routes. All equipment should be readily visible.

4 Fire fighting equipment shall be labelled as required by the relevant Australian Standard and should be sheltered or enclosed if located in outside or extreme areas.

5 All fixed fire protection and detection systems must be in accordance with relevant Australian Standards and must activate without delay.

6 If a fire alarm system is provided, Manual Call Points must be provided in safe locations near work areas. Evacuation and alert tones must be clearly distinguishable and a back up electricity supply must be provided.

7 Fire extinguishers shall be provided as per BCA and relevant Fire brigade requirements. Consideration must be given to the Dangerous Goods being stored and the electrical equipment.

8 Fire hose reels must be provided as per BCA and relevant Fire Brigade requirements. Fire hose reels must be provided to serve every storey of a building where the floor area used to store dangerous goods exceeds 300m^2. The stream from a fire hose reel must be able to reach every part of the floor area including the top of rack storage.

9 If foam fire hose reels are utilised they must be able to produce foam as per manufacturer's specifications.

10 Where monitors are used they must be capable of applying the required water density and quantity at the store. 50% more water must be provided above the calculated quantity to take

into account adverse wind conditions. Adjustable monitors must be operable in a safe remote location. Fixed monitors should be provided with adjustable constant flow and fog to straight stream nozzles. Monitors should be 15-30m from the facility being protected. If closer, radiant heat protection should be considered.

11 Fire protection systems must be maintained to AS 1851:2005[6].

12 An environmental management plan to ensure run off fire fighting water does not enter the surface or ground water should be implemented.

13 The following table specifies the fire protection required for package stores containing classes, divisions or sub risks Class 3, Class 4 or Class 5.1, aerosols or combustible liquids. These requirements are in addition to any BCA requirements.

Table 4 - Fire Protection for Stores[2]

Store Capacity (kg or L)	Fire Protection Requirements
≤10 000	Portable Fire Extinguishers
> 10 000 ≤ 50 000	Portable Fire Extinguishers Fire Hose Reels
> 50 000 ≤ 100 000	Portable Fire Extinguishers Fire Hose Reels Fire Hydrants
> 100 000 ≤ 250 000	Portable Fire Extinguishers Fire Hose Reels Fire Hydrants Automatic Fire Suppression or equivalent
> 250 000 ≤ 1 000 000	Portable Fire Extinguishers Fire Hose Reels Fire Hydrants Automatic Fire Suppression or equivalent
1 000 000	Portable Fire Extinguishers Fire Hose Reels Fire Hydrants Automatic Fire Suppression or equivalent

9.1.7.1 Management in Use

1 Decanting, repacking (other than to meet orders), blending, heat shrink wrapping, battery charging, parking or maintenance of vehicles are not to be carried out within 3m of the storage area. The primary function of the RDC is for the storage of goods.

2 Any combustible liquids or dangerous goods of Classes 2.1, 2.2, 3, 4.1, 4.3 and 5 are to be kept away from heating and ignition sources. Smoking inside the facility is to be prohibited. Signs notifying occupants of No smoking and No ignition sources are to be displayed at the entrances.

3 Work permits are to be obtained before any construction and maintenance works are undertaken.

4 All personnel handling dangerous goods must be educated in the hazards and trained in the safe and proper handling procedures.

5 Upon detection of a leak or spill the area affected must be isolated and the spill must be cleaned without delay. Emergency procedures to be carried out.

6 All packaging must be inspected upon arrival. If packaging if found to be damaged it must be moved to a clean, safe location for repair or repackaging.

7 Tinting of flammable paints or opening of containers must be carried out away from potential

ignition sources in well ventilated areas. AS 1940:2004[2] should be referenced.

9.1.7.2 Emergency Procedures

1 Emergency procedures for the premises should be prepared specifically for the premises. All personnel must be provided with training in the emergency procedures upon commencement of their employment. Annual training sessions for personnel should be provided. Personal and protective equipment must be provided for personnel.

2 Upon detection of a leak or spill the affected area should be isolated and cleaned up immediately. Table 5 outlines the spill equipment that should be available.

3 The following procedure should be carried out immediately upon detection of a spill or leak:

a) Identify the hazard and ensure all personnel are warned whilst spill equipment are collected.
b) Cordon off the area and display warning signs.
c) Consult the Material Safety Data Sheet (MSDS) or undamaged container to identify any safety precautions.
d) Clean up the spill.
e) Dispose of material safely.
f) Do not return spilt material to its original packaging unless it is known the risk will not increased.

Table 5 - Spill equipment

Spill Equipment
Absorbent Material
Mop and bucket
Adequate water
Broom, brush, dustpan and Bin
Safety lines and warning signage
Protective gloves and mask

9.1.7.3 Personnel Training

1 All personnel which will come into contact with or handle Dangerous Goods on the premises must be fully trained in the properties, applicable safety regulations and safe handling procedures. MSDS must be made available to all personnel.

2 All personnel on the premises must be trained in:

a) The nature of the work and safe methods of operation.
b) The properties and hazards of the substances handled.
c) The location of first aid equipment, and first aid measures.
d) The correct use of personal protective equipment, its care and maintenance.
e) Actions to be taken in various emergencies.
f) Evacuation drills and simulated emergencies are to be comprised in the training.

3 Contractors on the premises must be trained in:

a) Safety rules of the installation, including any restrictions on movement, access, activities and the use of personal protective equipment.
b) Conditions and obligations associated with work permits and confined space entry permits.
c) Hazards likely to be encountered, including any materials stored or handled on site.

d) Procedures to be followed in the event of an incident.

9.1.7.4 Hygiene

1 The following directions must be adhered to when handling Dangerous Goods.

a) Where Dangerous Goods are kept all food and smoking to be prohibited.

b) Wash hands after handling Dangerous Goods, before eating, drinking or using the toilet and after work.

c) Injuries involving Dangerous Goods must be addressed immediately.

d) Signs stating the above requirements must be displayed in the work area.

9.1.7.5 Personal Protective Equipment

1 All personnel must be provided with adequate personal protective equipment in areas where Dangerous Goods are stored or handled. Personal protective equipment must be ready for use, be regularly maintained and located in designated locations which are well identified.

2 The following types of personal protective equipment must be provided as appropriate to the operational requirements:

a) Protective clothing suitable for the specific Dangerous Good complying with AS/NZS 4501.2:2006[7].

b) Eye protection selected in accordance with AS/NZS 1337:1992[8].

c) Protective gloves complying with AS/NZS 2161:2000[9].

d) Safety helmets complying with AS/NZS 1801:1997[10] and selected in accordance with AS/NZS 1800:1998[11].

e) Safety footwear complying AS/NZS 2210:1994[12].

f) Respirators having appropriate filters, complying with AS/NZS 1716:2003[13] and selected, used and maintained in accordance with AS/NZS 1715:1994[14].

3 All personal protective equipment to be kept separate from normal clothing and maintained as follows:

a) After use all protective equipment to be maintained and cleaned in accordance with manufacturer's instructions and specific to material exposed to.

b) Safety helmets to be maintained in accordance with AS/NZS 1800:1998[11].

c) Self contained breathing apparatus to be maintained in accordance with AS/NZS 1715:1994[14].

9.1.7.6 Work Permits

1 Except for routine non hazardous work, all work within the restricted area must be authorised through means of a work permit.

2 The work permit should include:

a) The nature and extent of the work.

b) Any conditions to be observed

c) Any personal protective equipment to be used.

d) The period for which the permit is valid.

e) Any necessary regular checking to ensure safety requirements and conditions are maintained.

f) Any necessary procedures and precautions required to return the area to normal service.

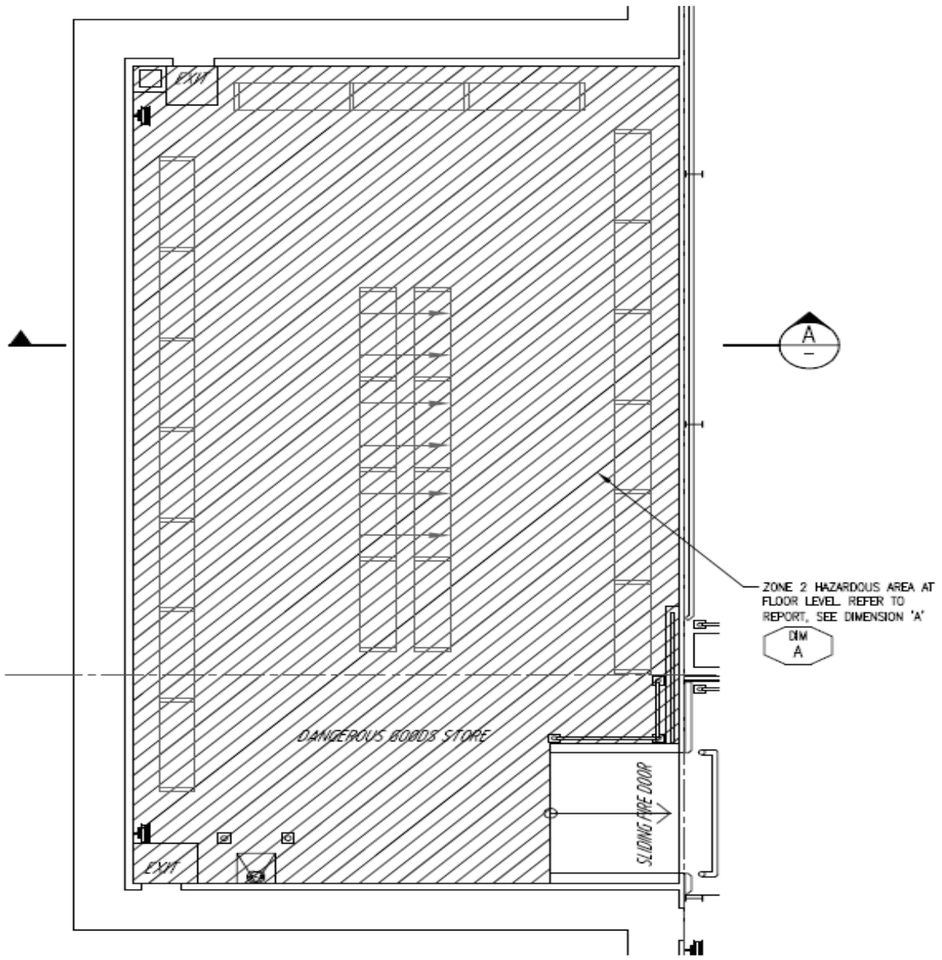
g) Any fire fighting equipment required at hand.

9.1.7.7 Waste Storage & Disposal

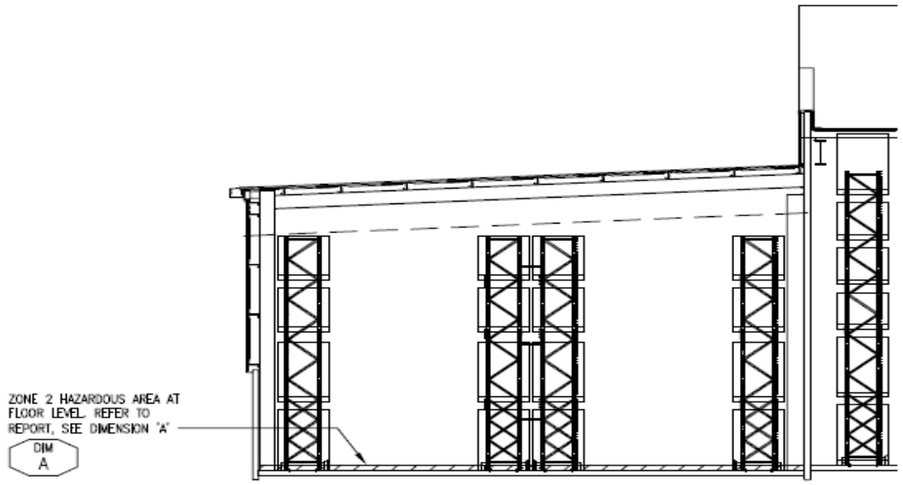
- Where dangerous goods are stored a facility must be provided for the storage of wastes and items contaminated with dangerous goods. Requirements applicable to Dangerous Goods store are applicable to the waste storage facility for Dangerous Goods.

- Assessments are to be made on the disposal or recycling of the following goods:
  - Goods that have been stored for extended periods of time where the contents may be deteriorated.
  - Wastes and residues from spills and leaks.
  - Unidentifiable goods.
  - Contaminated clothing.
  - Goods that are in excess of possible use or demand.

- Where goods are to be disposed, consultation with the local waste disposal authority, the environment protection authority and the health department must occur to determine the most appropriate method of disposal. Advice from manufacturers and other outside sources may be beneficial



PLAN VIEW
SCALE 1:100



SECTION A
SCALE 1:100

NOTES

1. FOR TEMPERATURE CLASS AND GAS GROUP REFER TO REPORT.

LEGEND

ZONE 2 (NE) HAZARDOUS AREA

Rev	Date	Amendment Description	By	Chk
01	07-09-06	DRAFT ISSUE	BI	FR

Client

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Project
BIG W REGIONAL DISTRIBUTION CENTRE
– DANGEROUS GOODS STORE
– SYDNEY, NSW

Drawing Title
RISK ENGINEERING
DANGEROUS GOODS STORE
HAZARDOUS AREA CLASSIFICATION

Scale @ A2	1:100
Date	17-09-06
Drawn	IM
Checked	JY
Approved	FM
Verified	DM

Project No. **60045489**
Drawing No. **R102**
Rev 0
Status **DRAFT**
Sheet No.- of-

Appendix J Physical and Chemical Data for Product Assessed

MATERIAL SAFETY DATA SHEET

Version: 2.0

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

Material Name: Listerine Antiseptic

Trade Name: LISTERINE®
Chemical Family: Mixture
Intended Use: plaque, gingivitis and bad breath

2. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous
Ingredient CAS Number EU EINECS List %
Menthol, USP 89-78-1 201-939-0 0.042
Ethyl alcohol (ethanol) 64-17-5 200-578-6 26.9
Benzoic Acid 65-85-0 200-618-2 *
Methyl salicylate 119-36-8 204-317-7 0.06
Thymol 89-83-8 201-944-8 0.064
Ingredient CAS Number EU EINECS List %
Caramel 8028-89-5 232-435-9 *
Listerine 470-82-6 207-431-5 0.092
Sodium benzoate 532-32-1 208-534-8 *
Water 7732-18-5 231-791-2 *
Poloxamer 407 9003-11-6 Not listed *
Additional Information: * Proprietary
Ingredient(s) indicated as hazardous have been assessed under standards for workplace safety.

3. HAZARDS IDENTIFICATION

Appearance: Yellow liquid
Signal Word: WARNING
Statement of Hazard: Flammable liquid and vapor.
May cause eye irritation
May cause respiratory irritation.
This product contains ethanol which can cause liver changes, central nervous system effects, and birth defects in the developing fetus.
Eye Contact: May cause eye irritation.
Skin Contact: May cause transient skin irritation.
Pfizer Consumer Healthcare
Pfizer Inc
201 Tabor Road
Morris Plains, NJ 07950
Pfizer Ltd
Walton Oaks
Dorking Road
Tadworth
Surrey KT20 7NS, UK
+00 44 (0)1304 616161
Emergency telephone number:
CHEMTREC (24 hours): 1-800-262-8200
Emergency telephone number:
ChemSafe (24 hours): +44 (0)208 762 8322
MATERIAL SAFETY DATA SHEET

Material Name: Listerine Antiseptic
Revision date: 01-Sep-2006
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Inhalation: Exposure to high concentrations may cause irritation, headache, drowsiness, and symptoms of alcohol intoxication. An Occupational Exposure Limit has been established for one or more of

the ingredients (see Section 8).
Ingestion: Ingestion of large quantities may cause headache, dizziness, nausea, vomiting, diarrhea, dehydration, and symptoms of alcohol intoxication. See 'Statements of hazard' and 'Other potential health effects' in this section.
Potential Health Effects: Chronic ingestion of ethanol has been associated with an increased incidence of cancer, liver cirrhosis, and, if ingested during pregnancy, congenital malformations. However, occupational handling of this product is not expected to result in relevant exposures.
EU Indication of danger: Irritant
EU Hazard Symbols:
EU Risk Phrases:
R10 - Flammable.
R36/37 - Irritating to eyes and respiratory system.
Additional Information: For a more detailed discussion of potential health hazards and toxicity see Section 11.
Note: This document has been prepared in accordance with standards for workplace safety, which require the inclusion of all known hazards of the product or its ingredients regardless of the potential risk. The precautionary statements and warnings included may not apply in all cases. Your needs may vary depending upon the potential for exposure in your workplace.

4. FIRST AID MEASURES

Eye Contact: Immediately flush eyes with water for at least 15 minutes. If irritation occurs or persists, get medical attention.
Skin Contact: Remove contaminated clothing and shoes. Wash skin with soap and water. If irritation occurs or persists, get medical attention.
Ingestion: Do not induce vomiting unless directed by medical personnel. Never give anything by mouth to an unconscious person. Seek medical assistance if symptoms occur or persist.
Inhalation: Remove to fresh air. If discomfort persists, get medical attention.

5. FIRE FIGHTING MEASURES

Extinguishing Media: Use carbon dioxide, dry chemical, or water spray.
Hazardous Combustion Products: Formation of toxic gases is possible during heating or fire.
Fire Fighting Procedures: Wear approved positive pressure, self-contained breathing apparatus and full protective turn out gear.
Fire / Explosion Hazards: Flammable liquid. Vapors are heavier than air and may travel along surfaces to remote ignition sources and flash back.
Additional Information: Vapors may form explosive mixture with air.

6. ACCIDENTAL RELEASE MEASURES

Health and Safety Precautions: Personnel involved in clean-up should wear appropriate personal protective equipment (see Section 8). Minimize exposure.
Measures for Cleaning / Collecting: Use non-combustible absorbent material to wipe up spill and place in a sealed container for disposal. Clean spill area thoroughly.
Measures for Environmental Protections:
Place waste in an appropriately labeled, sealed container for disposal. Care should be taken to avoid environmental release.
Additional Consideration for Large Spills:
Contain the source of the spill or leak if it is safe to do so. Collect spill with a non-combustible absorbent material. Transfer all waste to a labeled container and move it to a secure holding area.
Additional Information: Review Sections 3, 8 and 12 before proceeding with clean up.

7. HANDLING AND STORAGE

General Handling: Eliminate possible ignition sources (e.g., heat, sparks, flame, impact, friction, electricity), and follow appropriate grounding and bonding procedures. Use adequate ventilation. Avoid contact with eyes. Avoid contact with skin and clothing. Avoid breathing vapor or mist.
Storage Conditions: Keep container tightly closed when not in use. Store in a cool, dry, well-ventilated area. Keep

away from heat, sparks, flame, and other sources of ignition.
Storage Temperature: Store as directed by product packaging. (59-77 °F)

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls: Good general ventilation should be sufficient to control airborne levels.
Personal Protective Equipment:
Hands: Chemical protective gloves
Eyes: Not required under normal conditions of use. Wear safety glasses or goggles if eye contact is possible.
Skin: Not required for the normal use of this product. Wear protective clothing with long sleeves to avoid skin contact. Wash hands and arms thoroughly after handling this product.
Respiratory protection: None required under normal conditions of use. If the applicable Occupational Exposure Limit
(OEL) is exceeded, wear an appropriate respirator with a protection factor sufficient to control exposures to below the OEL.

9. PHYSICAL AND CHEMICAL PROPERTIES:

Solvent Solubility: Soluble: Alcohol
Physical State: Liquid
Australia TWA = 1000 ppm TWA
= 1880 mg/m3 TWA
Color: Yellow
Ethyl alcohol (ethanol)
Molecular Formula: Mixture **Molecular Weight:** Mixture
OSHA - Final PELS - TWAs: = 1000 ppm TWA
= 1900 mg/m3 TWA
ACGIH Threshold Limit Value (TWA) = 1000 ppm TWA

Solubility: Soluble: Water
pH: 4.3 (20 °C)
Relative Density: 0.967 (20 °C)
Flash Point (Liquid) (°C): 33

10. STABILITY AND REACTIVITY

Stability: Stable
Conditions to Avoid: Avoid direct sunlight, conditions that might generate heat, and sources of ignition.
Incompatible Materials: None known
Hazardous Decomposition Products: None known
Polymerization: No data available

11. TOXICOLOGICAL INFORMATION

General Information: The information included in this section describes the potential hazards of the individual ingredients.
Acute Toxicity: (Species, Route, End Point, Dose)
Acute Toxicity Comments: A greater than symbol (>) indicates that the toxicity endpoint being tested was not achievable
at the highest dose used in the test.
Irritation / Sensitization: (Study Type, Species, Severity)
Methyl salicylate
Mouse Oral LD50 1600 mg/kg
Rat Oral LD50 1700 mg/kg
Rat Oral LD50 887 mg/kg
Guinea Pig Dermal LD50 0.70 ml/kg
Thymol
Rabbit Dermal LD50 > 5000 mg/kg
Ethyl alcohol (ethanol)
Rat Oral LD50 980 mg/kg
Rat Oral LD50 2350 mg/kg
Mouse Oral LD50 3450 mg/kg
Rat Oral LD50 7060 mg/kg
Mouse Oral LD50 1800 mg/kg
Rat Inhalation LC50 10h 20,000 ppm
Guinea Pig Oral LD50 880 mg/kg
Sodium benzoate

Benzoic Acid
Mouse IV LD50 100 mg/kg
Benzoic Acid
Skin Irritation Rabbit Mild
Listerine
Eye Irritation Rabbit Severe
Rat Oral LD50 4,070 mg/kg
Rat Oral LD50 2480 mg/kg
MATERIAL SAFETY DATA SHEET

Repeated Dose Toxicity: (Duration, Species, Route, Dose, End Point, Target Organ)
Reproduction & Development Toxicity: (Duration, Species, Route, Dose, End Point, Effect(s))
Carcinogen Status: Carcinogenicity of the mixture has not been determined. Consumption of alcoholic beverages
is considered carcinogenic to humans (Group 1) by IARC, though ethanol itself has not been classified by this agency. No other components are listed as carcinogens by IARC, US OSHA or NTP.

12. ECOLOGICAL INFORMATION

Environmental Overview: The environmental characteristics of this material have not been fully evaluated. Releases to
the environment should be avoided.
Aquatic Toxicity: (Species, Method, End Point, Duration, Result)

13. DISPOSAL CONSIDERATIONS

Disposal Procedures: Observe all local and national regulations when disposing of this material.

14. TRANSPORT INFORMATION

This material is regulated for transportation as a hazardous material/dangerous good.
Proper shipping name: Ethanol solution
UN / ID No: UN 1170
Hazard class: 3
Flash Point (°C): 33
Packing group: III
Methyl salicylate
Sodium benzoate
10 Day(s) Rat Oral 27370 mg/kg LOAEL Liver, Blood
Eye Irritation Guinea Pig Severe
Thymol
10 Day(s) Mouse Oral 45 g/kg LOAEL Liver, Kidney, Blood, Ureter, Bladder
Skin Irritation Guinea Pig Severe
Ethyl alcohol (ethanol)
Sodium benzoate
Ethyl alcohol (ethanol)
Skin Irritation Rabbit Corrosive
Rainbow Trout LC50/96h 12,900-15,300 mg/L
Embryo / Fetal Development Rat Oral 44 g/kg LOEL Developmental toxicity
Eye Irritation Rabbit Severe
MATERIAL SAFETY DATA SHEET

For small quantities packed in combination packaging [limited to inner packaging <= 0.5L (0.1 gal)) and outer packaging <= 30 kg (66
lb.) gross weight], the following will apply.
If your commodity meets the definition of a limited quantity and is packaged for retail sale, it may be considered a consumer commodity
and excepted from additional requirements as applicable.
IATA / ICAO
IATA Proper shipping name: Consumer Commodity
IATA UN / ID No: ID 8000

IATA Hazard Class: 9
IMDG
IMDG Proper shipping name: Ethanol solution, Limited Quantity
IMDG UN / ID No: UN 1170
IMDG Hazard Class: 3
Flash Point (°C): 33
IMDG Packing Group: III
ADR/RID
ADR/RID Proper shipping name:
1170 Ethanol solution
ADR / RID UN / ID No: UN 1170
ADR / RID Hazard Class: 3 Flammable liquids
ADR / RID Packing Group: III
DOT
DOT Technical Shipping Name: Consumer Commodity
DOT UN / ID No: UN 1170
DOT Hazard Class: ORM-D

15. REGULATORY INFORMATION

EU Symbol: Xi
EU Indication of danger: Irritant
EU Risk Phrases:
R10 - Flammable.
R36/37 - Irritating to eyes and respiratory system.
EU Safety Phrases:
S7 - Keep container tightly closed.
S16 - Keep away from sources of ignition - No smoking.
S26 - In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36 - Wear suitable protective clothing.
OSHA Label:
WARNING
Flammable liquid and vapor.
May cause eye irritation
May cause respiratory irritation.
This product contains ethanol which can cause liver changes, central nervous system effects, and birth defects in the developing fetus.
Canada - WHMIS: Classifications

WHMIS hazard class:
Class D, Division 2, Subdivision B
Class B, Division 2
Inventory - United States TSCA - Sect. 8(b) Present
Inventory - United States TSCA - Sect. 8(b) Present
Australia (AICS): Present
Inventory - United States TSCA - Sect. 8(b)
EU EINECS List 200-618-2
Present
Listerine
Australia (AICS): Present
Inventory - United States TSCA - Sect. 8(b) Present
Australia (AICS): Present
EU EINECS List
EU EINECS List 207-431-5
201-939-0
Methyl salicylate
Inventory - United States TSCA - Sect. 8(b) Present
Ethyl alcohol (ethanol)
Australia (AICS):
Australia (AICS): Present
Present

EU EINECS List 204-317-7
California Proposition 65 developmental toxicity, initial date 10/1/87 (when in alcoholic beverages)
Sodium benzoate
Inventory - United States TSCA - Sect. 8(b) Present
Australia (AICS): Present
Inventory - United States TSCA - Sect. 8(b) Present
EU EINECS List 208-534-8
EU EINECS List
Thymol
Australia (AICS):
Inventory - United States TSCA - Sect. 8(b) Present
Present
232-435-9
Australia (AICS): Present
Caramel
EU EINECS List 201-944-8
EU EINECS List 200-578-6
Water
Inventory - United States TSCA - Sect. 8(b) Present
Benzoic Acid
Australia (AICS): Present
Menthol, USP
EU EINECS List 231-791-2
CERCLA/SARA Hazardous Substances and their Reportable Quantities:
= 2270 kg final RQ
= 5000 lb final RQ

MATERIAL SAFETY DATA SHEET

Material Name: Listerine Antiseptic
Revision date: 01-Sep-2006
Page 8 of 8
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16. OTHER INFORMATION

Reasons for Revision: Updated Section 2 - Composition / Information on Ingredients. Updated Section 3 - Hazard
Identification. Updated Section 11 - Toxicology Information. Updated Section 15 - Regulatory Information.
Prepared by: Toxicology and Hazard Communication
Pfizer Global Environment, Health, and Safety
Pfizer Inc believes that the information contained in this Material Safety Data Sheet is accurate, and while it is provided in good faith, it
is without a warranty of any kind, expressed or implied.
End of Safety Data Sheet
Australia (AICS): Present
Poloxamer 407
Inventory - United States TSCA - Sect. 8(b) XU

Appendix C

Draft Fire Engineering Report

DRAFT

Big W Distribution Centre Fire Engineering Report

Big W

16 December 2009
Document No.: 60044407-FER-Rev 1

D R A F T

Fire Engineering Report

Prepared for

Big W

Prepared by

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16 December 2009

60044407

D R A F T

Quality Information

Document Fire Engineering Report

Ref 60044407 / 60044407-FER-Rev0z4.doc

Date 16 December 2009

Prepared by Mohd Ikhwan Razali

Reviewed by Dr Xijuan Liu

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	
0	30/01/09	For Revision	Dr Amer Magrabi Director - Fire & Risk Eng.	
1	16/12/09	For Revision	Dr Amer Magrabi Director - Fire & Risk Eng.	

Table of Contents

Executive Summary

This Fire Engineering Report (FER) relates to the proposed Big W Distribution Centre at Hoxton Park, NSW. It should be read in conjunction with the Fire Engineering Brief (FEB) 60044407-FEB-Rev 2 dated 08 December 2009 that was presented toall project stakeholders.

AECOM has been appointed by the client to undertake a Performance Requirement Assessment of the Building Code of Australia 2009 (BCA) for the proposed Alternative Solutions identified in Section 4.1 (page 7) of this report.

Based on the fire engineering assessment presented in this report, it is the considered opinion of AECOM that the proposed Alternative Solutions satisfy the BCA Performance Requirements CP1, CP9, DP4, DP6, EP1.4, EP1.1, EP1.3 and EP2.2. This is subject to, but not limited to, the implementation of the fire safety strategy for this building, as outlined in Section 4.0 (page 7) of this report.

The readers' attention is drawn to the scope and conditions of use of this document that are outlined in Section 1.0 - Introduction (page 2), Section 3.0 – Design Objectives (page 6) and Section 10.0 – Validity & Limitations (page 57).

1.0 Introduction

1.1 The Project

The project relates to the Big W Distribution Centre in Hoxton Park, NSW. The centre is of an area of approximately 92,505 m^2 (to be confirmed by the Architect).

The facility is a warehouse building (Class 7b) that will hold mixed commodities. The eastern half of the warehouse area will incorporate a single storey area with hi-racks distributed for the mixed commodities storage.

The western half of the warehouse area will incorporate five rows of 2 level platforms forming 2 mezzanine levels extending from the south side to the middle of the warehouse. Conveyor belts will be running on these platforms on each level and they will be connected to the ground floor. There will be hi-racks on both sides of each of the 5 rows of platforms for mix commodities storage. There are also a confectionery store (with sheet metal enclosure), and a caged mesh (chain wire) enclosure for an aerosols area and a security store area located on the western elevation, while there will be a sorter head platform located between the eastern and western halves of the warehouse.

There are also ancillary areas, plant rooms finger docks and offices around the perimeter of the warehouse area. The distribution centre will be operational seven days a week, 24 hours a day (To be confirmed by Big W)

Big W is insured by FM Global, who requires compliance with a set of prescriptive fire protection standards as part of the insurance contract. These requirements focus mainly on property and business protection; although they do, generally, have life safety benefits.

1.2 Terms of Reference

AECOM has been appointed by Woolworth Limited to assess the proposed Alternative Solutions[1] identified in this report against the relevant Performance Requirements of the Building Code of Australia 2009 (BCA).

1.3 FER Scope

The scope of the Fire Engineering Report (FER) is to assess the proposed Alternative Solutions against the relevant BCA Performance Requirements for the subject building. The proposed Alternative Solutions were based on the variations from the BCA Deemed-to-Satisfy (DtS) Provisions identified by the BCA Consultant, Philip Chunin their BCA assessment report dated 26 November 2009. The FER outlines a performance-based fire safety design strategy that gives an overview of the building to support the proposed Alternative Solutions. The FER should be read in conjunction with the Fire Engineering Brief (FEB) 60044407-FEB-Rev 2 dated 8 December 2009 that has been presented to project stakeholders.

