Preliminary Hazard Analysis

Warehouse A2

WestPark Industrial Estate, Erskine Park, NSW

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Document No:	8056-10
Revision No:	6
Date:	11 June 2009

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1	22/02/09	Internal Release	John Marks	JGM	David Moore	DFM		
2	24/02/09	Draft Release to Client	John Marks	JGM	David Moore	DFM		
3	18/03/09	Draft Release Revised	John Marks	JGM	David Moore	DFM		
4	05/04/09	Draft Release	John Marks	JGM	David Moore	DFM	Daniel Howard	DH
5	30/04/09	First Release	John Marks	JGM	David Moore	DFM	Daniel Howard	DH
6	11/06/09	Final Release	John Marks	JGM	David Moore	DFM	Daniel Howard	DH

Unless otherwise advised, the parties who have undertaken the Review and Endorsement confirm that the information contained in this document adequately describes the conditions of the works proposed for *Warehouse A2, West Park Industrial Estate, Erskine Park, NSW, Australia.*

Executive Summary

Moore Consulting and Engineering (MCE) have been engaged by FDC Building Services Pty Ltd (Fitout and Construction), known as FDC, to undertake a Preliminary Hazard Analysis (PHA) of the storage of dangerous goods in Warehouse A2 at the WestPark Industrial Estate, Erskine Park, New South Wales, Australia. WestPark Industrial Estate is owned by ING Industrial Custodian Pty Ltd. Warehouse A2, located on the WestPark Industrial Estate will be leased and operated by Reckitt Benckiser (Australia) Pty Ltd.

The Warehouse A2 will be used for the receipt, storage and dispatch of products, typically being cosmetics, pharmaceutical and household goods. The storage of cosmetic, pharmaceutical, and household goods will include Class 2.1 (aerosols), Class 2.1 sub-risk 8, Class 3 and Class 4.1 materials. A PHA is required for the warehouse due to the quantity of dangerous goods that will be stored at the warehouse exceeding the threshold limits described by the State Environmental Planning Paper No.33 (SEPP 33).

Methodology

The development of the PHA, is described by the following steps:

1. Identifying the potential hazards by evaluating the chemicals and processes undertaken within the warehouse. Identifying each of the hazards and potential sources of loss that are associated with their storage;

2. Undertaking a qualitative risk assessment of the identified potential hazards, with the implementation of controls associated with the hazard;

3. Evaluation of potential hazards to identify major hazards that require further quantification;

4. Estimation of the consequences of major hazardous events were determined quantitatively;

5. Evaluation of the effects of these consequences to determine if their effects would pose an off-site risk;

6. Estimation of the frequency of a hazardous incident occurring; and

7. Evaluation of the risks for the major hazardous incidents against the guidelines in the DOP *Risk Criteria from Land Use Safety Planning – HIPAP No.4.*

Conclusion

The methodology used for this PHA established that the risks associated with the proposed development were low. The determining features of the low risk levels observed were:

The proposed activities for the receipt storage and distribution of ethanol were examined against the risk criteria in DOP *Risk Criteria from Land Use Safety Planning – HIPAP No.4*. It was found that the development did not exceed any established criteria for individual, societal or bio-physical risk or increase the level of risk associated with the existing facilities

The risks associated with the proposed activities, being low, would not significantly contribute to the risks associated with the existing activities. This does not imply that there are no risks to surrounding land uses from the existing activities, but that the contribution to risks from the proposed activities does not increase the risks significantly above those risks for existing activities.

There are two (2) existing facilities, located on the industrial estate that store dangerous goods that could contribute the risks associated with the surrounding land use. These facilities are:

- Warehouse A1 and
- Warehouse C3/C4.

These warehouses were examined in conjunction with Warehouse A2 to establish if the cumulative risk on the surround land uses. The cumulative effects of the three (3) warehouses were examined against the risk criteria in DOP *Risk Criteria from Land Use Safety Planning – HIPAP No.4*. It was found that the development did not exceed any established criteria for individual, societal or bio-physical risk.

Recommendations

The following recommendations have been made for the proposed development of Warehouse A2 located at the WestPark Industrial Estate, Erskine Park, NSW. The following recommendations are not in any listed in order of priority and are presented below. The recommendations are:

- Development of a site evacuation plan suitable for multiple warehouses storing dangerous goods on the WestPark Industrial Estate; and
- The Level One and Level Two aerosol are stored closest to the flammable liquids providing greater distances of separation in the event of a fire event.

Glossary and Abbreviations

DIPNR	Department of Infrastructure, Planning and Natural Resources (refer DOP)
DOP	Department of Planning, NSW
DUAP	Department of Urban Affairs and Planning, NSW (refer DOP)
FGS	Flammable Goods Section of Warehouse C3/C4
GSS	General Storage Section of Warehouse C3/C4
HIPAP	Hazardous Industry Planning Advisory Paper
HSE	Health and Safety Executive, Great Britain
MCE	Moore Consulting & Engineering Pty Ltd
NSWFB	New South Wales Fire Brigade
PHA	Preliminary Hazard Analysis
PPE	Personal Protective Equipment
SEPP 33	State Environmental Planning Paper No.33
SR	Sensitive Receptor
SUSDP	Standard for the Uniform Scheduling of Drugs and Poisons
NDPSC	National Drugs and Poisons Schedule Committee

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1 Introduction

Moore Consulting and Engineering (MCE) have been engaged by FDC Building Services Pty Ltd (Fitout and Construction), known as FDC, to undertake a Preliminary Hazard Analysis (PHA) of the storage of dangerous goods in Warehouse A2 at the WestPark Industrial Estate, Erskine Park, New South Wales, Australia. WestPark Industrial Estate is owned by ING Industrial Custodian Pty Ltd. Warehouse A2, located on the WestPark Industrial Estate will be leased and operated by Reckitt Benckiser (Australia) Pty Ltd.

The Warehouse A2 will be used for the receipt, storage and dispatch of products, typically being cosmetics, pharmaceutical and household goods. The storage of cosmetic, pharmaceutical and household goods will include Class 2.1 (aerosols), Class 2.1 subrisk 8, and Class 3 and Class 4.1 materials. A PHA is required for the warehouse due to the quantity of dangerous goods that will be stored at the warehouse exceeding the threshold limits described by the State Environmental Planning Paper No.33 (SEPP 33).

The following section describes the objectives, study scope and methodology employed in the PHA.

1.1 Project Background

The development under consideration is Warehouse A2 located at WestPark Industrial Estate, Erskine Park, NSW, Australia. Reckitt Benckiser (Australia) Pty Ltd operates a warehousing and distribution service to clients, and currently operates from West Ryde, NSW Australia. Reckitt Benckiser (Australia) Pty Limited is a wholly owned subsidiary of the UK-based Reckitt Benckiser plc, a manufacturer and marketer of branded products in household cleaning and health and personal care. Reckitt Benckiser (Australia) Pty Limited intends to relocate the storage of materials from their west Ryde storage facilities to Warehouse A2, WestPark Industrial Estate. The manufacturing facilities will remain at West Ryde with the Warehouse A2 to be used for storage only.

1.2 Objectives

The quantities of dangerous goods stored at the warehouse exceed the threshold limits established for SEPP 33, and a PHA required for the development.

The PHA will include the following items:

- Consideration of inherently safe design principles and identification of areas where the facilities design can be further enhanced;
- Assess the potential risk associated with the warehouse and goods stored at the warehouse; and
- Preparing a PHA of the proposed warehouse, with Hazardous Industry Planning Advisory Paper (HIPAP) No. 6, "Hazard Analysis Guidelines" (Ref 2).

1.3 Study Scope

This study will be limited to the storage of goods, by Reckitt Benckiser (Australia) Pty Limited at the Warehouse A2, WestPark Industrial Estate, Erskine Park, New South Wales, Australia. The study has been prepared to be consistent with Hazardous Industry Planning Advisory Paper (HIPAP) No. 6, "Hazard Analysis Guidelines".

1.4 Methodology

The warehouse has been considered as potentially hazardous since it has exceeded the threshold levels for dangerous goods stored within the warehouse, which are set out in the *State Environmental Planning Policy (SEPP 33).* SEPP 33 requires that once these threshold limits are exceeded, a more detailed analysis be undertaken. This more detailed analysis is described as a Preliminary Hazard Analysis (PHA).

The PHA is developed using the Department of Planning (DOP) *Multi-Level Risk Assessment,* and *Guidelines for Hazard Analysis – Hazardous Industry Planning Advisory Paper (HIPAP) No.6.*

The development of the PHA included the following steps:

1. Identifying the potential hazards by evaluating the chemicals and processes undertaken within the warehouse. Identifying each of the hazards and potential sources of loss that are associated with their storage;

2. Undertaking a qualitative risk assessment of the identified potential hazards, with the implementation of controls associated with the hazard;

3. Evaluation of potential hazards to identify major hazards that require further quantification;

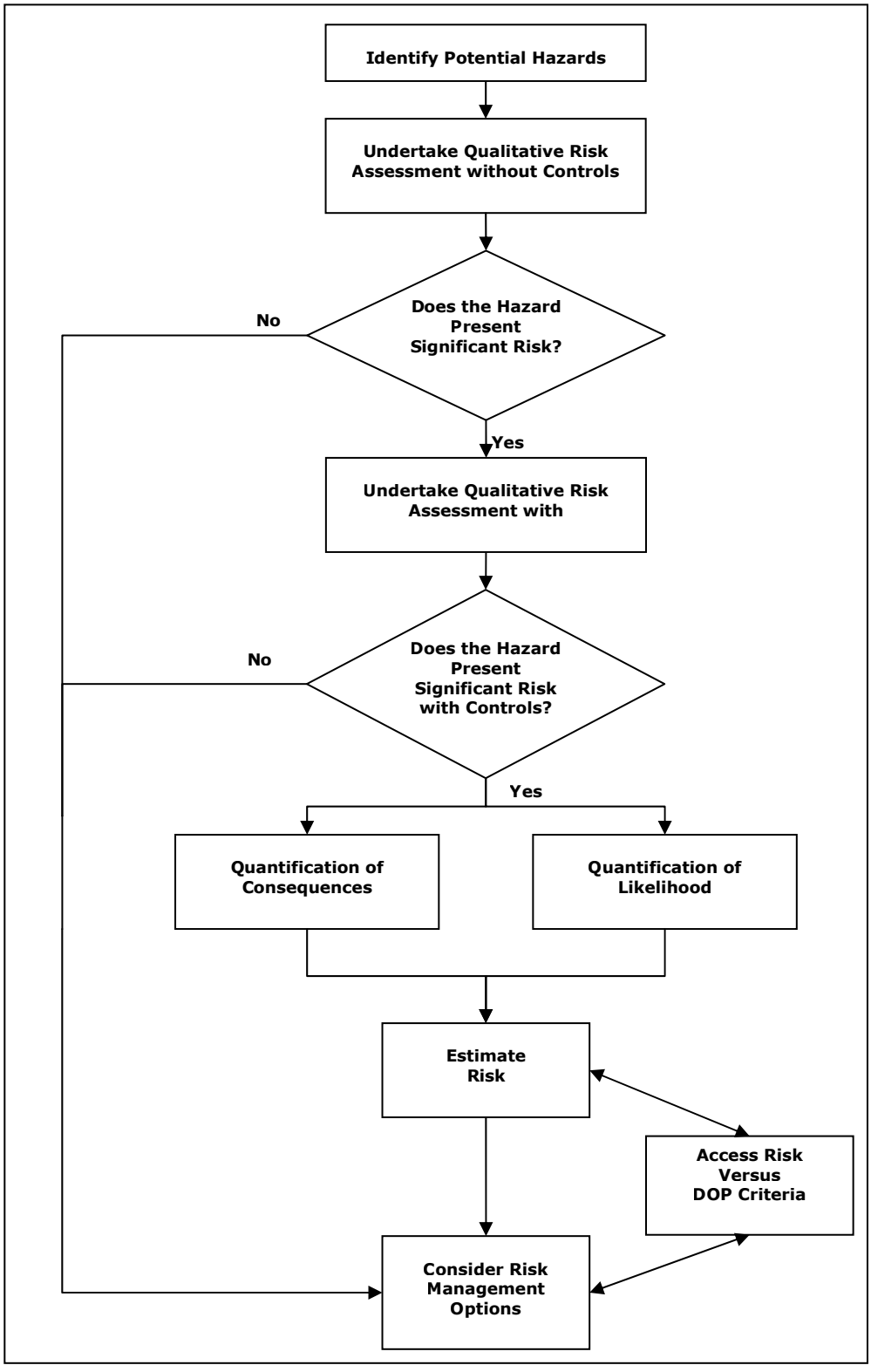
4. Estimation of the consequences of major hazardous events were determined quantitatively;

5. Evaluation of the effects of these consequences to determine if their effects would pose an off-site risk;

6. Estimation of the frequency of a hazardous incident occurring; and

7. Evaluation of the risks for the major hazardous incidents against the guidelines in the DOP *Risk Criteria from Land Use Safety Planning – HIPAP No.4.*

Figure 1.1 Methodology



2 Description of Facilities

Details of the Warehouse A2 at WestPark Industrial Estate, Erskine Park are described in the Section.

2.1 Site Location

The warehouse is located on the corner of Erskine Park Road, and Mamre Road, Erskine Park, New South Wales, Australia and forms part of the ING WestPark Industrial Estate. The site entrance is on Erskine Park Road. The subject site is triangular with a frontage to Mamre Road of approximately 600m and a frontage along Erskine Park Road of approximately 1,150m. The site has a total area of 38.84 hectares, of which the northern 14.16 hectares of the site is affected by a Transmission Easement and 5.9 hectares in the south western corner has been approved as a biodiversity conservation area (See DA02/3303). The subject site is known as the ING WestPark Industrial Estate, currently comprising a single allotment, Lot 116 in DP 1106722. As the subject site is burdened by a Conservation area in the south-west corner of the site, a two-lot subdivision has been approved under DA07/0142 for the developable portion of the site to be on a separate title to the conservation area. The northern side of the WestPark Industrial Estate has a transmission easement that runs along the boundary.

2.2 Adjacent Land Uses

The proposed warehouse is to be located in Erskine Park, in western Sydney. The proposed warehouse will be located within Penrith Council Area; the warehouse will lie within the Erskine Business Park (EBP). The overall EBP site lies to the east of Mamre Road, about 3.5 kilometres south of the M4 Motorway, essentially at the southern outskirts of the existing Erskine Park residential area. The site is subject to the controls of Penrith City Council and is zoned 4(e1) (Employment – Restricted Zone) for industrial use under the Erskine Park Local Environmental Plan.

The overall EBP is surrounded by residential development to the north-west of Erskine Park Road (the suburb of St Clair) as well as to the south-east of Erskine Park Road (the suburb of Erskine Park). It is bounded by vacant and predominantly rural lands to the east. The south and south west of the site is bounded by the Erskine Park Industrial Estate. This land is also zoned for industrial use. The Sydney Water Supply pipeline delineates a continuous east-west corridor to the south of the site, in the vicinity of Kemps Creek.

The site is zoned 4(e1) (Employment – Restricted Zone). The location of WestPark Industrial Estate in the EBP is shown in Figure 2.2.

The site is situated in a predominantly industrial area, with the nearest residential area located on the northern side of the site. The suburb of St Clair has the closest proximity to the site of residential areas, with the closest residence located across the easement that runs on the northern side of the site. The residential sub-division of St Clair is located at 170 metres from the northern edge of the warehouse.

Sensitive receptors are located to the north within the St Clair sub-division. Blackwell Primary School is located 680 metres from the centre of the Warehouse A2. Sensitive receptors are located to the south, with Emmaus Village, a low care, aged residential community being 2,100 metres from the centre of the warehouse. To the west, Erskine Park High School is located 2,000 metres away. The South/Wianamatta Creek is located to the east of the site and is 1,100 metres from the centre of the warehouse. Kemps Creek is located 4,600m towards the south. The nearest New South Wales Fire Brigade (NSWFB) is located at St Marys which is approximately 5 kilometres away. A Biodiversity protection area is located to the west of the WestPark Industrial Estate. This biodiversity area located on-site is 130 metres from the centre of the Warehouse A2.

On the WestPark Industrial Estate is a series of three warehouses, with each building containing smaller warehouse units. The location of the Warehouse, Block A, Block B and Block C within the WestPark industrial Estate is indicated on Figure 2.5.

2.3 Neighbouring Warehouses

The Warehouse A2 forms part of the tenant Block A at WestPark Industrial Estate. This block has occupants in Warehouse A1 and no occupants in Warehouse A3. This occupant, in Warehouse A1, is Kagan Logistics.

Two (2) warehouses on the WestPark Industrial Estate are presently storing dangerous goods. The warehouses that contain dangerous goods are:

- Warehouse A1; and
- Warehouse C3/C4.

The warehouses that contain dangerous goods, as mentioned above will be described in this section.

2.3.1 Warehouse A1

Kagan Logistics operates Warehouse A1, for the distribution of materials that include dangerous goods. The warehouse is used to store paints for domestic and commercial purposes as well as aerosols and polymers.

The warehouse building is separated into two areas by a fire rated wall, with the eastern half proposed to house Kagan Logistics. A maximum volume of 6 million litres of paint products is typically stored in Warehouse A1. The paints include individual volumes, up to 10-litre containers, and are stored in cardboard packaging on pallet racks. Approximately 600,000 litres of the paints are classified as a Flammable Liquid. Class 2.1 aerosol products are stored in a caged, double-rack shelfing, against the fire rated wall, with capacity to hold 1,500 pallets of aerosol cans, equating to 432 tonnes in total product weight. There are 1,500 pallets of Class 2.1 (aerosols in package sizes of 150 grams to 300 grams. The aerosol cans packed in cardboard boxes. Aerosol goods are segregated from other goods by a cage consisting of a chain wire mesh with chain wire sliding doors. Polyvinyl Butyral (PVB) rolls will be stored in the cool room. This material is not classified as a dangerous good and will be stored in the cool room between 4-6^{o}C. The cool room has sprinklers and fire retarded refrigerant panels.

The warehouse is then connected to the fire fighting water containment system with a capacity for in excess of 90 minutes of fire fighting water.

2.3.2 Warehouse C3/C4

Kagan Logistics operates a Warehouse C3/C4 for the storage of paint, paint-related products, food additives and assorted agricultural chemicals. The Warehouse A2 has 17,421m^2 of warehouse floor area: and 508m^2 of ancillary office area. A proportion of the floor area has been separated internally with a fire-rated wall that extends 500mm above the roof of the warehouse. The area has been designed specifically to house the storage of the dangerous goods (warehouse Class 2.1, Class 3, Class 3 (sub-risk Class 8), Class 4.1, and Class 6.1 (sub-risk 8)) in the Warehouse C3/C4. This section of the Warehouse C3/C4 is called the flammable goods storage (FGS) section. The FGS racking for storage of 1,300,000 litres of Class 3 material, 10,000 kilograms of Class 4.1 material, 40,000 kilograms of Class 6.1 (sub-risk 8), 1,000 kilograms of Class 3 (sub-risk 8) and a purpose-built caged area for the storage of 2,000 litres of Class 2.1 material; a 240/240/240 FRL walls extends 500mm above the roof line; and fire protection is as per NFPA 30 Scheme A.

There is also the storage of general materials and storage of food grade packaging. For operations, this warehouse is effectively divided into three (3) areas. These areas are described as the Dangerous Goods Area, the General Products Area, and the Food Grade Area. Each area within the General Storage Section (GSS) of the warehouse will comprise approximately one-third of the available warehousing area. The dangerous goods section of the warehouse will contain Class 8 and Class 9 materials.

The GSS of the warehouse is protected by an ESFR (Early-Suppression, Fast-Response) sprinkler system.