1 Alternative Solution is defined in the BCA as a Building Solution, which complies with the Performance Requirements other than by reason of satisfying the Deemed-to-Satisfy Provisions.

1.4 Relevant Project Stakeholders

The relevant project stakeholders that have been nominated by the Client for purposes of participating in the fire engineering process are outlined in Table 1-1.

Table 1-1 – Relevant project stakeholders.

Name	Company	Role
Mach Caoxuan	Big W	Client
Ben Hughes Brown	NSW Fire Brigades	Regulatory Authority
Warren Dixon	MNIA	Architect
Michael Lindley	Shelmerdines	Mechanical Engineers
Rob Marinelli	Philip Chun	BCA Consultant
TBC	TBC	Certifying Authority
Stephen Hall	AECOM	Fire Services Engineer
Mina Abdo/ Mohd Ikhwan / Xijuan Liu	AECOM	Fire Safety Engineer

1.5 Definitions

The following definitions apply to terminology utilised in the report:

Architect – refers to Warren Dixon
BCA – refers to the Building Code of Australia 2008
BCA DtS – refers to the Building Code of Australia 2008 (BCA) Deemed-to-Satisfy Provision (DtS)
Certifying Authority – refers to To be confirmed
Client – refers to Big W
Fire Safety Engineer – refers to AECOM
Fire Services Engineer - refers to AECOM
Mechanical Engineer – refers to Shelmerdines
FEB – refers to the Fire Engineering Brief prepared by AECOM
FER – refers to the Fire Engineering Report prepared by AECOM (This document)
NSWFB– refers to the NSW Fire Brigades.

2.0 Building Characteristics

2.1 Building Description

2.1.1 General

The following Table 2-1 outline the general building description for the Big W Regional Distribution Centre

Table 2-1 – General Building Description

Level	Use	Gross Floor Area (m^2)	Population as advised by Client	Design Population To be Utilised in analysis
Warehouse area ground floor	Warehouse storage area with racks for mixed commodities (Class 7b)	77,931	200 - 250	200 - 250
Warehouse mezzanine floors	Five (5) rows of platform conveyors forming two (2) mezzanine levels in the western half of the warehouse where racks for mixed commodities storage provided on both sides of each row. (Class 7b)	6,300	10	10
Aerosol caged areas	Confectionary store area, Security caged store, and aerosol caged area (Class 7b)	3,832	20 – 30	20 – 30
Offices area	office area (Class 5)	1,940	40 – 50 (Including L1 & L2 office areas and allowing training)	40 – 50 (Including L1 & L2 office areas and allowing training)
Workshop area	Workshop area (Class 8)	765	10	10
Level 2	Lunchroom & Amenities	<2400	180 – 200 (Includes Kitchen staff & visitors)	180 – 200 (Includes Kitchen staff & visitors)

2.1.2 Egress

Egress from the building will be via designated exits as shown by the architectural drawings listed in Section 9.3.

2.2 BCA DtS Reference Criteria

Table 2-2 outlines key classification criteria in accordance with the Building Code of Australia 2009 (BCA) Deemed-to-Satisfy (DtS) Provisions, as identified by the BCA Consultant, Philip Chun in their BCA Compliance Reports dated 26 November 2009.

Table 2-2 – BCA Deemed-to-Satisfy (DtS) reference criteria.

BCA Clause		Description or requirement
A1.1	Classification	• Class 5 (Office), • Class 7b (Storage) and • Class 8 (Process Workshop)
A3.2	Rise in Storeys	Three (3)
C1.1	Effective Height	Less than 25 m
C1.2	Construction Type	Type B
C2.2	Floor Areas	Gross floor area ~ 92,505 m^2
C2.3	Large-Isolated Building	Yes
D1.13	Floor populations	See Table 2-1

3.0 Design Objectives

3.1 Fire Safety Objectives

The design objectives for this fire engineering assessment are contained in the relevant BCA Performance Requirements in Sections C, D and E, which may be summarised as:

- Occupant Life Safety − to safeguard people from illness or injury due to a fire in a building and whilst evacuating a building during a fire.
- Protection of adjacent property − to avoid the spread of fire between buildings and protect other property from physical damage caused by structural failure of a building as a result of fire.
- Fire Brigade Intervention − to facilitate the activities of emergency services personnel.

The fire safety objectives are based on acceptable levels of occupant life safety as absolute fire safety within buildings is not attainable. Accordingly, the BCA is utilised as a benchmark for establishing an acceptable level of fire safety. The process used to define the acceptance criteria for this project will include community representation via the Certifying Authority and other Regulatory Authorities such as NSW Fire Authority and input from other relevant project stakeholders.

This assessment will be consistent with the objectives and limitations of the BCA and therefore specifically excludes arson (other than as a source of initial ignition), multiple ignition sources, acts of terrorism, protection of property (other than adjoining property), business interruption or losses, personal or moral obligations of the owner/occupier, reputation, environmental impacts, broader community issues etc. As an Alternative Solution is not identical to a BCA Deemed-to-Satisfy (DtS) solution, it should be noted that losses resulting from a fire in the subject building could under some circumstances be greater than those for a building complying fully with the BCA DtS Provisions.

3.2 BCA Compliance Objectives

In terms of BCA Compliance, the primary objective of this report is to assess the proposed Alternative Solutions identified in Section 5.0 in order to meet the relevant BCA Performance Requirements. With the exception of these Alternative Solutions all other fire safety aspects of the building are to comply with BCA DtS Provisions.

3.3 Fire Brigade Objectives

Fire brigade objectives with respect to building design and fire brigade intervention are to be addressed in accordance with the relevant BCA Performance Requirements. It should be noted that the Fire Brigade have their own charter for the protection of life, property and environment. However, Fire Brigade responsibilities that may be contained within their Statutory Act or other objectives are over and above the BCA and beyond the scope of this report.

4.0 Fire Safety Strategy

The overall fire safety strategy for this building is based on a combination of fire safety measures arising from compliance with BCA DtS Provisions and other additional requirements resulting from assessing the BCA DtS variations as Alternative Solutions. Accordingly, the fire safety measures nominated by this report are in addition to the measures identified by the BCA Consultant/Certifying Authority for compliance with BCA DtS Provisions.

4.1 BCA DtS Variations & Proposed Alternative Solutions

The following variations to the BCA DtS Provisions have been identified by the BCA Consultant, Philip Chun in their BCA Compliance Reports dated 26 November 2009. Table 4-1 shows the BCA DtS Variations, Proposed Alternative Solutions, relevant BCA Performance Requirements and BCA Assessment Methods. All other fire safety aspects of the building are to comply with BCA DtS Provisions.

Table 4-1 – BCA DtS Variations, Proposed Alternative Solutions, relevant BCA Performance Requirements and Assessment Methods.

Alt Sol No.	BCA Clause	BCA DtS Provisions	Alternative Solution	Relevant Performance Requirement	Assessment Method
1.	Specification C1.1 Table 4	For a Type B construction of Class 7b facility , other load bearing internal walls and columns are to have FRL 240/-/-	Generally a non-fire rated structure to be adopted in the facility. The steel columns of the main structure located in the pick modules will be protected to have 2 hrs FRL	CP1	Quantitative & Qualitative analysis based on BCA A0.5b (ii), A0.9c. The acceptance criteria would be a pick module structure design that maintains its structural stability during occupant evacuation
2.	C2.3	BCA C2.3 (a) states that 'A large isolated building protected throughout with a sprinkler system complying with Specification E1.5, is to be provided with perimeter vehicular access complying with C2.4 (b) (In other words, vehicle access must have a minimum unobstructed width of 6.0 m ensuring that there are no overhead encroachments and that the furthest part of the 6.0 m of the vehicular access way is	Some part of the perimeter vehicular access exceed 18 m (up to 30 m)	CP1	Qualitative analysis based on BCA A0.5b (ii), A0.9c. This Alternative Solution requires support from NSWFB

Alt Sol No.	BCA Clause	BCA DtS Provisions	Alternative Solution	Relevant Performance Requirement	Assessment Method
		no greater than 18 m from the building).			
3.	C2.3 b)	Large Isolated building exceeds 18,000 m^2 floor area or 108,000 m^3 in volume is protected throughout with a sprinkler system complying with Specification E1.5, is provided with a perimeter vehicular access complying with C2.4b and if (ii) the ceiling height is more than 12 m, it has a smoke exhaust system in accordance with specification E2.2b	The smoke exhaust rate and the smoke reservoir are to be determined using CFD modelling The whole warehouse ceiling space will be regard as one smoke reservoir. The smoke exhaust rate is approximately 230 m^3/s.	EP2.2	Quantitative analysis based on BCA A0.5b (i), A0.9 (b) (ii) 'acceptable verification methods'. The performance of the smoke exhaust system will be determined via ASET/RSET analysis
4.	D1.4(c)	Maximum travel distance to an exit not to exceed 40 m where there is a point of choice..	Travel distances are more than 40 m in most areas. The worst case travel distance measured is approximately 107 m.	DP4, DP6	Quantitative analysis based on BCA A0.5b(i), A0.9(b)(ii) 'acceptable verification methods'. Verification method to be ASET/ RSET analysis.
5.	D1.4(c)	Maximum travel distance distance to a point of choice not to exceed 20 m (or to exit where there is no choice of direction)).	Distance to point of choice exceeds 20 m (up to a maximum 40 m) at the elevated picking module and mezzanine store in workshop.	DP4, DP6	Quantitative & Qualitative analysis based on BCA A0.5b(i), A0.9(b)(ii) 'acceptable verification methods'. Verification method to be ASET/ RSET analysis & reducing likelihood of fire blocking occupants exits.
6.	D1.5(c) (iii)	Exits to be located so that alternative exits are not more than 60 m apart.	Distances between exits at the warehouse exceed 60 m. The worst case measured was found to be 213 m. The distance between exits at the battery room and workshop exceeds 60 m up to 81 m.	DP4	Quantitative analysis based on BCA A0.5b(i), A0.9(b)(ii) 'acceptable verification methods'.

Alt Sol No.	BCA Clause	BCA DtS Provisions	Alternative Solution	Relevant Performance Requirement	Assessment Method
					Verification method to be ASET/ RSET analysis.
7.	D1.6(b)(i)	The unobstructed width of each exit or path of travel to an exit, except for doorways, must be not less than 1m	The clear width of the aisles at the drive locations in the pick modules are 876 mm from one side and 941 mm from the other side. Also an EPRM is provided in the aisles that will reduce the clear width to be approximately 600 mm from both sides	DP4, DP6	Quantitative analysis based on BCA A0.5b(i), A0.9(b)(ii) 'acceptable verification methods'. Verification method to be ASET/ RSET analysis.
8	D1.9	No point on floor requiring the use of such an exit to open space must exceed 80 m. The bottom of the stair must be within 20 m of an exit or 40 m if two exits are available	Conveyor picking platforms does not comply as distance towards exit exceeds 80 m (up to a maximum of 160 m to the final exits)	DP4, DP6	Quantitative analysis based on BCA A0.5b(i), A0.9(b)(ii)'acceptable verification methods' Verification method will consist of ASET/RSET analysis.
9.	D2.13	Minimum stair tread to be 250 mm and maximum 355 mm & riser to be minimum 115 – 190 mm maximum	The dimension of stairs leading to the conveyor picking platforms do not comply as detailed	DP4, DP6	Quantitative analysis based on BCA A0.5b(i), A0.9(b)(ii)'acceptable verification methods' Verification method will consist of ASET/RSET analysis and approval by the Principal Certifying Authority
10.	E1.3(b)(v)	External hydrants within 10m of fire wall to be protected by construction FRL90/90/90, at least 3m above the ground; and extending by 2 m either side of the outlet. Hydrant to be in open air.	Fire rated wall to be less than 2 m wide (approx. 1 m) on one side of the outlet, where adjacent to exit door. Hydrants under awnings.	EP1.3	Qualitative analysis based on BCA A0.5b(i), A0.9(b)(ii) 'acceptable Verification Methods', Support from

Alt Sol No.	BCA Clause	BCA DtS Provisions	Alternative Solution	Relevant Performance Requirement	Assessment Method
					NSW Fire Brigades is required
11.	E1.4(c)(iv)(B)	Internal hose reels to be maximum 36 m long. .	Hose reels will be greater than 36 m (50 m) long.	EP1.1	Qualitative analysis based on BCA A0.5b(i), A0.9(b)(ii) 'acceptable Verification Methods', Support from NSW Fire Brigades is required
12.	E4.8(a)	Required exit signs must comply with AS/NZS2293.1.	Signs to be hung at height greater than maximum in AS/NZS2293.1 at maximum 4.5 m from the floor level	EP4.2	Qualitative & quantitative analysis based on BCA A0.5b(i), A0.9(b)(ii) 'acceptable Verification Methods', A0.9(c) 'Comparison to DtS Provisions'

4.2 Fire Resistance & Compartmentation

The proposed Alternative Solutions in relation to fire resistance/compartmentation provisions (i.e. BCA Section C) in the building are outlined in Section 4.1. All other provisions are to comply with DtS Provisions of BCA Section C. Significant aspects of the design include:

a) The building is to be treated as a Large-isolated Building.
b) Fire resistance and compartmentation in the building are to be in accordance with BCA DtS Provisions of Section C of type C construction, except for fire rated structural elements and fire separation discussed below. Applying fire rating requirements for Type C construction in general is the subject of an Alternative Solution, as detailed in Section 4.1.
c) Perimeter vehicle access to be as per BCA Section C, DtS Provision C2.4 (b) for large isolated buildings, with exception of the Alternative Solutions proposed as outlined in Table 4.1.

4.2.1 Fire Compartments

Generally, the distribution centre forms a single fire compartment, with non-fire rated construction. The offices will not be fire separated from the warehouse. There are some rooms, separated from the rest of the warehouse with construction of FRL120/120/120 (or -/120/120 if not load bearing), or separated by a distance of more than 6 m in absence of fire wall. These include:

- Mains switchroom;
- Fire Control centre and outdoor area; and
- Generator room.
- Battery Room

Other rooms may be fire separated to comply with BCA DTS Provisions; FM Global requirements; or other codes and legislation.

4.2.2 Structural Frame

The structural frame will be steel. Type C construction is to be adopted, which in general does not require fire rated structure. However it is proposed to protect steel columns of the main structure framework located within the pick module to achieve FRL of 120/-/-. The pick module area is the only part of the building that has three levels, which results in DtS requirement of a Type B construction. The cladding adjacent to hydrant outlets will require fire rating (see section 4.2.3 below)

4.2.3 Cladding

The cladding for the building is to be as follows

- Clad with pre-cast panels up to 3 m above ground level;
- Pre-cast panels to be used to provide fire rated shield to hydrant outlet (FRL 90/90/90);
- Other pre-cast panels are to be designed, to avoid early failure of the panel fixing; and to avoid the panels falling outwards in the event of a fire.
- Steel profile sheeting above this level and
- Loading dock to have steel roller shutter doors.

4.2.4 Roof

The roof covering will generally be FM Approved translucent roof panels, with steel profile sheeting used in some areas.

4.2.5 Ceiling

The warehouses ceiling is to be constructed from non-combustible materials. The ceiling height will vary from 8.5 to 13.2 m above floor level.

4.2.6 Perimeter Vehicular Access

The perimeter vehicular access shall comply with BCA DtS Provision with the exception of Alternative Solutions identified in Table 4-1.

4.3 Egress Provisions

The proposed Alternative Solutions in relation to egress provisions (i.e. BCA Section D) in the building are outlined in Section 4.1. All other egress provisions are to comply with DtS Provisions of BCA Part D. Significant aspects of the design include:

a) The total aggregate final exit widths shall not be less than 16 m.
b) Maximum travel distance on the ground floor shall not exceed 107 m.
c) Maximum distance to point of choice at the picking module and workshop mezzanine shall not exceed 40 m.
d) The maximum travel distance from the elevated picking module shall not exceed 160 m
e) The egress widths at the picking module are to be minimum 600 mm due to the introduction of the EPRM. All other paths of travel shall have clear width of no less than 1 m.

4.3.1 Exit Construction

The exit construction shall comply with BCA DTS Provisions.

On fire detection, all security devices on doors, gates and other barriers on egress routes must automatically release, to allow unobstructed movement of occupants to the exits.

4.4 Fire Services

This section summarises the fire safety services that are proposed within the building. This list is not a complete list of fire safety systems to be provided within the building, but highlights fire safety systems, which are considered critical to the proposed Alternative Solution within this report. All other fire safety systems not specifically mentioned below must comply fully with the BCA DtS Provisions. More detailed information on the fire services can be found in the relevant Architect's and Engineers' specifications and drawings. The proposed Alternative Solutions in relation to fire services (i.e. BCA Section E) in the building are outlined in Section 4.1.

4.4.1 Sprinkler System Design

4.4.1.1 Design Basis

Big W will have a sprinkler system to comply with Factory Mutual (FM) requirements. The system will also be designed to comply with AS2118.1. Where FM and AS2118.1 requirements differ, the more stringent of the two is applied

The sprinkler system will be installed throughout the distribution centre, including the warehouse and offices.

4.4.1.2 Zones

There will be up to 34 sprinkler zones in the building. The zone areas are approximately 50% of the maximum allowed in AS2118.1.

4.4.1.3 Sprinkler System Details

- ESFR system in the main warehouse;
- In-rack sprinkler system on both sides of each of the 5 rows of platforms in the western half of the warehouse (Mixed commodities mezzanine section), with ESFR heads protecting the top two tiers of pallets;
- ESFR heads to be rated to 93ºC and have an RTI ≤ 26 $m^{½} s^{½}$;
- Goods store and Aerosol caged areas will have an in-rack sprinkler system, with ESFR heads protecting the top two tiers of pallets;

- Sprinklers in finger docks to be FM Ordinary hazard (10mm/min over 280 m^2)
- Standard ceiling sprinkler system in the battery charging room will be 141ºC, to comply with FM Global Data Sheets;
- Standard ceiling sprinkler system in the ceiling voids, to comply with AS2118.1; and
- External sprinklers under awnings, to comply with AS2118.1, with an operation temperature of 141ºC.

The ESFR sprinkler system will be designed to comply with FM Global design requirements.

4.4.2 Smoke Detection

There will be smoke detection throughout the warehouse, except in the following areas:

- No smoke detection in the finger docks;
- No smoke detection to the external awnings; and
- No smoke detection within the roof voids spaces above the suspended ceilings.

In areas with smoke detection, point type smoke detectors will be fitted at 20m centres (with some minor variations to suit conditions in some parts of the building).

4.4.3 Smoke Exhaust

4.4.3.1 Main Warehouse and Cellar

There will be an automatic smoke extract system composed of XX exhaust fans located close to the ridge at the apex of the ceiling.
At this stage it is preferred that this will operate at the following extract rates (Refer to Section 8.0 for the assessment for the smoke extract rate):

1. 160 m^3/s for the Western side of the distribution centre where the mezzanine platforms are located
2. 80 m^3/s for the Eastern side of the distribution centre where the Hi-rack commodities are provided

The whole warehouse forms a single smoke reservoir. There is no smoke baffle between the zones.

The fans must not run near the fire, close to the fire and smoke plume, otherwise the effectiveness of the ESFR system is reduced, and may be ineffective in controlling the fire; therefore, the fans local to the fire must shut down in fire mode. This would be achieved if the power cable reaches a critical temperature (pre-set with temperature rated cable as per FM global design criteria) to prevent them operating prior to the smoke sprinkler heads. Fan cabling shall be able to sustain a temperature of up to 200^{o}C for 60 min..

The fans will operate in fire mode away from the centre of the fire. FM Global method will be adopted to prevent the fans close to the fire from operating**.**

The caged areas are not separated from the rest of the warehouse area, other than with wire mesh; therefore they can be treated as part of the main warehouse smoke zone.

High level louvers (not more than 7.5 m) will be used for replacement air general ventilation of 144 m^2 area, where the fans and louvers will need to be operable from the fire control room for smoke clearance purposes.

4.4.3.2 Loading Dock

The loading dock areas can be ventilated using the roller shutter doors.

4.4.3.3 Other Areas

There will be no smoke venting from the ceiling voids at the Aerosol Cage area and the Bean Bag room. These are protected with sprinklers and have non-combustible construction and minimal fire loads.

4.4.4 Occupant Warning System

An occupant warning system is installed to be audible throughout out the building.

4.4.5 Emergency Lighting and Signage

Floor level walkways will have emergency lighting as per BCA DtS Part E4 and AS 2293.1:2005.

Where exit signs are hung at a height greater than allowed in AS 2293 at no more than 4.5 m, jumbo exits signs will be provided, for clearer visibility. ..

4.4.6 Hydrant

Hydrants are to be installed as per BCA DTS Provisions, except hydrant coverage is to be addressed by external hydrant outlets and internal outlets to give compliant coverage.

There will also be a reduced width of fire rated panel around hydrant outlet (approx. 1m) on one side of the outlet where adjacent to exit door in the wall. This is subjected under Alternative Solution as discussed in Table 4-1.

Exit door adjacent to the fire hydrant shall have FRL of -/120/30 and the shield of the hydrants shall have FRL of 90/90/90.

Internal hydrants along the centre line of the warehouse are to be provided if full coverage is not achieved from the external hydrants.

The fire hydrant system to be supplied via a perimeter ring main.

4.4.7 Fire Hose Reels

Fire Hose reels are to be installed as per BCA DTS Provisions and AS 2441.1, except that 50 m long hose are to be used (flow rates to be as per Australian Standards) and there will be hose reels located more than 4 m from an exit.

4.4.8 Portable Fire Extinguishers

Portable Fire extinguishers are to be installed as per BCA DTS Provisions.

4.4.9 Water Supply

- The total water storage on-site will be over 1 million litres of water, split between 2 tanks with fast fill make up equal to the 1800l/min sprinkler demand.
- This represents Full capacity storage for the duration of the sprinkler in the event of a fire.
- There will be no internal bunding within the building.

4.4.10 Fire Fighting Access

There will be full access to the perimeter of the building, including a minimum 6 m width unobstructed width, as per the DtS Provisions for Large Isolated Buildings, except at the north, east and west sides of the building.

The awnings on the northern side of the building as well as the B-double awnings on the eastern side of the building provide weather protection.

4.4.11 Fire Control Centre

The fire control centre is provided in a building near the gatehouse at the northern side of the warehouse. The gatehouse has a repeater panel.

4.5 Management Requirements

Management requirements, for inclusion into the main Big W management and emergency response procedures will be presented in the Fire Engineering Report. At this stage the following are noted:

- Electric forklifts are to be well maintained to lower risk of fire.
- Staff working on high level platform of the picking module shall be trained and inducted for fire emergency.
- No disable people are allowed to work on the high platform.

5.0 Dominant Occupant Characteristics

5.1 Population

Table 5-1 summarises the floor population on the warehouse ground floor, mezzanine levels, Aerosols caged areas, offices and workshop, as well as the design population that will be utilised in the analysis. The Gross floor population is to be confirmed by the Architect:

Table 5-1 – Floor population and gross floor areas to be confirmed by the Architect

Level	**Use**	**Gross Floor Area (m^2)**	**Population as advised by Client**	**Design Population To be Utilised in analysis**
Warehouse area ground floor	Warehouse storage area with racks for mixed commodities (Class 7b)	77,931	200 - 250	200 - 250
Warehouse mezzanine floors	Five (5) rows of platform conveyors forming two (2) mezzanine levels in the western half of the warehouse where racks for mixed commodities storage provided on both sides of each row. (Class 7b)	6,300	10	10
Aerosol caged areas	Confectionary store area, Security caged store, and aerosol caged area (Class 7b)	3,832	20 – 30	20 – 30
Offices area	office area (Class 5)	1,940	40 – 50 (Including L1 & L2 office areas and allowing training)	40 – 50 (Including L1 & L2 office areas and allowing training)
Workshop area	Workshop area (Class 8)	765	10	10
Level 2	Lunchroom & Amenities	<2400	180 – 200 (Includes Kitchen staff & visitors)	180 – 200 (Includes Kitchen staff & visitors)

5.2 Occupant Groups

A majority of the building occupants can be classified as staff members who are expected to have the following characteristics as shown in Table 5-2 below. Visitors to premises will be supervised by staff members at all times. It is assumed that occupants in the warehouse will be reasonably fit, mobile and awake.

Table 5-2 – Occupant group characteristics

Characteristic	Description
Distribution – Age, Gender, Location	Staff are considered to be representative of the general workforce population with no specific or unusual distributions applicable in gender, age (other than age of workforce) and physical or mental attributes
State of Awareness	Occupants are expected to be awake and conscious of their surroundings.
Familiarity - egress routes, group roles, training	Staff are generally expected to be familiar with egress routes, and some will have fire warden duties or similar; and have some emergency response training.
Mobility	Generally able-bodied occupants within the warehouse. In the offices some occupants may have mobility impairments or other disabilities and require assistance from other people. This will need to be addressed as a management in use issue.

5.2.1 Egress for Persons with Disability

The egress provided for people with a disability in this building are to be at least equivalent to that of the BCA DtS Provisions

Managing the evacuation of a person with a disability from a building relies on individual building management systems, procedures and training, which are outside the scope of the BCA, but substantially contribute to the overall evacuation efficiency. The egress provided for people with a disability in this building are to be at least equivalent to that of the BCA DtS Provisions. Therefore, disabled access and independent disabled egress has not been specifically addressed by this report and should be considered by the BCA Consultant, Architect and the Certifying Authority.

The implementation of an emergency evacuation plan for all occupants including persons with disabilities is recommended in accordance with AS 3745:2002. This is considered to reasonably address disabled egress and improve evacuation efficiencies in relation to the fire safety strategy for this building.

6.0 Acceptance Criteria

The following acceptance criteria are considered appropriate for the fire engineering analysis that will be undertaken to assess the proposed Alternative Solution against the relevant BCA Performance Requirement, as agreed with the project stakeholders via the FEB.

6.1 Acceptance Criteria - Alternative Solutions

The acceptance criteria for the Alternative Solutions are detailed in Table 6-1

Table 6-1 – Acceptance Criteria for Proposed Alternative Solutions

No	Alternative Solutions	Acceptance Criteria
1.	FRL of structural steel elements	The structure shall stand at least during the duration of occupant evacuation and confirmation of structural stability during fire from structural engineers.
2.	Perimeter Vehicular Access	The acceptance criterion is support from NSW Fire Brigades.
3	Smoke Exhaust Variation	The acceptance criterion is ASET being greater than RSET with 1.5 safety factor (for design case)
4, 5 & 6.	Extended travel distances, distance to point of choice and distance between exits	The acceptance criterion is that the smoke filling such that the Available Safe Egress Time (ASET) being greater than the Required Safe Egress Time (RSET). An ASET/RSET safety factor of at least 1.5 will be investigated for a sprinkler controlled fire based on tenability criteria in accordance with Section 7.2.
7.	Reduced egress path width	The acceptance criterion is a design that will adequately enable occupant to move safely.
8	Travel via non fire isolated stair	The acceptance criterion is that the smoke filling such that the Available Safe Egress Time (ASET) being greater than the Required Safe Egress Time (RSET) in the walkway. An ASET/RSET safety factor of at least 1.5 will be investigated for a sprinkler controlled fire based on tenability criteria in accordance with Section 7.2.
9.	Dimension of stair treat and riser	The acceptance criterion is a design that will adequately enable occupant to move safely towards final exit.
10.	Hydrants	The acceptance criterion is a building design that is at least equivalent or better than a BCA DtS solution. Approval from NSW Fire Brigades is required
11.	Hose reels	The acceptance criterion is a building design that is at least equivalent or better than a BCA DtS solution. Supportl from NSW Fire Brigades is required
12.	Exit Signage	The acceptance criterion is a building design that is at least equivalent or better than a BCA DtS solution.

6.2 Design Tenability Criteria

Table 6-2 outlines design tenability criteria for occupant life safety for CFD modelling that will be undertaken on this project. The CFD modelling is intended to demonstrate that the existing fire safety design enables occupant evacuation to a place of relative safety prior to the onset of untenable conditions.

CFD modelling on this project was undertaken using Field model – FDS V 5.0[2]. The adapted tenability criteria for the CFD modelling in relation to occupant life safety were based on the following parameters:

Table 6-2- Design tenability criteria for CFD modelling.

Tenability Criteria	Description
Air/smoke temperature	• Air/smoke temperature reaches 183°C (approximately equal to 2.5 kW/m^2) consistently across the entire fire enclosure at any height; or • Significant pockets of air/smoke reaches 100°C in the vicinity of the egress path at a height of 2.1 m; or
Visibility	• Substantial accumulation of smoke below 2.1 m in the vicinity of the egress path such that visibility is limited to less than 10 m (i.e. an optical density of 0.1 m^{-1}) or. • Substantial accumulation of smoke below 2.1 m in the vicinity of the egress path such that visibility is limited to less than 5 m (i.e. an optical density of 0.2 m^{-1}), subject to CO and CO_2 concentration being maintained within tenable limits.
Carbon monoxide	• In the event that visibility falls below 10 m, carbon monoxide (CO) concentration exceeds 2700 ppm in the vicinity of the egress path at a height of 2.1 m or below.
Carbon dioxide	• In the event that visibility falls below 10 m, carbon dioxide (CO2) concentration exceeds 7% in the vicinity of the egress path at a height of 2.1 m or below.

6.3 Fire Brigade Acceptance Criteria

6.3.1 Structural Adequacy

The building is to remain structurally sound until fire brigade intervention commences or an equivalent level of structural adequacy to that of a similar BCA DtS compliant building at the commencement of fire brigade intervention.

6.3.2 Heat Radiation

Notwithstanding the structural adequacy discussed above, the limiting condition for radiant heat from the upper layer will be taken as 4.5 kW/m^2 at a height of 1.5 m above the floor level in accordance with the Fire Brigade Intervention Model[5].

6.4 Environmental & Loss Control Acceptance Criteria

Environmental and loss control acceptance criteria are outside the scope of this report and are not addressed herein.

2. NIST (2007), FDS, Version 5, National Institute of Standard and Testing, Gathersburg, MD

7.0 Fire Hazard and Scenarios

7.1 Fire Hazards

An assessment of the fire hazards present in the building is set out below:

Table 7-1 Fire Hazards

Description	**Estimated Fire Growth Rate[1]**
Main Warehouse	
Pallet Movers	Fast
Machinery underneath Platform	Fast
Hi-rack - mixed commodities (Mezzanine section)	Ultra-fast
Trucks at finger dock receiving	Ultra-fast
Hi-rack - mixed commodities (Hi-rack section)	Ultra-fast
Office area at Northern side	Medium
Goods Store	Fast

[1] TM19 CIBSE Technical Memorandum

The typical fuel loads likely to be encountered in the warehouse storage area include: stored goods with packaging, rubbish bins, electrical equipment and truck fire.

These fire hazards are considered to be mitigated by the activation of the sprinklers, controlling, but, as conservative measure in the assessment, not reducing the fire size. Also, where sprinkler shielding may occur, it is assumed that continued fire growth may occur, in the shielded areas. For this reasons a 20MW fire has been adopted for the truck fire in the covered finger docks, within the warehouse (see Scenario, Section 7.2 below).

Other fire hazards in the warehouse include:

- Switchrooms and other electrical equipment rooms
- Generators rooms
- Battery recharge room

These above fire hazards are fire separated from the main warehouse, so it is considered that further assessment of these is not required.

7.2 Fire Scenarios

Table 7-2 Fire Scenarios based on Sprinkler activation

Zone or Item	Description	Fire Growth	Ceiling Height (Average)	Sprinkler Protection	Sprinkler Spacing	RTI	Temp	Fire Size at Activation	Design Fire Size	Model Smoke
A	Pallet Movers	Fast	9.1 m	ESFR	High Hazard - Max coverage 9.3 m^2.	26	93°C	3.27 MW at 265 s		
B	Machinery underneath platform	Fast	12.3 m	ESFR	High Hazard - Max coverage 9.3 m^2.	26	93°C	5.11 MW at 331 s	6 MW	Yes
C	Hi-rack Mixed commodities (Mezzanine Section)	Ultra-fast	11.6 m	ESFR	High Hazard – Max coverage 9.3 m^2 Max horizontal distance is 3.3 m.	26	93°C	4.92 MW at 162 s	5 MW	Yes
D	Hi-rack Mixed commodities (Hi-rack Section)	Ultra-fast	11.6 m	ESFR	Maximum coverage 9.3 m^2 [2]	26	93°C	4.92 MW at 162 s	5 MW	Yes
E	Office Area (at Northern side)	Medium	3 m	Standard ceiling sprinklers	LH - Maximum coverage 21 m^2	100	68°C	0.92 MW at 280 s		
F	Goods Store	Fast	5.5 m	ESFR + In-racks sprinklers	High Hazard - Max coverage 9.3 m^2.	26	93°C	1.66 MW at 189 s		

Table 7-3 Fire Scenarios for Sensitivity Study

Zone or Item	Description	Fire Growth	Ceiling Height (Average)	Sprinkler Protection	Sprinkler Spacing	RTI	Temp	Fire Size at Activation	Design Fire Size	Model Smoke
S1	Trucks at finger dock receiving	Fast	5.5 m	Standard ceiling sprinklers	FM – Ordinary Hazard (10 mm/min over 280 m^2)	150	141°C	5.68 MW at 349 s	20 MW	Yes
S2	Sprinkler controlled fire ultrafast with 6 MW peak HRR in conjunction with partial smoke exhaust failure running at 25% of total exhaust capacity (60 m^3/s)									

Initial analysis shows detection to occur at the following times:

Table 7-4 Smoke Detectors Activation for scenarios

Zone or Item	Description	Fire Growth	Ceiling Height (Average)	Smoke detectors spacing	RTI[1]	Temp[1]	Time for Activation
A	Pallet Movers	Fast	9.1 m	14 m	0.5 (high sensitivity)	33°C	1.48 MW at 178 s
B	Machinery underneath platform	Fast	12.3 m	14 m	0.5 (high sensitivity)	33°C	2.32 MW at 223 s
C	Hi-rack Mixed commodities (Mezzanine Section)	Ultra-fast	11.6 m	14 m	0.5 (high sensitivity)	33°C	2.15 MW at 107 s
D	Hi-rack Mixed commodities (Hi-rack Section)	Ultra-fast	11.6 m	14 m	0.5 (high sensitivity)	33°C	2.15 MW at 107 s
E	Office Area (at Northern side)	Medium	3 m	14 m	0.5 (high sensitivity)	33°C	0.28 MW at 155 s
F	Good Store	Fast	5.5 m	14 m	0.5 (high sensitivity)	33°C	0.7 MW at 123 s

[1] Preliminary assessment for FEB only. Detection response to be modelled by FDS

Table 7-5 Smoke Detectors Activation for Sensitivity Scenario

Zone or Item	Description	Fire Growth	Ceiling Height (Average)	Smoke detectors spacing	RTI	Temp	Time for Activation
S1	Trucks at finger dock receiving (No detector in Finger dock)	Fast	5.5 m	14 m	0.5 (high sensitivity)	33°C	Detection to be amended using FDS

The 33°C detection activation temperature is considered for a very low sensitivity. Actual detection was calculated using FDS, and thermocouples at the ceiling based on extended spacing at 0.8 % smoke obscuration.

8.0 Fire Engineering Assessment

8.1 Introduction

This section of the report contains the fire engineering analysis to assess the proposed Alternative Solutions identified in Section 4.1 against the relevant BCA Performance Requirements.

The fire analysis will consider the following sub-systems in accordance with the International Fire Engineering Guidelines to assess the proposed Alternative Solutions.

- Sub-system A – Fire initiation, development and control
- Sub-system B – Smoke development and spread and control
- Sub-system C – Fire spread and Impact and Control
- Sub-system D – Fire detection, warning and suppression
- Sub-system E – Occupant evacuation and control
- Sub-system F – Fire Brigade intervention

8.2 Alternative Solution 1- Type of Construction

8.2.1 BCA DtS Provision

BCA Specification C1.1 Table 4 states that for a type B construction of Class 7b facility, other load bearing internal walls and columns are to have FRL 240/-/-.

8.2.2 Variation to BCA DtS Provisions

Generally a non fire rated structure to be adopted in the facility. The column supporting the main structure located at within the picking module is to have 2 hrs FRL constructions

8.2.3 Methodology

Qualitative analysis based on BCA A0.5b (i), A0.9 (b) (ii) 'acceptable Verification Methods'.

The verification method was based on the confirmation from structural engineer in relation to the stability of the building during fire.

8.2.4 Assessment

The Guide to BCA describes the intent of BCA Section C as "to establish the minimum fire resisting construction required for class 2-9 building".

The reason behind the type B construction and of 240/-/- fire rating requirements is due to increase in risk due to the increased level of the building. A type B construction is implied on by DtS on a class 7 building having rise in level of more than 2. It is considered that the structure having such rise in level would have to withstand a lot more load than in a single storey structure. It is also imposed so that safety of fire fighters doing operation inside it is maintain for at least 240 minutes so that the structure will not collapse on them while they are doing their fire fighting or rescue activity.

This building is classified for type B construction due to the existence of 2 levels of pick module on top of the ground floor at western area of the building. In general without the mezzanine level, this building would have been classified as a type C construction which will not requires any fire rating.

The building structure in general is proposed to have no fire rating except for steel column of the main structural framework that are located in the pick module which will be protected to achieve FRL of 120/-/-. The pick module and structure and performance in fire are explained by the pick module structure engineer , Mr Murray Clarke from Dematic Pty Ltd in his letter dated 03 February 2009. The letter is attached in Appendix C. Key points of the letter are on thelevel of redundancy being put into the design; he states *"Each pick module is a fully interconnected structure with a high degree of structural redundancy in both cross-aisle and down aisle directions. Each bay of the pick module*

contributes approximately equally to the stability of the overall structure". This basically means that a localise fire such as a fire having perimeter of around 10 m would not affect the overall stability of the pick module.

Apart from the picking module section above in the warehouse, other areas are considered to have at least the same level of risk as in the BCA DtS design. Therefore the use of a non fire rated structure is in line with the type C construction allowed for the building if picking modules did not exist.

Moreover, the building is also equipped with an ESFR sprinkler (Fast Response) having RTI of less than 50 means that it would controlled fire during it early stage at a smaller size when compared with a standard version. The average compartment temperature is expected not to exceed $200^{o}C$[3] which is less than a typical designed limiting temperature for steel i.e. approximately $550^{o}C$. The risk of sprinkler failure is very low such that some insurers put the reliability of sprinklers[4] to be in the range of 95 % to 99 %.

Notwithstanding the effectiveness and reliability of the sprinklers and the level of redundancy put into the structural design, it is noted that the risk of the structure falling onto the fire fighters are very low due to the fact that if fire happen to be near the picking module, fire fighter would not be standing underneath the module and fighting it from there. it is expected that search and rescue operation is not required in the pick module because by the time fire brigade arrived at the scene the occupants would have safely evacuated from the building due to mobility, familiarity with egress route by training and low occupancy..

As the failure of the pick module structure is local to the fire location, the egress route away from the fire would not be structurally affected. Occupants would have left the fire location before the fire grow to such a significant size to threaten the structure. The non fire rated pick module structure should not affect occuopant evacuation.

Based on the above discussion, it is considered that the proposed level of fire rating for the building is at least satisfactory in terms of occupants' life safety.

8.2.5 Compliance with BCA Performance Requirements

The proposed Alternative Solution for the fire rating was assessed against the BCA Performance Requirements CP1, as shown by the tables below.

Table 8-1 -Assessment of compliance with BCA Performance Requirement EP1.3.

Parameter for Consideration	Discussion
CP1 – A building must have elements which will, to the degree necessary, maintain structure stability during a fire appropriate to	
(a) the function or use of the building	The function or use of the building has been considered and discussed in Section 2.0.
(b) the fire load	The fire load of the building has been considered and discussed in Section 7.0
(c) the potential fire intensity	The potential fire intensity has been considered and discussed in Section 7.0
(d) the fire hazard	The fire hazard of the building has been considered and discussed in Section 7.0

3. The Chartered Institute of Building Services, CIBSE Guide E – Fire Engineering, London 1997.

4. Warrington Fire Research and Building Control Commission, Fire Resistant Barriers and Structures, Victoria, August 2000.

Parameter for Consideration	Discussion
(e) the height of the building	The height of the building has been considered and discussed in Section 2.1
(f) its proximity to other property	Large isolated building is not in proximity to other property
(g) any active fire safety system installed	The active fire safety system installed in the building has been considered and discussed in Section 8.2.4
(h) the size of any fire compartment	The size of the fire compartment has been considered and is equivalent to the BCA DtS provisions design. This is discussed in Section 8.2.4
(i) fire brigade intervention	Fire brigade intervention has been considered and discussed in Section 8.2.4 and Appendix C.
(j)other elements they support	The elements the structure support has been considered and discussed in Section 8.2.4 and Appendix D
(k) the evacuation time	The evacuation time needed for this building has been considered and discussed in Section 8.4.4 and Appendix A.

8.2.6 Conclusion

Each of the above provisions of CP1 was assessed as appropriate to determine the consequences of the proposed Alternative Solution. Based on the above analysis and discussion, it is our considered opinion that the proposed Alternative Solution satisfies the BCA Performance Requirement CP1.

8.2.7 Schedule of works arising from the Alternative Solution

a) In line with the proposed Alternative Solution, in general the structure can be made without having any FRL.
b) The structure of the picking module shall be design on higher level of redundancy such that the failure of a localise components of its member will not affect the entire structure.

8.3 Alternative Solution 2 – Perimeter Vehicular Access

8.3.1 BCA DtS Provision

BCA C2.3 (a) states that 'A large isolated building protected throughout with a sprinkler system complying with Specification E1.5, is to be provided with perimeter vehicular access complying with C2.4 (b)

(In other words, vehicle access must have a minimum unobstructed width of 6.0 m ensuring that there are no overhead encroachments and that the furthest part of the 6.0 m of the vehicular access way is no greater than 18 m from the building).

8.3.2 Variation to BCA DtS Provisions

Although, the building has perimeter emergency vehicle access, there is vehicle access that is further than 18 m (up to 30 m) from the building at the Southern area as illustrated in Figure 8-1,

There are high level awnings that is used to provide weather proof for commodities being loaded/unloaded. Fire fighters can drive under the awnings to get closer to the building.

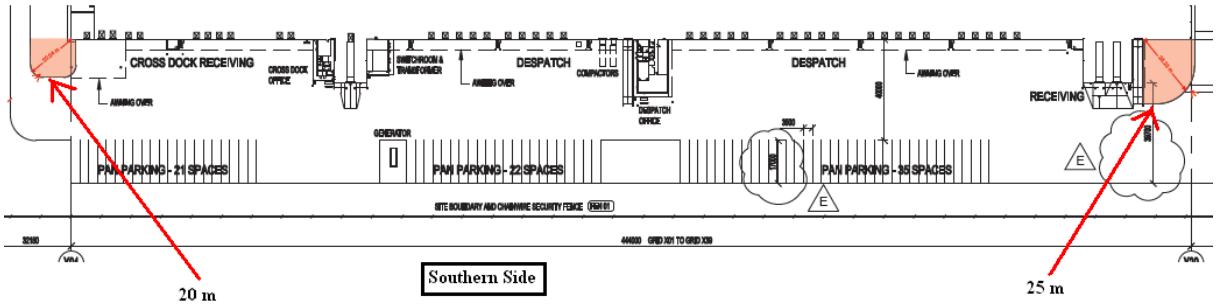


Figure 8-1 – Site plan showing perimeter fire brigade vehicle access for the facility.

8.3.3 Methodology

The methodology for assessing the proposed Alternative Solution will be a Qualitative Assessment based on BCA A0.5b (i), A0.9 (b) (ii) 'acceptable Verification Methods' and referral to the NSW Fire Brigades. The acceptance criterion is a building design that is acceptable to the NSW Fire Brigades in relation to perimeter vehicle access.

8.3.4 Assessment

The intent of BCA C2.4(b) for the perimeter vehicle access for the fire brigade must have a minimum unobstructed width of 6.0 m with no overhead encroachments and that the furthest part of the 6.0 m of the vehicular access way is no greater than 18 m from the building is so that vehicle access point of brigade be limited to that distance and so the fire brigade would only have to walk for certain short distance to directly attack the fire. This will ensure that from the vehicle access point, fire brigade would only take a short period of time thus able to control or attack the fire as soon as possible.

The two nearest fire stations to the subject building are the Horningsea Park Station and the Bonnyrigg Heights Station located at a radial distance of approximately 3 – 4 km.It has been determined from the FBIM calculation as attached in Appendix D that fire brigade intervention will occur at approximately 25 minutes. By the time fire brigade intervene (25 minutes) occupants are expected to have completely evacuated from the building based on the egress calculation of 11 minutes as shown in Appendix A. Therefore fire brigade activity will only be limited to control and fighting the fire rather than doing search and rescue work.. The occupants are trained staff, familiar with egress routes and emergency procedure, are off better than average mobility and are in relatively small number.

Furthermore the building being address is not a complex high multi storey building that requires fire fighter a valuable time to find/search and fight the source of fire or to do search and rescue operation. It is a fairly simple layout plan building with high ceiling that would mean less time needed to find the fire location thus fighting it..

The Figure 8-2 below showed the visibility condition at the time of fire brigade intervention at approximately 1500 s (25 minutes) extracted from the CFD modelling of a 20 MW fire from the finger dock area.

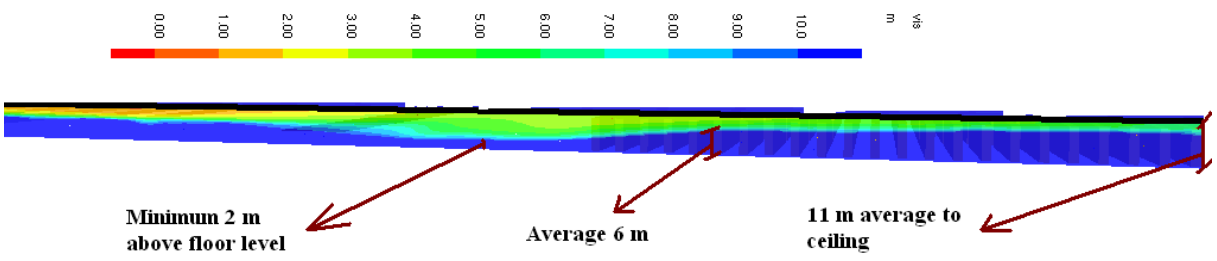


Figure 8-2 – CFD modelling visibility results of 20 MW fire at 1500 s

In the light of the above discussion, it is the opinion of AECOM that the variation of perimeter vehicular access to exceed 18 m (30 m maximum) does not have significant impact to fire brigade operation.

The proposed Alternative Solution was based on discussions with the NSW Fire Brigades during the FEB process and the following provisions:

a) Emergency vehicle access– With the exception of the above variations, the other sides of the building are provided with appropriate access points and roads suitable for emergency vehicle access.
b) Consideration of fire hazards and design fire scenarios as discussed in Section 7.0.
c) Pedestrian access – A minimum 1 m clear trafficable pedestrian path is to be designated on the sides of the building with >18 m perimeter vehicle access to provide foot access for Fire Brigade personnel.
d) Fire hydrants – Compliant hydrant coverage is to be provided on all sides of the building along with pedestrian access to these hydrants.
e) Point type smoke detector, specification in accordance with AS1668.
f) Mechanical smoke exhaust with total capacity of 240 m^3/s.
g) Fire Brigade Intervention – The Fire Brigade Intervention Modelling showed that the Fire Brigade are expected to arrive and apply water on site at 1800 s (30 minutes). It is considered that by this period, occupants would have completely evacuated from the building. Therefore, the fire brigade's role will be restricted to controlling the fire rather than assisting in building evacuation.
h) The following measures are to be provided to assist in fire brigade intervention:
    i. Designated safe areas away from the building for appliance staging, breathing apparatus staging, rehabilitation, and ambulance staging and evacuation assembly.
    ii. Emergency information box containing diagrams including a site map, building layout; diagrams, contact numbers and hazardous materials register adjoining the main Fire Indicator Panel and control room.
    iii. Emergency controls and stop switches for compactors and other automated processes;
    iv. Emergency procedures are to be developed in consultation with the local responding fire stations.

In light of the above discussion, the proposed Alternative Solution is considered satisfactory with respect to meeting NSW Fire Brigade operational requirements.

8.3.5 Compliance with BCA Performance Requirements

The proposed Alternative Solution for perimeter vehicle access was assessed against the BCA Performance Requirements CP9, as shown by the table below.

Table 8-2 - Assessment of compliance with BCA Performance Requirement CP9.

Parameter for Consideration	Discussion
CP9 – Access must be provided to and around the building, to the degree necessary, for fire brigade vehicles and personnel to facilitate fire brigade intervention appropriate to-	
(a) the function or use of the building; and	The function or use of the building as a Class 5 and Class 8 facility was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Section 2.0.
(b) the fire load	The fire load in the building was considered in relation to the proposed Alternative Solution as discussed in Sections 7.0.
(c) the potential fire intensity	The potential fire intensity in the building was considered in relation to the proposed Alternative Solution and found to be

Parameter for Consideration	Discussion
	equivalent to a similar BCA DtS building, as discussed in Sections 7.0.
(d) The fire hazard.	The potential fire intensity in the building was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 7.0 and 8.3.4.
(e) any active fire safety systems installed in the building	The building is equipped with detection and smoke exhaust system, which were considered in relation to the proposed Alternative Solution, as discussed in Section 8.3.4.
(f) the size of any fire compartment	The size of fire compartment and emergency vehicle access was considered in relation with the Proposed Alternative Solution, as discussed in Section 8.3.4.

8.3.6 Conclusion

Each of the above provisions of CP9 was assessed as appropriate to determine the consequences of the proposed Alternative Solution. Based on the above discussion, it is our considered opinion that the proposed Alternative Solution satisfies the BCA Performance Requirement CP9.

8.3.7 Works arising from the Alternative Solution

a) Emergency vehicle access– With the exception of the above variations, the other sides of the building are to be provided with appropriate access points and roads suitable for emergency vehicle access.

b) Pedestrian access – A minimum 1 m clear trafficable pedestrian path is to be designated on the sides of the building without perimeter vehicle access to provide foot access for Fire Brigade personnel.

c) Compliant hydrant coverage is to be provided on all sides of the building along with pedestrian access to these hydrants.

d) The following measures are to be provided to assist in fire brigade intervention:

   i. Designated safe areas away from the building for appliance staging, breathing apparatus staging, rehabilitation, ambulance staging and evacuation assembly.

   ii. Emergency information box containing diagrams including a site map, building layout; diagrams, contact numbers and hazardous materials register adjoining the main Fire Indicator Panel and control room.

   iii. Emergency controls and stop switches for compactors and other automated processes;

   iv. Warning signs to alert fire brigade personnel of unfenced garbage pits with dangerous depths, maturation pads and other hazards.

   v. Emergency procedures are to be developed in consultation with the local responding fire stations.

8.4 Alternative Solution 3 – Smoke Exhaust Variation

8.4.1 BCA DtS Provision

BCA clause C2.3b states that a large isolated building exceeds 18,000 m2 floor area or 108,000 m3 in volume is protected throughout with a sprinkler system complying with Specification E1.5, is provided with a perimeter vehicular access complying with C2.4b and if (ii) the ceiling height is more than 12 m, it has a smoke exhaust system in accordance with Specification E2.2b.

8.4.2 Variation to BCA DtS Provision

The smoke exhaust system does not comply with BCA Specification E2.2 b in the following aspect:

a) Smoke exhaust rate are to be determined by the CFD modelling at total capacity of 240 m^3/s
b) The smoke reservoir size exceeds the allowable size of 2000 m^2. The whole warehouse ceiling area is regard as one smoke reservoir.
c) The smoke exhaust nearest to the fire location/activated fire sprinkler will be shut down upon detection

8.4.3 Methodology

The methodology to assess the performance of the smoke exhaust system is based on ASET/RSET analysis.

The acceptance criteria would be an ASET being greater than RSET with 1.5 safety factor for the design cases.

8.4.4 Assessment

The Guide to BCA 2009 describes the intent of BCA as “to grant concessions for large isolated buildings from the floor area and volume limitations” and the Specification E2.2b as “to specify the requirements for minimising the smoke risks”.

CFD modelling has been carried out for the subject building using smoke exhaust with total capacity of 240 m^3/s provided by 24 individual smoke exhaust fans. The nearest smoke exhaust point to the fire was turned off in the simulation hence resulting in total smoke exhaust capacity of 230 m^3/s. This is required for proper operation of the ESFR sprinkler system. A comparison of ASET and RSET from the modelling results has indicated that life safety of the occupants has not been compromised by the smoke exhaust variation as shown in Table 8-3. Safety factor of more than 1.5 has been achieved in all design case. Smoke stratification has not been observed in the modelling due to extra large reservoir.

Table 8-3 – ASET/RSET comparison

Egress Scenario	ASET	RSET	Safety factor
Normal Egress	1800 s	601 s	2.9
One Exit block (Alternative Egress)	1800 s	753 s	2.4
Mezzanine Egress	340 s	191 s	1.7

Based on the above discussion, it is the considered that the proposed smoke exhausts system satisfy the Performance Requirement of the BCA

8.4.5 Compliance with BCA Performance Requirement

The proposed Alternative Solution for perimeter vehicle access was assessed against the BCA Performance Requirements EP2.2, as shown by the table below.

Parameter for consideration	Discussion

Parameter for consideration	Discussion
EP2.2 (a) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that-	
(i) the temperature will not endanger human life; and	The temperature in the building was considered in relation to the proposed Alternative Solution, as discussed in Sections 8.4.4 and Appendix B.
(ii) the level of visibility will enable the evacuation route to be determined; and	The visibility level in the building was considered in relation to the proposed Alternative Solution, as discussed in Sections 8.4.4 and Appendix B.
(iii) The level of toxicity will not endanger human life.	The toxicity level in the building was considered in relation to the proposed Alternative Solution, as discussed in Sections 8.4.4 and Appendix B.
(i) the number, mobility and other characteristics of the occupants; and	The number, mobility and other characteristics of occupants were considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 5.0, Section 8.4.4, and Appendix A.
(ii) the function or use of the building; and	The function or use of the building as a Class 7 facility was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 2.2 and Section 8.4.4.
(iii) the travel distance and other characteristics of the building; and	The travel distances and other building characteristics were considered in relation to the proposed Alternative Solution as discussed in Section 8.4.4 and Appendix A.
(iv) the fire load; and	The fire load in the building was considered in relation to the proposed Alternative Solution and found to be at least similar to a BCA DtS building as discussed in Section 7.0, Section 8.4.4 and Appendix B.
(v) the potential fire intensity; and	The potential fire intensity was considered in relation to the proposed Alternative Solution and found to be less than a similar BCA DtS building (warehouse with high pilled storage of dry goods), as discussed in Section 7.0, Section 8.4.4 and Appendix B.
(vi) the fire hazard; and	The potential fire hazard in the building was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 7.0, Section 8.4.4 and Appendix B.
(vii) any active fire safety systems installed in the building; and	The impact of an active fire safety system in the building was considered when analysing the consequences of fire scenarios as discussed in Section 7.0 and Section 8.4.4.
(viii) Fire brigade intervention.	Fire Brigade intervention was considered in relation to the proposed Alternative Solution, as discussed in Section 8.4.4 and Appendix C.

8.4.6 Conclusion

Each of the above provisions of EP2.2 was assessed as appropriate to determine the consequences of the proposed Alternative Solution. Based on the above discussion, it is our considered opinion that the proposed Alternative Solution satisfies the BCA Performance Requirement EP2.2.

8.4.7 Work arising from Alternative Solution

a) The smoke exhaust capacity shall be no less than 230 m^3/s
b) In line with the proposed Alternative Solution, the smoke reservoir is allowed to exceed 2000 m^2 i.e. the whole ceiling spaces of the warehouse are to be regarded as one smoke reservoir.
c) The minimum make up vent area shall be minimum 144 m^2.

8.5 Alternative Solution 4, 5 & 6 – Extended Travel Distances, Travel distances to point of choices and Exit Separation

8.5.1 BCA DtS Provision

BCA D1.4 states 'No point on a floor must be more than 20 m from an exit, or a point from which travel in different two directions to 2 exits is available in which case the maximum distance to one of the exits must not exceed 40m'

BCA D1.5 states that 'Exits that are required as alternative means of egress must not be less than 9 m apart and not more than 60 m apart'.

8.5.2 Variation to BCA DtS Provisions

Variations on travel distances and exits separation from BCA DtS provision are as following:

1. *Maximum travel distances are up to 107 m at the warehouse in lieu of 40 m*
2. *Maximum distance to a point of choice on the picking module and workshop mezzanine exceed 20 m (up to 40 m)*
3. *Maximum Exits separation is up to 213 m through point of choice apart in lieu of 60 m*

These are illustrated in Figure 8-3

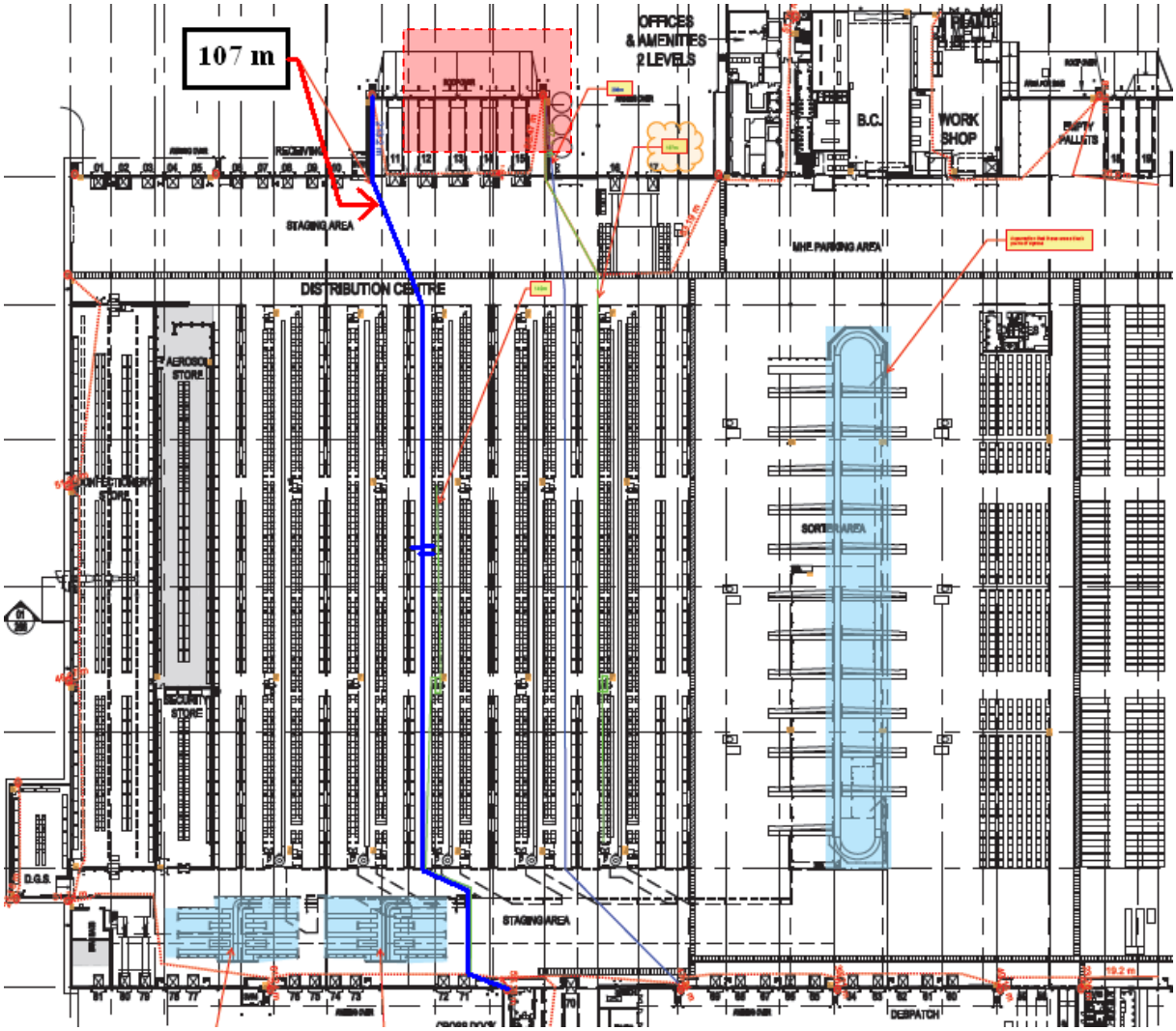


Figure 8-3 – Worst case Travel Distance Layout at ground level.

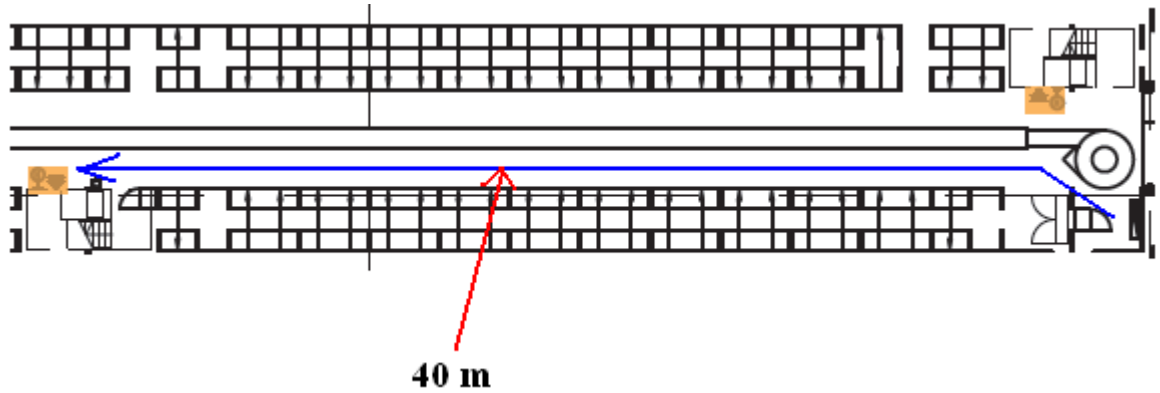


Figure 8-4 – Travel to a point of choice on the elevated picking module

8.5.3 Methodology

The methodology that was used to assess the proposed Alternative Solution is quantitative and qualitative analysis based on BCA A0.5b (i), A0.9 (b) (ii) 'acceptable Verification Method'.