2.4 Proposed Warehouse Developments

The proposed development of the Warehouse A2 at WestPark Industrial Estate will involve the receipt storage and handling of cosmetic, pharmaceutical and household good. Some of the materials are defined as dangerous goods as per the Australian Transportation of Dangerous Goods Code. The warehouse 'A2' comprises a warehouse of 10,769m² and an office of 428m² including amenities. The warehouse will be used for the receipt, storage and dispatch of product, including some dangerous goods.

The layout of the warehouse is shown in Figure 2.6

The warehouse can be generally described as having three distinct storage areas. These areas are:

1. Aerosol storage, for the storage of Class 2.1 and Class 2.1 sub risk 8 material;
2. Flammable Goods Storage Class 3 Material; and
3. Temperature-controlled storage, containing a small quantity of Class 4.1 material and pharmaceutical and therapeutic products.

2.5 Proposed Transportation

The road entry to the site is from Erskine Park Road. Product for storage will be delivered to the site on pallets, in differing vehicles depending on the quantity of goods to be moved.

2.5.1 Incoming Deliveries

Container deliveries will be via "drop trailers" and/or driver-operated trailers or side loaders. Most deliveries are turned around and dispatched within 1 hour of receipt at the site. Typically, deliveries occur 24 hours per day, with the bulk of the deliveries expected between 3am and 5pm. Empty containers are normally removed from site during the same hours.

Trucks delivering incoming goods from manufacturing sites will drop goods between 5am and 7pm. Containers will be unloaded by both hand and forklift unloading. The site is expected to receive approximately 5–10 container loads on a daily basis, most of which are unloaded immediately and taken from site. This is undertaken via the recessed loading docks. A further 5–10 trucks will arrive on site on a daily basis to unload products directly from manufacturing sites.

2.5.2 Outgoing Deliveries

Typically, semi trailers and B-doubles will be used for the transportation of products to product retailers. Vehicles will be loaded between 5am and 10pm with an expectation that up to 25 vehicles will travel to and from the site on a daily basis. There will be export containers loaded at the facility for transportation overseas. Between 5-10 containers will be loaded for export each week.

2.6 Personnel Employed

The facility will operate 24 hours/7 days per week on a three-shift basis. Shifts will typically start at 5am, 1pm, and 9pm but this may vary depending on seasonal requirements. The facility will employ up to 25 staff within the warehouse. Approximately 10 staff will be based full-time in the office during standard business hours.

2.7 Warehouse Security

The warehouse is to be fully electronically alarmed with 24/7 monitoring by security firm. There will be closed circuit television installed at the warehouse and access to the warehouse area will be restricted at all times.

Figure 2.1 WestPark Industrial Estate Location

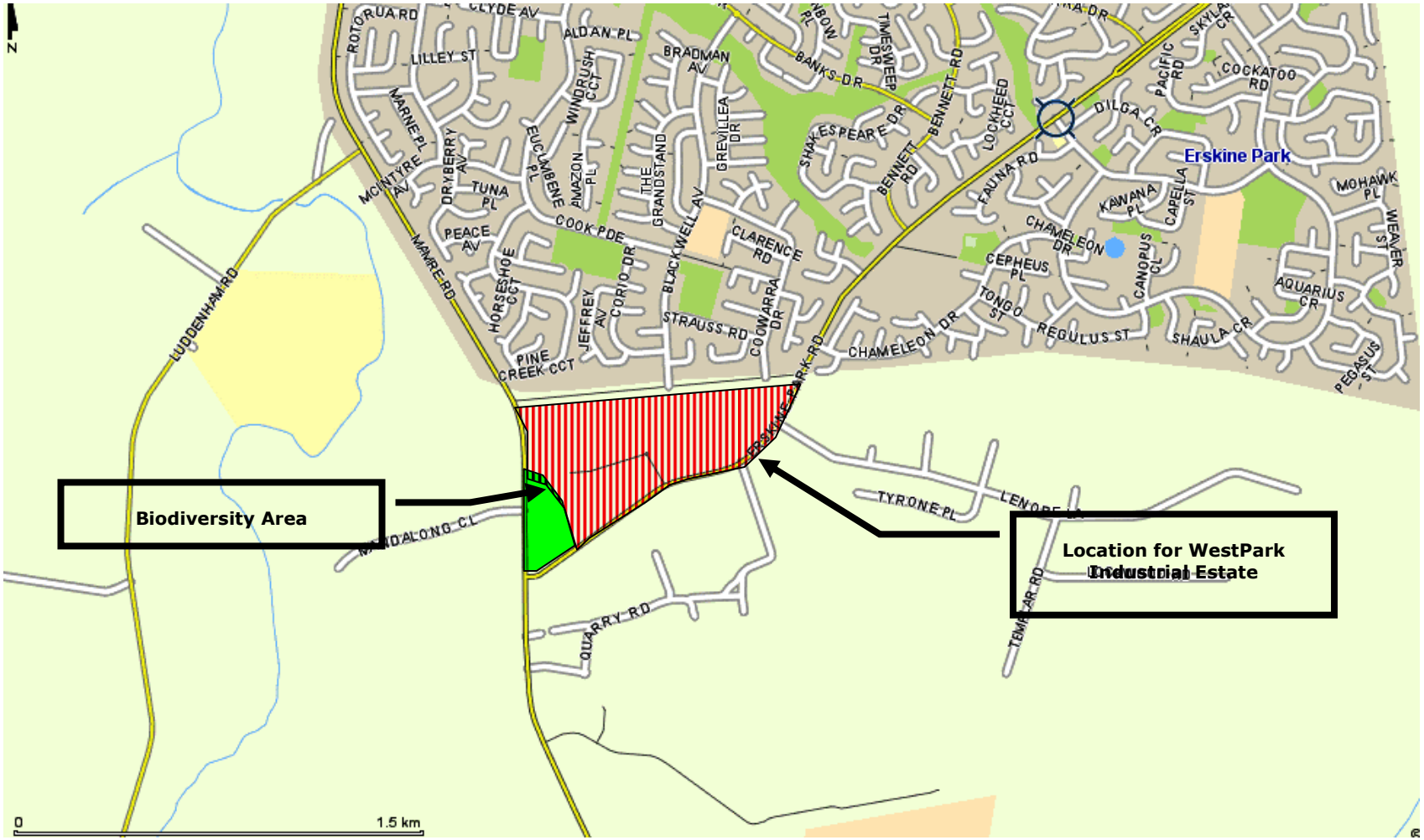


Figure 2.2 Surrounding Land Uses

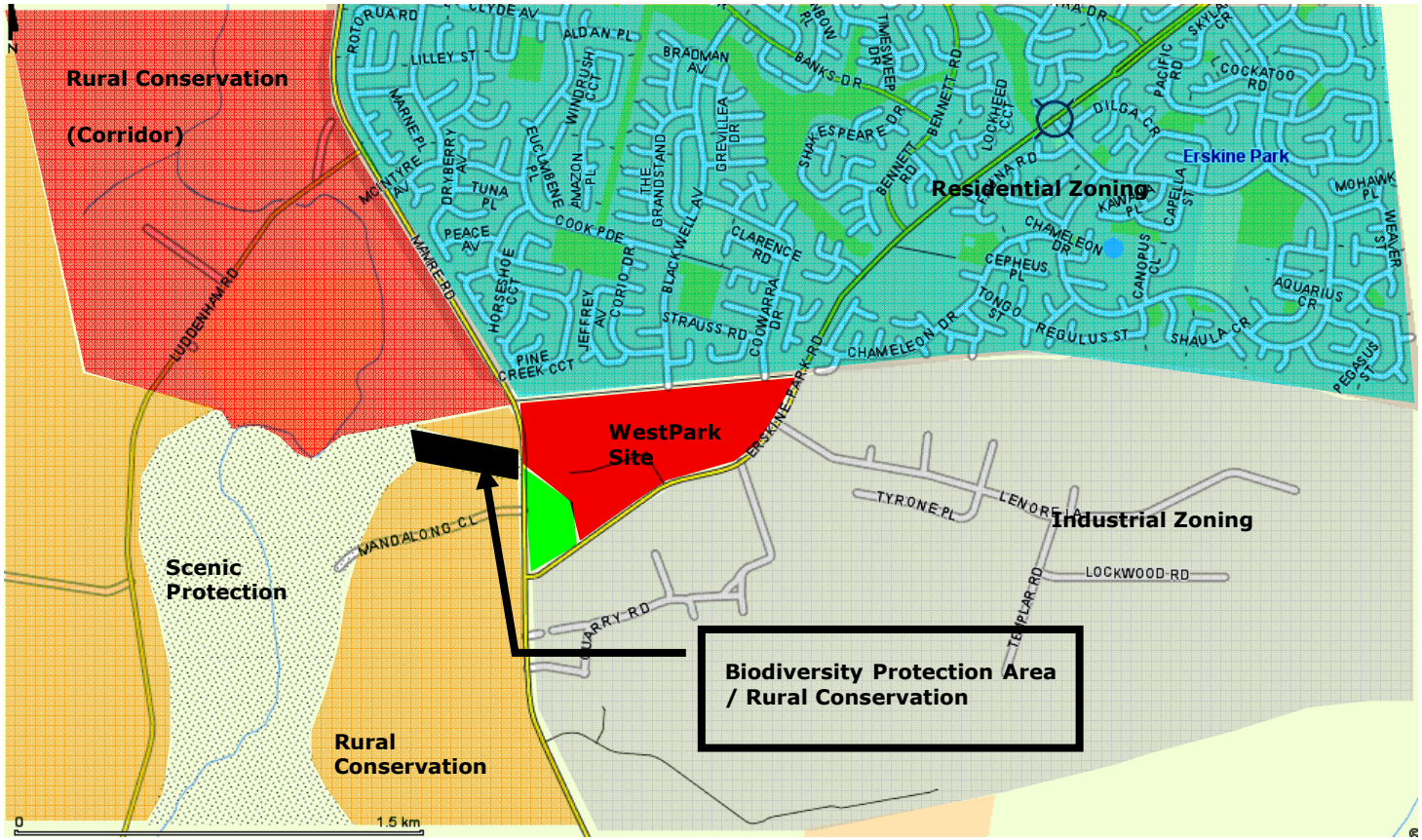


Figure 2.3 Local Planning Map

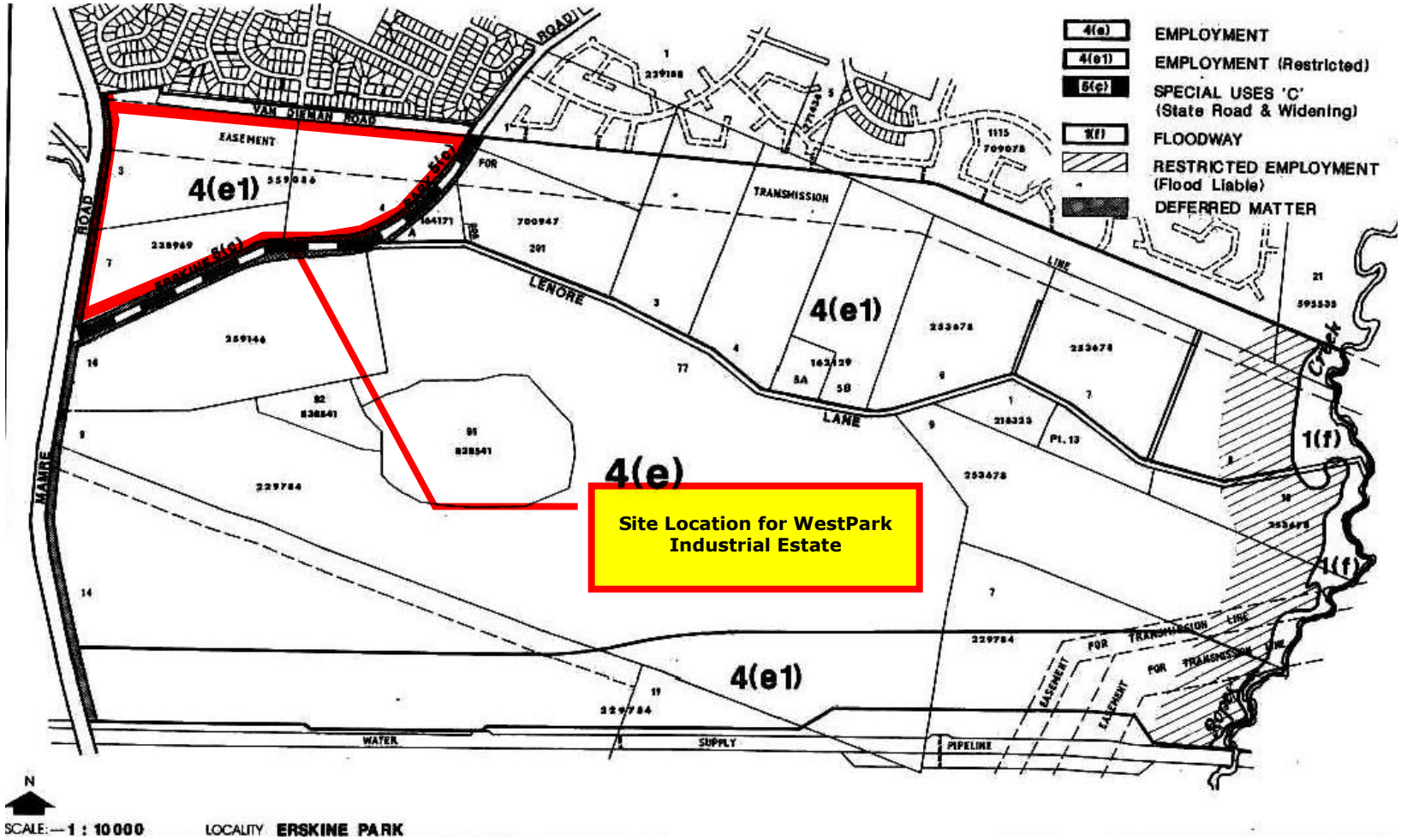


Figure 2.4 Biodiversity Management Strategy

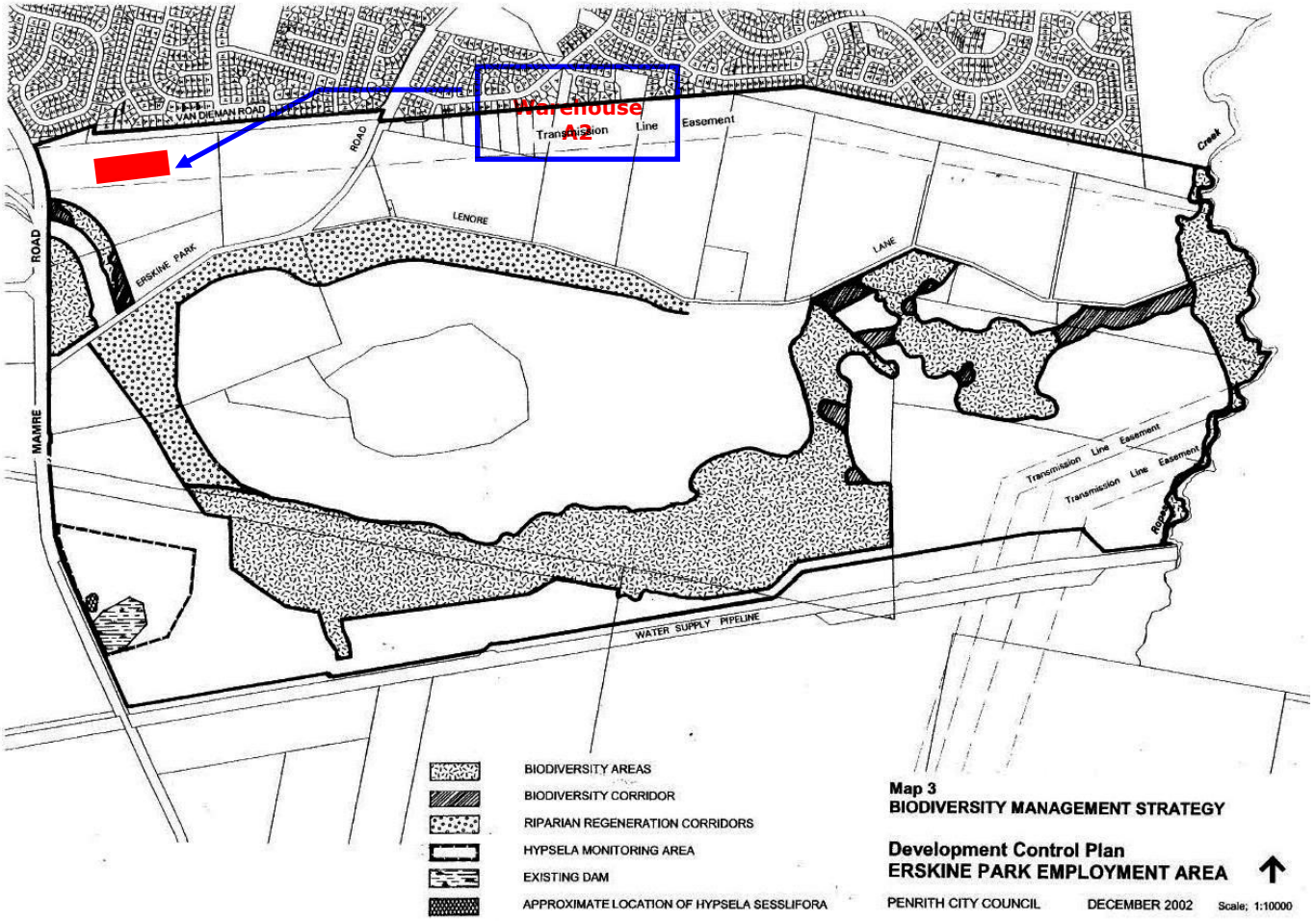


Figure 2.5 WestPark Layout

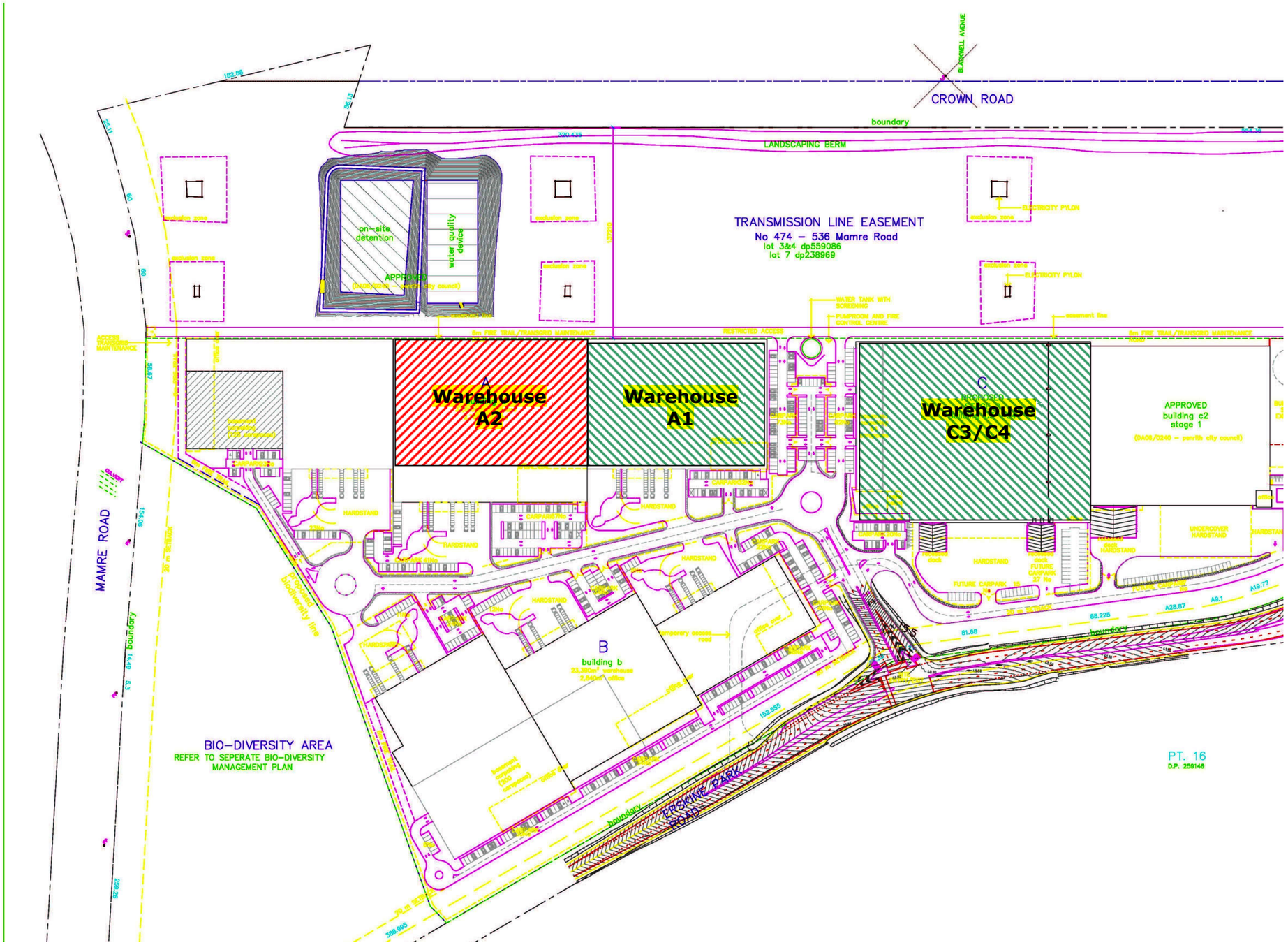


Figure 2.6 Warehouse Layout

[Page Intentionally Left Bank]

See Next Page Drawing

DIMENSIONS IN MILLIMETRES

A22 A21 A20 A19 A18 A17 A16 A15 A14 A13 A12

AA AB AC AD

9400 11800 11800 11800 11800 11800 11800 11800 11800 11800 11800

3680 3680 3680

10 BAYS @ 2743 C/E = 28420

9 BAYS @ 2743 C/E = 25585

800

TEMP CONTROLLED AREA
4000 PALLETS

Class 4.1 Material at minor storage levels

DANGEROUS GOODS AREA
2000 PALLETS

Class 3.1 PG III

Non DG / Inert Storage

ACCESS

Block Stack Class 2.1 NFPA Level 1&2

BLOCK STACK AREA
6000 PALLETS

Class 2.1
NFPA Level 2&3

Block Stack Class 2.1 NFPA Level 3

PROPOSED BUNDED AREA

MESH FENCE TO REAR OF DOCK AREA

DOCK AREA

NOTE: ALL FIT-OUT COMPONENT WORKS ARE TO BE PLANNED IN SUCH A WAY TO ALLOW MAKE GOOD OF FACILITY EASY.