The verification method consisted of an ASET/RSET analysis for the Class 8 areas of the building. The variation of the travel to the point of choice will be analysed qualitatively.

8.5.4 Assessment

The Guide to BCA 2009 describes the intent of the relevant BCA clauses as following:

BCA D1.4 as "to maximise the safety of occupants by enabling them to be close enough to an exit to safely evacuate"

BCA D1.5 as "To require that if an exit is inaccessible, access to any required alternative exit must be available within a reasonable distance"

The limitation on the travel distance would mean that the period that occupant needed to travel would be limited and the BCA considered that travel distance within 20 m to a point of choice and 40 m to an exit is adequate. The reason behind the limitation of the exits separation is so that exits would not be constructed very close to each other such that if fire happen close to one of the exit, it would render both of the exits useless because of the close proximity with each other while BCA also limit the furthest separation between exits to 60 m so that if one of the exit being blocked, the occupant would not have to travel a long distance to an alternative exits. Travelling at a long distance would consume a lot of time hence would increase the chances of the occupant being exposed to untenable condition.

In this case, if one of the exits is blocked, occupant is expected to travel a maximum 197 m distances to go to the other alternative exits in a worst case scenario. This illustrate in the Figure 8-5. Technically, the maximum distance of exits separation in accordance with BCA report is measured to be 213 m due to interpretation of BCA however based on the layout of the building, in the case of one exit being blocked there are exits in other directions which is located no more than 90 m from that exit.

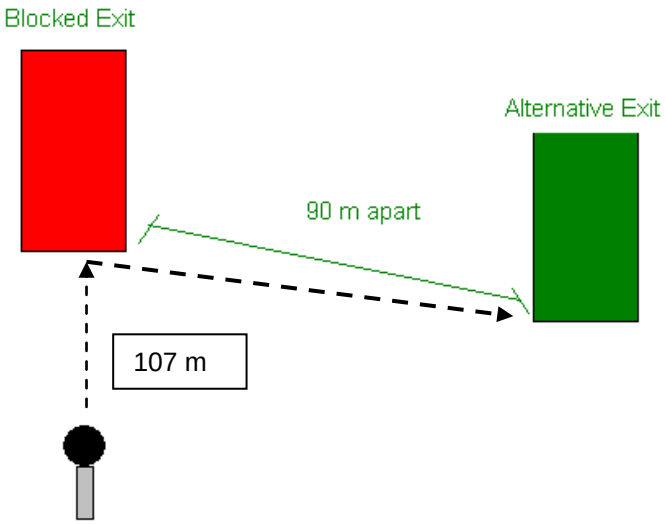


Figure 8-5 – Distance of travel in the case of one exit being blocked in worst-case scenario.

A CFD modelling has been carried out as discussed in Appendix B to predict the time of untenable condition and the time required for the occupants to safely evacuate have also been calculated in Appendix A. The CFD model is equipped with smoke exhaust system with total capacity of 240 m^3/s. In the event of fire, the nearest smoke exhaust is shut down to allow fast activation of sprinkler system while the rest will operate simultaneously. Therefore the total effective smoke exhaust being modelled is approximately 230 m^3/s.

The International Fire Engineering Guidelines (IFEG, 2005)[5] states that an acceptable level of safety has been established in a fire safety system if:

ASET >RSET + Safety Margin

Where,

ASET is the available safe egress time (s)
RSET is the required safe egress time (s)

An ASET/RSET comparison was undertaken to assess the extended travel distances and exit separation in the processing areas. A comparison of Available Safe Egress Time (ASET) / Required Safe Egress Time (RSET) times for the building is tabulated in.

Table 8-4 – ASET – RSET comparison.

Egress Scenario	ASET	RSET	Safety factor
Normal Egress	1800 s	601 s	2.9
One Exit block (Alternative Egress)	1800 s	753 s	2.4
Mezzanine Egress	340 s	191 s	1.7
Normal Egress (Sensitivity Case)	1200 s	601 s	1.9

A safety factor of at least 1.5 has been achieved in all fire scenarios and egress scenarios being considered . The longest time needed by the occupant to evacuate from the building occur when one

5. International Fire Engineering Guidelines (2005), Australia Building Code Board, Canberra.

of the exits being blocked is considered. This is as predicted since the travel distance is the longest among the scenarios assessed. However this event is considered very unlikely to occur since the facility has in place OHS procedure and exit will be well maintained. Even in this very unlikely event, it is shown that safety factor of 1.5 is still achievable. Sensitivity case where the smoke exhaust rate is reduced to 25% of its capacity has also shown promising results with safety factor of 1.5 being achieved.

This finding has shown the significance of smoke exhaust system in prolonging the tenable condition.

In light of above discussion it is considered that the proposed extended travel distance, variation of travel distance to the point of choice and separation of exits meet the performance requirement of Building Code of Australia (BCA).

8.5.5 Compliance with BCA Performance Requirements

The proposed Alternative Solution for extended travel distances was assessed against the BCA Performance Requirements DP4 and DP6 as shown by the tables below.

Table 8-5 - Assessment of compliance with BCA Performance Requirement DP4.

Parameter for Consideration	Discussion
DP4 - Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to-	
(a) the travel distance; and	The travel distance distances are to comply with BCA DtS Provisions. The travel distances were considered in relation to the proposed Alternative Solution as discussed in Section 8.5.4 and Appendix A.
(b) the number, mobility and other characteristics of occupants; and	The number, mobility and other characteristics of occupants were considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 5.0 and Appendix A.
(c) the function or use of the building; and	The function or use of the building as a Class 5 and Class 8 facility was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 2.2 and Section 8.5.4.
(d) the height of the building; and	The effective building height is less than 25 m. The building height was considered in relation to the proposed Alternative Solution, as discussed in Section 2.2 and Section 8.5.4.
(e) Whether the exit is from above or below ground level.	The locations of exits in this alternative Solution are above ground level, as discussed in Section 2.2, Section 8.5.4 and Appendix A.

Table 8-6 - Assessment of compliance with BCA Performance Requirement DP6.

Parameter for Consideration	Discussion
DP6 - So that occupants can safely evacuate the building, paths of travel to exits must have dimensions appropriate to-	

Parameter for Consideration	Discussion
(a) the number, mobility and other characteristics of occupants; and	The number, mobility and other characteristics of occupants were considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Section 5.0, Section 8.5.4 and Appendix A.
(b) The function or use of the building.	The function or use of the building as a Class 5/ Class 6/ Class 7a facility was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Section 2.2 and Section 7.0 and Section 8.5.4.

8.5.6 Conclusion

Each of the above provisions of DP4 and DP6 were assessed as appropriate to determine the consequences of the proposed Alternative Solution. Based on the above analysis and discussion, it is our considered opinion that the proposed Alternative Solution for extended travel distances satisfies the BCA Performance Requirements DP4 and DP6.

8.5.7 Works arising from the Alternative Solution

a) Total final exit widths shall not be less than 16 m clear width.

b) In line with the Alternative Solution, extended travel distance is permitted to be up to 107 m from the warehouse and 160 m from the picking module.

c) Travel distance to point of choice shall not exceed 40 m from the picking module and the workshop mezzanine.

d) Exit separation is permitted to be up to 213 m.

e) All other aspect of the exit system shall be in accordance with BCA DtS provisions.

f) Smoke Exhaust system shall be as per describe in Section 4.4.3

8.6 Alternative Solution 7, 8 & 9 – Exit Path Dimensions, travel distance & stairs dimension at the Picking Module

8.6.1 BCA DtS Provision

BCA D1.6(b)(i) states that "in a required exit or paths of travel to an exit, the unobstructed width of each exit or path of travel to an exit, except for doorways must be not less than 1 m."

BCA D1.9 states that "no point on the floor requiring the use of such an exit to an open space must exceed 80 m. The bottom of the stair must be within 20 m of an exit or 40 m if two exits are available."

BCA D2.13 states "minimum tread to be 250 mm and maximum 355 mm and riser to be minimum 115 – 190 mm maximum"

8.6.2 Variation to BCA DtS Provisions

Reduced egress widths of approximately up to 600 mm are proposed for elevated walkways at the platform level with the EPRM (Empty Pallet Removal Machine). The minimal egress width is 876 mm without the EPRM.

The furthest travel point from the picking module platform using the non fire isolated stair exceed 80 m to the final exits (up to 160 m)

The tread and riser of the stair at the picking module varied from the dimension allowed in the BCA DtS.

8.6.3 Methodology

Qualitative and quantitative analysis based on BCA A0.5b (i), A0.9 (b) (ii) 'acceptable Verification Methods'.

The verification method was based on the use of anthropometric data to demonstrate that the reduced egress width does not adversely impact on occupant movement speeds during a fire emergency.

The egress speed of the occupants at the picking module will be reduce to 0.6 m/s to take into account the effect of the reduced egress width of the platform and non compliance stair tread and riser.

The acceptance criteria would be based on design that does not impede occupant evacuation and ASET being greater than RSET with 1.5 safety factor.

8.6.4 Assessment

The Guide to BCA 2009 describes the intent of the BCA Clauses as following:

BCA D1.6 "To require exits and paths of travel to an exit to have dimensions to allow all occupants to evacuate within a reasonable time"

BCA D1.9 "To require that a person using a non fire isolated stairway or ramp be provided with a safe evacuation path"

BCA D2.13 "To enable the safe movement of people using stairways"

The reason behind the above requirements is so that occupant's evacuation is not impeded and hence would enable them to clear the building before the onset of untenable condition.

Reduced egress widths are proposed at the elevated platform at approximately 600 mm. The clear width of the aisles at the drive locations in the pick modules are 876 mm from one side and 941 mm

from the other side. An EPRM is provided in the aisles that further reducing the egress width to approximately 600 mm from both sides as shown in Figure 8-6.

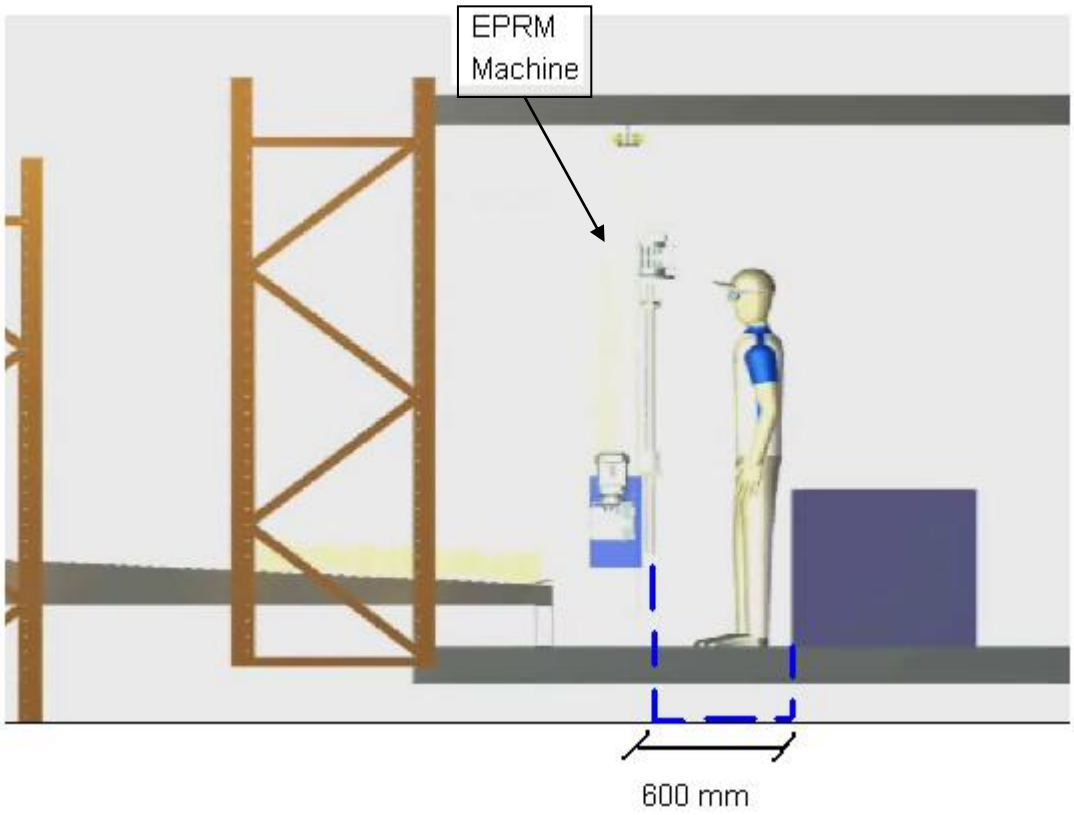


Figure 8-6 – EPRM machine and egress width at aisles.

BCA D1.6(b)(i) stipulates a minimum unobstructed egress width of 1 m with the exception of doorways that may have minimum width of 750 mm. The Guide to BCA 2008 states 'that the intent of this clause is to require exits and paths of travel to an exit to have dimensions to allow all occupants to evacuate within a reasonable time'. It further adds 'The width of a doorway must be clear of all obstructions. This includes door handles or other attachments or any part of the door leaf and any part of the door frame, including the door stop'. Other source such as NFPA 130[6] allowed the use of a minimum 450 mm width barrier in train station concourse. Both of the above statements illustrate the flexibility or minimum egress width that is possible to be considered other than 1 m as stipulated by BCA.

6. NFPA, NFPA 130 – "Standard for Fixed Guideway Transit System", 2000 Edition" National Fire Protection Association, US

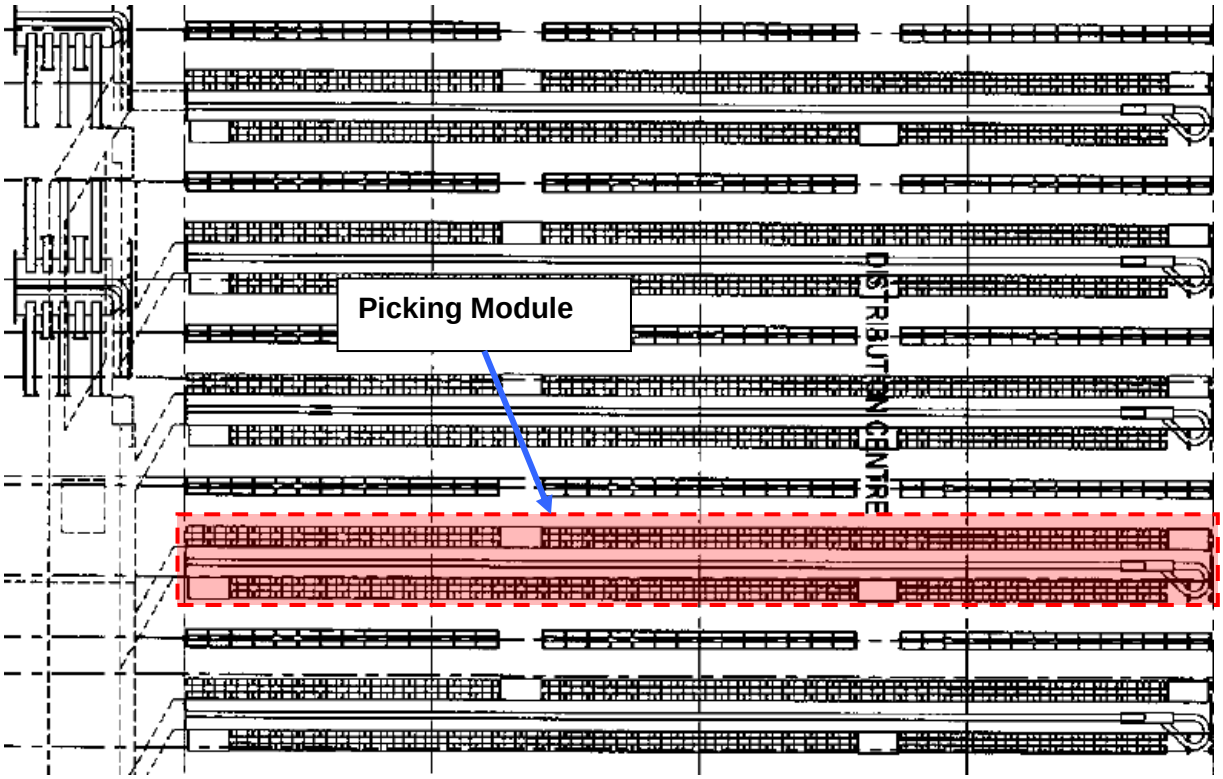


Figure 8-7 – Overview of picking module.

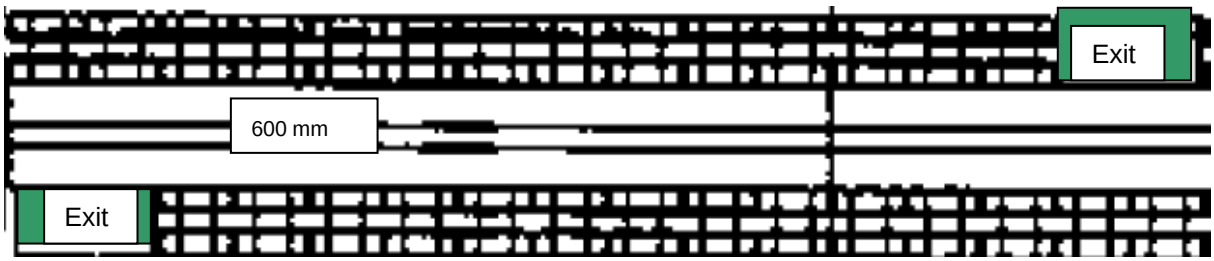


Figure 8-8 – Closer view of Picking module.

A typical barrier of approximately 450 mm is expected to allow one person through at a time which is why it is allowed in certain standard such as NFPA 130 as described above. Anthropometric data indicates that average shoulder width for a male is approximately 450 mm and an optimum door width of 600 - 800 mm can accommodate a single male (Fairweather and Sliwa, 1969)[7]. Although the cited anthropometric data is more than 30 years old, there is an adequate margin in the 600 mm walkways under consideration to accommodate variations (if any) in the 100th percentile shoulder width over the years. Additional data from US standard confirm the finding above, as can be seen in Figure 8-9 (Pheasant S, 1998)[8] that shows the maximum width of a male shoulder collected from various countries are approximately 520mm.

7. Fairweather, L. and Sliwa, J.A. (1969), AJ Metric Handbook, 3rd Edition, the Architectural Press, London.

8 . Pheasant S, Bodyspace. Taylor and Francis, US 1998

Population	Breath (cm)	Depth (cm)	Area (m2)
British Males	51.00	32.50	0.26
British Females	43.50	30.50	0.21
Polish Males	47.50	27.50	0.21
Polish Females	41.00	28.50	0.18
Japanese Males	41.00	28.50	0.18
Japanese Females	42.50	23.50	0.16
Hong Kong Males	47.00	23.50	0.17
Hong Kong Females	43.50	27.00	0.18
Elderly Males	48.00	29.00	0.22
Elderly Females	41.50	30.50	0.20
USA Males	51.50	29.00	0.23
USA Females	44.00	30.00	0.21
French Males	51.50	28.00	0.23
French Females	47.00	29.50	0.22
Swedish Males	51.00	25.50	0.20
Swedish Females	42.50	30.00	0.20
Swiss Males	47.50	29.50	0.22
Swiss Females	45.50	32.50	0.23
Indian Males	45.50	23.50	0.17
Indian Females	39.00	25.50	0.16
Average	45.58	28.20	0.20
Maximum	51.50	32.50	0.26

Figure 8-9 – Anthropomorphic sizes of the world's population

In this case, the impact of 600 mm egress width on occupant movement speeds in the walkways is expected to be minimal based on the relatively low occupant numbers. A reduced walking speed up to 0.6 m/s is considered and this is reflected in egress calculation as shown in Appendix A. it should be noted that client has advised that no disable staff will work on the platform hence the use of walking speed of 0.6 m/s in lieu of 1.2 m/s is considered a very conservative assumption.

AS 1657:1992, Clause 5.5.5 stipulates that the clear space between handrails for a step ladder shall not be less than 550 mm nor more than 750 mm. The rationale for the lower limit is body width accommodation, while the upper limit is based on the support provided by the handrail for the person using the ladder.

It is also shown in Appendix B that occupant at the platform with a low walking speed (0.6 m/s) due to the narrow paths and non compliance stair tread and riser of the picking module area would still be able to evacuate from the platform before smoke completely log the place (based on 10 m visibility). The use of the reduced travelling speed in considered reasonable due to the occupants characteristic of the picking module area which are able and healthy. Under normal circumstances for example at the ground level, the walking speed of those occupants would have been 1.19 m/s in lieu of 0.6 m/s. The required time for the furthest occupant to move to the ground level of the warehouse is approximately 100 s while the time for smoke to completely fill the space above the platform is approximately 300 s in the case of a severe 20 MW truck fire as shown in Appendix B. In this case safety factor of at least 1.5 has been achieved.

It shall also be noted that the EPRM machine can be easily pushed along the egress path to the open stair if necessary.

To further assist in occupant evacuation and reduced egress, the occupant of the building (excluding visitor) are to undergo site induction and fully trained in emergency evacuation procedures from the building in accordance with AS 3745:2002.

8.6.5 Compliance with BCA Performance Requirements

The proposed Alternative Solution for exit path dimensions was assessed against the BCA Performance Requirements DP4, and DP6, as shown by the tables below.

Table 8-7 - Assessment of compliance with BCA Performance Requirement DP4.

Parameter for Consideration	Discussion
DP4 - Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to-	
(a) the travel distance; and	The travel distance distances are to comply with BCA DtS Provisions. The travel distances were considered in relation to the proposed Alternative Solution as discussed in Section 8.5.4, Section 8.6.4 and Appendix A.
(b) the number, mobility and other characteristics of occupants; and	The number, mobility and other characteristics of occupants were considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 5.0, Section 8.6.4 and Appendix A.
(c) the function or use of the building; and	The function or use of the building as a Class 5 and Class 8 facility was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 2.2 and Section 8.6.4.
(d) the height of the building; and	The effective building height is less than 25 m. The building height was considered in relation to the proposed Alternative Solution, as discussed in Section 2.2 and Section 8.6.4.
(e) Whether the exit is from above or below ground level.	The locations of exits in this alternative Solution are above ground level, as discussed in Section 8.5.4, Section 8.6.4 and Appendix A.

Table 8-8 - Assessment of compliance with BCA Performance Requirement DP6.

Parameter for Consideration	Discussion
DP6 - So that occupants can safely evacuate the building, paths of travel to exits must have dimensions appropriate to-	
(a) the number, mobility and other characteristics of occupants; and	The number, mobility and other characteristics of occupants were considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 5.0 and Appendix A.
(b) The function or use of the building.	The function or use of the building as a Class 5 and Class 8 facility was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 2.2and Section 8.6.4.

8.6.6 Conclusion

Each of the above provisions of DP4 and DP6 were assessed as appropriate to determine the consequences of the proposed Alternative Solution. Based on the above analysis and discussion, it is our considered opinion that the proposed Alternative Solution for exit dimensions satisfies the BCA Performance Requirements DP4 and DP6.

8.6.7 Works arising from the Alternative Solution

a) Occupant characteristics and floor population are to be in accordance with Section 5.0.
b) Reduced egress path widths are permitted for picking module up to 600 mm clear width.
c) The total width of final exits must not be less than 16 m clear width.
d) Staff using the high platform of the picking module shall be trained with emergency procedure and participate in appropriate fire drill
e) All of the above in item (d) must be documented as part of the management in use plan.

8.7 Alternative Solution 10 - Fire Hydrants

8.7.1 BCA DtS Provision

BCA E1.3 (b) (v) external hydrants within 10 m of the external wall to be protected by construction havil FRL 90/90/90, at least 3 m above ground and extending 2 m at either side of the outlet.

8.7.2 Variation to BCA DtS Provisions

An Alternative Solution is proposed for the fire hydrant to be protected with approximately 1m wide of FRL construction 90/90/90.

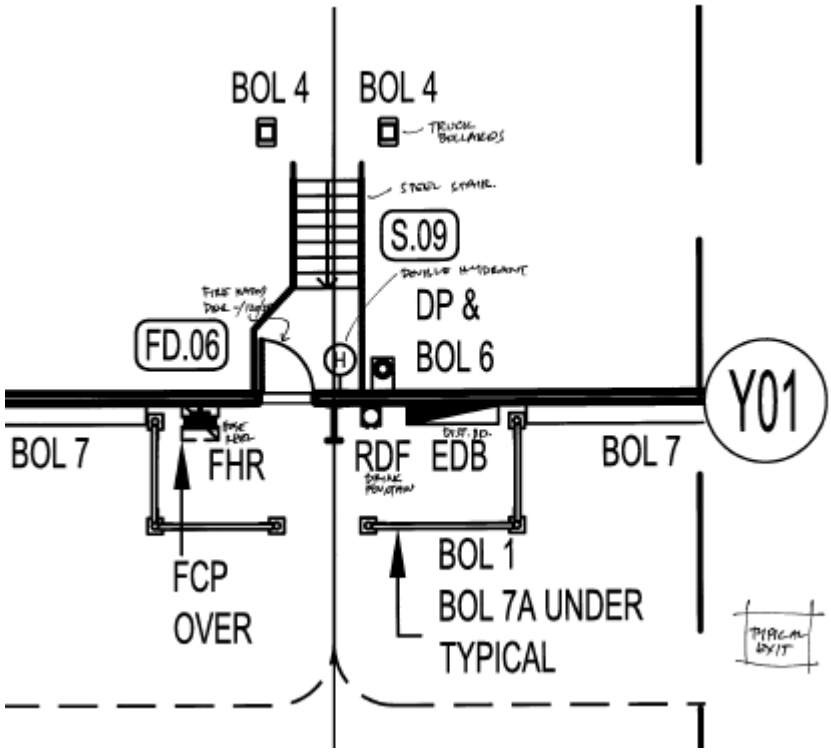


Figure 8-10 – Fire hydrant location.

8.7.3 Methodology

The methodology that was used for the assessment is a qualitative analysis based on BCA A0.5b (ii), A0.9 (b) (ii)'Acceptable Verification Methods'.

The acceptance criterion is a hydrant design that satisfies NSW Fire Brigades' operational requirements.

8.7.4 Assessment

Figure 8-10 shows the proposed fire hydrant location for the building. The hydrant design was developed in consultation with the NSW Fire Brigades to meet their operational requirements.

BCA E1.3 (b) requires external fire hydrant located within 10 m of the wall to be "shielded" based on construction having FRL of 90/90/90. The shield must be 3 m height and expanding 2 m on each side of the hydrant outlet. Due to the close proximity location of the hydrant to the exit doors it is not possible to provide design to satisfy with DtS provisions. Alternatively it is proposed for the fire hydrant to be shield with construction consisting of 3 m in height, 2 m on one side of the outlet and less than 1 m on the other side, in addition of a fire door of -/120/30 measuring at least 750 mm. This is shown in Figure 8-11 below.

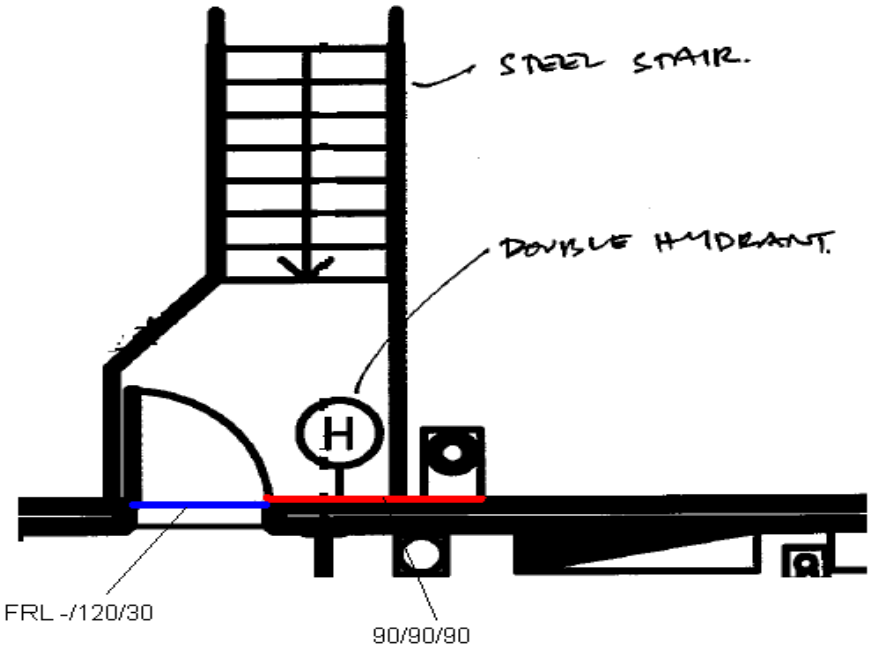


Figure 8-11 – Location of shield and fire door.

The intent of BCA in providing the "shield" to external fire hydrant is so that fire fighters would be able to use and operate the fire hydrants safely due to its close proximity to the external wall from the hazardous effect of fire such as radiation. Therefore it is important that safe condition be maintained around the fire hydrant so that fire brigade operation can be run smoothly.

As discussed in Section 6.3 of fire brigade acceptance criteria, the maximum accepted radiation criteria that a fire fighter would be able to withstand is approximately 4.5 kW/m^2. Based on the configuration of the door, the shield and the possible opening factor, a radiation model has been set up and calculates using Firewind as shown in figures below. The maximum width of opening is considered to be 30 m[9] and opening height is approximately 11 m based on the average height of the building and fire temperature of 900^{o}C based on the work of McCafrey.

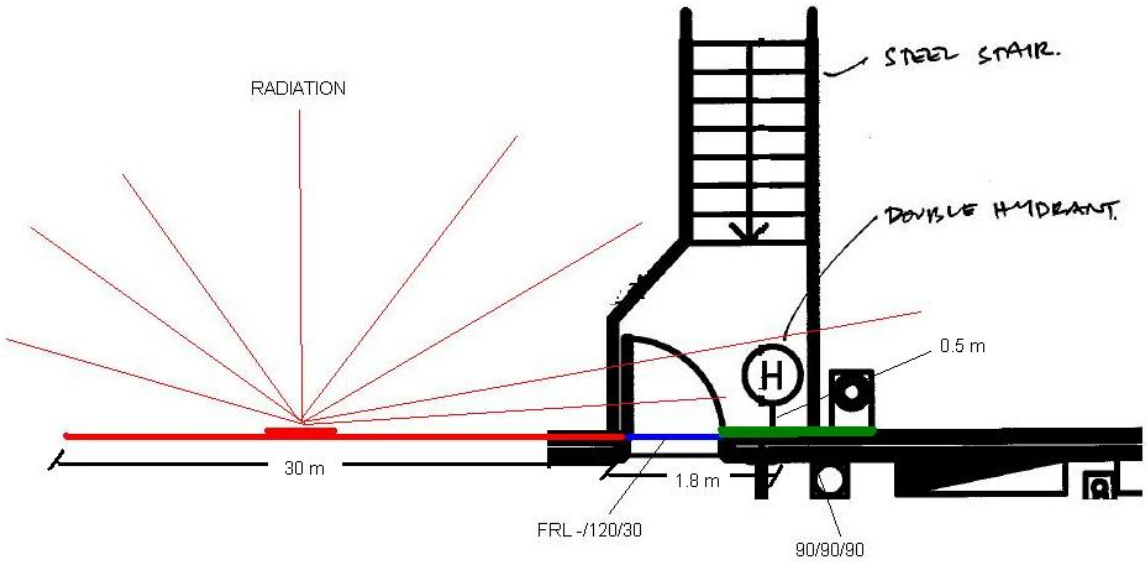


Figure 8-12 – Sketch of opening that emitting thermal radiation in relation with hydrant location.

9 C/AS1, Compliance Document for New Zealand Building Code, Fire Safety, Section 7, External Fire Spread, 2008.

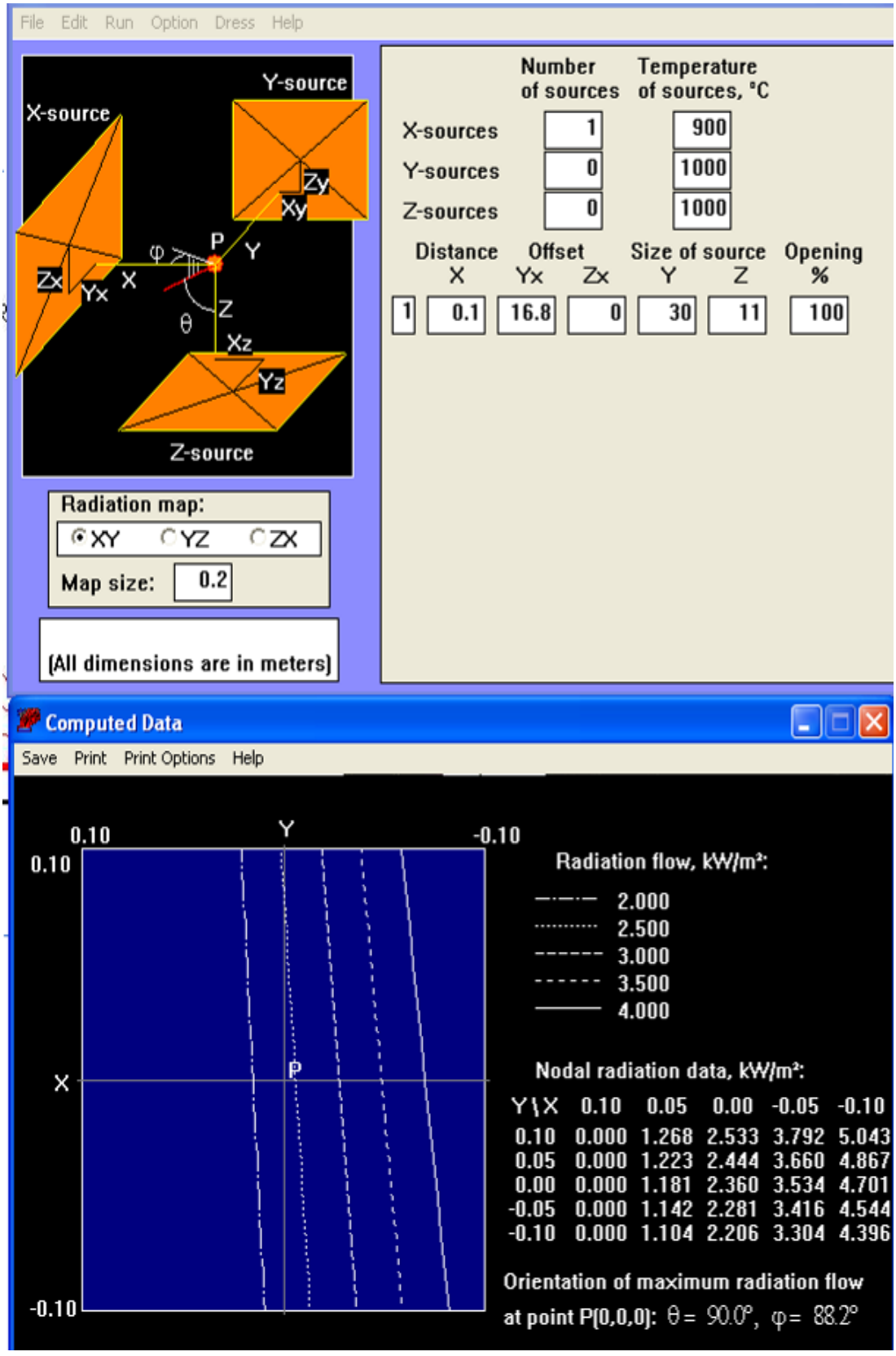


Figure 8-13 – Firewind input and results.

It is considered that for the duration of at least 90 minutes, the door and the shield would be able to withstand the fire and minimize fire radiation going through it while other wall areas beside them would fail thus giving full radiant heat to the hydrant location. As can be seen from the Firewind result, at the fire hydrant point, the measured radiation level is only approximately 2.3 kW/m^2. This is indeed way below than the limiting radiation that can be tolerated by fire fighters.

Moreover, there are plenty of external hydrants provided along the perimeter of the building. At the time of fire brigade arrival as discussed in Appendix C, it is expected in a worst case scenario, only part of the hydrants would be directly affected by the fire (however due to our calculation above, it is demonstrate that the risk is minimal). Therefore the fire fighters would have plenty of choice of fire hydrant to choose from and different angle and direction to attack the fire. The coverage shortfall can be addressed using double hose length.

Based on the discussion above, it is considered that the risk of the fire hydrant become unusable due to the variation of the shielding is very low and in any case the fire fighter may still have plenty of choice since there are probably only a small portion of the hydrant would be unusable by the time of their arrival.

8.7.5 Compliance with BCA Performance Requirements

The proposed Alternative Solution for the fire hydrant system was assessed against the BCA Performance Requirements EP1.3, as shown by the tables below.

Table 8-9 -Assessment of compliance with BCA Performance Requirement EP1.3.

Parameter for Consideration	Discussion
EP1.3 - A fire hydrant system must be provided to the degree necessary to facilitate the needs of the fire brigade appropriate to	
(a) fire-fighting operations; and	Fire fighting operations were considered in relation to proposed Alternative Solution, as discussed in Section 8.7.4 and Appendix C.
(b) the *floor area* of the building; and	The floor area of the building is to comply with BCA DtS Provisions and was considered in relation to the proposed Alternative Solution, as discussed in Section 8.7.4.
(c) fire hazard	The fire hazard in the building was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Sections 7.0 and Section 8.7.4.

8.7.6 Conclusion

Each of the above provisions of EP1.3 was assessed as appropriate to determine the consequences of the proposed Alternative Solution. Based on the above analysis and discussion, it is our considered opinion that the proposed Alternative Solution satisfies the BCA Performance Requirement EP1.3.

8.7.7 Schedule of works arising from the Alternative Solution

a) In line with the proposed Alternative Solution, the shield of the fire hydrant is permitted to be less than 1m on one side near the fire door only.

b) The door adjacent to the fire hydrant shall have FRL of -/120/30.

c) All other aspect of the fire hydrant design shall be in accordance to BCA DtS provisions.

8.8 Alternative Solution 11 - Fire Hose Reels

8.8.1 BCA DtS Provision

BCA E1.4 requires all points on the floor to be within reach of a 36 m fire hose length. Additionally, fire hose reels are to be located within 4 m of a required exit or adjoining a fire hydrant.

8.8.2 Variation to BCA DtS Provisions

An Alternative Solution is proposed for the following fire hose reel variations:

a) The use of 50 m fire hose reels.

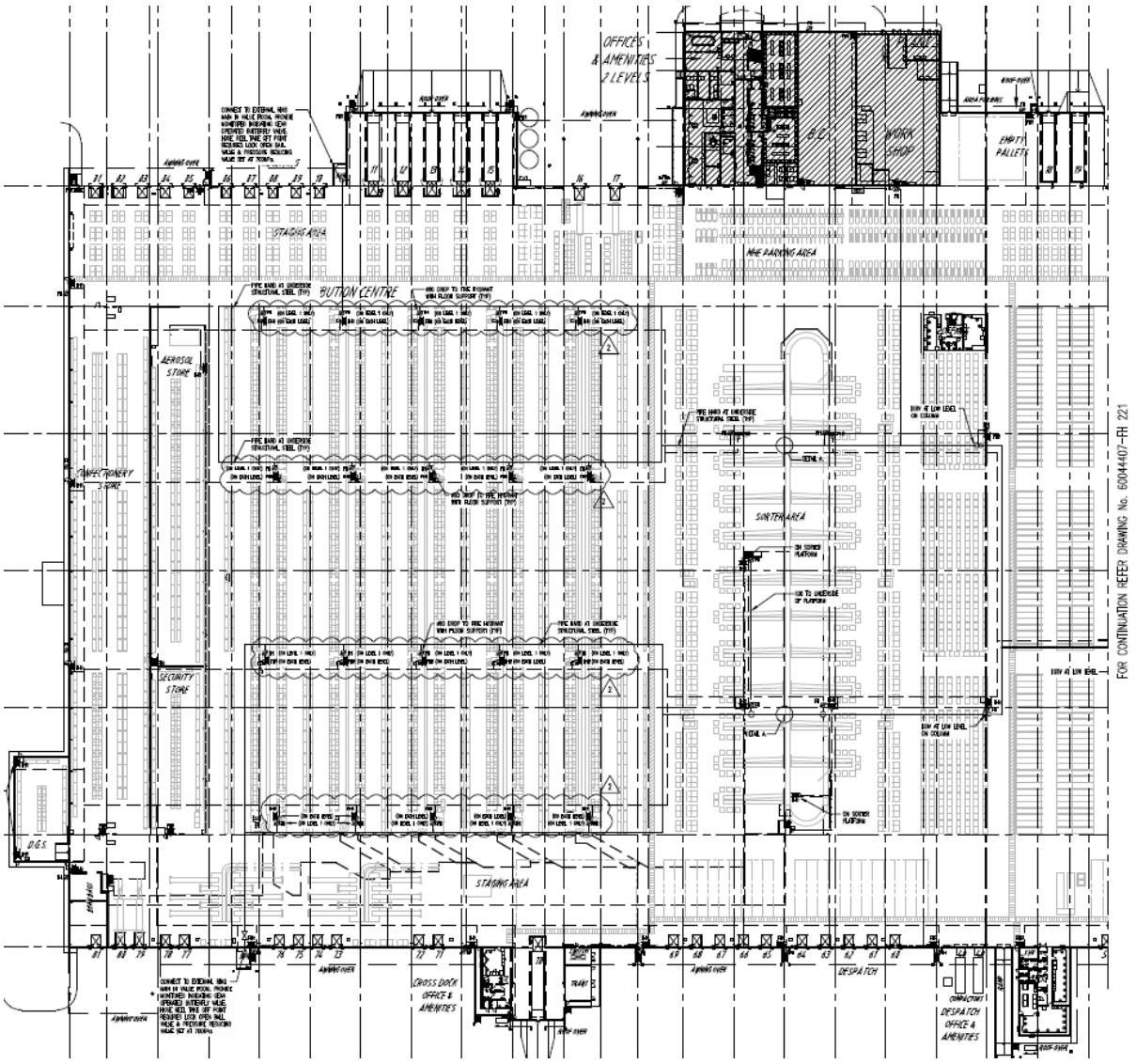


Figure 8-14 – Fire hose reel location and coverage part 1.

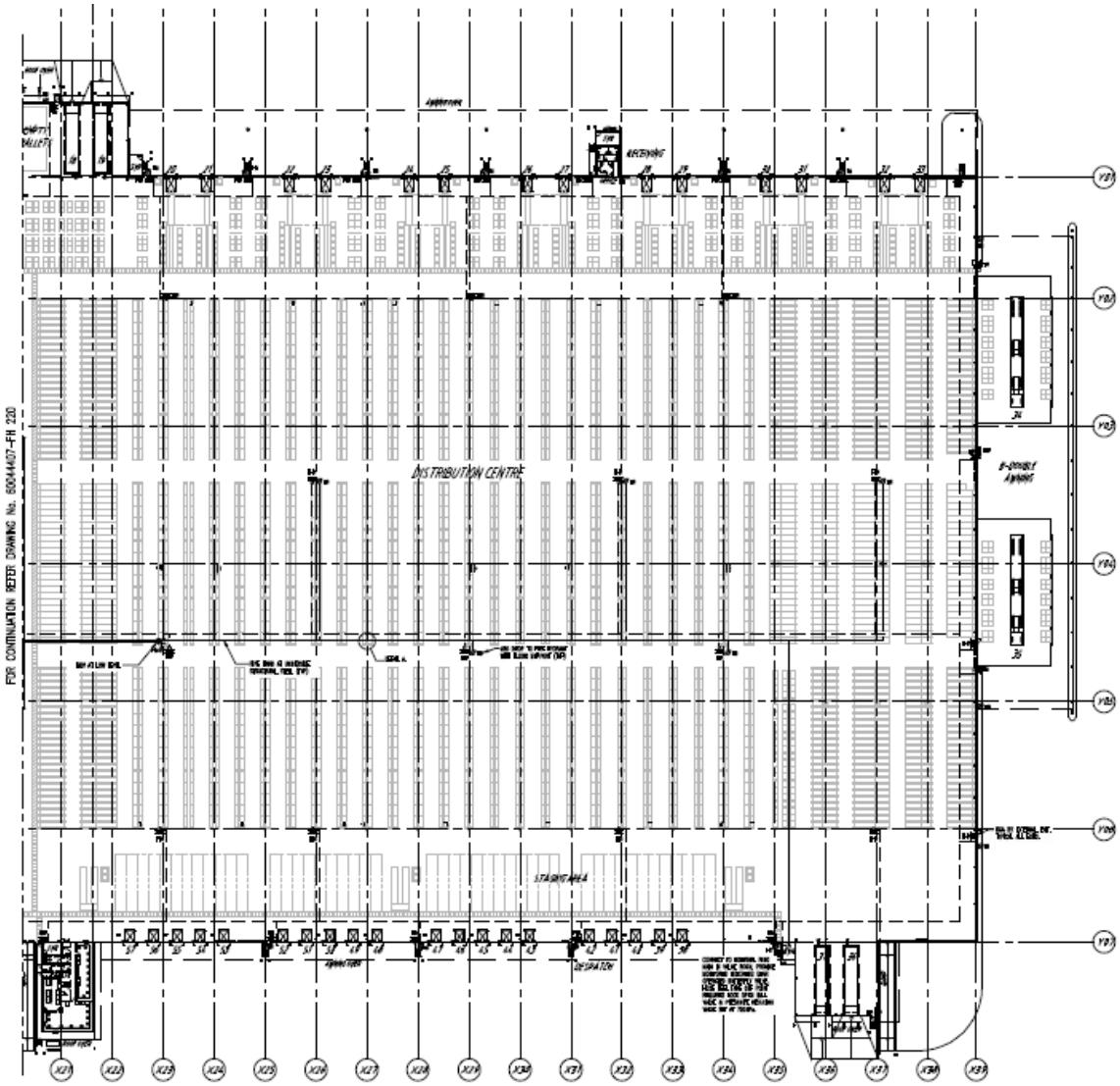


Figure 8-15 – Hose Reels location and coverage part 2.

8.8.3 Methodology

The methodology that was used for the assessment is Qualitative analysis based on BCA A0.5b (i), A0.9 (b) (ii) 'acceptable Verification Methods'.

The acceptance criterion is a fire hose reel location and length that does not adversely impact on the ability of occupants to retreat to the closest exit in the event of not being able to control a 100 -250 kW fire.

8.8.4 Assessment

Fire hose reels are essentially a first aid fire-fighting tool for use by occupants to fight a fire in its early stages. The intent of BCA E1.4 in relation to fire hose reel location is based on enabling occupants, where appropriate, the opportunity to undertake initial fire fighting activities. The requirement for a fire hose reel to be located within 4 m of an exit is based on the reasoning that if the occupant attacking the initial fire with a fire hose reel is forced to retreat, the hose would allow the occupant to safely locate the exit and evacuate from the building, if conditions within the fire compartment deteriorate to a point where occupant life safety is threatened. However, BCA E1.4 permits fire hose reel to be located either within 4 m of an exit or adjoining an internal fire hydrant (other than one located within a fire-isolated exit).

Furthermore, BCA E1.4 restricts fire hose reel lengths to 36 m to allow a trained person to easily handle a fire hose and to minimise the retreating distance that an occupant has to travel to within 50 m. In this case, the fire hose reel under review has a 50 m hose length to provide coverage.

The 50 m hose reel will have a similar water jet length (~ 4m) as per a compliant hose reel length. The additional hose length would be heavier than a compliant hose reel and will need to be pulled around one corner to service the facility. In general the area constitutes of open plan space with clear circulation area around the high racking and machinery. Therefore, hose reel handling is expected to be relatively simpler than say a 36 m BCA DtS compliant hose reel which has to negotiate many corners or obstructions for example in a typical residential setup as illustrated in Figure 8-17. Note that in any case at the high racking area, only one corner need to be negotiated by potential user. Furthermore, staff members are to be trained in the use of fire hose reels including 50 m hose reels.

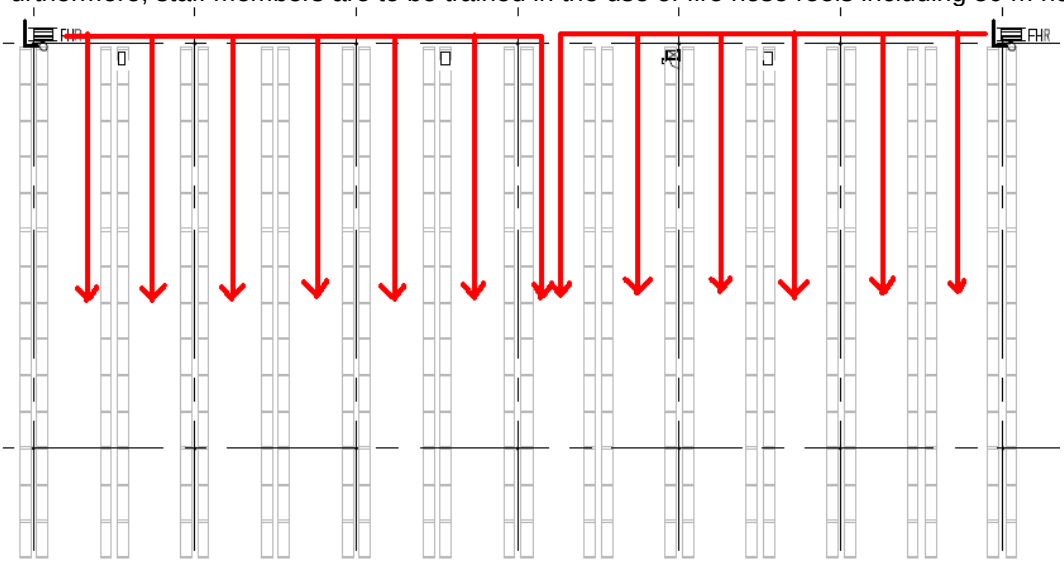


Figure 8-16 – Illustration of the Fire Hose Reel expected coverage path.

Some of the fire hose reels are located up to 90 m from an exit to provide coverage to the facility main warehouse. In the event of occupants having to retreat in the event of uncontrollable fire, way finding to the exit is expected to be not a major problem since the hose reels is located in the line of sight between each other. Furthermore, ASET/RSET analysis in Section 8.4 has already shown that occupant evacuation of the building prior to the onset of untenable conditions is possible for the design fire scenarios. In addition, the smoke layer does not fall below 2.1 m (based on 10 m visibility criteria) on the Ground Floor for at least 1800 s for the design case. Hence, if an occupant initially attacking

the fire is forced to retreat to an exit, there would be an appropriate level of visibility for the occupants to identify the pathway and move towards an exit.

The acceptance criterion nominated in Section 6.1 requires that occupants have a visible path of travel to an exit in the event of not being able to control a 100 -250 kW. The latter condition is expected to be satisfied by virtue of ASET/RSET analysis discussed in the previous paragraph, which is based on a fire scenario that has a larger peak heat release rate than 100-250 kW.

The building has the following measures that are expected to assist in occupant evauation:

a. Automatic smoke exhausts system and a ceiling height of ~11.2 m to delay the onset of untenable conditions.
b. Smoke detection system to provide early warning.

In cases where an exit is not within direct line of sight of a fire hose reel and is not visible from the fire hose reel, additional exit signage shall be provided to direct occupants to the closest exit.

It is recommended that emergency response procedures and staff training in accordance with AS 3745:2002 be developed and implemented for this building. This should include the using of portable fire extinguishers and/or fire hose reels when safe to do so by occupants who have been trained in the use of 50 m fire hose reels. Occupants who have not been trained to use fire extinguishers and/or fire hose reels should evacuate the building immediately and notify the Fire Brigades.

8.8.5 Compliance with BCA Performance Requirements

The proposed Alternative Solution to provide fire hose reels in exceed of 4m from exit and 50m hose length to achieved coverage was assessed against the BCA Performance Requirements EP1.1, as shown by the table below.

Table 8-10 - Assessment of compliance with BCA Performance Requirement EP1.1

Parameter for Consideration	Discussion
EP1.1 - A fire hose reel system must be installed to the degree necessary to allow occupants to safely undertake initial attack on a fire appropriate to-	
(a) the size of the fire compartment; and	The size of the subject fire compartment was considered in relation to the proposed Alternative Solution, as discussed in Section 7.0 and Section 8.8.4.
(b) the function or use of the building; and	The function or use of the building as a Class 5 and Class 8 facility was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Section 8.8.4.
(c) any other fire safety systems installed in the building; and	The impact of active safety systems present in the building was considered in relation to the proposed Alternative Solution, as discussed in Section 8.8.4.
(d) the fire hazard.	The potential fire hazard in the building was considered in relation to the proposed Alternative Solution and found to be equivalent to a similar BCA DtS building, as discussed in Section 7.0 and Section 8.8.4.

8.8.6 Conclusion

Each of the above provisions of EP1.1 was assessed as appropriate to determine the consequences of the proposed Alternative Solution. Based on the above analysis and discussion, it is our considered opinion that the proposed Alternative Solution satisfies the BCA Performance Requirement EP1.1.

8.8.7 Schedule of works arising from the Alternative Solution

a) In line with the proposed Alternative Solution, the use of 50 m fire hose reels is permitted to provide coverage.

b) Training shall be given to the staff on the usage of a 50 m hose reels. This shall be documented in the management planning.

8.9 Alternative Solution 12 – Mounting Height of Exit Signage

8.9.1 BCA DtS Provision

BCA Specification E4.8(a) states “required exit signs must comply with AS 2293.1”.

AS 2293.1 Section 6, clause 6.8.1 states “Exit signs shall be mounted not less than 2 m and not more than 2.7 m above floor level or immediately above the doorway if the doorway is higher than 2.7 m”.

8.9.2 Variation to BCA DtS Provisions

In general, the exits signs in this building are proposed to be mounted at 3 m height and at no more than 4.5 m height.

8.9.3 Methodology

Qualitative analysis based on BCA A0.5b (i), A0.9 (b) (ii) ‘acceptable Verification Methods’.

The verification method was based on the level of smoke layer height and visibility of the mounted exit signs during fire.

8.9.4 Assessment

The standard AS 2293.1 limit the mounting height of a signs in between 2.0 m and 2.7 m. The reason of the lower limit is set slightly above most of human height so that during egress, the signs itself would not be an object that could impede the evacuation process. A signs which is located below 2 m height is easily blinded by normal everyday object such as high racking and others and would also slow down occupant during egress. While the reason of the upper limit of 2.7 m is clearly due to the fact that an exit signs which is located higher, would easily be consumed by smoke during fire which accumulated upward at the ceiling exactly where the signs are normally located. This will reduce the illumination of the signs (as shown in Figure 8-17) thus hinder its objective of providing occupant with direction assistance during emergency.

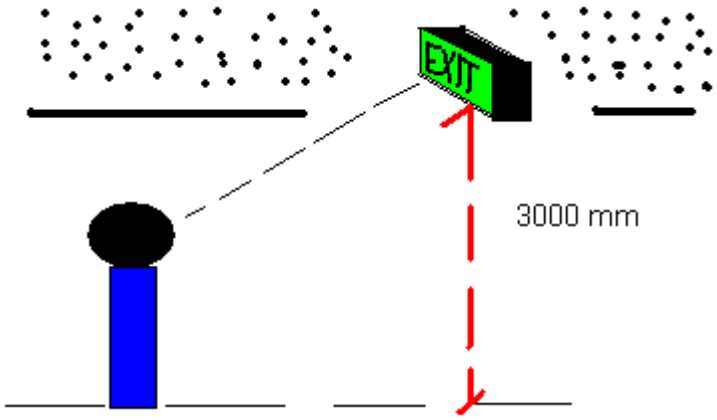


Figure 8-17 – Smoke reducing exit signs visibility.

The building under study is a building with high ceiling (~12 m) and high racking with light vehicle such as forklift passing through. A clearance of 3 m above the floor is needed so that this vehicle can pass through underneath. The concern of smoke obscuring the occupant visibility to the signage is understandable if the subject building has a typical floor to ceiling height in common building which is between 3 – 4 m however this is not the case in this building. With its clear peak ceiling height of ~12 m and provision of automatic smoke exhaust, a clear smoke layer height is easily maintain above the exit signs height (3 m) at least for the duration needed for egress. This is clearly indicate by FDS modelling in the case of severe fire of 20 MW as shown in Figure 8-18

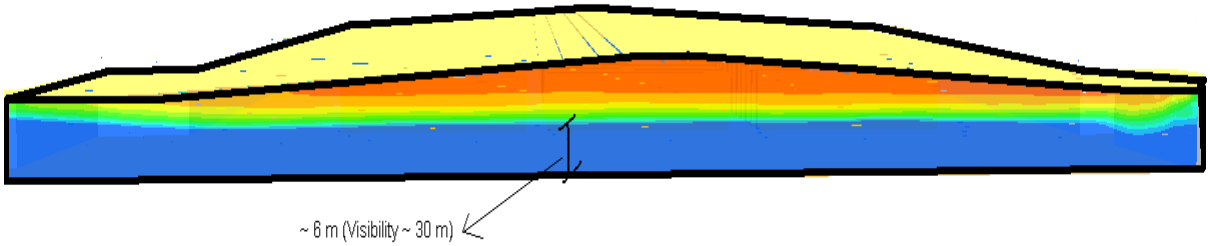


Figure 8-18 – Clear smoke layer height observed in FDS modelling during occupant evacuation period.

It shall be noted, that all other aspect of the signage design is in accordance with the BCA DtS and the standard AS2293.1 with the exception of the mounting height. Therefore it is considered that in relation with the ability to operate in power failure, ability in giving guidance to the occupant to the exit, the level of performance is expected to be at least equivalent to the DtS design.

Based on the discussion above, it is the opinion of AECOM that in the case of the subject building, exit signs can be located at any height below than 4.5 m. The performance of such arrangement is at least equivalent to that of BCA DtS design.

8.9.5 Compliance with BCA Performance Requirements

The proposed Alternative Solution for the fire rating was assessed against the BCA Performance Requirements EP4.2, as shown by the tables below.

Table 8-11 -Assessment of compliance with BCA Performance Requirement EP1.3.

Parameter for Consideration	Discussion
EP4.2 – To facilitate evacuation, suitable signs or other means of identification must, to the degree necessary	
(a) be provided to identify location of exits	The signs are provided and considered to be at least equivalent to BCA DtS provision. This is discussed in Section 8.9.4.
(b) guide occupants to exit	The signs are design in accordance with BCA DtS provision with the exception of its height. In relation to giving guide to the occupants to exit, the proposed signs are considered to be at least equivalent to the BCA DtS performance. This is discussed in Section 8.9.4.
(c) be clearly visible to occupants	The visibility to the signs is considered at least equivalent to that of DtS design. The visibility toward the signs is found to be satisfactory. This is discussed in Section 8.9.4.
(d) Operate in the event of a power failure of the main lighting system for sufficient time for occupants to safely evacuate.	The proposed signs in terms of operation during power failure are in accordance with BCA DtS provision. Therefore the level of performance is at least equivalent to DtS design. This is discussed in Section 8.9.4.

8.9.6 Conclusion

Each of the above provisions of EP4.2 was assessed as appropriate to determine the consequences of the proposed Alternative Solution. Based on the above analysis and discussion, it is our considered opinion that the proposed Alternative Solution satisfies the BCA Performance Requirement EP4.2.

8.9.7 Schedule of works arising from the Alternative Solution

a) In line with the proposed Alternative Solution, the signage is allowed to be mounted more than 3 m height from the floor level however no more than 4.5 m height.

b) All other aspect of the design shall comply with AS 2293.1.

9.0 Reference Information

9.1 Contractual Framework

The design team will be responsible for developing the designs to tender documentation so the client can obtain market pricing and engage a building and trade subcontractor to carry out the construction of the facility.

9.2 Regulatory Framework

Philip Chun is the Certifying Authority (CA) for purposes of assessing an application for a Construction Certificate (CC) for this project. The variations from BCA DtS Provisions that have been identified by the BCA Consultant are outlined in Section 4.1. The Client has appointed AECOM to address these BCA DtS variations as proposed Alternative Solutions in accordance with the methodology set out in the BCA to meet relevant BCA Performance Requirements.

9.2.1 Reference Legislation

This assessment is based on the following reference legislation:

a) NSW Environmental Planning and Assessment Act, 1979.
b) NSW Environmental Planning and Assessment Regulation, 2000.
c) Building Code of Australia 2008, Australian Building Codes Board, 2008.

9.2.2 Reference Codes & Guidelines

This assessment is based on the following reference codes and guidelines:

a) International Fire Engineering Guidelines, Australian Building Code Board, 2005.
b) Guide to the BCA, Australian Building Codes Board, 2007.
c) Engineers Australia, Society of Fire Safety, Code of Practice for Fire Safety Design, Certification and Peer Review, 2003, available on www.sfs.au.com/publications.

9.3 Documentation Considered

This assessment is based on the following documentation:

a) BCA Assessment dated 26/11/2009 by Philip Chun.
b) FEB meeting No.2 dated 10/12/2009 with the NSW Fire Brigades and other stake holders.
c) Architectural drawings by MNIA Architects as shown in Table 9-1.

Table 9-1 – Architectural drawings.