PLAN - WAREHOUSE LAYOUT

REV	DATE	AMENDMENTS	CHECKED
B	22.01.09	REVISED DG AREA SURROUND	PA
C	26.01.09	ADDED ELEVATIONS, BAYS REVISED TO 2743C/E	PA

PROJECT

WESTPARK WAREHOUSE

CLIENT

RECKITT BENCKEISER

CONSULTANT

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DRAWING STATUS

PRELIMINARY

DRAWING TITLE

WESTPARK
WAREHOUSE LAYOUT

SCALE	DRAWN BY	DATE FIRST CREATED
NTS @ A3	PA	21.01.2009
PROJECT No.	DWG No.	REV
8056	LAY-HAZ-008	C

3 Process Description

This section describes the materials to be stored at Warehouse A2 and the activities to be undertaken at this warehouse.

3.1 General Description

The Warehouse A2 will be used for the receipt, storage and dispatch range of goods includes household cleaning items and healthcare items. The products are received on-site, unloaded and then allocated to one of three allocated storage areas. These storage areas are:

- Aerosol Storage area;
- Flammable Liquids Storage Area; and
- Temperature-controlled room.

3.2 Storage Quantities

The quantities of dangerous goods to be stored in Warehouse A2 are shown in Table 3.1.

Table 3.1 Dangerous Goods to be Stored

DG Class	Packing Group	Sub-risk	NFPA 30B Level	Units	Maximum Quantity
2.1			Level 1	kilograms	130,000
2.1			Level 2	kilograms	900,000
2.1			Level 3	kilograms	680,000
2.1		Class 8		kilograms	12,000
3	PGIII			Litres	360,000
4.1	PGII			kilograms	1,200

The differentiation of the different types of aerosol to be stored provided information on the appropriate fire fighting measures and the effectiveness of any controls used in the event of the Class 2.1 material being involved in a hazardous event.

The quantities presented in Table 3.1 are maximum quantities to be stored at the warehouse. Stock variations will occur and the quantities presented in Table 3.1 are the maximum levels.

3.3 Materials Storage

Material storage will be undertaken under the Australian Standard AS 3833, the storage of mixed dangerous Classes. This standard describes the storage of mixed Classes of dangerous goods with special consideration for Class 2.1 and Class 3. As such, this standard is considered appropriate for the internal design of the warehouse. The aerosols will be protected as per Factory Mutual Data Sheet 7-29 (NFPA 30B equivalence). This section contains information in the materials being stored and some fundamental controls being used.

3.3.1 Class 2.1 Storage

There will be Class 2.1 material stored in the Warehouse A2. The Class 2.1 material will be in the form of aerosol cans. The aerosols have a total product weight of 1,710 tonnes. In order to further enhance the understanding of the Class 2.1 material, the material is broken into three (3) levels as described by NFPA 30B. Each of these levels represents different consequences and has been further described in section 6.1. Representative products, for the Class 2.1 material for each Level are presented in Table 3.2 and MSDSs are shown Appendix J.

Table 3.2 Representative Products

Grouping	Typical Products
Class 2.1 Level 1	Airwick Air Freshener Aerosol
Class 2.1 Level 2	Mortein Ultra Low Allergenic Fly and Insect Killer
Class 2.1 Level 3	Mortein Fast Knockdown Fly and Insect Killer

Controls

Mechanical Protection for Aerosols. Propagation within the warehouse and to other adjacent site by the means of rocketing aerosol can will be of importance in reducing the frequency of escalation of the initial hazardous event. The installation of wire mesh, as per Factory Mutual Data Sheet 7-31, will reduce likelihood of propagation of a fire from the aerosol storage area into adjacent storage areas. The aerosols being stored are small and the mechanical protection will have a high probability of ensuring that aerosols do not escape from the area. Doors to the caged area will be of mesh and close on the activation of the FIP (Fire Indicator Panel).

Firewalls. Firewalls on the eastern and western walls of the Warehouse A2 reduce the likelihood of a fire escalation from the adjacent warehouse, or to adjacent warehouses.

Sprinkler System for Class 2.1. The sprinkler protection provided to the aerosol storage area will be as per Factory Mutual Data Sheet 7-31 (NFPA 30B) with a 9.1-metre ceiling. The sprinkler provides cooling to any potential fire and are effective in controlling both fire developing and propagation.

Internal Separation of Class 3. AS 3833 will determine the minimum separation distance between the flammable liquids and the Class 2.1 aerosol storage. The Level 1 and Level 2 aerosols are to be stored closest to the flammable liquids providing greater distances of separation.

Bunding for Class 2.1. The Class 2.1 material will be provided with a bunded area with containment for 20 minutes of sprinkler-applied water.

3.3.2 Class 2.1 Subsidiary Risk 8 Storage

There will be Class 2.1 (sub-risk 8) materials stored in the Warehouse A2. The Class 2.1 (sub-risk 8) materials will be in the form of aerosol cans. The aerosol cans will have a total product weight of 12 tonnes. This material will be stored in the caged aerosol area with the Class 2.1.

Table 3.3 Representative Products

Grouping	Typical Products
Class 2.1 (sub-risk 8)	Veet Hair Removal Mousse

Representative products, for the Class 2.1 (sub-risk 8) material is presented in Table 3.3 and MSDS is presented in Appendix J.

Mechanical Protection for Aerosols. Propagation within the warehouse and to other adjacent site by the means of rocketing aerosol can will be of importance in reducing the frequency of escalation of the initial hazardous event. The installation of wire mesh, as per Factory Mutual Data Sheet 7-31, will reduce likelihood of propagation of a fire from the aerosol storage area into adjacent storage areas. The aerosols being stored are small and the mechanical protection will have a high probability of ensuring that aerosols do not escape from the area. Doors to the caged area will be of mesh and close on the activation of the FIP (Fire Indicator Panel)

Firewalls. Firewalls on the eastern and western walls of the Warehouse A2 reduce the likelihood of a fire escalation from the adjacent warehouse, or to adjacent warehouses.

Sprinkler System for Class 2.1. The sprinkler protection provided to the aerosol storage area will be as per FM 7-31 (NFPA 30B) with a 9.1-metre ceiling. The sprinkler provides cooling to any potential fire and is effective in controlling both fires developing and propagation.

Internal Separation of Class 3. AS 3833 will determine the minimum separation distance between the flammable liquids and the Class 2.1 aerosol storage. The Level 1 and Level 2 aerosol are to be stored closest to the flammable liquids providing greater distances of separation.

Bunding for Class 2.1. The Class 2.1 material will be provided with a bunded area with containment for 20 minutes of sprinkler-applied water.

3.3.3 Class 3 Storage

There will be Class 3 material stored in the Warehouse A2. The Class 3 material will be in the form of small packages with the majority being plastic and glass. The major component recognised as Class 3 is ethanol. These properties have been used in the selection of the sprinkler control.

Table 3.4 Representative Products

Grouping	Typical Products
Class 3	Aerogard Personal Insect Repellent Tropical Strength Pump Spray

Representative products, for the Class 3 material is presented in Table 3.4 and MSDS is shown in Appendix J.

Controls

Sprinkler System for Class 3. Scheme A will protect the Class 3 material. The use of sprinklers in the flammable area is above the Australian standard, AS 1940, for the volume being stored. The use of sprinklers will reduce the frequency of this event and provide cooling water, minimising heat radiation and the transfer of the fire into other areas of storage. This materials being stored, being predominantly ethanol, are appropriate to have a water sprinkler system used. The sprinkler scheme is specified for the material being described under Factory Mutual Data Sheet 7-29 and NFPA 30.

Bunding for Class 3. A release of a flammable liquid will pool on the floor and if ignited result in a pool fire. This pool fire must be contained and not be spread into the aerosol storage area. This will be achieved by the use of a bunded area, separating the Class 3 for other Classes of dangerous goods. The bunding will have the capacity to hold 20 minutes of sprinkler water by the volume as described in AS 1940.

Internal Separation of Class 3. AS 3833 will determine the minimum separation distance between the Class 3 liquids and the Class 2.1 aerosol storage. Greater distances may be achieved with inert material, or materials that require greater radiant heat to ignite. The Level 1 and Level 2 aerosol would be recommended as being stored closest to the flammable liquids providing greater distances of separation.

3.3.4 Temperature-controlled Storage

The range of goods includes household cleaning items and healthcare items. The healthcare item swill include Schedule 2 and Schedule 3 items as described by the standard for the uniform scheduling of drugs and poisons (SUSDP) and its Amendments. The SUSDP and its Amendments contain the decisions of the National Drugs and Poisons Schedule Committee (NDPSC), regarding the classification of drugs and poisons into Schedules for inclusion in the relevant legislation of the States and Territories. These scheduled items will require a license to supply by wholesale poisons and/or restricted substances for therapeutics from the Department of Health and the Therapeutic Goods Administration (TGA).

There will be 1,200 kilograms of Class 4.1 storage in Warehouse A2. The majority of the product represented in this Class 4.1 material is used for cosmetics. The Class 4.1 material will be stored in a temperature-controlled room. The Class 4.1 material is not required to be stored at a controlled temperature for any reason other than to ensure the presentation of the material to the final customer is at a maintained level. Normal atmospheric temperatures do not affect the properties of the Class 4.1 in terms of increasing risk of that product initiating a hazardous event.

Table 3.5 Representative Products

Grouping	Typical Products
Class 4.1	Clearasil Ultra Deep Pore Face Wipes

Representative products, for the Class 4.1 material are presented Table 3.5 and a MSDS is shown in Appendix J.

Controls

Sprinkler System for Temperature-controlled Room. The temperature-controlled area of the warehouse is protected with ESFR sprinklers.

Firewalls. Firewalls on the eastern and western walls of the Warehouse A2, reduce the likelihood of a fire escalation from the adjacent warehouse, or to adjacent warehouses.

3.4 Activities to be Undertaken

The warehouse is proposed for the receipt, storage and dispatch of product including some Dangerous Goods. Specific services to be conducted at Warehouse A2 include:

- Unloading and receipt of finished goods via trucks and shipping containers;
- Management of inventory in a racked and block stacked environment;
- Order fulfillment including picking and packing of finished orders to customers;
- Loading of transport vehicles;
- Management of product returns;
- Inspection of goods for QA purposes;
- Product Embellishment (e.g. stickering, neck-hangers, custom packs assembly, etc).

No manufacturing of products will occur within, or in areas surrounding this warehouse. There is no decanting, filling or mixing of products to be undertaken at the warehouse.

Material Handling Equipment includes electric battery-operated forklifts (suitable for use in Zone 2 areas) and ride-on movers. The facility will include pallet stretch wrap machines, which are standard for most warehousing activities of this nature. Waste Storage Bins will include a number of 1.5 cubic metres and one 160-litre bin within the warehouse.

4 Hazard Identification

The quantities of dangerous goods are listed in Table 3.1 that will be stored in Warehouse A2, WestPark, Erskine Park, NSW. Having quantified the amount of material, this section will undertake hazard identification for the potentially hazardous material. The potential cause of the hazardous event is identified and the consequences of that event qualitatively described. The controls applied to the design of the warehouse and management controls are then identified.

The hazards identification associated with the transportation of the material to and from the warehouse is shown in Appendix I.

For sources of ignition, the following items are representative of potential ignition sources.

- Smoking;
- Vehicle Fire;
- Forklifts;
- Electrical;
- Arson;
- Hot Work; and
- Fire during forklift charging.

Table 4.1 Hazard Identification

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
1	Storage of Class 2.1 Aerosols	Release of aerosol can contents.	Release of aerosol cans contents through damaged cans in transportation to and from storage. Collision with forklift and damage to cans.	Inhalation of material by site personnel. Release into the environment of liquid material contained within the aerosol can.	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Site spill containment. Bunding of the aerosol storage area. Spill kits.
2	Storage of Class 2.1 Aerosols	Fire.	Release of aerosol cans contents through damaged cans in transportation to and from storage. Collision with forklift and damage to cans, followed by ignition. Fire commences in packaging (cardboard boxes) surrounding aerosol cans. Fire propagates from other internal area of the Warehouse A2.	Smoke generated in a building. Heat radiation projects off-site. Smoke generated and smoke plume effects adjacent residential area. A projects into other areas of the facility.	First Aid fire fighting. Training of personnel. Control of ignition sources. Emergency Response Plan. PPE supplied for personnel. Automatic dial out to the third party for notification of NSWFB. Aerosols pallets to be within a caged area as per FM 7-31 on all walls. Site Spill containment. Separation from other dangerous goods as per AS 3833. Charging of forklifts to be undertaken remote area. Sprinklers to be provided as per FM 7-31 (NFPA 30B).

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
3	Storage of Class 2.1 sub risk 8 material aerosols	Release of Gas.	Damaged cans in transportation to and from storage. Collision with forklift/ and damage to aerosols.	Localised effects of personnel through displacement of oxygen. Chemical burns to skin and other areas of contact. Inhalation of fumes generated by the material or by reaction with incompatible chemicals. Fumes generated by incompatible chemicals. Leakage into drain and escape into surrounding environment. Reaction with incompatible chemicals, source of ignition or generation of toxic plume.	Small storage quantity. PPE available on site. Handling procedures. Separation and Storage from incompatible materials. Spill kits available on the site. Site spill containment. Packaging material compatible with product. Product provided from known supplier with quality control system.
4	Storage of Class 3 material	Release of Class 3 materials into environment.	Release of packaged goods contents through damage to packaged goods through impact with forklift, dropping, or fall of containers from storage, defective containers.	Inhalation of material by site personnel. Contact with skin of operating personnel. Release into the environment of liquid material.	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Site Spill containment. Bunding of the aerosol storage area. Spill kits.

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
5	Storage of Class 3 material	Fire.	Release of packaged goods contents through damage to packaged goods through impact with forklift, dropping, or fall of containers from storage, defective containers, followed by ignition. Fire commences in packaging (cardboard boxes) surrounding Class 3 material. Fire propagates from other internal area of the Warehouse A2. Forklift Charging.	Smoke generated with the area affecting operating personnel. Heat radiation with impact on operating personnel. Heat radiation projects off-site. Smoke generated and affecting off-site people and environment. Release of material into the environment. Contaminated fire-fighting water enters the environment.	First Aid Fire Fighting Equipment. Training of personnel. Control of ignition sources. Emergency Response Plan. Automatic dial out to the third party for notification of NSWFB. ESFR Sprinklers. Flammable warehouse bunded to contain 20 minutes of firewater application AS per AS 1940. On-site containment of fire fighting water. Separation from other dangerous goods as per AS 3833. Site handling procedures and process to minimise spills. Charging of forklifts to be undertaken in remote area. Electrical installation as per Australian Standards for Hazardous Zones.

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
6	Storage of Class 4.1 material	Fire.	Release of packaged goods contents through damage to packaged goods through impact with forklift, dropping, or fall of containers from storage, defective containers, followed by ignition. Fire commences in packaging (cardboard boxes) Class 4.1 material. Fire propagates from other internal area of the Warehouse A2. Forklift charging.	Heat radiation with impact on operating personnel. Smoke generated by fire. Heat radiation projects off-site. Release of material into the environment. Contaminated fire fighting water enters the environment.	First Aid Fire Fighting Equipment. Training of personnel. Control of ignition sources. Emergency Response Plan. Automatic dial-out to the third party for notification of NSWFB. ESFR Sprinklers. Separation from other dangerous goods as per AS 3833. Site handling procedures and process to minimise spills. Charging of forklifts to be undertaken remote area.

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
7	Temperature controlled Storage	Fire.	Fire propagates from other internal area of the Warehouse A2. Fire commences in packaging (cardboard boxes) materials being stored. Forklift charging.	Heat radiation with impact on operating personnel. Smoke generated by fire. Heat radiation projects off-site. Release of material into the environment. Contaminated fire fighting water enters the environment.	First Aid Fire Fighting Equipment. Training of personnel. Control of ignition sources. Emergency Response Plan. Automatic dial-out to the third party for notification of NSWFB. ESFR Sprinklers. Separation from other dangerous goods as per AS 3833. Site handling procedures and process to minimise spills. Charging of forklifts to be undertaken in remote area.
8	Refrigerant in Use	Fire or release of flammable gas.	Damage to pipe work, corrosion.	Release of flammable gas and potential contributor to fire.	Designed to Australian Standards. Small quantities. Regular maintenance. First Aid Fire Fighting Equipment. Training of personnel. Control of Ignition Sources. Emergency Response Plan. Automatic dial-out to the third party for notification of NSWFB. ESFR Sprinklers.

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
9	Unloading and Loading operations.	Release materials into environment.	Release of packaged goods contents through damage to packaged goods through impact with forklift, dropping or fall of containers from storage, defective containers.	Inhalation of material by site personnel. Contact with skin of operating personnel. Release into the environment of liquid material.	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Site spill containment. Bunding of the aerosol storage area. Spill kits.
10	Unloading and Loading operations.	Fire.	Release of packaged goods contents through damage to packaged goods through impact with forklift, dropping or fall of containers from storage, defective containers, and ignition of released materials.	Heat radiation with impact on operating personnel. Smoke generated by fire. Heat radiation projects off-site. Release of material into the environment. Contaminated fire fighting water enters the environment.	First Aid Fire Fighting Equipment. Training of personnel. Control of ignition sources. Emergency Response Plan. Automatic dial-out to the third party for notification of NSWFB. ESFR Sprinklers. Flammable warehouse bunded to contain 20 minutes of firewater application as per AS 1940. On-site containment of fire fighting water. Separation from other dangerous goods as per AS 3833. Site handling procedures and process to minimise spills. Charging of forklifts to be undertaken in remote area. Electrical installation as per Australian Standards for Hazardous Zones.