Drawing No.	Title	Date/Issue
60044407-FH 100	Fire Services Site Plan	May 2008
60044407-FH 220	Fire Services FHR Part 1	May 2008
60044407-FH 221	Fire Services FHR Part 2	May 2008
RPA 72	Master site and floor plan	12/05/2008
RPA 73	Conveyor platform section	08/05/2008
RPA 74	Conveyor platform plan	28/05/2008

10.0 Validity & Limitations

The reader's attention is drawn to the following limitations with respect to the fire engineering assessment undertaken in this report:

a) The report is limited to the assessment of Alternative Solutions for the BCA DtS variations identified in Section 4.1 of this report for compliance with relevant BCA Performance Requirements. With the exception of these Alternative Solutions, all other fire safety aspects of the building are to comply with the BCA DtS Provisions.

b) This assessment deals with the fire safety provisions of the BCA only and does not consider amenity or non-fire related matters in the building such as health, amenity, security, energy efficiency, occupational health & safety, compliance with Disability Discrimination Act (DDA) etc, which are to be addressed by others. Consequently, the outcomes of this assessment have not been checked or verified for their fitness for purpose for any non-fire safety related matters including the ones outlined above.

c) This assessment is not a full compliance or conformance audit for any fire safety system. Therefore, operational checks of fire safety equipment, verification of construction techniques, fire resistance levels or the witnessing of fire drills or exercises are specifically excluded from the scope of this assessment. The operational status of systems, items of equipment and staff training should be addressed as part of the inspection, commissioning, enforcement, maintenance, testing, training and management procedures for the building.

d) This assessment will be consistent with the objectives and limitations of the BCA and therefore specifically excludes major forms of arson involving accelerants and/or multiple ignition sources (other than minor forms of arson as a source of initial ignition), acts of terrorism, protection of property (other than adjoining property), business interruption or losses, personal or moral obligations of the owner/occupier, reputation, environmental impacts, broader community issues etc.

e) Egress and fire safety provisions for persons with disabilities were considered to the same degree as the BCA DtS Provisions.

f) Reports marked 'Draft' are subject to change and AECOMaccepts no liability pending release of the final version of the report.

g) The recommendations in this assessment are based on information provided by others. AECOMhas not verified the accuracy and/or completeness of this information and accepts no responsibility or liability for any errors or omissions which may be incorporated into this assessment as a result.

h) The recommendations, data and methodology documented in this assessment are based on the documentation in Section 8.0 and specifically apply to the subject building and must not be utilised for any other purpose. Any modifications or changes to the building, fire safety management system, or building usage from that described may invalidate the findings of this assessment necessitating a re-assessment.

11.0 Conclusions

Based on the fire engineering assessment presented in this report, it is the considered opinion of AECOM that the proposed Alternative Solutions satisfy the BCA Performance Requirements CP2, CP9, DP4, DP6, EP1.4, EP1.1, EP1.3 and EP2.2. This is subject to, but not limited to, the implementation of the fire safety strategy for this building as outlined in Section 1.0 of this report.

The readers' specific attention is drawn to the scope and conditions of use of this document that are outlined in Section 1.0 - Introduction (page 2), Section 3.0 – Design Objectives (page 6) and Section 10.0 – Validity & Limitations (page 57).

Appendix A Egress Calculations

Appendix A Egress Calculations

Occupant Egress

The total evacuation time from a building or floor is the summation of three component times as shown by the equation below[10]:

$$t_{evacuation} = t_{detection} + t_{pre\text{-}movement} + t_{movement} \quad (1)$$

Where
$t_{evacuation}$ = total egress time (s);
$t_{detection}$ = detection time or time until people become aware of the fire (s);
$t_{pre\text{-}movement}$ = pre-movement time (s);
$t_{movement}$ = movement or travel time to exits (s).

Detection Time

The detection time $t_{detection}$ is the time interval between the ignition of the fire and the time when occupants become aware of a fire incident within the building. The detection time is generally given by the time at which the fire alarm is sounded by the automatic fire detection system, or the occupants receive a clear visual or olfactory cue, such as smoke. In this case, the building is to be equipped with an aspirated smoke detection system linked to an occupant warning system in accordance with AS 1670.1:2004.

For a fire scenario in the compartment of fire origin, the occupants are likely to receive an instantaneous visual or olfactory cue before the smoke detectors activate. This is expected to occur when smoke layer falls below 5% of the ceiling height of the compartment. However, this may not occur readily due to the layout of the plant. Therefore, the detection time was based on the activation of the smoke detection system and the subsequent initiation of the occupant warning system as it represents the longest time.

The smoke detector activation time was predicted to be 120 s (main warehouse) by FDS[11] based on 8% smoke obscuration criteria as specified in AS 1668:1. The result is shown in Figure 11-1.

10. Fire Safety Engineering Guidelines (Second Edition), Australia Building Codes Board, November 2001.
11. NIST (2001), FPE Tools, Version 3.1.7, National Institute of Standards & Testing, Gathersburg, MD.

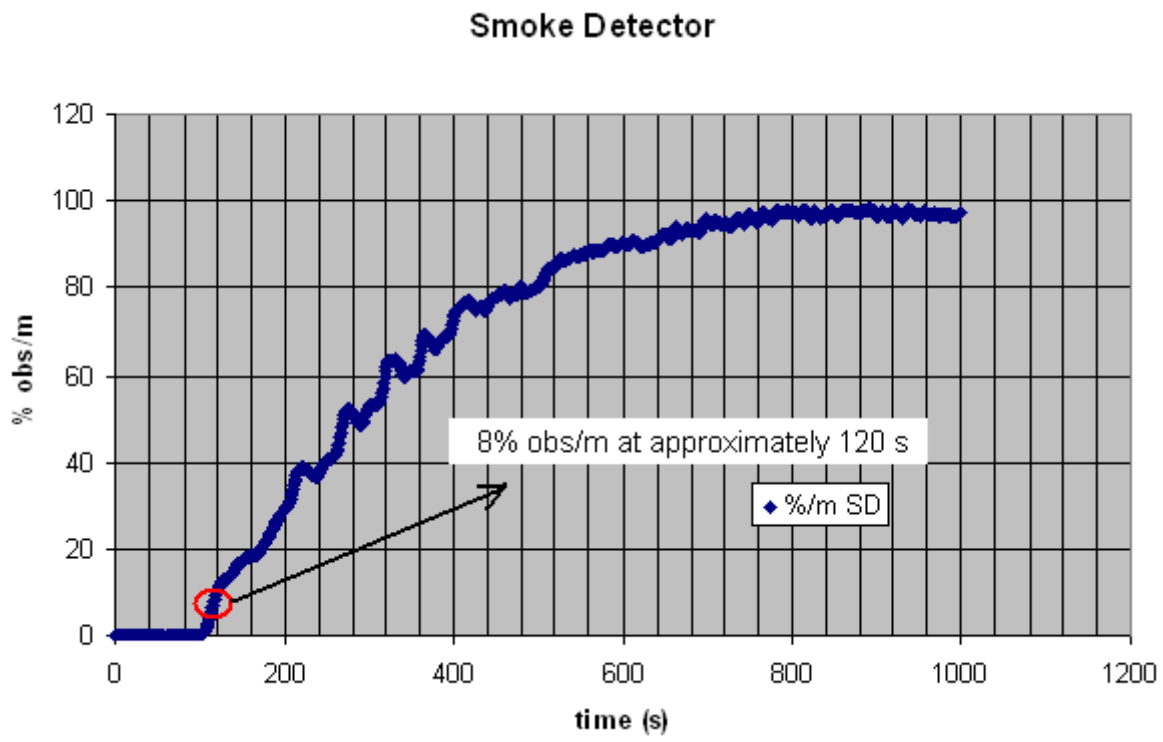


Figure 11-1 – Smoke detector activation time

Pre-movement Time

The pre-movement time, $t_{pre\text{-}movement}$ is the time from when people become aware of the fire until they begin to evacuate. One common reaction is to try to get more information about the fire and another is to try to extinguish the fire. Other factors that determine the pre-movement time include the occupant familiarity with the building, the reaction of the group that the occupants are in, the threat of the fire and the type of evacuation alarm. If the occupants have a clear visual cue, such as smoke, the pre-movement time will be short, as encountered in the room of fire origin.

Based on the type of alarm used in this facility, it has reported that for a best case scenario, the warning time, $t_{warning}$ for a fire alarm bell is 180 s, while a non directive pre-recorded public address or information warning system has a warning time of 120 s. In situations where there is a live public address system and closed circuit television, a warning time of 60 s is recommended.

A pre-movement time of approximately 60 s was recommended by Frantazich[12] for open plan buildings.

Based on the type of alarm used in the building, the pre movement time has been determined to be 180 s.

Movement Time

The movement time is the time that it takes occupants to move from their initial position to a safe place and is the sum of the queuing time at the exit and the travel time to reach the exit.

The movement times were based on the following parameters:

a) Maximum population as per Section 5.1.

b) Maximum travel distance of 107 m and Alternative Exit travel Distance of 257 m.

c) Total exit widths of 16 m based on 20 exits x 800 mm typical door width (for the main warehouse).

[12] Frantzich, H., Occupant Behaviour and Response Time – Results from Evacuation Experiments, Conference Proceedings to the 2nd International Symposium on Human Behaviour in Fire. Interscience Communications, 159-165, Boston, MA, 2001.

d) For a person with average mobility, an unobstructed evacuation speed of 1.19 m/s was reported by Nelson and MacLennan (1995)[13]. While a maximum specific flow through a door of 1.3 persons/s.m and an evacuation speed of 0.5 m/s down a stair were respectively reported by Pauls (1995)[14]. The research findings by Shields (1996)[15] recommend an average unobstructed evacuation speed of 0.69 m/s for a person in a manual wheel chair on a level surface. It is considered that all the occupants inside the facility will be a non handicapped person and a normal average healthy person, therefore evacuation speed of 1.2m/s will be used.

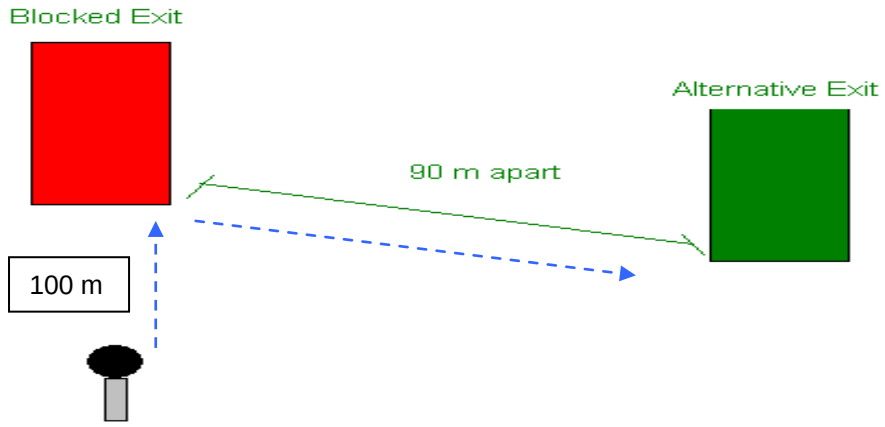


Figure 11-2 – Egress path due to one exit being blocked.

Inputs				
No. of Occupants	300	people		
Occupant Horizontal Travel Speed	0.6	m/sec		
Travel Distance to Stair/Exit Door	167	m		
Stair/exit Door Width	16	m		
Less Boundary Layer	6	m		
Calculations				
Travel time to exit door				
Calculated travel time	278	sec	or	4.64 min
Flow capacity through door				
Effective width of door	10	m		
Maximum Specific Flow (Fs)	1.3	persons/sec/m of effective width		
Doorway Specific Flow (Fs)	1.3	persons/sec/m of effective width		
Doorway Calculated Flow (Fc)	13	persons/sec		
	780	persons/min		
Outputs				
Travel time to exit door	278	sec		
Travel time through exit door	23	sec		
Total Travel Time	**301**	**sec**	**or**	**5.02 min**

Figure 11-3 – Normal pattern egress spreadsheet.

13 Nelson, H.E. and MacLennan, H. A., Emergency Movement Section 3/Chapter 14, The SFPE Handbook of Fire Protection Engineering, 2nd Edition, 1995.
14 Pauls, J., 'Movement of People', The SFPE handbook of Fire Protection Engineering, 2nd Edition, 1995.
15 Shields, T.J., Dunlop, K., and Silcock, G., (1996) "Escape of Disabled People from Fire. A Measurement and Classification of Capability for Assessing Escape Risk," BRE Report 301, British Research Establishment, Borehamwood, UK.

Inputs				
No. of Occupants	300	people		
Occupant Horizontal Travel Speed	0.6	m/sec		
Travel Distance to Stair/Exit Door	257	m		
Stair/exit Door Width	15	m		
Less Boundary Layer	5.7	m		
Calculations				
Travel time to exit door				
Calculated travel time	428	sec	or	7.14 min
Flow capacity through door				
Effective width of door	9.3	m		
Maximum Specific Flow (Fs)	1.3	persons/sec/m of effective width		
Doorway Specific Flow (Fs)	1.3	persons/sec/m of effective width		
Doorway Calculated Flow (Fc)	12.09	persons/sec		
	725.4	persons/min		
Outputs				
Travel time to exit door	428	sec		
Travel time through exit door	25	sec		
Total Travel Time	**453**	**sec**	**or**	**7.55 min**

Figure 11-4 – Alternative Exit Egress spreadsheet (one exit being blocked).

Egress from mezzanine level

The mezzanine level area will be occupied by a limited number of occupants. There are several features that make it significant to be looked closely. Firstly the path way on the mezzanine is only approximately 900 mm, with the addition of EPRM machine the egress width is further reduced to approximately 600 mm. The mezzanine is connected to the ground with stairs measuring approximately 800 mm in width. It is open to the main warehouse and therefore is exposed to the smoke hazard from that area.

Due to the above limitation and hazard existed in the mezzanine level; it is considered that the egress of the occupants from the mezzanine level should be look upon closely. Pathway from the mezzanine to the final exits of the warehouse is the sum of Egress time from mezzanine to the ground level of the warehouse and from the warehouse to the final exit leading to outside as following:

Total egress time for mezzanine level: $T_{mezzanine} + T_{warehouse}$

The following assumptions are made for the egress parameter on the mezzanine level:

- Due to width restriction occupant speed would be reduced to 0.6 m although all the occupants are of a healthy normal condition which should have average walking speed of 1.2 m/s.
- Detection time and pre movement time is considered and response time is considered to be 60 s due to instantaneous visual and oral cue from the smoke.
- Speed ascending the stairs would be considered equivalent to walking on the platform.
- Egress time when the occupant reached the ground of the warehouse would be the same as calculated in ordinary evacuation scenario.

Inputs				
No. of Occupants	5	people		
Occupant Horizontal Travel Speed	0.6	m/sec		
Travel Distance to Stair/Exit Door	40	m		
Stair/exit Door Width	1.8	m		
Less Boundary Layer	0.9	m		
Calculations				
Travel time to exit door				
Calculated travel time	67	sec	or	1.11 min
Flow capacity through door				
Effective width of door	0.9	m		
Maximum Specific Flow (Fs)	1.3	persons/sec/m of effective width		
Doorway Specific Flow (Fs)	1.3	persons/sec/m of effective width		
Doorway Calculated Flow (Fc)	1.17	persons/sec		
	70.2	persons/min		
Outputs				
Travel time to exit door	67	sec		
Travel time through exit door	4	sec		
Total Travel Time	**71**	**sec**	**or**	**1.18 min**

Figure 11-5 – Egress spreadsheet from Mezzanine level to the ground floor of the warehouse.

Based on the above spreadsheet and Figure 11-4 the movement time from the mezzanine to the stair is 71 s

RSET Summary:

Table 11-1 – RSET Summary

Scenario	Detection Time	Pre-Movement Time	Movement Time	RSET
Normal Egress (Warehouse)	120 s	180 s	301 s	601 s
Alternative Exit (One exit redundancy)	120 s	180 s	453 s	753 s
Mezzanine (Pick module) Level	60 s	60 s	71 s	191 s

Appendix B Smoke Modelling

Appendix B Smoke Modelling

General

Computational Fluid Dynamics (CFD) program Fire Dynamics Simulator [16] (FDS Version 5) was utilised to simulate the flow of heat and smoke caused by a fire as described in Design Fire Scenario Section.

The CFD program FDS 5 is a field model, based on the approach of Large Eddy Simulation technique, where low Mach number combustion equations (representing a simplified form of equations describing the transport of mass, momentum and energy by the fire induced flows) are solved numerically in a large number of rectangular cells representing the physical space. This approach is considered suitable to simulate the flow of heat and smoke through a large area.

The results generated from FDS 5 are illustrated by colour graphics showing levels of contamination and temperature by Smokeview[17], a module of the computer program where 3-dimensional graphical representations of the results are developed.

Basic Model Geometry

The compartment configuration utilised in the CFD is illustrated in Figure F.1. The bounding dimensions and openings in the building structure were scaled from the architectural drawings.

Design Fire Scenario & Input Data

The design fire scenarios that were utilised in the CFD modelling are in accordance with Section 9. CFD modelling was only carried out for Fire Scenarios B1, B2, B3 and B4 based on the following parameters.

Table B-1 – Key input parameters for CFD modelling.

Fire Scenario	T_a	H_{con}	H_{rad}	H_{comb}	y_{co}	y_{ch}	y_s
Fire Scenario B-1	20°C	0.7	0.3	19.3	0.038	-	0.1
Fire Scenario B-2	20°C	0.7	0.3	22.7	0.013	-	0.1
Fire Scenario B-3	20°C	0.7	0.3	22.7	0.013	-	0.1
Fire Scenario B-4	20°C	0.7	0.3	22.7	0.013	-	0.1
Fire Scenario B5 (Sensitivity Study)	20°C	0.7	0.3	22.7	0.013	-	0.1
Grid Resolution	~ 1.6 million cells (Mesh size: 0.6 x 0.5 x 0.3 /cell)						
Grid Sensitivity	Maximum allowable mesh size as per current AECOM computer capability.						
Modelling duration	900 s, 1200 s and 1800 s						

Table B-2 – Legend for the above table.

Legend	Notation
Ambient air temperature (deg C)	Ta
Convective heat fraction for well-ventilated fires	H_{con}

16 McGrattan KB, Forney GP, Floyd JE, Hostikka S and Prasad K, Fire Dynamics Simulator Version 3, NISTIR 6784, 2007 Ed, NIST BFRL, US, Nov 2007.

17 Forney GP and McGrattan KB, Smokeview Version 3.1, NISTIR 6980, NIST BFRL, US, April 2003.

Legend	Notation
Radiative heat fraction for well-ventilated fires	H_{rad}
Heat of combustion (kJ/g)	H_c
Smoke yield (g/g)	y_s
Carbon monoxide yield (g/g)	y_{co}
Hydrocarbon yield (g/g)	y_{ch}

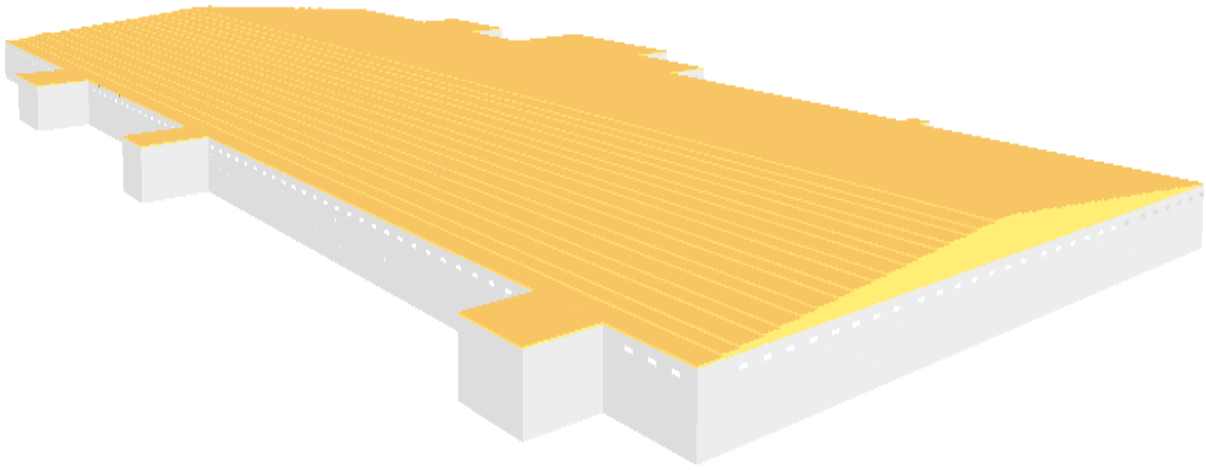


Figure B.1: Schematic illustrating compartment configuration utilised in the CFD model.

Tenability Criteria

The adapted tenability criteria for the CFD modeling in relation to occupant life safety will be based on the following parameters.[18]. The compartment is deemed to have untenable conditions when one or more of the following occur/s:

a) Air/smoke temperature reaches 183°C (approximately equal to 2.5 kW/m^2) consistently across the entire fire enclosure at any height; or

b) Significant pockets of air/smoke reaches 100°C in the vicinity of the egress path at a height of 2.1 m; or

c) Substantial accumulation of stagnant smoke is formed below 2.1 m in the vicinity of the egress path such that visibility is limited to less than 4 m (i.e. an optical density of 0.25 m^{-1}).

Temperature

The temperature criteria are related to the exposure of radiation and convected heat from hot smoke as recommended in the Fire Engineering Guidelines[19].

Visibility

The Fire Engineering Guidelines[20] recommend a minimum visibility of 10 m (0.1 m^{-1}) be maintained in large spaces during evacuation.

18 Fire Engineering Guidelines, Fire Code Reform Centre Limited, 1st Ed, Sydney, NSW, March 1996.
19 Fire Engineering Guidelines, Fire Code Reform Centre Limited, 1st Ed, Sydney, NSW, March 1996.

Model Duration

The modelling duration was 900 s. This duration is considered adequate to demonstrate tenability during occupant evacuation.

Tenability Criteria
ASET
The table below summarises the ASET results obtained from CFD modelling.

Table B-4 – ASET summary at ground level.

Fire Scenario	Temp < 183°C across enclosure	Temp < 100°C at 2.1 m in egress path	Visibility > 10 m at 2.1 m above floor.	ASET
B1 – 6 MW fast t^2 fire underneath machinery platform	900 s	900 s	900 s	900 s
B2- 5 MW ultrafast high rack mixed commodities at mezzanine	900 s	900 s	900 s	900 s
B3 – 5 MW ultrafast high rack mixed commodities at mezzanine	900 s	900 s	900 s	900 s
B4 – 20 MW fast t^2 truck fire at finger dock	1800 s	1800 s	1800 s	1800 s
B5 – sprinkler controlled 6 MW fast t^2 fire with 25% smoke exhaust rate (60 $m3/^s$) (sensitivity study)	1200 s	1200 s	1200 s	1200 s

Based on the design fire B4, it can be extrapolated that design fire B1, B2 and B3 would also have at least 1800 s ASET time.

ASET/RSET

The tables B-5 below show the ASET/RSET comparison.

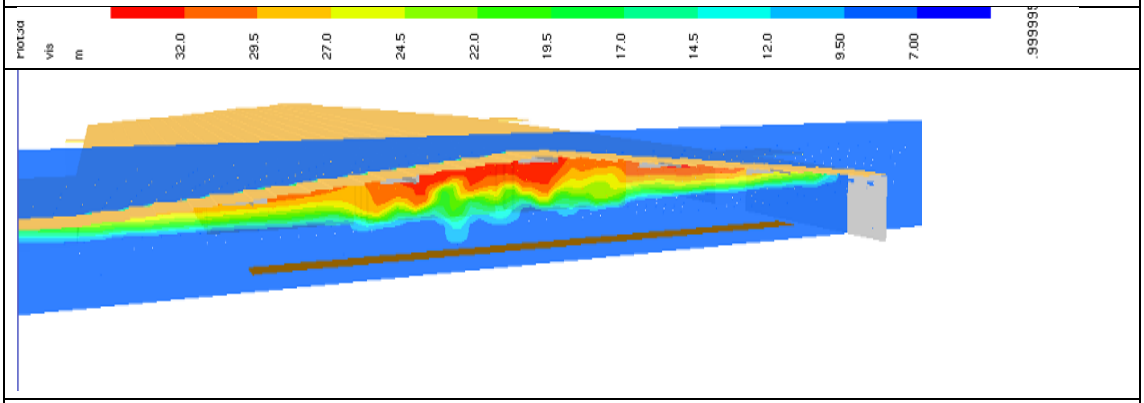
Table B-5 – ASET/RSET Comparison in design case

Egress Scenario	ASET	RSET	Safety factor
Normal Egress	1800 s	601 s	2.9
One Exit block (Alternative Egress)	1800 s	753 s	2.4
Mezzanine Egress	340 s	191 s	1.7
Normal Egress (Sensitivity Scenario)	1200 s	601 s	1.9

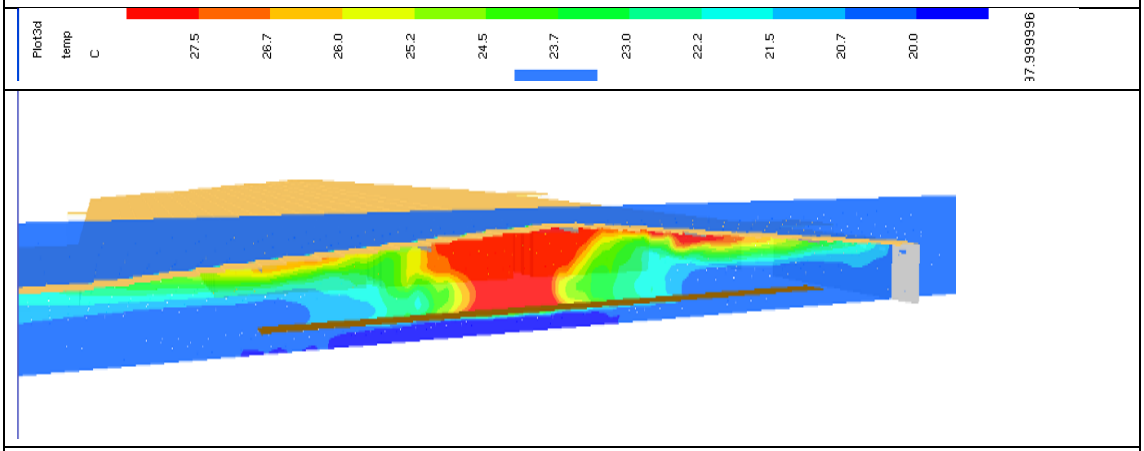
20 .Australian Fire Engineering Guidelines, 1st Edition, Fire Code Reform Centre, 1996.

Results

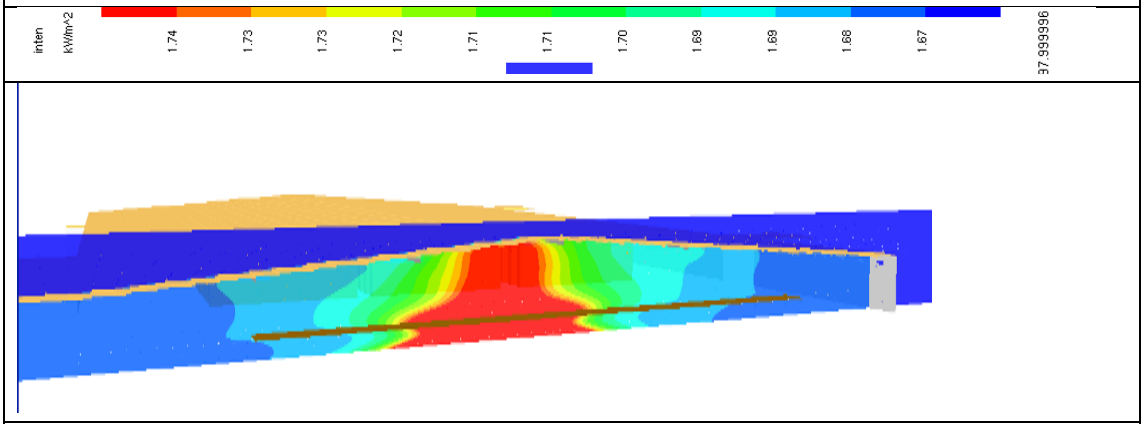
Fire B1 – Machinery under platform fire – Fast 6 MW



Visibility at 900 s

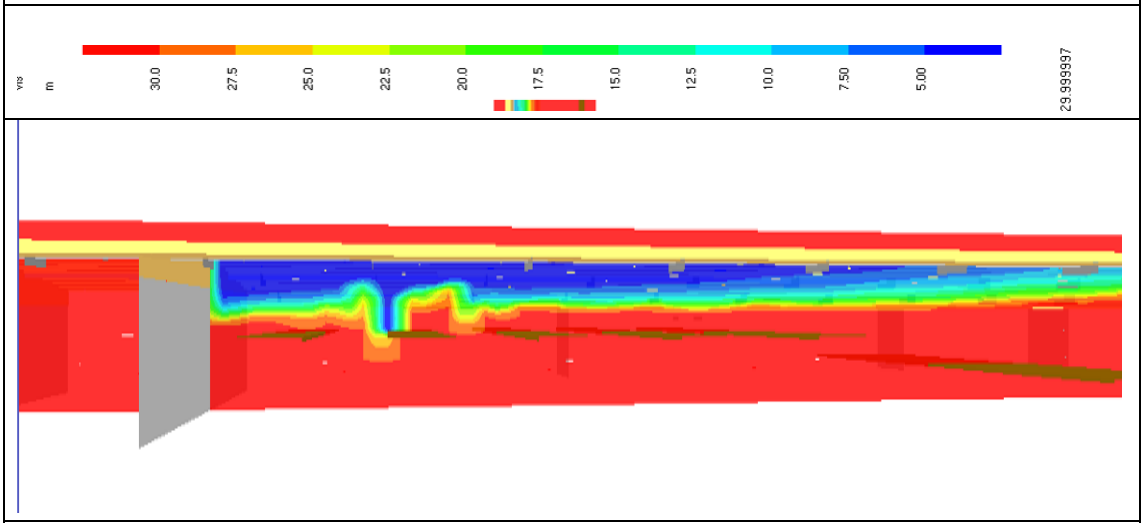


Temperature at 900 s

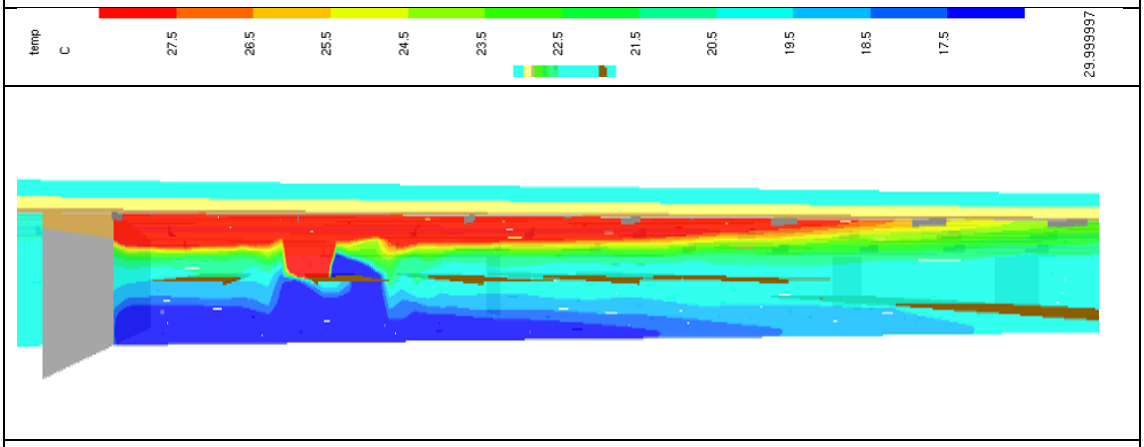


Radiant Intensity at 900 s

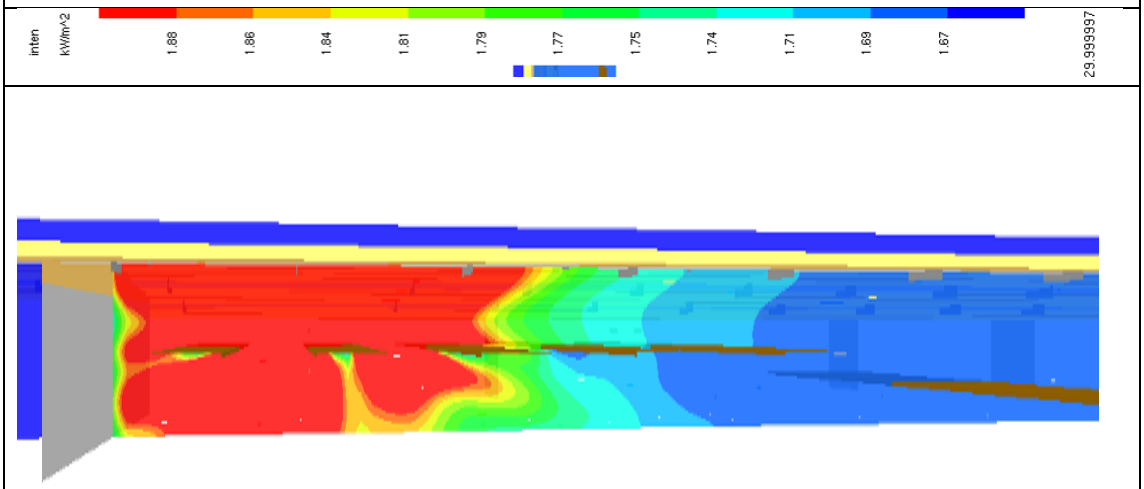
Fire B2 – High rack mezzanine - ultrafast 5 MW fire