5 Qualitative Risk Assessment

In the previous Section, the hazards were identified for the storage facility and the associated activities that may affect the proposed activities. In this Section, the hazards identified will be examined using a qualitative risk assessment.

The *DUAP Multi-Level Risk Assessment Guidelines* (page 17) states:

> *"Where the risk appears to be low, quantification need only be continued to the extent needed to demonstrate that no combination of events is possible that would lead to the relevant risk criteria being exceeded."*

The risks associated with the site are assessed according to the Risk Criteria identified in Table 5.1.

This qualitative risk assessment is used to determine potentially hazardous events that require further quantification. This is not to say that the events do not have any risks associated with them, merely that the risks from the potential hazard are very likely to be minimised to a small area and unlikely to influence the results of any quantified risk assessment.

5.1 Risk Criteria

A qualitative risk assessment has been used to assess risks that require further development in the consequences. For the qualitative risk assessment, the following risk criteria have been used:

Table 5.1 Risk Criteria Table

Risk	Description of Risk
Low	The storage is minor under relevant Australian Standard. The event described is unlikely to develop consequences that could result in significant impact on the operating personnel, neighbours or the environment.
Medium	The event may result in small impacts on the operating personnel, neighbours, or the environment. The event is unlikely to result in the propagation of the hazardous event; or The controls will maintain the consequences within the site boundaries and will have negligible impact on surrounding land use.
High	The event described may impact on the operating personnel, neighbours or the environment; or May propagate the hazardous event into other areas or involve other activities.

5.2 Risk Assessment

The risk assessment undertaken in Table 5.2 is a qualitative risk assessment. The risk assessment examines the risk associated with the proposed activities identified in the hazard identification. Firstly, the risk, for each hazard, is qualitatively assessed as if there were no controls. This uncontrolled risk is then described as either low, medium or high. Secondly, the risk for each hazard is qualitatively assessed once the controls proposed for the hazard are evaluated. The residual risk is then described as either low, medium or high.

Table 5.2 Qualitative Risk Assessment

			Consequences						
Hazard ID	**Activity**	**Event**	**Onsite**	**Neighbours**	**Environment**	**Propagation**	**Risk without Controls**	**Controls**	**Risk With Controls**
1	Storage of Class 2.1 Aerosols	Release of aerosol can contents	Inhalation of materials by operating personnel.	Unlikely to affect to neighbour land uses.	Negligible environmental damage.	Unlikely to propagate into large event as a release of gas only.	**Medium**	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Site Spill containment. Bunding of the aerosol storage area. Spill kits.	**Low**
2	Storage of Class 2.1 Aerosols	Fire	Smoke generated within the area. Heat radiation with impact on operating personnel.	Smoke generated and travelling to neighbouring areas.	Smoke generated damaging the environment. Release of material into the environment.	Package projects into other areas and properties. Heat radiation initiates fires in General Warehouse and/or in adjacent facilities.	**High**	First Aid fire fighting. Training of personnel. Control of ignition sources. Emergency Response Plan. PPE supplied for personnel. Automatic dial out to the third party for notification of NSWFB. Aerosols pallets to be within a caged area as per FM 7-31 on all walls. Site spill containment. Separation from other dangerous goods as per AS 3833. Charging of forklifts to be undertaken remote area. Sprinklers to be provided as per FM 7-31 (NFPA 30B).	**High**
3	Storage of Class 2.1 sub risk 8 material aerosol.	Release of gas	Inhalation of materials by operating personnel. Skin contact and alkali burns.	Unlikely to affect to neighbour land uses.	Negligible environmental damage.	Unlikely to propagate into large event as a release of gas only.	**Medium**	Small Storage quantity. PPE available on site. Handling procedures. Separation and Storage from incompatible materials. Spill kits available on the site. Site spill containment. Packaging material compatible with product. Product provided from known supplier with quality control system.	**Low**

			Consequences						
Hazard ID	**Activity**	**Event**	**Onsite**	**Neighbours**	**Environment**	**Propagation**	**Risk without Controls**	**Controls**	**Risk With Controls**
4	Storage of Class 3 material	Release of Class 3 materials into environment	Inhalation of materials by operating personnel. Contact on skin by operating personnel.	Fumes generated by incompatible chemicals.	Leakage into drain and escape into surrounding environment from spillage. Contamination of fire-fighting water in the event of a fire in the General Warehouse.	Reaction with incompatible chemicals. Spillage of material is unlikely to propagate in a larger event.	**High**	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Site spill containment. Bunding of the aerosol storage area. Spill kits.	**Low**
5	Storage of Class 3 material	Fire	Smoke generated within the area. Heat radiation with impact on operating personnel.	Smoke generated and travelling to neighbouring areas.	Smoke generated damaging the environment. Release of material into the environment.	Package projects into other areas and properties. Heat radiation initiates fires in General Warehouse and/or in adjacent facilities.	**High**	First Aid Fire Fighting Equipment. Training of personnel. Control of ignition sources. Emergency Response Plan. Automatic dial out to the third party for notification of NSWFB. ESFR Sprinklers. Flammable warehouse bunded to contain 20 minutes of firewater application AS per AS 1940. On-site containment of fire-fighting water. Separation from other dangerous goods as per AS 3833. Site handling procedures and process to minimise spills. Charging of forklifts to be undertaken in remote area. Electrical installation as per Australian Standards for Hazardous Zones.	**High**
6	Storage of Class 4.1 (Temperature-controlled area)	Fire	Smoke generated within the area. Heat radiation with impact on operating personnel.	Smoke generated and travelling to neighbouring areas.	Smoke generated damaging the environment.	Heat radiation initiates fires in other material stored in Flammables Warehouse.	**Medium**	First Aid Fire Fighting Equipment. Training of personnel. Control of ignition sources. Emergency Response Plan. Automatic dial-out to the third party for notification of NSWFB. ESFR Sprinklers. Separation from other dangerous goods as per AS 3833. Site handling procedures and process to minimise spills. Charging of forklifts to be undertaken in remote area.	**Low**

			Consequences						
Hazard ID	**Activity**	**Event**	**Onsite**	**Neighbours**	**Environment**	**Propagation**	**Risk without Controls**	**Controls**	**Risk With Controls**
7	Temperature-controlled storage	Fire	Smoke generated within the area. Heat radiation with impact on operating personnel.	Smoke generated and travelling to neighbouring areas.	Smoke generated damaging the environment.	Heat radiation initiates fires in other material stored in Flammables Warehouse.	**Medium**	First Aid Fire Fighting Equipment. Training of personnel. Control of ignition sources. Emergency Response Plan. Automatic dial-out to the third party for notification of NSWFB. ESFR Sprinklers. Separation from other dangerous goods as per AS 3833. Site handling procedures and process to minimise spills. Charging of forklifts to be undertaken remote area.	**Medium**
8	Temperature-controlled Storage	Release of flammable gas coolant	Inhalation of materials by operating personnel. Potential source of fire or flash fire.	Unlikely to cause neighbouring land uses to be affected.	Minimum effect on the environment as the gas is dispersed.	Potential initiating source for a larger fire.	**Medium**	Designed to Australian Standards. Small quantity. Regular maintenance. First Aid Fire Fighting Equipment. Training of personnel. Control of ignition sources. Emergency Response Plan. Automatic dial-out to the third party for notification of NSWFB. ESFR Sprinklers.	**Low**
9	Unloading and Loading operations.	Release materials into environment	Inhalation of materials by operating personnel. Contact on skin by operating personnel	Fumes generated by incompatible chemicals.	Leakage into drain and escape into surrounding environment from spillage. Contamination of fire-fighting water in the event of a fire in the General Warehouse.	Reaction with incompatible chemicals. Spillage of material is unlikely to propagate in a larger event.	**Medium**	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Site spill containment. Bunding of the aerosol storage area. Spill kits.	**Low**
10	Unloading and Loading operations.	Fire	Smoke generated within the area. Heat radiation with impact on operating personnel.	Smoke generated and travelling to neighbouring areas.	Smoke generated damaging the environment. Release of material into the environment.	Package projects into other areas and properties. Heat radiation initiates fires in General Warehouse and/or in adjacent facilities.	**Medium**	First Aid Fire Fighting Equipment. Training of personnel. Control of Ignition Sources. Emergency Response Plan. Site handling procedures and process to minimise spills. Small quantities.	**Low**

5.3 Risk Screening

The risk assessment undertaken in Section 5.3 identified, qualitatively, the risks associated with the major hazardous events. In order to assess the risks with the warehouse, those risks described as low after the implementation of controls are considered unlikely to contribute significantly to the risk produced by the warehouse operations and will not undertake any further quantification.

The hazardous event identified for further quantification:

- Fire in the Class 2.1 storage;
- Fire in the Class 3 material storage;
- Fire in the temperature-controlled store room of the Warehouse A2; and
- Escalation into a full warehouse fire, through the propagation of other fire events.

6 Consequence Analysis

This section discusses the potential consequences of the hazards identified in section 5 that required further quantification to evaluate the risks. These hazardous events include:

- Fire in the Class 2.1 storage;
- Fire in the Class 3 material storage;
- Fire in the temperature-controlled store room of the Warehouse A2; and
- Escalation into a full warehouse fire, through the propagation of other fire events.

6.1 Fire in Class 2.1 Material

6.1.1 Radiant Heat from Class 2.1 Fire

The consequences of a fire within the Class 2.1 storage are may result in the overheating, and pressurisation of the aerosol storage cans. The aerosol undergoing dome aversions (swelling and bulging outwards). Finally, the seams of the aerosol can unwrap at either the top or bottom resulting in the ends of the can blowing off. Occasionally the middle of the can may fail, again instantaneously releasing the entire contents of the aerosol. The failure of an aerosol can could have the following consequences[1]:

- Rocketing of the aerosol can 90-100 metres spreading the flammable contents;
- Produce a fire ball approximately one (1) metre in diameter; and
- Project stream of burning liquid up to two (2) metres to produce burning pools of liquid.

These consequence are dependent on the materials stored within the can. NFPA 30B describes three (3) levels for aerosol cans. For each level, a description of the product and the potential hazard is provided below.

Level One aerosol products include shaving cream, spray starch, window cleaners, alkaline oven cleaners, rug shampoos, some air fresheners, and some insecticides. The storage hazard of Level One aerosols is about the same as ordinary combustible goods in cartons. Storage should be arranged and protected accordingly. When a Level One aerosol can fails, the non-flammable product has a quenching effect on the flammable contents. Some products have very small quantities of flammable product. These products will have an overall chemical heat of combustion that is low.

Level Two products include many personal care products such as deodorants (except for oil-based anti-perspirants), hair sprays, antiseptics, and anaesthetics. Other products may include some furniture polishes, and windshield de-icers. These products typically have a higher heat of combustion and are more difficult to extinguish than Level One products.

Level Three products include many automotive products (engine and carburettor cleaners, undercoats), home products (some wood polishes), paints and lacquers, lubricants, some insecticides, and oil-based antiperspirants. These products typically contain a liquid hydrocarbon, which in the event of a fire may result in a pool fire, in connection with the release of flammable gas.

These properties of different aerosols have been used with the lower risk materials Level One aerosols being stored towards the centre part of the warehouse. The properties of the aerosol can being used to reduce the frequency of propagation from other internals areas of the warehouse.

[1] Fire and Emergency Services Authority of Western Australia, HAZMAT Article, *Aerosol Spray Cans*.

As described above, the consequences of aerosols fires are difficult to quantify in any meaningful description. Individual packages behave differently and result in different consequences. For the purposes of this PHA, the consequences of an aerosol fire may result in propagation into other areas of the warehouse, and/or other adjacent facilities. The controls and frequencies of these potential events will be examined in Section 7.

Quantification of a single fireball was undertaken with a diameter of 3.1 metres. The radiant heat levels are described in Table 6.1.

Table 6.1 Heat Radiation Levels Class 2.1 Fireballs

	Distance to Heat Radiation Level (Metres)		
Hazardous event	**23 kWm^{-2}**	**12.6 kWm^{-2}**	**4.7 kWm^{-2}**
Fireball from Aerosol Can	5.6	7.5	12.0

These results are presented in Table 6.1 are further shown in Figure 6.1. As these results reveal the heat, radiation is contained with the site boundary of the WestPark Industrial Estate.

6.1.2 Generation of Smoke from Class 2.1 Material

The products identified as being strode in the Class 2.1 storage area contain products that contain ingredients that may affect adjacent land uses.

Warehouse fires have two phases: the initial phase and the secondary phase. The initial phase typically occurs within the first two hours of the fire. For a warehouse, the amount of oxygen required for complete combustion exceeds both the amount of oxygen available within the building or that can be drawn in from outside. The starved combustion process results in toxic gases within the smoke cloud. These are a mixture of unburnt, partially combusted and combustion products. The fire will continue to burn at a restricted rate that is determined by the available oxygen. This phase of the fire will be referred to as "ventilation controlled" burning.

The fire continues to develop and will eventually (without controls being successful) cause a failure of the roof and/or structure. This failure will generally allow an increase in the rate of combustion, as the introduction of air is no longer limited by restricted ventilation. This second phase of the fire, during which the size of the fire dramatically increases, produces a large smoke plume and flames often leaping metres into the air. The gas and smoke associated with the secondary phase rises to a great height with the temperatures being generated from burning material. The lift-off of the smoke plume results in a plume that reaches a significant height but that will not have significant consequences for neighbouring land uses.

The most significant period for hazard assessment is usually during the earlier low buoyancy or ventilation-controlled stage and a key issue in risk assessment is the time taken for significant failure of the building skin.

The airborne concentrations in residential areas which could cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community was determined using an exposure level of 13 ppm of Bioallethrin, released at 0.2 kg per minute.

Modelling was undertaken and the results are presented in Appendix C. It was found that the Bioallethrin could travel 209 metres from the developing fire with concentration levels of 13ppm Bioallethrin. This worst-case scenario occurs for wind conditions described by the stability Class F with a wind speed of 1.5 ms^{-1}. These wind conditions produce a long narrow cloud. The maximum width of a cloud with the stability Class F with a wind speed of 1.5 ms^{-1} was 11 metres. This is equivalent to approximately one (1) housing property wide.

The Criteria Land Use Safety Planning, HIPAP No.4 requires the assessment airborne concentration that is capable of seriously injuring sensitive members of the community or cause acute physiological responses to sensitive members of the community. Bioallethrin at a level of 40ppm, with a release rate of 0.2 kg per minute has been used to assess this criterion.

Modelling was undertaken and the results are presented in Appendix C. It was found that the Bioallethrin could travel 100 metres from the developing fire with concentration levels of 40 ppm Bioallethrin. This worst-case scenario occurs for wind conditions described by the stability Class F with a wind speed of 1.5 ms^{-1}. These wind conditions produce a long narrow cloud. The maximum width of a cloud with the stability Class F with a wind speed of 1.5 ms^{-1} is 10 metres wide. This is equivalent to approximately one (1) housing property wide.

The results reveal that for many wind conditions the concentration of Bioallethrin at the site boundaries will be below those considered for airborne concentrations in residential areas, which could cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community. This result was consistent with the low proportion of material within each aerosol can that is an active pesticide ingredient.

Figure 6.1 Fire Event in Class 2.1 Material

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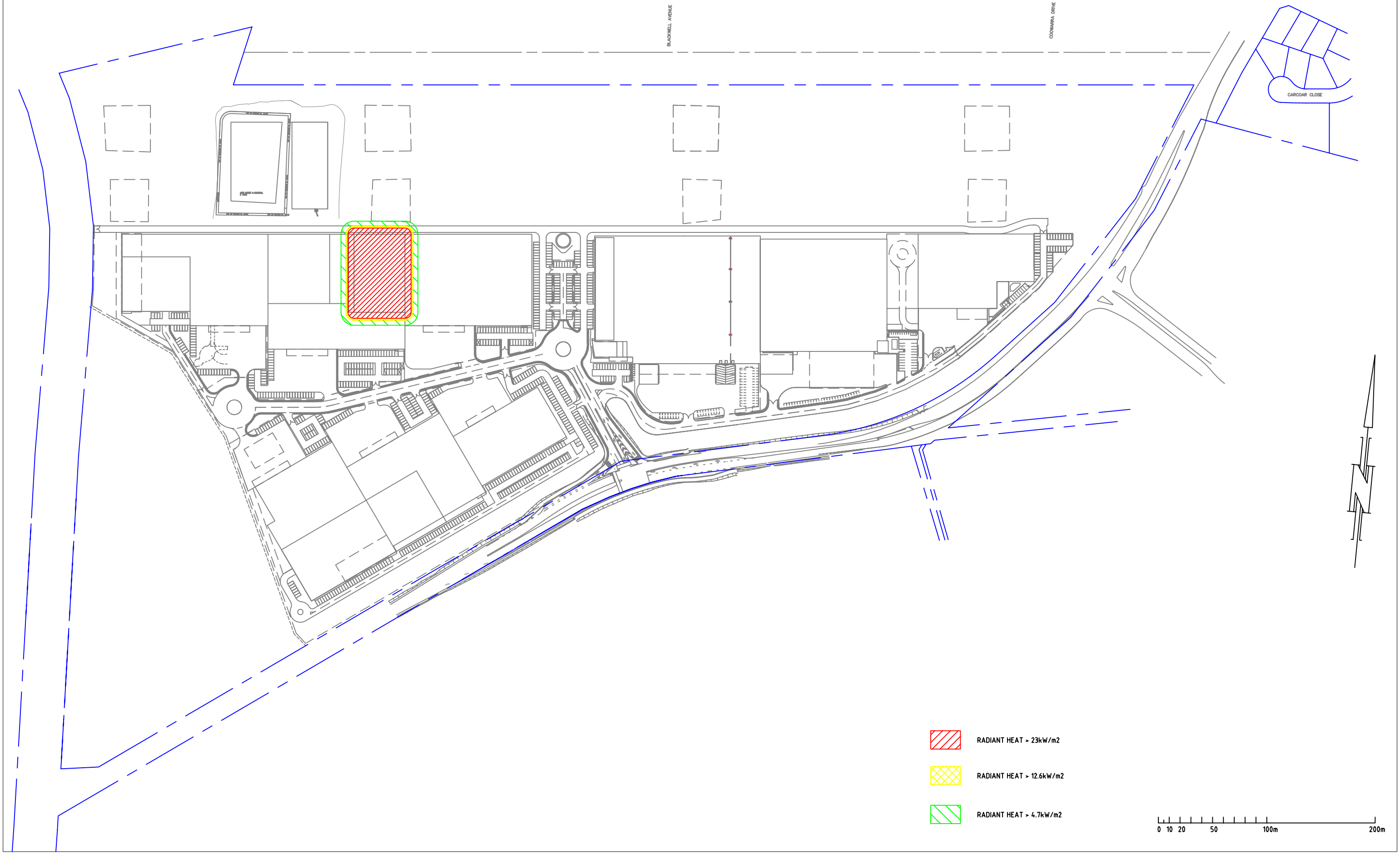
See Next Page Drawing No. 8056-HAZ-LAY-002



REV	DATE	AMENDMENTS	CHECKED
00	19/02/2009	PRELIMINARY	MCE
01	16/03/2009	FOR PHA	MCE

CLIENT

FDC BUILDING SERVICE PTY LTD

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PROJECT

WAREHOUSE A2
WESTPARK INDUSTRIAL ESTATE
ERSKINE PARK, NSW, AUSTRALIA

DRAWING TITLE

CLASS 2.1, RADIANT HEAT LEVELS

DRAWING STATUS

FOR PHA

SCALE	DRAWN BY	DATE FIRST CREATED
AS SHOWN @ A3	MCE	19/02/2009
PROJECT No.	DWG No.	REV
8056	LAY-HAZ-002	01

6.2 Fire in Class 3 Material

The storage of Class 3.1 material within the warehouse will follow the guidelines of AS 3833. This standard requires the separation of the Class 3 material from other dangerous goods. This material will be protected by a sprinkler system. This system has been specifically designed for the storage of flammable material as per NFPA 30. Fire detection is installed for alarm and automatic dial-out to a third party to contact the fire brigade.

6.2.1 Radiant Heat from Class 3 Fire

For the consequence analysis, it has been assumed that a fire has flashed over, with the majority of the product being involved in a fire that covers the entire bunded area for the storage of Class 3. This scenario is considered conservative and it would be expected that fire services would be available on site by this time. The fire services role would primarily involve control of propagation, ensuring that the fire did not escalate into adjacent facilities or other sections within the warehouse.

Flashover is caused by the radiation feedback of heat radiation. Heat from the growing fire is absorbed into the upper walls and contents of the room, heating up the combustible gases and liquids to their auto-ignition temperature. This build-up of heat in the room triggers flashover. For the purposes of this study, a flashover would result in no access to the building and control of propagation becoming the primary goal of any fire fighting services that are provided. It has been assumed that flashover could occur after 20 minutes of the initiating fire not being controlled.

Modelling was undertaken quantify the effects of a pool fire in the storage area of the flammables goods and the results are shown in Table 6.2.

Table 6.2 Heat Radiation Levels Class 3 Bund Fire

	Maximum Distance to Heat Radiation Level (metres)		
Hazardous Event	**23 kWm^{-2}**	**12.6 kWm^{-2}**	**4.7 kWm^{-2}**
Fire in Flammable Goods Area	22	38	78

These results presented in Table 6.2 are further shown in Figure 6.2. As these results reveal the heat, radiation is contained with the site boundary of the WestPark Industrial Estate and does not impact on surrounding land uses.

6.2.2 Generation of Smoke from Class 3 Material

The products identified as being strode in the Class 3 storage area contain products that contain ingredients that may affect adjacent land uses.

The airborne concentrations in residential areas which could cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community was determined using a exposure level of 15ppm of Nitrogen Dioxide (ERPG-2) at a release rate of 0.5 kg per minute.

Modelling was undertaken and the results are presented in Appendix C. It was found that the Nitrogen dioxide could travel 306 metres from the developing fire with concentration levels of 15-ppm Nitrogen dioxide. This worst-case scenario occurs for wind conditions described by the stability Class F with a wind speed of 1.5 ms^{-1}. These wind conditions produce a long narrow cloud. The maximum width of a cloud with the stability Class F with a wind speed of 1.5 ms^{-1} is 10 metres wide. This is equivalent to approximately one (1) housing property wide.

The Criteria Land Use Safety Planning, HIPAP No.4 requires the assessment airborne concentration that is capable of seriously injuring sensitive members of the community or cause acute physiological responses to sensitive members of the community. Nitrogen dioxide at a level of 30 ppm, with a release rate of 0.5 kg per minute was used to assess this criterion.

Modelling was undertaken and the results are presented in Appendix C. It was found that the nitrogen dioxide could travel 206 metres from the developing fire with concentration levels of 30-ppm nitrogen dioxide. This worst-case scenario occurs for wind conditions described by the stability Class F with a wind speed of 1.5 ms^{-1}. These wind conditions produce a long narrow cloud. The maximum width of a cloud with the stability Class F with a wind speed of 1.5 ms^{-1} is 8 metres wide. This is equivalent to approximately one (1) housing property wide.

The results reveal that for many wind conditions the concentration of concern at the site boundaries will be below those considered for airborne concentrations in residential areas that could cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community. This is consistent with the material being handled and the form of this material.

Figure 6.2 Fire Event in Class 3 Material

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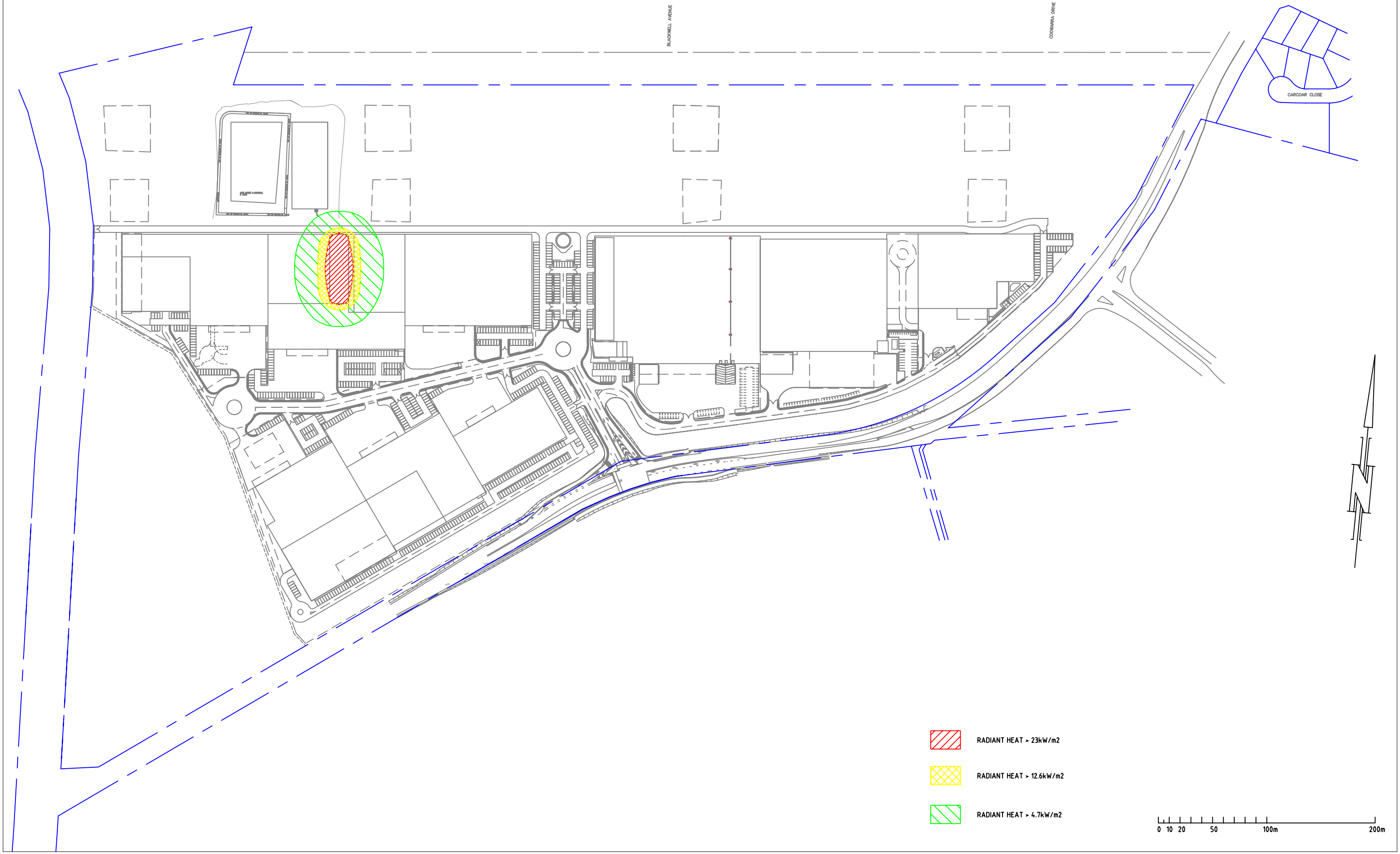

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PROJECT

WAREHOUSE A2
WESTPARK INDUSTRIAL ESTATE
ERSKINE PARK, NSW, AUSTRALIA

DRAWING TITLE

CLASS 3, RADIANT HEAT LEVELS

DRAWING STATUS

FOR PHA

SCALE	DRAWN BY	DATE FIRST CREATED
AS SHOWN @ A3	MCE	19/02/2009
PROJECT No.	DWG No.	REV
8056	LAY-HAZ-001	01

6.3 Fire in Temperature-controlled Area

The range of goods to be stored in the temperature-controlled area includes household cleaning items and healthcare items. The following dangerous good is also to be stored within the temperature-controlled area of the warehouse:

- Class 4.1 material.

6.3.1 Radiant Heat from Temperature-controlled Room

Fire in Temperature-controlled area could result in heat radiation affecting surrounding land uses. It has assumed that the fire will reach a steady state heat generation of 40 MW. This heat generation rate has been used to estimate the distance to heat radiation levels of concern using a point source method. This is described in Appendix C, Section C.4. The results are shown in Table 6.3. The radiant heat levels are shown in Figure 6.3.

Table 6.3 Radiant Heat from Temperature-controlled Room

	Distance to Heat Radiation Level		
Hazardous event	**23 kWm^{-2}**	**12.6 kWm^{-2}**	**4.7 kWm^{-2}**
Fire in all Areas	6.7	9.40	15.4

6.4 Fire in Entirety of Warehouse A2

A fire event involving the entirety of the Warehouse A2 has been used by summation of the events described throughout this section.

6.5 Consequences for Surrounding Warehouses

The consequences for surrounding Warehouse A1 and Warehouse C3/C4 have been drawn from previous PHA produced for these individual warehouses. For Warehouse A1 the following consequences were identified:

- Major Flammable Liquids Spill in Warehouse A1;
- Fire in the Warehouse A1;
- Production of Toxic Smoke from a fire event, Warehouse A1; and
- Flammable Gas Leak in Warehouse A1.

For Warehouse C3/C4 the following consequences were identified:

- Fire in FGS of Warehouse C3/C4;
- Fire in Resins, Polymer Elastomers or Plastic of Warehouse C3/C4;
- Fire in FGS involving Class 6.1 Material of Warehouse C3/C4; and
- Fire in GSS involving Class 9 Material of Warehouse C3/C4.

The consequences of these potentially hazardous events are described in Appendix D.

Figure 6.3 Fire Event in Temperature-controlled Room

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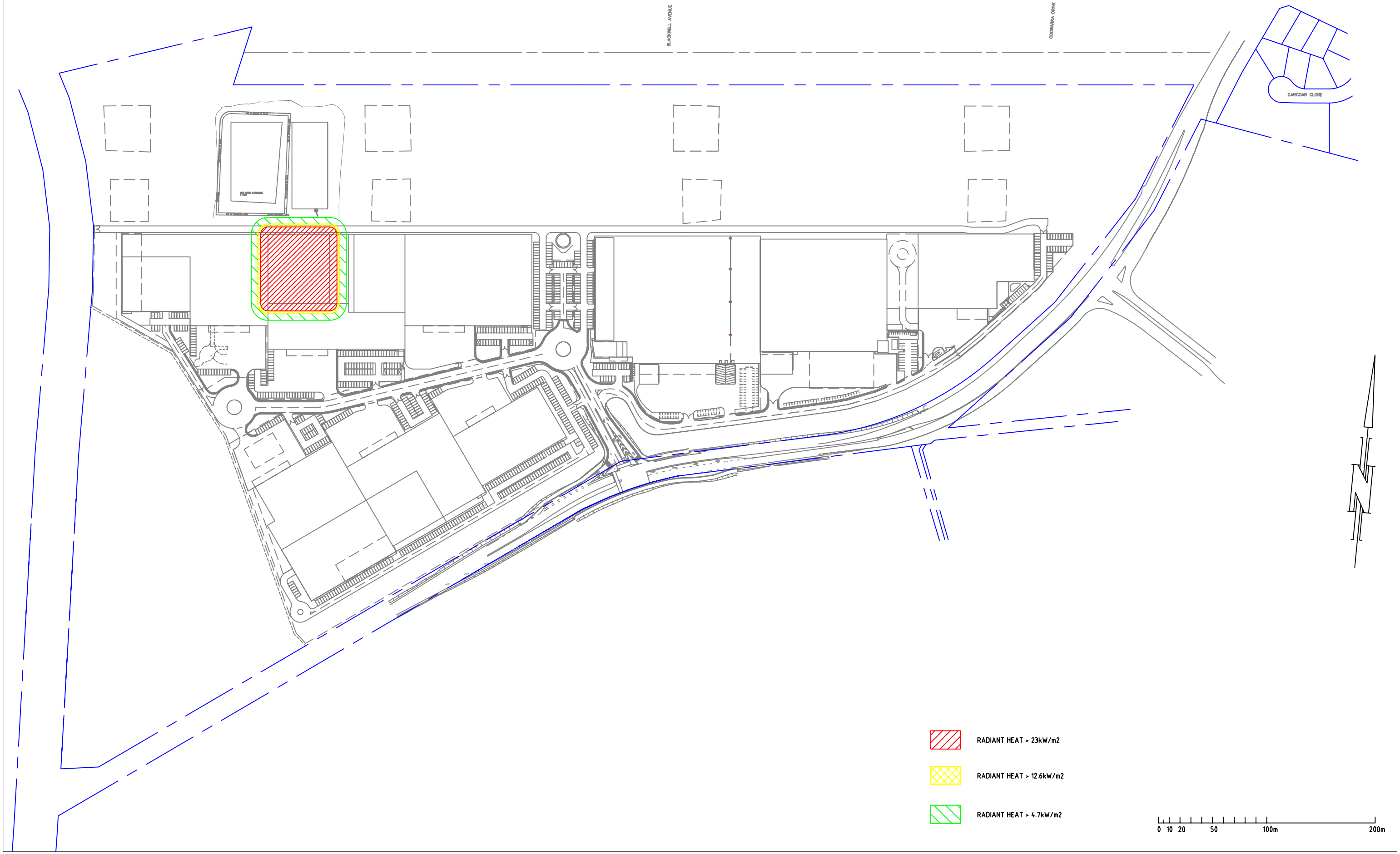

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PROJECT

WAREHOUSE A2
WESTPARK INDUSTRIAL ESTATE
ERSKINE PARK, NSW, AUSTRALIA

DRAWING TITLE

TEMPERATURE CONTROLLED ROOM
RADIANT HEAT LEVELS

DRAWING STATUS

FOR PHA

SCALE	DRAWN BY	DATE FIRST CREATED
AS SHOWN @ A3	MCE	19/02/2009
PROJECT No.	DWG No.	REV
8056	LAY-HAZ-003	01

6.6 Containment of Spills and Fire Fighting Water

The spillage of a dangerous good may result in material being released into the environment that could damage that environment.

The containment available on-site includes:

- Bunding of the Flammable Goods section of the Warehouse to AS 1940 requirements; and

- On-site containment bunding consisting of two containment ponds in series. The first of these ponds will contain 5,000,000 litres of liquid; the second containment pond will contain 6,000,000 litres of liquid. This equates to 11,000,000 litres of on-site containment.

6.6.1 Containment of Spills and Fire Fighting Water

The controls for spills and potential fire fighting water releases are examined in Table 6.4 against potential environmental hazards.

Table 6.4 Environmental Consequence Controls

Environmental Hazard	Potential Consequences	Control
Fire in Class 2.1 Material	Sprinklers and firewater applied to fire generate contaminated fire fighting water that could damage the environment	Bunding with sufficient containment for 20 minutes of sprinkler water. Additional fire-water above this would be contained on-site with the on-site containment pond.
Spill of Class 3	Effects on waterways and other environmental impacts.	Bunding with sufficient containment as per AS1940.
Fire in Class 3 Material	Sprinklers and firewater applied to fire generate contaminated fire fighting water that could damage the environment.	Bunding with sufficient containment for 20 minutes of sprinkler water (to the requirements of AS 1940). Additional fire-water above this would be contained on-site with the on-site containment pond.
Fire temperature-controlled room	Sprinklers and firewater applied to fire generate contaminated fire fighting water that could damage the environment.	On-site containment of fire-fighting water and sprinkler systems.

Further details on the on-site detection pond can be found in Appendix K.

7 Estimation of Likelihood of Hazardous Events

This section discusses the frequencies of the hazardous events for the facilities. From the qualitative risk assessment carried out in Section 5 the following potentially hazardous incidents were identified that required further quantification of the risks:

- Fire in the Class 2.1 storage;
- Fire in the Class 3 material storage;
- Fire in the temperature-controlled store room of the Warehouse A2; and
- Escalation into a full warehouse fire, through the propagation of other fire events.

7.1 Frequency Controls

The causes of fires in warehouses can include that malicious ignition is the dominant, electrical faults, friction heat and sparks, and careless disposal of smoking materials. Hot working, including shrink wrapping, grinding, cutting, and welding have been responsible for many fires. Other important initiators can include:

- Malfunctioning forklift trucks;
- Lorry fires;
- Spillage of incompatible chemicals;
- Storage of unstable compounds near to steam pipes and other similar sources of heat;
- Ignition of spills of flammable liquids; and
- Static ignition of flammable liquids during transfer operations.

The operations at Warehouse A2 will implement the following controls in order to reduce the likelihood of ignition occurring in the flammable area. These will include the controls listed in Table 7.1.

Table 7.1 Control of Ignition Sources

Ignition Source	Control
Smoking	No smoking policy for the warehouse.
Vehicle Fire	Vehicles will not unload in the warehouse; extinguishers available in the unloading area.
Forklifts	Forklifts will be suitable for use in the hazardous zones as determined for the warehouse.
Spill of Material	The staff is trained and will have access to spill kits available and materials will be examined on a regular basis for deterioration.
Electrical	The electrics of the warehouse will be zoned hazardous Class 1, Zone 2 where required by Australian standards.
Arson	The site will have a security fencing, internal security, and regular security patrols.
Hot Work	A permit to work system and risk assessment prior to starting work.
Fire during Forklift Charging	The forklifts will not be charged within the flammable goods storage section of the warehouse. The charging area has been allocated an area within the temperature-controlled area.

The Warehouse A2 will also have protection provided in the event of a fire. These protection methods are shown in Table 7.2.

Table 7.2 Protection Methods in A2 Warehouse

Protection	Description
Sprinkler System	The Class 2.1 Material will be protected by a sprinkler system design to Factory Mutual Standards. Class 3 material will be protected by a Scheme A sprinkler system. The temperature-controlled area will be protected by a ESFR sprinkler system.
Fire Fighting Arrangements	There will be staff training in the use of fist aid fire fighting equipment; and first-aid fire fighting will be available within the warehouse.
Firewalls	4-hour firewall (both ways) will enclose the ends of the Warehouse.

7.2 Frequency of Fire and Smoke Events Warehouse A2

The effects of the Warehouse A2 that could potentially affect surrounding land uses were examined in Section 6. In this section the frequency of these events, associated with Warehouse A2 will be evaluated.

7.2.1 Frequency of Fire (Initiating in Class 2.1 Material)

As discussed in Section 6 the consequences of fire in the aerosol storage area could result in a fireball and the release of radiant heat energy. The frequency of the fire event involving the Class 2.1 material and producing heat radiation is examined in Appendix E using an event tree. It was found that the frequency of a fire event was 45.93 x 10^{-6} p.a. This is a fire involving the entire area of the Class 2.1 storage area.

7.2.2 Frequency of Smoke Plume (Initiating in Class 2.1 Material)

As discussed in Section 6 the consequences of fire in the aerosol storage area could result in the release of smoke containing un-reacted chemicals in the smoke plume. The frequency of the fire event involving the Class 2.1 material and producing heat radiation is examined in Appendix E using an event tree. It was found that the frequency of a fire event was 45.93 x 10^{-6} p.a. This is a fire involving the entire area of the Class 2.1 storage area. This frequency was used for the initiating fire event producing early burning before the "lift off" of the smoke plume.