Visibility at 900 s

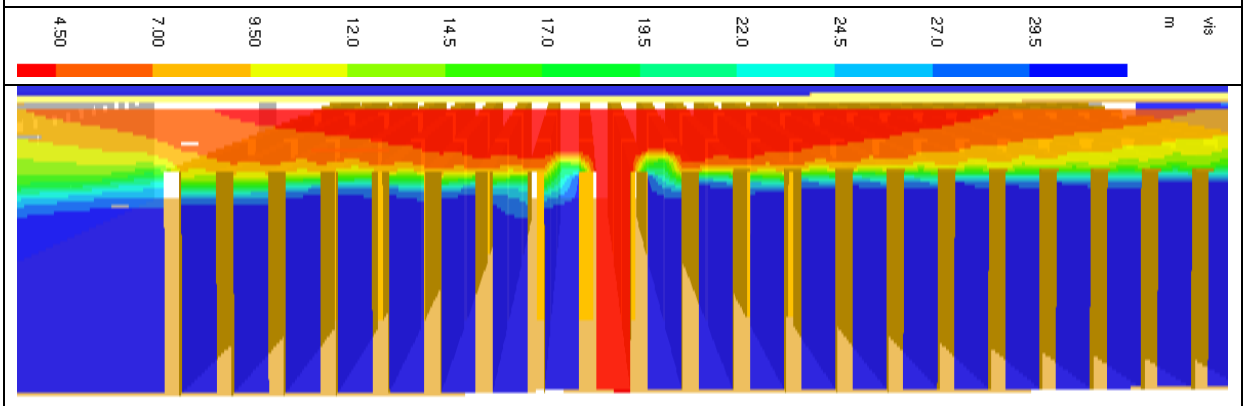


Temperature at 900 s

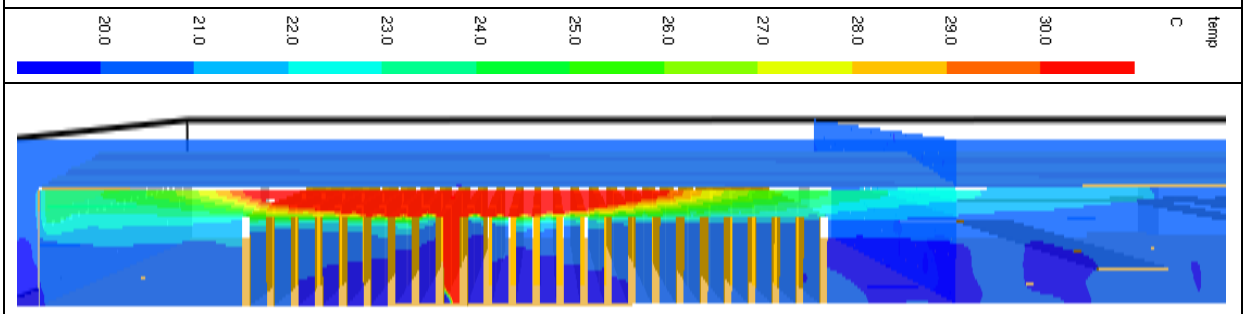


Radiant Intensity at 900 s

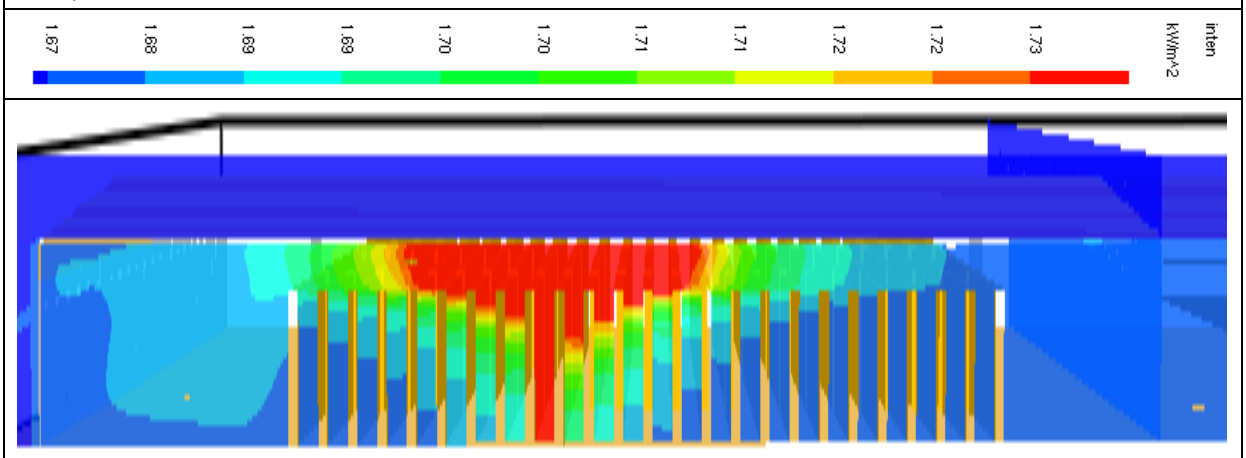
Fire B3 – High rack mixed commodities - ultrafast 5 MW fire



Visibility at 900 s

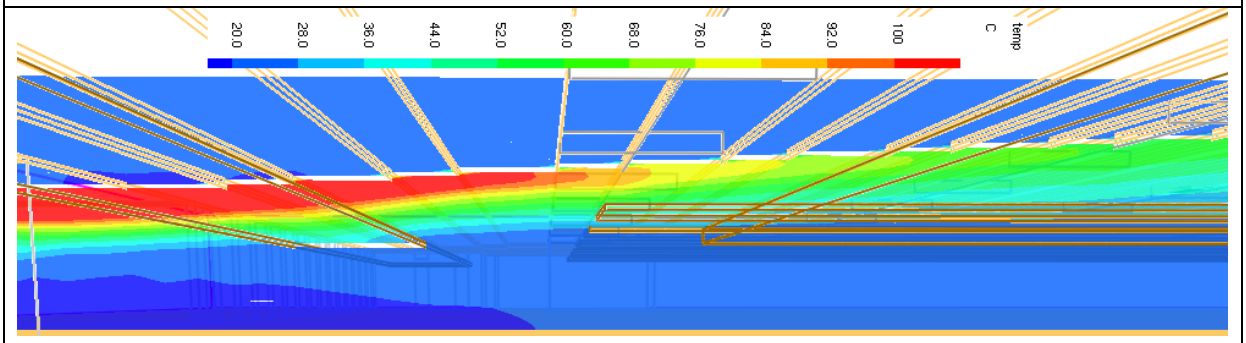


Temperature at 900 s

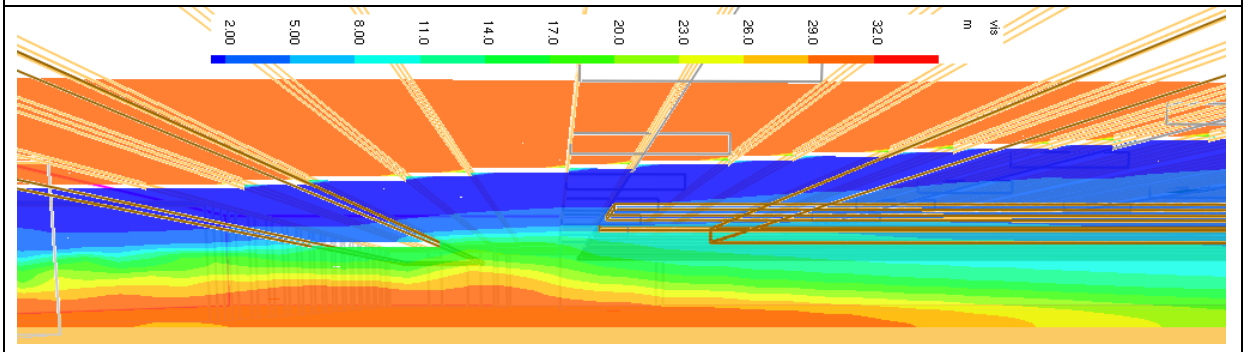


Radiant Intensity at 900 s

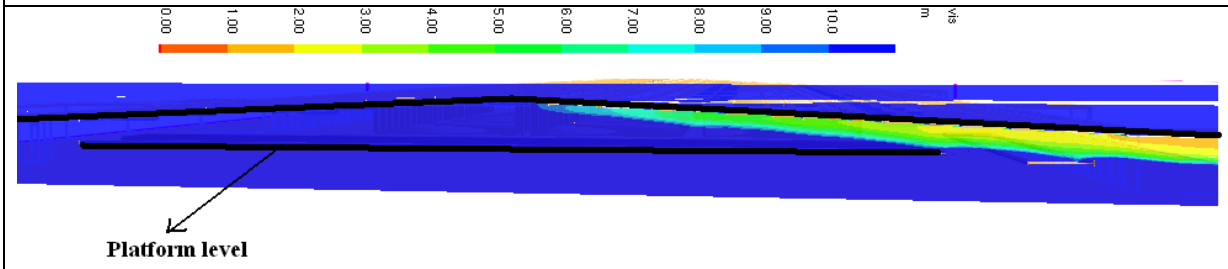
Fire B4 – 20 MW truck fire at finger dock area



Temperature at 1800 s

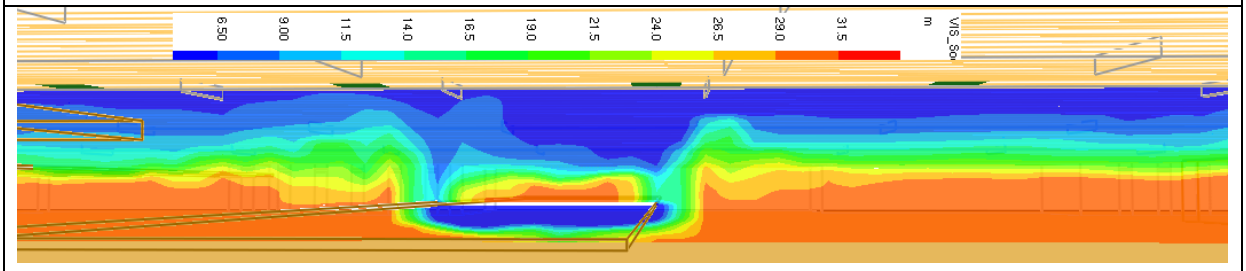


Visibility at 1800 s

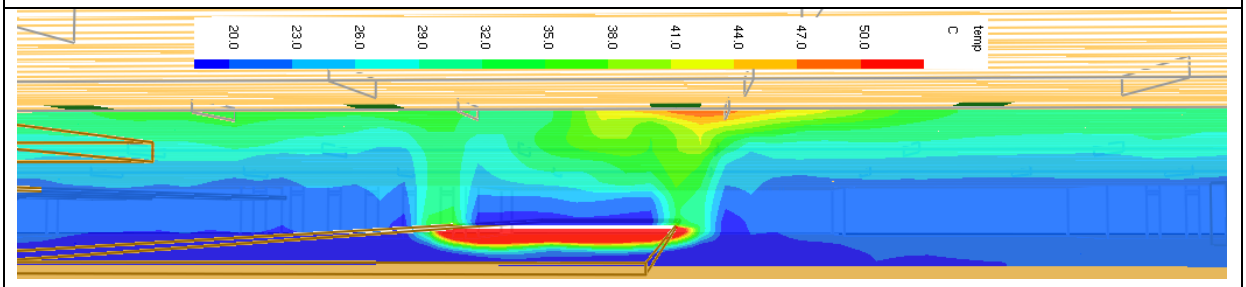


Visibility at platform level at 340 s

Fire B5 – Sensitivity Case – 6 MW Fire with 25% smoke exhaust rate (60 m^3/s)



Visibility at 1200 s



Temperature at 1200 s

Appendix C Fire Brigade Intervention Modelling

Appendix C Fire Brigade Intervention Modelling

The subject building is located at Hoxton Park, 2127, NSW. The NSW Fire Brigades websites has shown that that the two closest responding fire stations would be the Horningsea Park Station and Bonnyrigg Heights Fire Station. The Horningsea Park Fire Station at 162 Greenway drive is located at a radial distance of approximately 3.4 km from the building, while Bonnyrigg Heights Fire Station at 70 Gluocester St is located at a radial distance of approximately 4.2 km.

The Fire Brigade Intervention Model (FBIM) developed by the Australasian Fire Authorities Council (AFAC, 1997) [21] was utilised in consultation with the NSWFB to predict Fire Brigade intervention time, as detailed by the calculations below.

The modelling showed that the Horningsea Park Fire Crew are expected to arrive after 13 minutes including notification time and would apply water after 22 minutes. In comparison, the Bonnyrigg Height Fire Crew is expected to arrive after 15 minutes including notification time and would apply water after 24 minutes. Fire Brigade notification in this case is expected to occur via the smoke detection system that will be connected to an approved monitoring service.

Hereafter in this report, Fire Brigade intervention time refers to the time at which water is first applied to a fire in this building by NSWFB i.e. 22 minutes including notification.

Table C-1 – Fire Brigade Intervention Modelling Summary.

Responding Stations	Arrival Time*	Time to apply water*
Horningsea Park Fire Station, 162 Greenway Drive, 2171, NSW	13 minutes	22 minutes
Bonnyrigg Heights Fire Station, 70 Gluocester St, NSW, 2177	15 minutes	24 minutes

* The mean times are utilised in the above calculations. The time includes 120 s for detector activation and fire brigade notification as outlined below.

Fire Brigade Intervention Model: Big W RDC Hoxton Park

Activity (module)	Ref	Value	Units
Detection			s
Chart 1-Time taken for initial Brigade notification			
(2) Automatic detection	Yes	120	
(5) Suppression system	Yes	0	s
(7) Alarm verification delay	Table B	60	s
(9) Automatic connection to FB	Yes		
(15) Time to transmit information to fire brigade		180	s
Chart 2-Time taken to dispatch resources			
(4) Call electric	Yes		

[21] Australasian Fire Authorities Council, Fire Brigade Intervention Model, Version 2.1, Nov 1997.

(6) Call taken at central communications	Yes		
(10) Time to relay dispatch information by phone or radio	Table D	0	s
(11) Time for fire fighters to respond to call and leave station	Chart 3	90	s
(12) Time to respond		90	s

Chart 3-Time taken for firefighters to respond to dispatch call

(2) Station manned full time	Yes		
(4) Fire fighters in the fire station	Yes		
(5) Time to dress, assimiliate information and leave station	Table E	90	s
(7) Time to respond & depart fire station		90	s

Chart 4-Time taken to reach fire scene(kerb side)

(2) Percentile response time to be used	No		
(4) Turnout from fire station	Yes		
(7) Radial distance from fire station (Horningsea Park)	km	3.4	
(7) Radial distance from fire station (Bonnyrigg Heights)	km	4.2	
(9) Design Speed	km/hr	26.8	
(11) Travel Time (Horningsea park)		457	s
(11) Travel Time (Bonnyrigg Heights)		564	s

Chart 5-Time taken for initial determination of fire location

(2) Road travel within site necessary	No		
(4) Fire visible on arrival	No		
(5) Premises occupied	Yes		
(6) Time to don safety equipment	Chart 6	301	s
(7) Hindernace Factor	Table S	0.8	
(8) Security Procedures	Table G	0	
(9) In accredited fire warden present	No		
(16) FB pre-planning documented	Yes		
(17) Time for internal travel to primary target	Chart 9	0	s
(19) Time for information gathering	Table L	90	s
(20) Time taken to determine fire location		466	s

Chart 6-Time taken to don safety equipment and gather necessary tools

(2) Time to dismount fire appliance and don BA	Table M	158	s
(3) Other safety equipment necessary	No		
(5) Time to conduct safety procedures	Table O	74	s
(6) Tools necessary for initial access and set up (hoses etc)	Yes		
(7) Time to remove necessary tools from appliance	Table P	69	s
(8) Time taken to don safety equipment and gather necessary tools		301	s

Chart 7-Time taken to assess fire

(2) Fire location and extent obvious without recon	No		
(3) Building greater then 3 storeys	Yes		
(5) Time for OIC to walk to floor below fire compartment		71	s
Vertical Travel Speed	Table	0.9	steps/s

	T		
	Table		
Horizontal Speed	Q	1.4	m/s
Vertical Travel Distance		0	steps
Horizontal Distance		100	m
	Table		
Rest Breaks	T	1.9	steps/s
(6) Time for OIC to walk from floor below fire compartment to above (21st floor)		53	s
	Table		
Vertical Travel Speed	T	0.9	steps/s
	Table		
Horizontal Speed	Q	1.4	m/s
Vertical Travel Distance		30	steps
Horizontal Distance		6	m
	Table		
Rest Breaks	T	1.9	steps/s
(7) Time for OIC to walk back to set up area		71	s
	Table		
Vertical Travel Speed	T	1	steps/s
	Table		
Horizontal Speed	Q	1.4	m/s
Vertical Travel Distance		0	steps
Horizontal Distance		100	m
	Table		
Rest Breaks	T	1.9	steps/s
(8) Additional resources	Yes		
	Chart		
(9) Notify additional resources	2	90	s
(10) Time for fire assessment		286	s

Chart 8-Time taken to travel to set-up area

(2) Road travel within site necessary	No		
(5) Safety equipment donned	Yes		
(7) Set up area inside the building	No		
(12) Time taken to travel to set-up area		100	s

Chart 9-Time taken for firefighter travel

(2) Doors to be negotiated	No		
(6) Horizontal travel	Yes		
(7) Horizontal travel time		100	s
	Table		
Horizontal Speed	Q	1.4	m/s
Horizontal Distance		140	m
(8) Vertical travel time		0	s
	Table		
Vertical Travel Speed	T	0.9	steps/s
Vertical Travel Distance		0	steps
	Table		
Rest Breaks	T	1.9	steps/s
(15) Travel time		100	s

Chart 10-Time taken to set up water for initial fire fighter protection

(2) Fire attack from appliance	No		
	Chart		
(9) Time to set up water requirements	11	135	s
(10) Time taken to set up water for initial fire fighter protection		135	s

Chart 11-Time taken to set up water supply requirements

(2) Appropriate hydrant system flow and pressure	Yes				
(12) Time takem to connect and charge hoses	Table V	135	s		
(15) Time taken to set up water requirements		135	s		
(Horningsea Park) Fire Station Charts 1-4		817	s	13.6	min
(Bonnyrigg Heights) Fire Station Charts 1-4		924	s	15.4	min
(Horningsea Park) Station (Largest time Charts 5-12)		466	s	7.8	min
(Bonnyrigg Heights) Fire Station (Largest time Charts 5-12)		466	s	7.8	min
(Horningsea Park) FBIM		1283	s	21.4	min
(Bonnyrigg Heights) FBIM		1390.4	s	23.2	min

Appendix D NSWFB Meeting Minutes

Please refer to the attached Appendix Report for this project.

Appendix E NSWFB Meeting Minutes

Minutes of Meeting

Big W RDC

Subject:	Big W RDC 2nd FEB meetings		
Venue:	NSWFB fire safety division office		
Date:	09-Dec-2009		
Time:	2.00 pm		
File/ref number:	60044407 (AECOM) & NFB 03162		
Participants:	Name	Organisation	Role
	Ben Hughes Brown (BHB)	NSWFB	
	Richard Spetiri (RS)	NSWFB	
	Chris Brown (CB)	NSWFB	
	Warren Dixon(WD)	MNIA	Architect
	Mohd Ikhwan (MI)	AECOM	Fire Engineer
	Liu Xijuan (XL)	AECOM	Fire Engineer
	Stephen Hall (SH)	AECOM	Fire Services Engineer
Apologies:	Rob Marinelli (RM)	Philip Chun	BCA Consultant

Distribution: As above

No	Item	Action
1.	**Draft FEB Rev 2z3 dated 08/12/2009 tabled at meeting** **Building Description** XL described the overall building and the proposed Alternative Solution. SH and WD described the fire safety system and the usage of the building	Note
2.	**Fire Hydrant & Fire Hose Reel** SH described combined fire hydrant and sprinkler system BHB advised that any fire hydrant-sprinkler combination system shall comply with AS2419 part 6. BHB advised that separate meeting specifically for the fire services system to be organised to resolve the issue. BHB advised that fire hydrants underneath a canopy will be regarded as internal hydrants. BHB advised that the use of extended 50 m hose length for hose reel is not recommended / accepted unless it can be demonstrates that	NSWFB to organise hydrant & sprinkler design meeting with AECOM Fire Services AECOM to provide drawings to be included in the FER

No	Item	Action
	use of the hose will only be in a straight line with minimal negating around the corner.	
3.	**Fire Rating requirement** XL described the building in general to be built in a type C construction rather than type B as required by BCA DtS. The building being requires type B by virtue of having a 2 storey picking module. In addition the main structure steel columns located within the picking module will be fire rated up to 2 hrs. BHB advised to emphasize on the use of ESFR sprinkler on limiting the temperature, and study from a pick module supplier showed that typical picking module starts to deform at 300°C. Once fails, the part of pick module affected will dump to the floor without causing general collapse of the pick module. Modelling should show that the temperature in the pick module does not reach 300°C under sprinkler controlled fire scenario. Evacuation time should also be analysed against the structural stability. BHB also advise that certain structure aspects shall be included in the fire safety statement and be checked annually. Details of aspects to be listed as essential elements will be included in the NSWFB response to the FEB review.	AECOM to include sprinkler reliability and temperature assessment in the FER NSWFB to specify structural aspects to be included as essential elements for maintenance
4.	**Travel distance & egress issue** BH advised that a definitive value should be put on the extended travel distance. The non compliance with the stair thread rise to the picking module should be advised by an access consultant for people with disability. Warren advised that only healthy and mobile occupants/staff will be allowed to work in the warehouse due to job function requirements. BHB advised that the issue related to disabled occupants to be determined by the BCA Consultant/certifier.	AECOM to confirm definitive travel distances with the BCA consultant / certifier.
5.	**Exit Signs** BHB advised that the assessment should demonstrate that the exit signs visibility shall not be compromised by the smoke layer while occupants are evacuating. AECOM should put a limit to the height of the signs. In any case the exit signs above the door should remain the same as BCA DtS and Jumbo signs should be used for the extended height.	AECOM to incorporate in FER
6.	**Fire Scenario** BH advised that the scenarios listed in the FEB are acceptable; however sensitivity scenario shall be included. Examples of the sensitivity scenarios such as having smoke exhaust failure at 25% running capacity or having an exit blocked.	AECOM to include the sensitivity scenario for assessment in the FER

No	Item	Action
7.	**Other comments** BHB advised that the statement of "NSWFB approval" is incorrect instead a statement such as "NSWFB support" is recommended. BHB advised that a caption of scenario of the CFD results inside the building at the time of fire brigade intervention to be included in the report BHB advised that AECOM should proceed with the FER as the solution is agreeable in general, if comments herein are addressed.	AECOM to include recommendations in the FER. AECOM to proceed with FER.

Appendix E Structural stability letter from DEMATIC

Appendix E Structural stability letter from DEMATIC

DEMATIC

From Murray Clarke
Phone +61 2 9486 5393
Fax +61 2 9486 5588
Email murray.clarke@dematic.com

Date 03 February 2009

Mr Mina Abdo
Fire Engineer
Bassett Consulting Engineers
Level 5, 44 Market Street
Sydney NSW 2000

Dear Mina

Re: Big W NSW
Performance of Dematic Pick Module under Fire

I am writing to provide some information relating to the performance under fire of the Dematic pick module in the proposed Big W NSW facility.

The Dematic pick module has not been designed with any BCA (Building Code of Australia) *deemed to satisfy* fire resistance period in mind.

The Big W building has been configured such that structural building columns are *not* located within the pick module. It may therefore be appropriate for you to assume that a localised fire in the pick module will not interact on the structural integrity of the main building structure.

My understanding from our discussions is that a 5MW fire may cover an area of approximately 10 square metres. An area of this magnitude corresponds to less than one bay of a pick module, with each pick module exceeding 40 bays in length. Each pick module is a fully interconnected structure with a high degree of structural redundancy in both the "cross-aisle" and "down-aisle" directions. Each bay of the pick module contributes approximately equally to the stability of the overall structure. As a consequence, a local collapse of any bay of the module does not impact on the global stability of the remaining part of the module. There are no critical areas of the module, such as bracing towers, which, if destroyed by fire, would threaten the overall stability of the module.

In the event that the sprinkler system fails and the fire spreads along the complete length of the module, the following worst case example may serve to indicate the overall level of integrity present in the module in the presence of a widespread fire.

If it is assumed that a widespread fire destroys all of the pallet live storage support beams located directly above the first picking floor (and consequently the module is relieved of the storage load located on this level), then structural calculations confirm that the module will not collapse en-masse.

I trust that this information is sufficient for your purposes; please contact me if further explanation is required.

Yours sincerely

MClarke

Murray Clarke, BSc BE PhD MIEAust
Structural Design Manager
Dematic Pty Ltd

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Belrose NSW 2085 Australia
Phone +61 (2) 9486 5555

ISO 9001 SGS Certificate No 94/211

www.dematic.com.au

Appendix D

Transportation Report

MIRVAC PROJECTS PTY LTD

TRANSPORT REPORT FOR PROPOSED DISTRIBUTION CENTRES AND WAREHOUSE DEVELOPMENT AT HOXTON PARK

FEBRUARY 2010

COLSTON BUDD HUNT & KAFES PTY LTD
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REF: 7675/2

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APPENDIX

1. INTRODUCTION

1.1 Colston Budd Hunt and Kafes Pty Ltd has been commissioned by Mirvac Projects Pty Ltd to prepare a report on the transport implications of the proposed distribution centres and warehouse development at Hoxton Park. The site is located within the former Hoxton Park Airport site, as shown on Figure 1, which has been rezoned under the Liverpool LEP 2008.

1.2 The Hoxton Park Airport site has been identified for a mixed use development containing general industrial, residential and commercial/retail uses. The regional and local traffic effects of the proposed development, comprising 45.7ha of industrial area, 14.2ha of residential and 2.5ha of commercial/retail area, have previously been assessed through a number of studies undertaken in association with the rezoning of the former airport site. These studies are appended and include:-

- Hoxton Park Airport Redevelopment - Traffic Impact Assessment (Sinclair Knight Merz, September 2006);

- Hoxton Park Airport Regional Modelling -Traffic Study (Sinclair Knight Merz, April, 2007).

1.3 Mirvac Projects proposes to develop a number of lots within the portion of identified industrial land located on the southern part of the site. A concept and project application have been developed for these lots and associated road works, including a Big W distribution facility of some 89,000m^2, a Dick Smith distribution facility of some 50,000m^2 (ultimately) and two warehouse developments of some 22,400m^2.

1.4 The Director-General's Environmental Assessment Requirements include:-

*"**Transport***

- ***robust predictions of the traffic volumes likely to be generated during construction and operation; and***
- ***an assessment of the predicted impacts of this traffic on the capacity, efficiency, and safety of the surrounding road network, including modelling of key intersections."***

1.5 This report has been prepared with regards to the Director General's Requirements and assesses the transport implications of the proposed development, comprising the two distribution facilities and the two warehouse developments. The report forms part of a project application for the Big W and Dick Smith distributions facilities and two warehouse developments. The application has been prepared under Part 3A of the Environmental Planning and Assessment Act 1979. The findings of the assessment are set down through the following chapters:-

- Chapter 2- describing transport context; and

- Chapter 3- assessing the transport implications of the proposed development.

2. TRANSPORT CONTEXT

Site Location and Road Network

2.1 The site is located within the former Hoxton Park Airport site, which has been rezoned under the Liverpool LEP 2008. The site is bounded by the M7 Motorway to the west, Cowpasture Road to the east and by open space and residential areas to the north. The M7 and Cowpasture Road converge to the south of the site at a grade separated intersection. Access to the site is provided via a signalised intersection on Cowpasture Road located to the north of the M7 interchange.

2.2 The main roads in the vicinity of the site include Cowpasture Road, the M7 Motorway, Hoxton Park Road and Elizabeth Drive. Local collector roads such as Green Valley Road and North Liverpool Road connect Cowpasture Road with the residential areas of Green Valley and Bonnyrigg.

2.3 Cowpasture Road is a classified Main Road (MR648) and operates as an arterial road running north-south between the Horsley Drive and Camden Valley Way. South of the M7 and north of North Liverpool Road, Cowpasture Road provides a four lane divided carriageway with two traffic lanes in each direction, clear of intersections.

2.4 Cowpasture Road, between the M7 interchange and North Liverpool Road, provides one northbound lane and one southbound lane. This section of Cowpasture Road is currently being upgraded by the Roads and Traffic Authority to provide a divided carriageway with two traffic lanes in each direction. Main intersections along Cowpasture Road are generally controlled by traffic signals with additional storage lanes for turning vehicles.

2.5 The M7 Motorway is located to the west and connects to the M5 Motorway at Casula, the M2 Motorway at Baulkham Hills and intersects with the M4 Motorway at Eastern Creek. The M7 provides a divided carriageway with two traffic lanes in each direction. It intersects with Cowpasture Road at a grade separated interchange adjacent to the site.