The frequency of the aerosol storage area producing a smoke plume containing un-reacted chemicals was assessed for the following:

- Airborne concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure; and

- Airborne concentrations in residential areas, which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community.

The results are shown in Table 7.3.

Table 7.3 Smoke Plume containing Un-reacted Chemicals (Class 2.1)

Criteria Assessed	Maximum Frequency	Direction of Maximum Frequency (coming from)
Airborne concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure	Potentially injurious concentrations unlikely to occur outside site boundary.	
Airborne concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community	1.97x10^{-6} p.a.	South South West

The details and methodology used to estimate these frequencies can be found in Appendix E.

7.2.3 Frequency of Fire (Initiating in Class 3 Material)

As discussed in Section 6 the consequences of fire in the Class 3 storage area could result in a pools fires and the release of radiant heat energy. The frequency of the fire event involving the Class 3 material and producing heat radiation is examined in Appendix E using an event tree. It was found that the frequency of a fire event was 15.7 x 10^{-6} p.a. This is a fire involving the entire area of the Class 3 storage area.

7.2.4 Frequency of Smoke Plume (Initiating in Class 3 Material)

As discussed in Section 6 the consequences of fire in the Class 3 storage area could result in the release of smoke containing potentially hazardous decomposition products in the smoke plume. The frequency of the fire event involving the Class 3 material and producing heat radiation is examined in Appendix E using an event tree. It was found that the frequency of a fire event was 15.7 x 10^{-6} p.a. This is a fire involving the entire area of the Class 3 storage area. This frequency was used for the initiating fire event producing early burning before the "lift off" of the smoke plume.

The frequency of the Class 3 storage area producing a smoke plume containing potentially hazardous decomposition products was assessed for the following:

- Airborne concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure; and
- Airborne concentrations in residential areas, which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community.

The results are shown in Table 7.4.

Table 7.4 Smoke Plume Potentially Hazardous Decomposition Products (Class 2.1)

Criteria Assessed	Maximum Frequency	Direction of Maximum Frequency (coming from)
Airborne concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure	0.53x10^{-6} p.a.	South
Airborne concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community	0.53x10^{-6} p.a.	South

The details and methodology used for estimating these frequencies can be found in Appendix E

7.2.5 Fire in Temperature-controlled Room

Appendix E examined the fire event frequency in the temperature-controlled room using an event tree. The frequency of fire event in the temperature-controlled room is 54.95 x 10^{-6} p.a.

7.2.6 Total Warehouse A2 Fire

A fire event frequency for a fire involving the entire contents of the Warehouse A2 was estimated from the event trees presented in Appendix E. It was found that the frequency of fire event involving the entirety of the Warehouse A2 is 6.74x 10^{-6} p.a.

7.2.7 Fire Propagation to Other Warehouses

The propagation from Warehouse A2 to adjacent Warehouse A1 and A3 was estimated from the events trees presented in Appendix E. It was found that the frequency of fire event propagating from Warehouse A2 to adjacent Warehouse A1 and A3 is 1.3×10^{-7} p.a.

7.2.8 Total Smoke Plume Frequency (Warehouse A2)

As discussed in Section 7.2.2 and Section 7.2.4 the consequences of fire in the Class 2.1 or Class 3 storage areas could result in the release of smoke, which may affect surrounding land uses. These events are combined in Table 7.6 to produce the total maximum frequency that may affect surrounding land uses from smoke events involving Warehouse A2.

Table 7.5 Smoke Plume Total Frequency Warehouse A2

Criteria Assessed	Maximum Frequency	Direction of Maximum Frequency (coming from)
Airborne concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure	2.17×10^{-6} p.a.	South South West
Airborne concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community	0.53×10^{-6} p.a.	South

7.3 Cumulative Frequencies

The WestPark Industrial Estate has other warehouses that may have effects on the surrounding land uses. These warehouses have been identified as:

- Warehouse A1; and
- Warehouse C3/C4.

The hazards that are identified for these warehouses (A1 and C3/C4) are described in Appendix D section D.3 and the consequences are described in Appendix D section D.4. These results were extracted from PHAs written for each warehouse. The consequence analysis revealed that the Warehouse C3/C4 could produce smoke plumes, which could produce:

- Airborne concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure; or
- Airborne concentrations in residential areas, which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community.

These intersect with potential smoke events described for Warehouse A2. These areas of intersection were determined to have the following maximum frequencies.

Table 7.6 Smoke Plume Cumulative Frequencies

Criteria Assessed	Maximum Frequency	Direction of Maximum Frequency
Airborne concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure	9.07×10^{-6} p.a.	From Warehouse A2 South South West From Warehouse C3/C4 South
Airborne concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community	2.23×10^{-6} p.a.	From Warehouse A2 South From Warehouse C3/C4 South South East

The details and methodology used for the estimating these frequencies can be found in Appendix E.

8 Risk Assessment

In Section 4 a hazard identification was carried out to identify the hazards associated with the proposed activities. In Section 5 a qualitative risk assessment was conducted on the proposed activities to identify activities that required further quantification. Those potentially hazardous events requiring further identification were examined in Section 6 to determine the consequences of the potentially hazardous events. In Section 7, events that required estimation of their frequency were analysed. This section examines the risk to individuals resulting from potentially hazardous events associated with the proposed activities.

8.1 Individual Risk for Fixed Facilities

The DOP criteria for Land Use Safety Planning present a number of criteria that a new facility should achieve. The criteria is listed below.

Table 8.1 DOP Risk Criteria

Description/Risk Criteria	Criteria
Fatality risk to sensitive uses, including hospitals, schools, aged care	0.5×10^{-6} per year
Fatality risk to residential and hotels	1×10^{-6} per year
Fatality risk to commercial areas, including offices, retail centres and entertainment centres	5×10^{-6} per year
Fatality risk to sporting complexes and active open spaces	10×10^{-6} per year
Fatality risk contained to within the boundary of an industrial site	50×10^{-6} per year
Injury risk – incident heat flux radiation at residential areas should not exceed 4.7 kW/m^2 at frequencies of more than 50 chances in a million per year or incident explosion overpressure at residential areas should not exceed 7kPa at frequencies of more than 50 chances in a million per year	50×10^{-6} per year
Toxic exposure-toxic concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure	10×10^{-6} per year
Toxic exposure-toxic concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community	50×10^{-6} per year
Propagation due to Fire and Explosion – exceed radiant heat levels of 23 kW/m^2 or explosion overpressures of 14 kPa in adjacent industrial facilities	50×10^{-6} per year

8.2 Comparison with DOP Criteria for Proposed Activities

This report presents a individual risk level for 0.5 $x10^{-6}$ p.a. and is shown in Figure 8.1. Individual fatality risk levels above this 0.5 $x10^{-6}$ p.a., are contained within the 0.5 $x10^{-6}$ p.a. risk level. For the purpose of this study if the Individual Fatality Risk of 0.5 $x10^{-6}$ p.a. does not intersect with surrounding land uses described in the DOP Criteria, then the criteria has been met.

The DOP criteria for Land Use Safety Planning presents a number of criteria that the proposed facility should achieve at the site boundary. The fatality risk criteria is compared to the results of the PHA for the Warehouse A2 development. As revealed by Table 8.2 the risks for proposed development, being Warehouse A2, at WestPark Industrial Estate do not exceed the NSW DOP criteria for Land Use Safety Planning.

The risks associated with Warehouse A2 present in Figure 8.1. As Figure 8.1 reveals, the risk level of 0.5 $x10^{-6}$ p.a. is contained within the site boundaries of WestPark Industrial estate.

8.3 Risk Evaluation of Cumulative Activities

In Appendix D, we examined the consequences of potentially hazardous incidents associated with the storage of dangerous goods at Warehouse A1 and Warehouse C3/C4. These results have been used to establish the risk associated with the storage of dangerous goods at Warehouse A1 and Warehouse C3/C4. The risks of the storage of dangerous goods at Warehouse A1 and Warehouse C3/C4 have been combined with the risks associated with storage of dangerous goods at Warehouse A2 to produce a cumulative risk associated with all on-site activities.

This report presents a individual risk level for 0.5 $x10^{-6}$ p.a. and is shown in Figure 8.2. Individual fatality risk levels above this 0.5 $x10^{-6}$ p.a., are contained within the 0.5 $x10^{-6}$ p.a. risk level For the purpose of this study if the Individual Fatality Risk of 0.5 $x10^{-6}$ p.a. does not intersect with surrounding land uses described in the DOP Criteria, then the criteria has been met.

The risks associated with cumulative risk associated with all on-site activities are present in Figure 8.2. As this figure reveals the risk level of 0.5 $x10^{-6}$ p.a. is contained within the site boundaries of WestPark Industrial estate. These risks have been compared to the DOP criteria for Land Use Safety Planning in Table 8.3. As revealed by Table 8.3 the cumulative risks for all activities storing dangerous goods at WestPark Industrial Estate do not exceed the NSW DOP criteria for Land Use Safety Planning

8.4 Risk to the Biophysical Environment from Proposed Activities

Some of the materials handled at the facility could have an impact on the natural environment. There are chemicals, which could harm aquatic, bird and plant life if a spill was to find its way into a watercourse. HIPAP No.4 criteria for the assessment of risk to the biophysical environment are related to the threat to the long-term viability of a species or eco-system. This threat must occur after an accidental event and not from the result of continuous operations. There is uncertainty in the consequences to the biophysical environment of any accidental event.

The primary potential incidents that could affect the biophysical are examined in the following paragraphs.

Loss of Stored Flammable Liquids could have a localised impact within the area. The surrounding land use is industrial, design will be to AS1940, and all flammable and corrosive areas are bunded. It is considered unlikely that a release of this material would have significant impact on the local biophysical environment above the levels already in existence.

Smoke from Warehouse. The generation of a toxic cloud will have both non-combusted and combustion by-products. These could have an effect on the local environment. Concentration of the combustion products modelled revealed that effects would extend a distance from their source. It is considered that any consequences generated would not affect the eco-system any further than the present level of modification that has been undertaken by previous developments.

Containment of Contaminated Fire-Water. Any scenarios that could occur at the proposed facilities will be captured by the on-site fire-fighting containment or within a bunded area within the warehouse.

Figure 8.1 Risk Contour 0.5 x 10^{-6} (Proposed Development)

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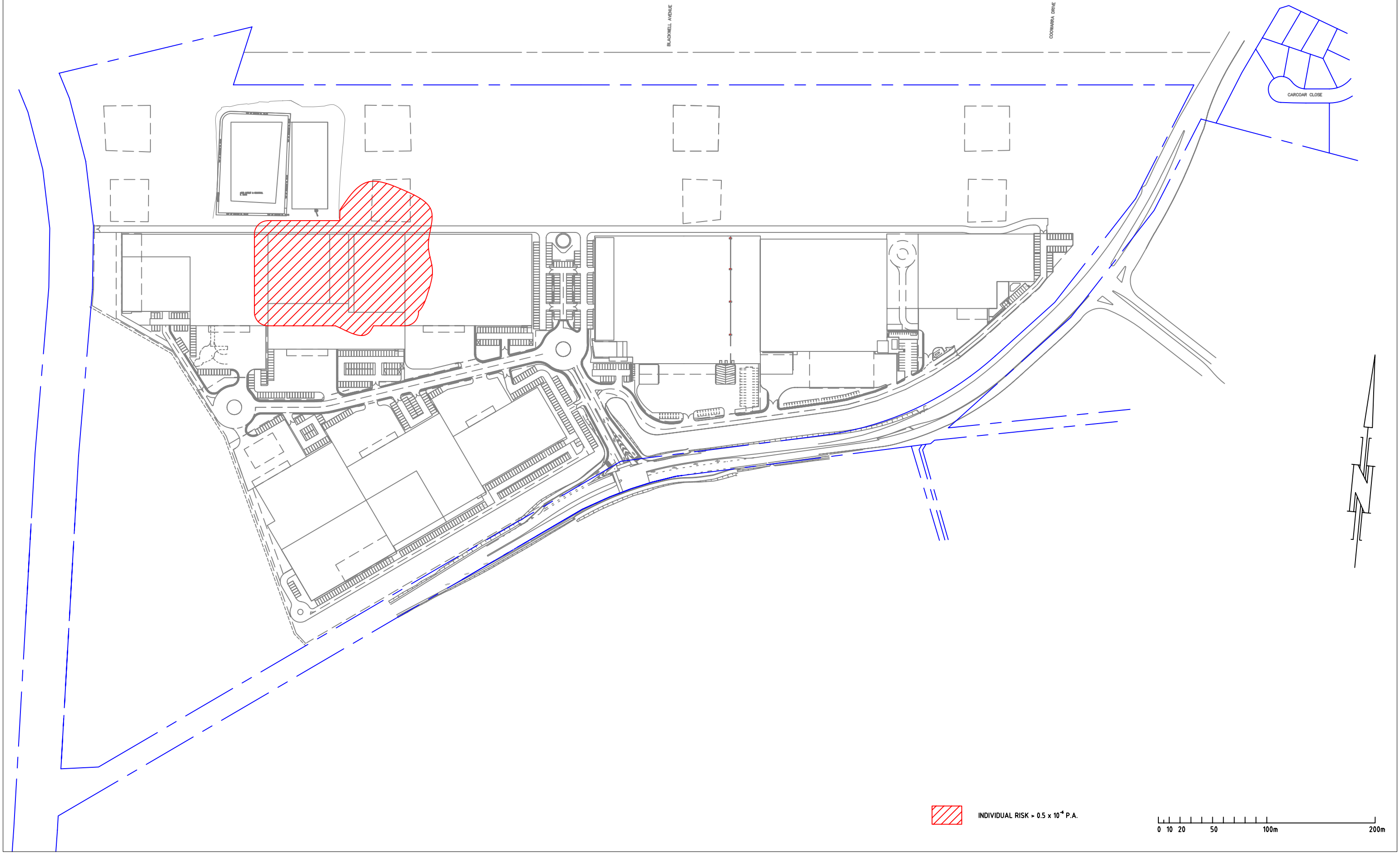

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PROJECT

WAREHOUSE A2
WESTPARK INDUSTRIAL ESTATE
ERSKINE PARK, NSW, AUSTRALIA

DRAWING TITLE

WAREHOUSE A2
INDIVIDUAL RISK GREATER THAN
0.5 x 10^{-6} P.A.

DRAWING STATUS

FOR PHA

SCALE	DRAWN BY	DATE FIRST CREATED
AS SHOWN @ A3	MCE	19/02/2009
PROJECT No.	DWG No.	REV
8056	LAY-HAZ-006	01

Figure 8.2 Risk Contour 0.5 x 10^{-6} (Cumulative Risks)

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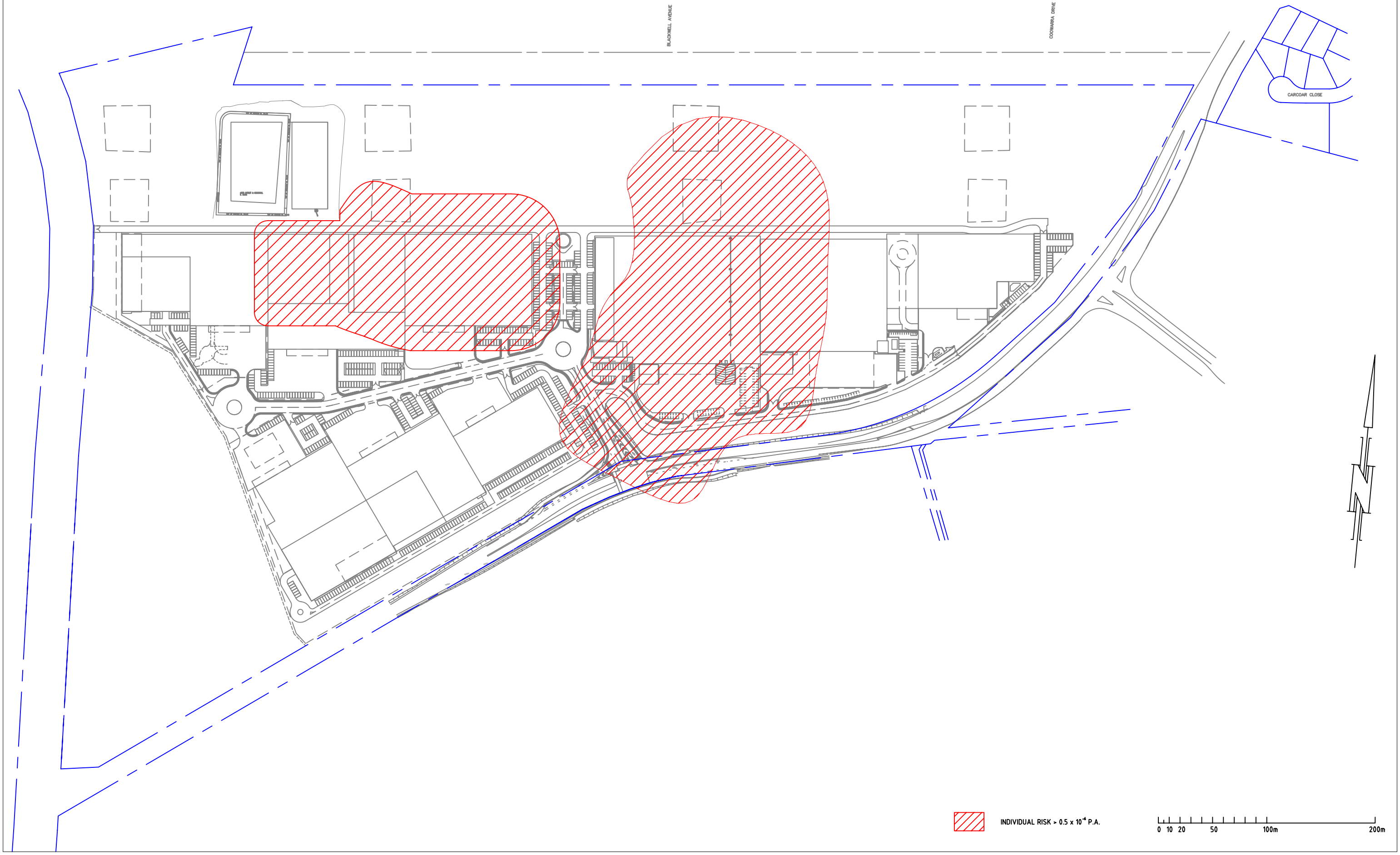
See Next Page Drawing No. 8056-HAZ-LAY-007



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PROJECT

WAREHOUSE A2
WESTPARK INDUSTRIAL ESTATE
ERSKINE PARK, NSW, AUSTRALIA

DRAWING TITLE

OVERALL SITE
INDIVIDUAL RISK GREATER THAN
0.5 x 10^{-6} P.A.

DRAWING STATUS

FOR PHA

SCALE	DRAWN BY	DATE FIRST CREATED
AS SHOWN @ A3	MCE	19/02/2009
PROJECT No.	DWG No.	REV
8056	LAY-HAZ-007	01

Table 8.2 DOP Risk Criteria for Proposed Activities (Warehouse A2)

Description/Risk Criteria	Criteria	Results	Meets DOP Criteria
Fatality risk to sensitive uses, including hospitals, schools, aged care	0.5 x 10^{-6} per year	The risks from warehouse A2 is shown in Figure 8.1 and does not exceed the site boundaries.	**YES**
Fatality risk to residential and hotels	1 x 10^{-6} per year	The risks from warehouse A2 is shown in Figure 8.1 and does not exceed the site boundaries.	**YES**
Fatality risk to commercial areas, including offices, retail centres and entertainment centres	5 x 10^{-6} per year	The risks from warehouse A2 is shown in Figure 8.1 and does not exceed the site boundaries.	**YES**
Fatality risk to sporting complexes and active open spaces	10 x 10^{-6} per year	The risks from warehouse A2 is shown in Figure 8.1 and does not exceed the site boundaries.	**YES**
Fatality risk contained to within the boundary of an industrial site	50 x 10^{-6} per year	The risks from warehouse A2 is shown in Figure 8.1 and does not exceed the site boundaries.	**YES**
Injury risk–incident heat flux radiation at residential areas should not exceed 4.7 kW/m^2 at frequencies of more than 50 chances in a million per year or incident explosion overpressure at residential areas should not exceed 7kPa at frequencies of more than 50 chances in a million per year	50 x 10^{-6} per year	Heat radiation levels of 4.7 kWm^{-2} and overpressure of 7 kPa are contained within the site boundary.	**YES**
Toxic exposure-toxic concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure	10 x 10^{-6} per year	The maximum frequency of concentrations in residential areas which would be seriously injurious to sensitive members of the community was found to be 0.53 x 10^{-6} p.a.	**YES**
Toxic exposure-toxic concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community	50 x 10^{-6} per year	The maximum frequency of concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community was found to be 2.17 x 10^{-6} p.a.	**YES**
Propagation due to Fire and Explosion–exceed radiant heat levels of 23 kW/m^2 or explosion overpressures of 14 kPa in adjacent industrial facilities	50 x 10^{-6} per year	The propagation of fire events were effectively controlled by firewalls.	**YES**

Table 8.3 DOP Risk Criteria for Cumulative Risk

Description/Risk Criteria	Criteria	Results	Meets DOP Criteria
Fatality risk to sensitive uses, including hospitals, schools, aged care	0.5 x 10^{-6} per year	The cumulative risk from all on-site warehouses is shown in Figure 8.2. There are no sensitive receptors within the 0.5 x 10^{-6} p.a. level.	**YES**
Fatality risk to residential and hotels	1 x 10^{-6} per year	The cumulative risk from all on-site warehouses is shown in Figure 8.2. There are no residents within the 0.5 x 10^{-6} p.a. level.	**YES**
Fatality risk to commercial areas, including offices, retail centres and entertainment centres	5 x 10^{-6} per year	The cumulative risk from all on-site warehouses is shown in Figure 8.2. . There are commercial areas within the 0.5 x 10^{-6} p.a. level.	**YES**
Fatality risk to sporting complexes and active open spaces	10 x 10^{-6} per year	The cumulative risk from all on-site warehouses is shown in Figure 8.2. There are sporting complexes / open areas within the 0.5 x 10^{-6} p.a. level.	**YES**
Fatality risk contained to within the boundary of an industrial site	50 x 10^{-6} per year	The cumulative risk from all on-site warehouses is shown in Figure 8.2 and . The 0.5 x 10^{-6} p.a. level is contained within the site.	**YES**
Injury risk – incident heat flux radiation at residential areas should not exceed 4.7 kW/m^2 at frequencies of more than 50 chances in a million per year or incident explosion overpressure at residential areas should not exceed 7kPa at frequencies of more than 50 chances in a million per year	50 x 10^{-6} per year	Heat radiation levels of 4.7 kWm^{-2} and overpressure of 7 kPa are contained within the site boundary.	**YES**
Toxic exposure - toxic concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure	10 x 10^{-6} per year	The maximum frequency of concentrations in residential areas which would be seriously injurious to sensitive members of the community was found to be 2.23 x 10^{-6} p.a.	**YES**
Toxic exposure - toxic concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community	50 x 10^{-6} per year	The maximum frequency of concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community was found to be 9.07 x 10^{-6} p.a.	**YES**

Description/Risk Criteria	Criteria	Results	Meets DOP Criteria
Propagation due to Fire and Explosion–exceed radiant heat levels of 23 kW/m^2 or explosion overpressures of 14 kPa in adjacent industrial facilities	50×10^{-6} per year	The propagation of fire events were effectively controlled by firewalls.	**YES**

9 References

1. DUAP 1996, Guidelines for Hazard Analysis, NSW Department of Urban Affairs and Planning: Hazardous Industry Planning Advisory Paper No. 6

2. DUAP 1997, Risk Criteria for Land Use Planning, NSW Department of Urban Affairs and Planning: Hazardous Industry Planning Advisory Paper No. 4

3. DUAP 1997, Multi – Level Risk Assessment, NSW Department of Urban Affairs and Planning

4. DUAP 1997, Applying SEPP 33, NSW Department of Urban Affairs and Planning; Hazardous and Offensive Development applications Guidelines

5. American Industrial Hygiene Association (AIHA).
   1991. Current ERPGs.
   AIHA Publications, Akron, OH.

6. HSE (2006) Safety report Assessment Guide : Chemical Warehouse – Hazards

7. NTIS publication No. PB-94-195047 Documentation for Dangerous to Life of Health Concentrations.

8. AICHE 2000, Guidelines for Chemical Process Quantative Risk Assessment, 2nd Edition

9. QEST (2005), PHA Intermodal Logistics Centre at Enfield

10. Rew P.J. and Houlding R.C., Benefits of Fire Compartmentation in Chemical Warehouses, Research Report 152, Health and Safety Executive, 2003

11. DUAP, 1995, Final Draft, Guidelines for Land Use and Environmental Safety Planning for Hazardous Materials, Road Transportation Considerations

12. INTRODUCTION TO FLAME RETARDANCY AND POLYMER FLAMMABILITY, Sergei V. Levchik Supresta U.S. LLC, Ardsley, New York

13. Harwood, D.W., Viner, J.G. and Russell, E.R. (1993). "Procedure for developing truck accident and release rates for HAZMAT routing." Journal of Transportation Engineering, Vol. 119, No. 2, 189-199

Appendix A Risk Criteria in Context

A.1 Introduction

The following tables, some of which were originally published in HIPAP 4, provide useful background information on the risks of various types of activity and the consequences of individual exposure to heat radiation and explosion overpressure. The tables provide a context against which some of the suggested numerical risk criteria can be compared and demonstrate the significant degree of conservatism in the criteria when compared against risks from normal daily activities.

A.2 Context of Risk

Table. A.1 shows the Annual risk of death for various United Kingdom age groups based on deaths in 1999 (Annual Abstract of Statistics, 2001/Health Statistics Quarterly – Summer 2001). Australian statistics would be expected to be similar.

Table. A.1 Annual Risk of Death from All Causes in the UK

Population group	Risk as annual experience	Risk as annual experience per million
Entire population	1 in 97	10,309
Men aged 65-74	1 in 36	27,777
Women aged 65-74	1 in 51	19,607
Men aged 35-44	1 in 637	1,569
Women aged 35-44	1 in 988	1,012
Boys aged 5-14	1 in 6,907	145
Girls aged 5-14	1 in 8,696	115

Regulators have concluded that if a risk from a potentially hazardous installation is below most risks being experienced by the community, then that risk may be tolerated. This is consistent with the basis of criteria selling used in Department of Planning guidelines, as well as those adopted by most authorities ,nationally and internationally.

Table. A.2 Risks to Individuals in NSW[2]

	Chances of Fatality per million person years
Voluntary Risks (average to those who take the risk)	
Smoking (20 cigarettes/day)	
▪ all effects	5,000
▪ all cancers	2,000
▪ lung cancers 1000	1,000
Drinking alcohol (average for all drinkers)	
▪ all effects	380
▪ alcoholism and alcoholic cirrhosis	115
Swimming	50
Playing rugby football	30
Owning firearms	30
Transportation Risks (average to travellers)	
Travelling by motor vehicle	145
Travelling by train	30
Travelling by aeroplane	10
Risks Averaged over the Whole Population	
Cancers from all causes	
- Total	1,800
- Lung	380
Air pollution from burning coal to generate electricity	0.07-380
Accidents in the home	110
Accidental falls	60
Pedestrians being struck by motor vehicles	35
Homicide	20
Accidental poisoning total	18
Venomous animals and plants	0.1
Fires and accidental burns	10
Electrocution (non-industrial)	3
Falling objects	3
Therapeutic use of drugs	2
Cataclysmic storms and storm floods	.2
Lightning strikes	.1
Meteorite strikes	.001

[2] Edited from D. J. Higson, Risks to individuals in NSW and in Australia as a Whole, Australian Nuclear Science and Technology Organisation

A.3 Heat Radiation

The values of interest for radiant heat as indicated in HIPAP No. 4 are shown in Table. A.3.

Table. A.3 Effects of Heat Radiation

Heat Flux (kW/m^2)	Effect of Heat Flux
1.2	Received from the sun at noon in summer.
2.1	Minimum to cause pain after 1 minute.
4.7	Will cause pain in 15-30 seconds and second degree burns after 30 seconds. Glass breaks.
12.6	30% chance of fatality for continuous exposure. High chance of injury. Wood can be ignited by a naked flame after long exposure.
23	100% chance of fatality for continuous exposure to people and 10% chance of fatality for instantaneous exposure. Spontaneous ignition of wood after long exposure. Unprotected steel will reach thermal stress temperatures to cause failure.
35	25% chance of fatality if people are exposed instantaneously. Storage tanks fail.
60	100% chance of fatality for instantaneous exposure.

Appendix B Hazardous Inventory

B.1 Introduction

This section presents the identification of the hazardous materials to be stored at the Warehouse A2 at WestPark Industrial Estate, Erskine Park, NSW. The materials have been presented according to their UN number.

B.2 Hazardous Inventory

The hazardous inventory is presented Table. B.1.

Table. B.1 Hazardous Inventory

UN Number	Correct Shipping Name	Class	Subsidiary Risk	HAZCHEM Code	Packing Group	Quantity	Units	Other Comments
1950	Aerosols	2.1				130,000	kg	Level 1 by NFPA 30B
1950	Aerosol	2.1				900,000	kg	Level 2 by NFPA 30B
1950	Aerosol	2.1				680,000	kg	Level 3 by NFPA 30B
1950	Aerosol	2.1	8		III	12,000	kg	
1300	Turpentine Substitute	3		3[Y]	III	25,000	Litres	
1993	Flammable Liquid N.O.S containing Iso-propanol.	3		3[Y]	III	35,000	Litres	
1170	Ethanol Solution	3		2[Y]	III	300,000	Litres	
3175	Solids containing Flammable Liquid. N.O.S.	4.1		2Y	II	1,200	Litres	

Appendix C Consequence Analysis Warehouse A2

C.1 Introduction

This appendix describes the assumptions and models developed to assess the consequences of the hazard identified with flammable goods at the site.

C.2 Fire in Class 2.1 Storage Area of the Warehouse A2

C.2.1 Radiant Heat from a Class 2.1 Fire

As discussed in Section 6 the consequences of fire in the aerosol storage area can include:

- Fireball;
- Projection of a can into other areas; and
- Smoke released containing unreached chemicals.

The radiant heat released from an aerosol can has been modelled as a 3.1-metre fireball. This was undertaken using TRACE 9.0, with a release of 200 grams of propane. The results are shown in Table. C.1.

Table. C.1 Heat Radiation from Fireball from Aerosol Can

	Distance to Heat Radiation Level		
Hazardous event	**23 kWm^{-2}**	**12.6 kWm^{-2}**	**4.7 kWm^{-2}**
Fireball from Aerosol Can	5.6	7.5	12.0

These results are considered conservative as not all the cans would release all the energy in the form of a fireball and this modelling is more consistent with fixed, liquefied gas storage.

C.2.2 Smoke Plume Containing Unreached Chemicals from a Class 2.1 Fire

A fire event within the Class 2.1 section of the aerosol cans may result in the release of a smoke plume containing combustion products that may be harmful to people.

The material selected to access the consequence distances for a fire initiating in the case 2.1 materials is Mortein Ultra Low Allergenic Fly and Insect Killer. This material contains Bioallethrin. This material has been assumed to be un-combusted and contained within a smoke cloud at the early developing stages of a fire.

A fire has two phases: the initial phase and the secondary phase. In the initial phase the amount of oxygen required for complete combustion exceeds both the amount of oxygen available within the building or that can be drawn in from outside. The starved combustion process results in toxic un-combusted material within the smoke cloud. For the Class 2.1 material, it has been assumed that un-combusted Bioallethrin will be contained in the cloud. The second phase of the fire, during which the size of the fire dramatically increases, produces a large smoke plume and flames often leaping metres into the air. The gas and smoke associated with the secondary phase rises to a great height with the temperatures being generated from burning material. The lift-off of the smoke plume results in a plume that reaches a significant height but that will not have significant consequences for neighbouring land uses.

It has been assumed that one pallet of Mortein Ultra Low Allergenic Fly burns per minute in this initial stage of the fire. The Bioallethrin released at one pallet per minute is 3.245 kg of Bioallethrin release per minute. It has been assumed that 20% of the Bioallethrin does not combust and is transported in the smoke plume. This results in a release rate of un-combusted Bioallethrin l, in the smoke plume of 0.16 (assumed 0.2 for modelling) kilograms per second.

C.2.3 Consequence Distances (Airborne Concentrations) for a Fire Initiating with Class 2.1 Material

It must be established airborne concentrations in residential areas, which could cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community. The data for Bioallethrin relates to TWA (8 hours) exposure of 10 mgm^{-3}. For this study a value of 30 minutes exposure, based in the TWA (8 hours) has been used. That is, an exposure level of 13 ppm of Bioallethrin.

The data for Bioallethrin relates to TWA (8 hours exposure). In a concentration level of three (3) times (i.e. 40 ppm) the irritation level has been used for a airborne concentration that may be potentially injurious to sensitive receptors.

These figures are used in the absence of other data and are considered conservative in nature. It would be anticipated that higher levels than those used in this study would be expected before the effects of individuals would be experienced.

The distance to each concentration level was modelled using TRACE 9.0. The results are shown in Table. C.2

Table. C.2 Consequence Distance to 13ppm and 40ppm for Class 2.1 Material (Bioallethrin)

Wind Velocity and Stability Class	Plume Characteristics	Distance to 13ppm (Metres)	Distance to 40ppm (Metres)
A1.5	Length	26.0	13.8
	Width	13.5	12.6
B3	Length	23.6	14.3
	Width	11.2	13.4
C3	Length	35.9	17.5
	Width	12.7	11.9
D3	Length	53.2	25.7
	Width	11.8	11.1
E1.5	Length	106.3	52.2
	Width	11.0	10.4
F1.5	Length	209.3	100.1
	Width	11.1	10.4

C.3 Fire in Class 3 Storage Area of the Warehouse A2

A fire can occur in the storage of Class 3 area. In order to access the consequences of this fire it has been assumed that:

- Flashover has occurred and the entire surface area of the flammable bunding is involved in the fire;
- The modelling was undertaken as three (3) simultaneous pool fires with diameter of 18 metres. These pool fires are equidistant down the entire length of the flammable goods storage section of the warehouse;
- The heat radiation at any point is the combination of these three simultaneous pool fires;
- The material used for modelling was ethanol; and
- The wind speed was assumed at 0.5 ms^{-1} achieving almost vertical flames.

Modelling was undertaken using Trace 9.0 and heat radiation levels were estimated at the same level as the base of the pool fire.

Table. C.3 Heat Radiation from Fire in Flammable Goods section of Warehouse

	Distance to Heat Radiation Level		
Hazardous event	**23 kWm^{-2}**	**12.6 kWm^{-2}**	**4.7 kWm^{-2}**
Fire in flammable bunding	9.6	12.7	23.1

The modelling of the pool fires resulted in a flame height of 15.3 metres with a radiant heat flux of 33.8 kW m^{-2}.

C.3.1 Consequence Distances for a Fire Initiating with Class 3 Material (Smoke Plume)

A fire event within Class 3 storage section of the Warehouse may result in the release of a smoke plume containing combustion products that may be harmful to people.

One useful way of characterising combustion product formation is to determine the conversion efficiency with which the mass of elements such as chlorine, sulphur, and nitrogen within agrochemicals is converted to HCl, SO_2, NO_2 and other toxic gases. These data enable the rate of production of low molecular weight toxic gases to be calculated.

The conversion to a potentially toxic combustion product has been estimated by the HSE method[3] and is shown in Table. C.4.

[3] This method is described by the HSE, Safety Report Assessment Guide: *Chemical Warehouse-Hazards*, Great Britain.

Table. C.4 Conversion Fraction to Toxic Combustion Product

Carbon to Carbon Monoxide CO	Chloride to Hydrochloric Acid HCl	Sulphur to Sulphur Dioxide SO_2	Nitrogen to Nitrogen Dioxide NO_2	Fluoride Hydrogen Fluoride HF
0.05	0.95	1.0	0.05	0.95

For the flammable liquids being stored in the Warehouse A2, Aeroguard Tropical has been used. This product contains the N,N-Diethyltoluamide $C_{12}H_{17}NO$. This material was assumed 20% by weight of a pool fire 5 metres in diameter burning down at 6mm per minute. This fire would consume 117 litres of mixture per minute and consume 20 kg per minute of N,N-Diethyltoluamide. The chemical species of concern for the N,N-Diethyltoluamide is the creation of nitrogen dioxide. The rate of release calculated has been doubled to represent other chemical specifies available in the mixtures. These assumptions were used to establish the following release rates of potentially toxic combustion products shown in Table. C.5.

Table. C.5 Release Rate of Toxic Combustion Products for a Fire involving Class 9 Material

	Nitrogen Dioxide NO_2
Release Rate kg min^{-1}	0.5

Modelling of these events was undertaken using Trace 9.0 for various wind conditions. The release is modelled as a point source release located in the middle of the designated area for Class 3 storage.

The warehouse is large in volume and dispersion of the combustion products would be expected to take place within the warehouse. For the modelling undertaken in this PHA, a point source model has been used that does not account for dispersion within the building. This will make the estimation of distances of effect conservative, as dispersion within the warehouse has not been integrated into the dispersion calculations.

In order to assess the toxic exposure criteria for an airborne concentration that is capable of seriously injuring sensitive members of the community or cause acute physiological responses to sensitive members of the community. For this event, the level ERPG-3 has been used. The definition of ERPG-3 is given by:

> *The ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.*

It must also establish toxic concentrations in residential areas, which could cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community. For this event, the level ERPG-2 has been used. The definition of ERPG-2 is given by:

> *The ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.*

The values for the ERPG–3 and ERPG-2 used in this study were gathered from American Industrial Hygiene Association (AIHA) and are shown below in Table. C.6.

Table. C.6 ERPG-2 and ERPG-3 for Chemicals of Interest (Class 3 Fire)

	Nitrogen Dioxide
	NO_2
ERPG-2	15
ERPG-3	30

The distance to each ERPG level was modelled using TRACE 9.0. The results are shown in Table. C.7

Table. C.7 Consequence Distance to ERPG-2 and ERPG-3 Combustion Products

Wind Velocity and Stability Class	Plume Characteristics	Distance to ERPG-2 (Metres)	Distance to ERPG-3 (Metres)
A1.5	Length	37.4	26.2
	Width	12.9	9.6
B3	Length	33.7	23.3
	Width	9.8	9.4
C3	Length	54.6	36.4
	Width	7.9	7.6
D3	Length	80.7	54.1
	Width	7.1	6.6
E1.5	Length	168.6	105.3
	Width	9.2	6.9
F1.5	Length	305.8	206
	Width	10	7.8

C.4 Fire in Temperature-Controlled Storage Area of the Warehouse A2

The fire in the contents in the Temperature-controlled area warehouse will result in the radiation that may affect the access to fire fighting equipment. It has assumed that the fire will reach a steady state heat generation of 40MW. This heat generation rate has been used to estimate the distance to heat radiation levels of concern. A point source heat radiation model has been used and is described by the equation shown below:

$$I = \frac{Q.f.\tau}{4\ \pi\ R^2}$$

Where Q is the heat Released (kW)

F is the fraction radiated (assumed 0.35)

τ transmittivity in air (assumed 1.0)

R distance from point source (m)

I Intensity

Table. C.8 Radiant Heat Levels from Temperature-Controlled Room Fire

	Distance to Heat Radiation Level		
Hazardous event	**23 kWm^{-2}**	**12.6 kWm^{-2}**	**4.7 kWm^{-2}**
Fire in all Areas	6.7	9.40	15.4

These results are taken from the edge of any racking or bunded area.