2.6 Hoxton Park Road is located to the south and provides an east-west connection between Cowpasture Road (south of the M7 interchange) with the Hume Highway at Liverpool. At its western end it provides an undivided road with one traffic lane in each direction. The RTA is currently upgrading Hoxton Park Road to a four lane divided road, similar to the eastern end upgrade, undertaken in association with the Liverpool-Parramatta Bus Transitway.

2.7 North Liverpool Road and Green Valley Road provide east-west connections from Cowpasture Road towards Liverpool, through the residential areas of Green Valley and Bonnyrigg. Both roads provide one traffic lane and one parking lane in each direction, clear of intersections, with residential driveways having direct access to the roadway. Intersections along both these roads are generally controlled by roundabouts or give-way signs, although traffic signals are located where these roads intersect with the Liverpool-Parramatta Bus Transitway and at main intersections including the intersection of Cowpasture Road/North Liverpool Road.

2.8 Elizabeth Drive is located to the north and provides an east-west connection between The Northern Road at Badgery's Creek and the Hume Highway at Liverpool. It intersects with Cowpasture Road to the north of the site at a signalised intersection. Elizabeth Drive generally provides a four lane divided carriageway.

Previous Studies

2.9 The overall site has been identified for a mixed use development containing general industrial, residential and commercial/retail uses, comprising:-

- industrial - 45.7ha;
- commercial/retail - 2.5ha; and
- residential - 14.2ha.

2.10 As shown on Figure 2, the development of the site will involve industrial development in the larger southern portion of the former Hoxton Park Airport. There will be residential development to the north with a central commercial/ retail buffer separating the industrial development from the residential. It is envisaged that there will be further residential development to the north which will link to residential areas in Cecil Hills.

2.11 Access to the site will ultimately be provided onto Cowpasture Road at two locations. One will be located to the north of the M7 interchange, and will replace the existing airport entrance. The second will be located approximately 500 metres south of Green Valley Road across Hinchinbrook Creek. Both access points will incorporate signalised intersections with Cowpasture Road. Ultimately Middleton Grange will also be connected with a road link beneath the M7 Motorway.

2.12 The residential component of the former Hoxton Park Airport will have access via the two proposed intersections onto Cowpasture Road plus secondary access via future connections to existing and future residential development to the north, west and north-east.

2.13 An internal north-south access road will be developed linking Cowpasture Road in the south to the residential development in the north. A secondary east-west connection will be provided at the northern end of the industrial development, and at a point in time in the future, eventually linking to Cowpasture Road across Hinchinbrook Creek and to the M7.

2.14 The previous studies prepared by SKM have assessed the regional and local traffic effects of the entire proposed Hoxton Park Airport redevelopment. These studies identified that the two local access points of the proposed development onto Cowpasture Road (whilst subject to detail design and approval by the RTA), will be signalised and will incorporate two through traffic lanes on Cowpasture Road, a right turn lane in Cowpasture Road of 100 metres, a left turn slip lane and a double right turn out of the site. The assessment (SKM 2006) found that under future traffic conditions these access points would operate at a satisfactory level of intersection operation.

Road Network Changes

2.15 The M7 Motorway is the most recent project in the vicinity of the Hoxton Park Airport site. It opened in late 2005, and captured some of the traffic that would otherwise use the north-south roads in the vicinity of the site, such as Cowpasture Road. The construction of the interchange with Cowpasture Road included an upgrade to Cowpasture Road on either side of the M7. This involved widening Cowpasture Road to two traffic lanes in each direction.

2.16 The RTA is in the process of widening Cowpasture Road to a four lane divided carriageway north of the M7. As part of the upgrade, the intersection of Cowpasture Road and Green Valley Road will be signalised.

2.17 The RTA has also prepared a Review of Environmental Factors for the widening of Hoxton Park Road to provide two traffic lanes in each direction from Cowpasture Road and to connect with the already upgraded sections east of Whitford Road.

2.18 In association with the development of the site, a new signalised access will be located on Cowpasture Road, to the north of the M7 interchange, which will replace the existing airport entrance. This southern signalised access, as shown on plans prepared by ADW Johnson, is being constructed in association with the current upgrading of Cowpasture Road, between North Liverpool Road to Westlink M7. Previous studies have also recommended that the northern east-west access from the site on Cowpasture Road (located some 500 metres south of Green Valley) should also be signalised.

Public Transport

2.19 Bus services in the area are provided by Metrolink and Busabout. All bus routes passing near to the development site are shown on Figure 3. There are currently no bus services operating along Cowpasture Road between North Liverpool Road and Hoxton Park Road. Nearby bus routes mainly access local residential developments to the north, east and south of the development site. However, with the increase in residential development to the north and west of the site, local bus operators have indicated that new bus routes and modifications to existing routes will be made to service these developing areas in the future.

2.20 Bus services in the area include:-

- Route 841 – Liverpool to Cecil Hills via Heckenberg and Bonnyrigg Heights;
- Route 842 – Liverpool to Hinchinbrook via Sadleir, Ashcroft and Busby;

- Route 844 – Liverpool to The Valley Plaza via Ashcroft, Heckensberg and Busby;

- Route 845 – Liverpool to The Valley Plaza via Bonnyrigg and Green Valley;

- Route 853 – Liverpool to Carnes Hill – Middleton Grange via Hoxton Park Road;

- Route 854 – Liverpool to Carnes Hill (Greenway Drive) via Hoxton Park Road; and

- Route 855 – Liverpool to Austral via Prestons and Churchill Gardens.

2.21 The closest existing bus route for the southern industrial land is Route 845 (operated by Metrolink) with a walking distance to this service of some 600 metres, measured from the southern boundary of the site. On weekdays buses on this route operate on a 30 minute headway in each direction and on a 60 minute headway on weekends, with more frequent services during the weekday peak periods.

2.22 All bus services through the area terminate/originate at Liverpool Station. Liverpool Station is located seven kilometres to the east and is serviced by trains on the City via Regents Park, Bankstown and Granville Lines, as well as Cumberland Line trains to Parramatta, Blacktown and Campbelltown. It is also two stations north of Glenfield interchange, which provides access to both the East Hills and Airport Lines.

2.23 The T-Way express bus route from Liverpool to Parramatta runs along Hoxton Park Road, turns right at Banks Road in Miller, then proceeds north towards

Parramatta. Buses generally operate on a 20 minute headway during weekday/weekends and on a 10 to 15 minute headway during weekday peak periods. The closest T-Way bus stop for the southern industrial land is located in Banks Road, Miller (near TAFE), which is some 2 kilometres from the southern boundary of the development site. Access to the T-Way from the development would require use of supplementary bus services or private transport (car, walk, or cycle).

3. TRANSPORT ASSESSMENT OF PROPOSED DEVELOPMENT

3.1 Mirvac Projects proposes to develop a number of lots within the 45.7ha portion of identified industrial land located on the southern portion of the Hoxton Park Airport. A project application has been developed for these lots and associated road works, including a Big W distribution facility of some 89,000m^2, a Dick Smith distribution facility of some 50,000m^2 (ultimately) and two warehouse developments of some 22,400m^2. The proposed development incorporates an area of some 35.6ha of the overall 45.7ha of industrial land.

3.2 The associated roadworks within the site include the development of an internal north-south access road linking Cowpasture Road in the south to the future residential development in the north. A secondary east-west connection will ultimately be provided at the northern end of the industrial development linking to Cowpasture Road across Hinchinbrook Creek.

3.3 Access to the site will ultimately be provided onto Cowpasture Road at two locations. One will be located at the northern end of the M7 interchange, and will replace the existing airport entrance. As previously discussed in Chapter 2, this access is being constructed in association with the upgrading of Cowpasture Road between North Liverpool Road and the Westlink M7. The second access would be located approximately 500 metres south of Green Valley Road across Hinchinbrook Creek. Both access points will incorporate signalised intersections with Cowpasture Road.

3.4 A project application has been prepared for the infrastructure and civil works and the first stage of development including the Big W and Dick Smith distribution facilities and the two warehouse developments. The associated roadworks for the first stage of development include the construction of the southern signalised

access onto Cowpasture Road, at the northern end of the M7 interchange, and the development of that portion of the internal road network linking to the southern access and servicing the two distribution facilities. Access arrangements for the Big W and Dick Smith distribution facilities will be provided onto the internal road network.

3.5 This chapter examines the transport implications of the proposed development through the following sections:-

- public transport;
- parking provision;
- internal road network;
- b-double routes;
- access, internal circulation and car parking arrangements;
- pedestrian and cycle network;
- work place travel plan;
- traffic generation and assessment;
- construction traffic management;
- Director-General's Requirements; and
- summary.

Public Transport

3.6 As previously discussed in Chapter 2, the site has limited access to existing public transport services. In order to encourage the use of public transport, new bus routes and/or modifications to existing routes should be introduced to service the site. It is recommended that discussions be held with Metrolink and Busabout to advance new bus routes and modifications to existing routes.

3.7 The proposed development, with its increase in employment density, will strengthen the demand for new and modified bus routes in the vicinity of the site. The location of the development close to existing and expanding residential areas within Sydney's south-west will reduce the need to travel by private car.

3.8 In association with the proposed development and in accordance with DCP 2008, provision will be made for buses on the internal access roads through the site. The preferred option for servicing the site with public transport would be to extend Metrolink service route 845. This would result in relative minimal disturbance to the existing route and its patrons, while also servicing the industrial section of the development and a large proportion of the proposed residential area located to the north. Re-routing this service would link the development with The Valley Plaza Shopping Centre, Liverpool-Parramatta T-Way and the suburbs of Green Valley, Bonnyrigg, Mt. Pritchard and Liverpool Station.

3.9 To support accessibility for cyclists, appropriate parking will be provided for bicycles. Pedestrian/cycle paths will be provided on the east-west road, linking to Cowpasture Road and to residential areas to the north of the site.

3.10 The proposed development is therefore consistent with government policy and the planning principles of:-

a) improving accessibility to employment and services by walking, cycling and public transport;

b) improving the choice of transport and reducing dependence solely on cars for travel purposes;

c) moderating growth in the demand for travel and the distances travelled, especially by car; and

d) supporting the efficient and viable operation of public transport services.

Parking Provision

3.11 Section 1.2 of the Liverpool Development Control Plan 2008 indicates that car parking for industrial developments should be provided at the following rates:-

- one space per 35m^2 of office LFA;
- one space per 75m^2 of factory/warehouse LFA or one space per two employees, whichever is the greater.

3.12 By comparison the RTA's *"Guide to Traffic Generating Developments"* suggests a rate of one space per 300m^2 GFA, equivalent to one space per 225m^2 of GLA for warehouses.

3.13 The proposed parking provisions for Big W and Dick Smith distribution centres are some 460 and 330 spaces respectively. This represents 1 space per 193m^2 and 1 space per 152m^2. These rates are in the range between Council and RTA rates and are consistent with government policy of reducing traffic generation.

3.14 In regards to the two warehouse developments of some 22,400m^2, concept plans prepared by the architect identify Lot 1 (some 8,300m^2) and Lot 2 (some 14,100m^2) providing some 85 and 116 spaces respectively. This represents a parking rate of 1 space per 98m^2 and 1 space per 122m^2. These rates are also in the range between Council and RTA rates.

3.15 The proposed parking provisions for the Big W, Dick Smith distribution facilities and the two warehouse developments are therefore considered appropriate.

Internal Road Network

3.16 Access to the site will ultimately be provided onto Cowpasture Road at two locations. One will be located at the northern end of the M7 interchange and will replace the existing airport entrance. The second will be located approximately 500 metres south of Green Valley Road across Hinchinbrook Creek. Both access points will incorporate signalised intersections with Cowpasture Road. The internal access roads connecting to these access points will include a north-south access road linking Cowpasture Road in the south to the residential development in the north. A secondary east-west connection will be provided at the northern end of the industrial development, linking to Cowpasture Road across Hinchinbrook Creek.

3.17 The road network within the southern industrial portion of the site, to be developed in association with the current project application, differs from the DCP 2008 road layout. The DCP 2008 layout incorporated a number of north-south access roads through the industrial area, providing access to smaller industrial developments. These roads converge at the southern end of the site to intersect with Cowpasture Road at a single access point to the north of the M7 interchange. At the northern end of the industrial area, these roads connect to a secondary east-west road linking to Cowpasture Road across Hinchinbrook Creek.

3.18 The road network will ultimately provide two access points onto Cowpasture Road and the secondary east-west road linking across Hinchinbrook Creek, in accordance with the DCP layout.

3.19 A road network, shown on plans prepared by ADW Johnson, incorporating a single north-south internal spine road through the industrial area and linking to the residential and commercial/retail development to the north, was developed providing an undivided industrial road with one traffic lane and one parking lane in each direction, clear of intersections. The east-west connection located at the northern end of the industrial development will also provide a two-way industrial road with one traffic lane and one parking lane in each direction. The future bridge across Hinchinbrook Creek will provide two 4 metre wide traffic lanes.

3.20 In accordance with DCP 2008, roads within the industrial development have been provided with minimum carriageways widths of 13 metres and intersections have been designed to cater for service vehicles including articulated vehicles and b-doubles. Swept paths of service vehicles on the internal road layout and accessing the distribution facilities are shown in Appendix C. The proposed access arrangements, internal intersections and new roads within the site have been provided in accordance with the Australian Standard for Commercial vehicle facilities (AS2890.2-2002) and Austroads Road Design Guide.

3.21 As will be discussed in the following sections, the main north-south spine road north of Cowpasture Road, will carry some 450 to 600 vehicles per hour two-way during the morning and afternoon peak periods. North of the secondary east-west connection, traffic flows will ultimately be some 250 to 300 vehicles per hour two-way during the morning and some 900 to 950 vehicles per hour two-way during the afternoon peak period.

3.22 Peak traffic flows on the future east-west connection to Cowpasture Road will be some 500 to 1100 vehicles per hour two-way.

3.23 The intersection of the main north-south spine road and the future east-west connection to Cowpasture Road, as shown on plans prepared by ADW Johnson, will be controlled by a two lane roundabout. Analysis of the roundabout found that it will operate at a good level of service, with average delays per vehicle, for the movement with the highest average delay, of less than 15 seconds per vehicle during peak periods.

3.24 Our assessment of the internal road network, has found it to be satisfactory and will provide a suitable road network for the proposed development.

B-Double Routes

3.25 Roads within the area approved for use by 25 and 26 metre b-doubles include the M7 Motorway, Cowpasture Road, Elizabeth Drive and Hoxton Park Road. The existing approved routes are shown on Figure 4.

3.26 In association with the development of the Hoxton Park Airport site and the provision of new industrial roads accessing the proposed industrial developments, it would be appropriate to classify all roads within the southern industrial precinct including the main north-south spine road and the east-west connection to Cowasture Road, across Hinchinbrook Creek, for b-double access. The RTA's *"Route Assessment Guidelines for Restricted Access Vehicles"* outlines the procedure for having roads classified for b-double use.

Access, Internal Circulation and Car Parking Arrangements

3.27 The proposed access arrangements for the various industrial developments within the southern industrial area will be designed to cater for the swept paths of

service vehicles including articulated vehicles and b-doubles. Swept paths for the larger b-doubles are shown in Appendix C.

3.28 The Big W distribution centre is expected to generate some 110 trucks per day and the Dick Smith facility some 120 trucks per day. The two warehouse developments would generate up to 60 trucks per day. Some 60% of these truck movements would occur between 6.00am and 2.00pm. The two distribution centres and warehouse developments will generate service vehicles ranging from small commercial vehicles to large rigid trucks and articulated vehicles, including b-doubles.

3.29 For the Big W and Dick Smith distribution centres, separate access driveways are provided for staff/visitor parking and industrial traffic. Security gates within the sites control service vehicle movements to/from the Big W and Dick Smith distribution centres. Each facility provides service vehicle entry driveways incorporating three entry lanes, including two truck queuing lanes and an express entry lane for each facility.

3.30 Exiting trucks will be accommodated within two dedicated exit lanes. The exit configuration will allow these lanes to operate independently, providing manoeuvring area for two trucks to pass. The proposed access arrangements for the distribution centres are considered appropriate and will provide efficient and practical arrangements to cater for the anticipated truck movements generated by the site.

3.31 The proposed car parking areas for the proposed facilities are laid out in a simple and clear manner with car parking dimensions of 2.4 metres wide by 5.4 metres long. Circulation aisle widths are provided at 5.8 to 6.1 metres wide for two-way circulation. These arrangements are considered appropriate and have been

provided in accordance with the Australian Standard for Off-street car parking facilities (AS2890.1-2004).

Pedestrian and Cycle Network

3.32 A network of pedestrian footpaths will be provided within the road reserves within the southern industrial area. The network will incorporate pedestrian footpaths of 1.2 metres in width. Controlled pedestrian crossings will also be incorporated at the two traffic signal controlled intersections on Cowpasture Road.

3.33 Cycleway provision will be made along the east-west link to connect into the cycleways serving the residential areas.

Work Place Travel Plan

3.34 In order to encourage travel modes other than private vehicle, it is proposed to adopt a travel demand management approach, through a work place travel plan to meet the specific needs of the site, future tenants and employees. The specific requirements and needs of the future tenants, including number of employees, hours of work, shift times, etc., will be incorporated in the work place travel plan to support the objectives of encouraging the use of public transport.

3.35 The principles of the work place travel plan, to be developed by the future tenants in consultation with Council, RTA and other stakeholders, will include the following:-

- encourage the use of public transport through new and modified bus services and the provision of conveniently located bus stops within the southern industrial area of the site, to be agreed with Council and local bus operators;

- bus services and bus stops to be provided on the main north-south spine road and the secondary east-west link to Cowpasture Road;

- work with local bus operators and public transport providers to improve services;

- encourage public transport by employees through the provision of information maps and timetables;

- provide appropriate pedestrian facilities which improve accessibility to employment and services from surrounding residential development and/or public transport nodes;

- raise awareness of health benefits of walking (including maps showing safe walking rotes);

- encourage cycling by providing safe and secure bicycle parking, including the provision of lockers and change facilities;

- provide pedestrian/cycle paths within the road reserves and through open space areas, linking to Cowpasture Road and to residential areas in the vicinity of the site; and

- provide appropriate on-site parking provision, consistent with government policy for reducing traffic generation.

3.36 The travel plan may take a variety of forms including a green transport plan or company travel plan. The work place travel plan will assist in delivering sustainable transport objectives by considering the means available for reducing dependence solely on cars for travel purposes, encouraging the use of public transport and supporting the efficient and viable operation of public transport services.

Traffic Generation and Assessment

3.37 The traffic assessment of the development of the Hoxton Park Airport site has been undertaken through previous studies (SKM September 2006 and SKM April 2007). For the industrial component of the development, the assessment has used a traffic generation rate of 15 trips per developed hectare of site area per hour during the morning and afternoon peak hour periods. This translates to a traffic generation of the proposed industrial development of some 686 vehicles per hour two-way during the morning and afternoon peak hour periods. This compares to a total traffic generation of the whole of the Hoxton Park Airport development of some 1044 vehicles per hour two-way during the morning and some 1652 vehicles per hour two-way during the afternoon peak periods.

3.38 The largest traffic effects of the proposed industrial development within the Hoxton Park Airport site will be at the intersection of Cowpasture Road/M7 intersection and the site access points onto Cowpasture Road. The SKM assessment found that these intersections (incorporating the proposed Cowpasture Road upgrading), would operate at satisfactory levels of service during peak periods in 2016.

3.39 The proposed Big W and Dick Smith distribution centres, and the two warehouse developments located adjacent to the southern boundary of the site represent

some 161,300m^2 of industrial development and cover some 35.6ha of industrial site area. Based on the traffic generation of 15 trips per developed hectare, the sites for the proposed distribution centres and two warehouse developments have been assessed by SKM with a total traffic generation of some 535 vehicles per hour two-way during peak periods.

3.40 Surveys of the Woolworths distribution centre at Minchinbury found that the facility has a traffic generation of 0.3 trips per 100m^2 GFA of the building during the morning and afternoon peak periods. The RTA Guidelines, based on extensive surveys, gives a rate of 0.5 trips per hour per 100m^2 for warehouses. Based on these rates, the estimated traffic generation for the two distribution centres and two warehouses would be some 530 vehicles per hour two-way during peak periods. The proposed development is therefore expected to generate similar traffic during the morning and afternoon peak periods than that which was previously assessed. As a result, the proposed development is in accordance with the traffic assessment for the rezoning.

3.41 Hence, the surrounding road network and signalised access points onto Cowpasture Road will operate at similar levels of service during peak periods to that previously assessed, with full development in 2016.

3.42 Based on the traffic assessment and distribution for the proposed overall development undertaken by SKM September 2006 and SKM April 2007, the estimated future traffic flows on the internal road network are shown on Table 3.1. It can be seen from this table that the north-south spine road will carry some 450 to 600 vehicles per hour two-way during peak periods through the industrial development and some 900 to 950 vehicles per hour two-way during the afternoon peak period accessing the northern commercial/retail and residential

development. Peak hour flows on the east-west connection to Cowpasture Road will be some 500 to 1100 vehicles per hour two-way.

3.43 In order to assess the operation of the internal road network, the intersection of the main north-south spine road and the east-west connection to Cowpasture Road was analysed using the SIDRA computer program. The analysis found that the roundabout controlled intersection will operate with average delays for the movement with the highest average delay, of less than 15 seconds per vehicle during the morning and afternoon peak periods. This represents a level of service A/B, which is a good level of intersection operation.

Table 3.1 Future Internal Two-Way Traffic Flows

Roads	Morning	Afternoon
North-South Spine Road		
- north of Cowpasture Road	435	590
- south of east-west road	290	560
- north of east-west road	275	970
East-West Road		
- east of north-south spine road	620	1070
west of north-south spine road	450	580

3.44 Construction of the industrial area will be staged. In accordance with the project application, the first stage development will include the construction of the Big W and the first stage (some 43,000m^2) of Dick Smith distribution facilities, construction of the southern signalised access onto Cowpasture Road at the northern end of the M7 interchange and the development of that portion of the internal road network linking to the southern access and servicing the two

distribution facilities (including the roundabout controlled intersection of the north-south spine road and the east-west connection to Cowpasture Road).

3.45 As previously noted, the two distribution facilities and two warehouse developments on the southern portion of the site, will generate some 530 vehicles per hour two-way during the morning and afternoon peak periods. This traffic generation is less than the ultimate two-way traffic flow (with full development of the site) on the north-south spine road, of some 600 to 900 vehicles per hour two-way, assessed by SKM 2006 and SKM 2007 for the ultimate 2016 traffic conditions.

3.46 The internal road network and the single signalised access onto Cowpasture Road at the southern end of the site will therefore have capacity to cater for the traffic generation of the two distribution facilities and the two warehouse developments. It should be noted that the southern signalised intersection is the subject of a detailed design with the Roads and Traffic Authority, and is being constructed in association with the upgrading works on Cowpasture Road. It is understood that the traffic signals will be introduced and operational prior to the completion of the Big W and Dick Smith distribution centres and the two warehouse developments.

Construction Traffic Management

3.47 A construction management plan for the proposed development has been prepared by Mirvac Construction Pty Ltd. The principles of traffic management during construction are as follows:-

- provide a convenient and appropriate environment for pedestrians/workers;
- minimise effects on pedestrian movement and amenity;

- manage and control construction traffic on the adjacent road network and truck movements to and from the construction activity;

- construction work will commence with the construction of the internal access roads and its connection onto Cowpasture Road;

- the introduction of traffic signals at the intersection of Cowpasture Road and the main north-south spine road, will be undertaken in association with the current upgrading works on Cowpasture Road;

- security gates and appropriate construction fencing will be located around the perimeter of the industrial area;

- construction access will be controlled onto Cowpasture Road at the southern end of the site;

- traffic capacity will be maintained at intersections and mid-block on the surrounding road network in the vicinity of the site;

- maintain safety for workers;

- restrict construction activity to designated truck routes through the area;

- work zones to be managed and controlled by qualified site personnel;

- provide appropriate parking for construction workers; and

- construction activity to be carried out in accordance with the approved hours of work.

3.48 It is understood that the construction of the distribution centres, the two warehouse developments and the internal road network within the site will be staged. As set out in the construction management plan prepared by Mirvac Construction Pty Ltd, the construction of the internal roads will typically generate some 40 to 50 truck movements per day, associated with the delivery of road base and construction material.

3.49 The construction of the distribution centres and the warehouse developments will generate a further 200 to 250 truck/light commercial vehicle movements per day, associated with the delivery of reinforcement, formwork, blockwork, concrete and other construction materials, including the removal of waste bins. This translates to an average of some 25 to 30 truck/light commercial vehicles per hour or one truck delivery every 2 minutes over the day. This is significantly less than the traffic generation of the ultimate development assessed by SKM 2006 and SKM 2007 for the ultimate 2016 traffic conditions. The surrounding road network and the southern signalised access onto Cowpasture Road will therefore be able to cater for the construction traffic generated during the construction process.

Director General's Requirements

3.50 The Director-General's Environmental Assessment Requirements include:-

"Transport

- ***robust predictions of the traffic volumes likely to be generated during construction and operation; and***
- ***an assessment of the predicted impacts of this traffic on the capacity, efficiency, and safety of the surrounding road network, with modelling of key intersections."***

3.51 With regard to traffic effects, these are discussed in the traffic generation and assessment section in Chapter 3.

3.52 With regard to construction traffic, this is discussed in the construction traffic management plan section in Chapter 3.

3.53 In addition to the Director General's Requirements, Liverpool City Council and the Roads and Traffic Authority have raised a number of matters. Liverpool City Council's matters include:-

"Traffic and Roads

A detailed traffic report, prepared by a suitably qualified consultant, assessing future traffic volumes, car parking demands and the proposed road network is adequate to cater for the overall future traffic volumes of the locality are required.

Liverpool Development Control Plan 2008 Part 2.9 – Land Subdivision in Former Hoxton Park Airport Site provides the required road network for the former West Hoxton Aerodrome site. It is noted the proposed road layout does not conform to the DCP road layout, in particular the deletion of the "runway street". Appropriate justification for the deletion of the 'runway street" is required as this was originally implemented as a marking for interpretation on the history of the site. In addition, it is recommended the western access cul-de-sac road to the warehouse and distribution centres be extended to connect to the access road so as to reduce the conflict of heavy vehicles and light traffic at the proposed east west road and any future residential development adjacent to the proposed detention basin and bridge.

It should also be noted the signalised intersection entering the site via Cowpasture Road (southern entrance) is the subject of a detailed design with the Roads and Traffic Authority (RTA) and is required to be provided prior to the development of more than 25 hectares of industrial land. As the project would see the development exceeding 37 hectares, the intersection will be required to be completed as part of the development."

3.54 With regard to the detailed traffic report the overall traffic assessment of the development of the Hoxton Park Airport site has been undertaken through previous studies (SKM September 2006 and SKM April 2007). Copies of these studies are appended. This CBHK report assesses the traffic and parking implications of the project application.

3.55 With regard to internal road network and the operation of the proposed internal roundabout, these aspects are discussed in the internal road section in Chapter 3 of this report. The JBA planning report addresses the historical aspects of the *"runway street"*

3.56 With regard to the signalisation of the main southern site access onto Cowpasture Road this is the subject of a detailed design by the Roads and Traffic Authority, and is being constructed in association with the upgrading works on Cowpasture Road. It is understood that the traffic signals will be operational prior to the opening of the Big W and Dick Smith distribution centres and two warehouse developments.

3.57 The Roads and Traffic Authority have raised the following matters:-

"1. It is noted that the transport and traffic impacts for the site were addressed in the 'Traffic Impact Assessment' prepared by Sinclair Knight

Merz and dated April 2007. These impacts should be reviewed and updated where necessary to reflect the impacts of the proposed industrial park.

2. ***The RTA has agreed in principle to the two access points on Cowpasture Road, however the intersections will need to be remodelled, with the latest modelling being compared against the modelling included in the 'Traffic Impact Assessment' prepared by Sinclair Knight Merz, dated April 2007.***

3. ***Details of the proposed accesses and the parking provisions associated with the proposed development including compliance with the requirements of the relevant Australian Standards (ie: turn paths, sight distance requirements, aisle widths, etc).***

4. ***Proposed number of car parking spaces and compliance with the appropriate parking codes.***

5. ***Details of service vehicle movements (including vehicle type and likely arrival and departure times).***

6. ***The RTA requires the EA report to assess the implications of the proposed development for non-car travel modes (including public transport use, walking and cycling); the potential for implementing a location-specific sustainable travel plan (eg 'Travelsmat' or other travel behaviour change initiative); and the provision of facilities to increase the non-car mode share for travel to and from the site. This will entail an assessment of the accessibility of the development site by public transport.***

7. ***It is noted that the Traffic Management and Accessibility Plan (TMAP) requirements for this site were addressed in the 'Traffic Impact Assessment' prepared by Sinclair Knight Merz, dated September 2006, which was undertaken as part of the rezoning of the site. The requirements contained in the previously prepared TMAP should be reviewed and updated where necessary for the proposed industrial park development.***

8. ***The RTA will require in due course the provision of a traffic management plan for all demolition/construction activities, detailing vehicle routes, number of trucks, hours of operation, access arrangements and traffic control measures."***

3.58 With regards to RTA points 1 and 2, as discussed in the traffic generation and assessment section of Chapter 3, the proposed development will generate a similar level of traffic to that assessed by SKM. The SKM modelling is therefore appropriate for the assessment of the traffic effects of the proposed development.

3.59 We have reviewed the SKM assessment. The largest traffic effects of the proposed industrial development within the site will be at the intersection of Cowpasture Road/M7 intersection and the site access points onto Cowpasture Road. Our review of the SKM assessment found that these intersections (incorporating the proposed Cowpasture Road upgrading), would operate at satisfactory levels of service during peak periods in 2016.

3.60 Hence, the surrounding road network and signalised access points onto Cowpasture Road will operate at similar satisfactory levels of service during peak periods to that previously assessed by SKM, with full development in 2016.

3.61 With regards to RTA point 3, details of the proposed access, internal circulation and car parking arrangements, including compliance with the relevant Australian Standard, have been provided in the access, internal circulation and car parking arrangements section in Chapter 3. Swept paths of service vehicles including articulated vehicles and b-doubles are shown in Appendix C.

3.62 With regards to RTA point 4, the number of car parking spaces for the distribution centres and the two warehouse developments are discussed in the parking provision section in Chapter 3.

3.63 With regards to RTA point 5, service vehicles movements have been discussed in the access, internal circulation and car parking arrangements section in Chapter 3.

3.64 With regards to RTA point 6, public transport, pedestrians and cyclists aspects are discussed in the public transport and pedestrian/cycle network sections in Chapter 3. A work place travel plan has also been discussed in Chapter 3.

3.65 With regards to RTA point 7, TMAP requirements contained in the SKM 2006 report have been reviewed and addressed in Chapter 3.

3.66 With regards to RTA point 8, the principles for the construction traffic management report have been discussed in Chapter 3.

Summary

3.67 In summary, the main points relating to the transport implications of the project application are as follows:-

i) the project application comprises two distribution centres and two warehouse developments;

ii) appropriate parking provisions have been made for the proposed development;

iii) the proposed road network will be able to cater for the traffic generation of the development;

iv) the Director General's requirements and matters raised by Liverpool Council and RTA have been addressed.