C.5 Full Warehouse Fire Warehouse A2

The distance for a full warehouse fire is considered as the largest distance of the radiant heat levels determined in Section C.2.1, Section C.3.1 and Section C.4. This level is used in any risk assessment undertaken.

Appendix D Consequences from Existing Storage Facilities

D.1 Introduction

The WestPark Industrial Estate contains a number of other facilities that contain dangerous goods and potentially hazardous materials. Two (2) warehouses are identified as containing dangerous goods and potentially hazardous materials. These warehouses are:

1. Warehouse A1; and

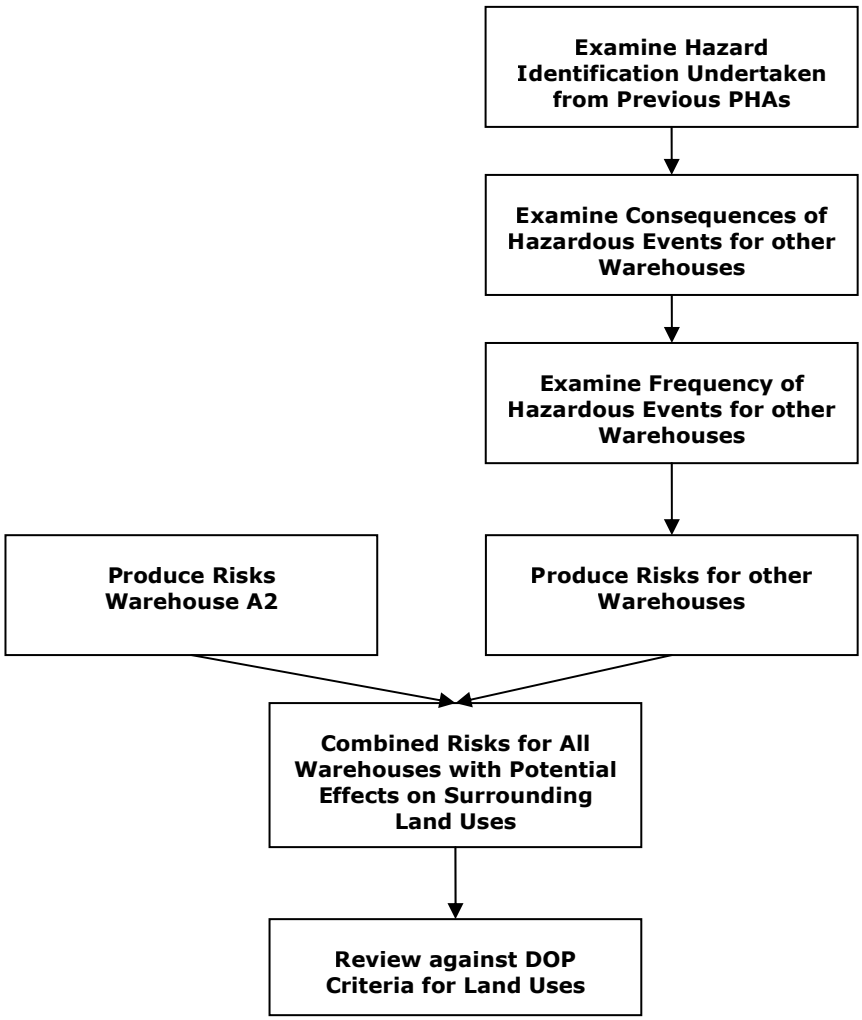
2. Warehouse C3/C4.

These warehouses have previously undergone development applications requiring the submission of a preliminary hazard analysis. These PHAs will be used to establish the risks to the surrounding land uses on a cumulative basis to ensure that surrounding land uses are not exposed to risks that exceed the criterion establish by the NSW Department of Planning.

D.2 Methodology

The methodology used in this section is described in the following flowchart:

Figure. D.1



D.3 Hazard Identification

This section contains a summary of the hazard identification undertaken for the Warehouse A1 and Warehouse C3/C4. The products and activities being undertaken at each of these warehouses are similar. That is the hazards presented by the dangerous goods, are similar for each Class of dangerous good.

D.3.1 Warehouse A1

The hazard identification for Warehouse A1, WestPark Industrial Estate is presented in Table. D.1.

D.3.2 Warehouse C3/C4

The hazard identification for Warehouse C3/C4, WestPark Industrial Estate is presented in Table. D.2.

Table. D.1 Hazard Identification Warehouse A1

Hazard ID	Activity and DG Class Area	Event	Causes	Possible Consequences	Controls
1	Storage of Paints (Class 3) material	Fire	Spill and or release of material and ignition of flammable materials.	Spill of Class 3 material into the environment. Ignition of spilt material and fire within the paint storage areas. Pool fire spreading along the ground. Development of fire into the Warehouse A2 and escalation in adjacent warehouses Release of contained fire fighting water into the environment.	Fire rated-wall for internal division of materials internally in the warehouse. Ignition control and hazardous zoning. Fire sprinklers and foam hose reels. Bunding of the flammables storage area to contain materials and early sprinkler action. Large on-site retention ponds. Training and procedures.
2	Storage of Aerosols	Fire and potential for rocketing cans.	Puncture of cans through forklifts or droppage of packages. Fire initiating in the package material surrounding cans.	Flammable gas released ignites and fire within the warehouse. Development of fire into the Warehouse A1 and escalation in adjacent warehouses. Heat radiation or projectiles reach adjacent land uses.	Fire-rated wall for internal division of materials internally in the warehouse. Compartmentalisation of dangerous goods. Fire sprinklers and on-site water supply. Control of potential ignition sources and hazardous zoning. Training and procedures.

Hazard ID	Activity and DG Class Area	Event	Causes	Possible Consequences	Controls
3	Receipt and Dispatch of materials	Spill of material into the environment. Fire Release of hazardous vapours.	Packages material damaged during transferring from transportation to storage.	Escape of material into the environment. Heat radiation and escalation into transportation of stock in transit. Personnel affected by vapours.	Training and procedures. Materials are all packaged goods, minimising consequences. Site retention for loading area. Spill control kits available at loading area. Control of ignition sources.
4	Battery Storage and Battery Recharging	Release of corrosive material.	Corrosive material escapes into the environment or reacts with incompatible chemicals.	Corrosive material escapes into the environment or reacts with incompatible chemicals. Personnel affected by vapours.	Regular inspection and rotation of batteries. Batteries stored in accordance with AS 3011 and AS2676.1. Spill procedures and spill kits.
5	Battery Storage and Battery Recharging	Fire	Release of hydrogen gas during recharging results in an explosion.	Explosion. Propagation into a larger fire.	Ventilation of recharging area. Sprinkler System. Separation by distance from dangerous goods.

Hazard ID	Activity and DG Class Area	Event	Causes	Possible Consequences	Controls
6	Refrigerated Storage	Fire	Failure of refrigeration panels and propagation from other areas. Fire from source of ignition.	Heat radiation projects off-site. Release of smoke potentially affecting surrounding land uses. Development of fire into the Warehouse A1 and escalation in adjacent warehouses. Release of contained fire fighting water into the environment.	Materials of construction for the wall and ceiling are fire retardant. Sprinkler system installed. Control of ignition sources. Training and procedures.

Table. D.2 Hazard Identification Warehouse C3/C4

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
1	Storage of Class 2.1 Aerosols	Fire and potential for rocketing cans.	Puncture of cans through forklifts or droppage of packages. Fire initiating in the package material surrounding cans.	Inhalation of materials. Localised flammable fire. Smoke generated in a building. Heat radiation projects off-site. Smoke generated and smoke plume effects adjacent residential area. Leakage of material. Material projects into other areas of the facility.	Mechanical ventilation of building. Caged area dedicated to storage of Class 2.1. Control of ignition source. In-rack sprinkler system. Fire detection for alarm/dial-out.
2	Storage of Class 2.2	Release and displacement of Oxygen.	Damaged cans in transportation to and from storage. Collision with forklift/ and damage.	Localised effects of personnel through displacement of oxygen.	Small inventory. Storage outside and well ventilated. PPE.

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
3	Storage of Class 3 (Paints) Material	Fire and potential for rocketing packages.	Spill and or release of material and ignition of flammable materials.	Smoke generated with the area affecting operating personnel. Heat radiation with impact on operating personnel. Heat radiation projects off-site. Smoke generated and affecting off-site people and environment. Release of material into the environment. Drum or package projects into the flammables area. Contaminated fire-fighting water enters the environment.	Fire-rated wall for internal division of materials internally in the warehouse. Ignition control and hazardous zoning. Fire sprinklers and foam hose reels. Bunding of the flammables storage area to contain materials and early sprinkler action. Large on-site retention ponds. Training and procedures.

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
4	Storage of Class 4.1 material	Fire	Fire in storage area.	Heat radiation with impact on operating personnel. Smoke generated by fire. Heat radiation projects off-site. Release of material into the environment. Contaminated fire fighting water enters the environment.	Small quantities. Fire-rated wall for internal division of materials internally in the warehouse. Ignition control and hazardous zoning. Fire sprinklers and foam hose reels. Bunding of the flammables storage area to contain materials and early sprinkler action. Large on-site retention ponds. Training and procedures.
5	Storage of Class 5.2 material	Fire	Defective containers. Ignition through mixing of incompatible material. Acceleration of a fire event.	Fire or explosion. Heat radiation with impact on operating personnel. Smoke generated by fire. Heat radiation projects off-site. Release of material into the environment. Contaminated fire-fighting water enters the environment.	Small quantities of storage. External storage of materials.

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
6	Storage of Class 8 material	Incompatible Reactions and spillage.	Damaged packages in transportation to and from storage by forklift. Release from corroded or damaged containers. Fire in general warehouse releases damage packages. Damage to racking through leakage of material.	Chemical burns to skin and other areas of contact. Inhalation of fumes generated by the material or by reaction with incompatible chemicals. Fumes generated by incompatible chemicals. Leakage into drain and escape into surrounding environment. Reaction with incompatible chemicals, source of ignition or generation of toxic plume.	Safety Shower to be installed at Class 8 storage area. Supply of PPE. Acids and Alkalis to be separated. Storage area to be installed within a bunded area within the GSS of the warehouse. Containment pond for fire fighting run-off.
7	Storage of resins, polymers, elastomers and plastics.	Fire.	Fire in packaged material or plastics.	Smoke generated with the area affecting operating personnel. Heat radiation with impact on operating personnel. Heat radiation projects off-site. Smoke generated and affecting off-site people and environment. Contaminated fire-fighting water enters the environment.	ESFR sprinkler system to be installed. Fire detection for alarm/dial out Automatic dial-out to third party to contact NSWFB. Operating training. Supply of PPE. Material is not classified as a Dangerous Good.

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
8	Storage of Class 6.1 (sub-risk 8) material	Fire.	Fire in Class 3 Material. Release of materials and ignition.	Fire producing smoke plume containing un-combusted toxic material. Contaminated fire-fighting water enters the environment. Heat radiation with impact on operating personnel.	Training of personnel. Personnel Protective Equipment (PPE) available for toxic product spills. Flammable warehouse bunded to contain 20 minutes of firewater application AS per AS 1940. On-site containment of fire fighting water. Firewall 240/240/240 around the flammable warehouse. Fire-rated doors. Site handling procedures and process to minimise spills. Scheme A water sprinkler system. Charging of forklifts to be undertaken in the general warehouse. Electrical installation as per Australian Standards for Hazardous Zones (AS 2430.3.3).

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
9	Storage of Class 9 material	Fire.	Damage to packaged goods through impact with forklift. Defective containers. Fire starting in general warehouse and involves Class 9 material.	Fire in early stages of development generates a smoke plume containing potentially toxic combustion products. Contaminated fire-fighting water enters the environment.	PPE available on site. Handling procedures. Spill Kits available on the site. Site Spill Containment suitable for 20 minutes of sprinkler addition. ESFR water sprinkler and fire detection within the general warehouse.

D.4 Consequence of Hazardous Events for Warehouse A1

The hazard identification undertaken in Appendix D Section has identified potentially hazardous events that may occur with the storage of dangerous goods in Warehouse A1. These potentially hazardous events consequences were examined in Benbow Environmental Preliminary Hazard Analysis (Ref 18090_REP). This section will present a brief summary of those results. No additional modelling or determination of consequences has been undertaken.

D.4.1 Major Flammable Liquids Spill in Warehouse A1

A major flammable liquid spill was modelled to establish that the potentially hazardous vapours that could be released by a spill of material. These hazardous vapours were modelled and it was revealed that the IDLH did not occur outside the site boundaries. That is, vapours produced by spills are unlikely to affect the surrounding land uses.

D.4.2 Fire in the Warehouse A1

A fire event in the Warehouse A1 was modelled using 100 m^2 pool fires, equidistant through the warehouse. The radiant heat produced by the fire is shown in Table D3.

Table. D.3 Radiant Heat Effects (Warehouse A1 – Pool Fire)

Radiant Heat Level	Distance to Radiant Heat Level
4.7 kWm^{-2}	53 metres
12.5 kWm^{-2}	37 metres
23 kWm^{-2}	30 metres

D.4.3 Production of Toxic Smoke Warehouse A1

A fire producing potential liquid spill was modelled to establish the potentially hazardous vapours that could be released by a spill of material. These hazardous vapours were modelled and it was revealed that the IDLH did not occur outside the site boundaries. That is, vapours produced by spills are unlikely to affect the surrounding land uses.

D.4.4 Flammable Gas Leak Warehouse A1

A release from the aerosol cans being stored at Warehouse A1 was modelled as the simultaneous release of the entire contents of every can in storage and a vapour cloud explosion. The explosive overpressure is shown in Table. D.4.

Table. D.4 Explosive Overpressures (Warehouse A1)

Radiant Heat Level	Distance to Radiant Heat Level
7 kPa	143 metres
14 kPa	37 metres

As these results revealed the explosive overpressures would be contained within the site boundaries, this scenario of simultaneous release of the entire contents is considered extremely remote and the frequency of such an event would be very small in comparison to other potentially hazardous incidents.

D.4.5 Summary of Hazardous Events for Warehouse A1

The potentially hazardous events for Warehouse A1 had their consequences determined for potential effects on surrounding land uses. This is summarised in Table. D..

Table. D.5 Summaries of Potentially Hazardous Consequences (Warehouse A1)

Hazardous Event	Consequence Modelled	Effect on Surrounding land use
Major Spill of flammable liquids	Dispersion of xylene	IDLH was not exceeded at site boundary and no further analysis is required.
Fire in Warehouse A1	Pool fire	Radiant heat levels above 4.7 kWm^{-2} were contained within the site boundaries.
Production of Toxic Smoke	Combustion products	IDLH was not exceeded at site boundary and no further analysis is required.

D.5 Consequence of Hazardous Events for Warehouse C3/C4

The hazard identification undertaken in Appendix D has identified potentially hazardous events that may occur with the storage of dangerous goods in Warehouse C3/C4. The potentially hazardous events consequences were examined in Moore Consulting and Engineering, Preliminary Hazard Analysis (Ref 7002-106 PHA 12 010807). This section will present a brief summary of those results. No additional modelling or determination of consequences has been undertaken.

The potentially hazardous events identified in the PHA for Warehouse C3/C4 were examined qualitatively to determine which potentially hazardous event required further analysis. The events identified as requiring further analysis were:

- Fire in the Flammable Goods section (FGS) of the Warehouse C3/C4;
- Fire, generating toxic combustion products for a fire in the resins, polymers, elastomers and plastics in the General Storage section of the Warehouse C3/C4;
- Fire in FGS of the Warehouse C3/C4 initiating in the Class 6.1 (sub-risk 8) material; and
- Fire in the General Storage section (GSS) of the Warehouse involving Class 9 material.

D.5.1 Fire in FGS Warehouse C3/C4

A fire event in the warehouse was modelled using 100 m^2 pool fires, equidistant through the warehouse. The radiant heat produced by the fire is shown Table D.6.

Table. D.6 Radiant Heat Levels fire in FGS (Warehouse C3/C4)

	Maximum Distance to Heat Radiation Level (metres)		
Hazardous Event	**23 kWm^{-2}**	**12.6 kWm^{-2}**	**4.7 kWm^{-2}**
Fire in FGS	22	38	78

D.5.2

D.5.3 Fire in Resins, Polymer, Elastomers or Plastic Warehouse C3/C4

Synthetic Resins, Polymers, Elastomers or Plastics, because of their chemical composition, release smoke that can contain toxic combustion products through the incomplete combustion of the material. These key toxic combustion products include carbon monoxide, hydrogen cyanide and other chemical compounds through incomplete thermal decomposition of the material. The early development of a fire involving resins, polymers, elastomers or plastics was assumed to occur involving 100 kg/min of resins, polymers, elastomers and plastics. The burning was assumed occur over two (2) hours.

In order to assess the toxic exposure criteria in airborne concentration that is capable of seriously injuring sensitive members of the community or cause acute physiological responses to sensitive members of the community an ERPG-3 level was used. It was found that the toxic combustion product hydrogen cyanide could travel 1,084 metres from the developing fire. This worst-case scenario occurs for wind conditions described by the stability Class F with a wind speed of 1.5 ms^{-1}. These wind conditions produce a long narrow cloud. The maximum width of a cloud with the stability Class F with a wind speed of 1.5 ms^{-1} is 26.6 metres wide. This is equivalent to approximately one (1) housing property wide.

In order to assess the toxic exposure criteria for airborne concentration in residential areas, which could cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community the ERPG-2, has been used. It was found that the toxic combustion product hydrogen cyanide could travel 617 metres from the developing fire with concentration levels of ERPG-2. This worst-case scenario occurs for wind conditions described by the stability Class F with a wind speed of 1.5 ms^{-1}. These wind conditions produce a long narrow cloud. The maximum width of a cloud with the stability Class F with a wind speed of 1.5 ms^{-1} is 16.3 metres wide. This is equivalent to approximately one (1) housing property wide.

D.5.4 Fire in FGS involving Class 6.1 Material (Warehouse C3/C4)

A fire developing in the Class 3 material, then enveloping the Class 6.1 (sub-risk 8) material may produce un-combusted toxic material. It was assumed that 5% of 40,000 kg of the Class 6.1 (sub-risk 8) material containing 50% cresol is consumed in a fire in the initiating stages. This initiation has been assumed to take 60 minutes. This equates to 11.1 kilograms per second of cresol being consumed in an initiating fire. It has been assumed that 20% of the cresol does not combust and is transported in the smoke plume. This results in a release rate of cresol, in the smoke plume of 2.2 kilograms per second.

In order to assess the toxic exposure criteria in airborne concentration that is capable of seriously injuring sensitive members of the community or cause acute physiological responses to sensitive members of the community TEEL-3. It was found that the un-combusted Class 6.1 material could travel 750 metres to TEEL-2 from the developing fire involving Class 6.1 materials. This worst-case scenario occurs for wind conditions described by the stability Class F with a wind speed of 1.5 ms^{-1}. These wind conditions produce a long narrow cloud. The maximum width of a cloud with the stability Class F with a wind speed of 1.5 ms^{-1} was 19 metres wide. This is equivalent to approximately one (1) housing properties wide.

In order to assess the toxic exposure criteria for airborne concentration in residential areas which could cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community the TEEL-2 for cresol had been used. It was found that the un-combusted Class 6.1 material could travel 198 metres to TEEL-2 from the developing fire involving Class 6.1 materials.

D.5.5 Fire in GSS involving Class 9 Material

The early development of a fire was assumed to have 7,075-kilograms of Class 9 involved (with 50% as active ingredient). This is based on 5% of the inventory being involved in a developing fire. This fire is assumed to generate smoke over a 90-minute period. This results in a release of 3,532-kilograms of an "average" agrochemical being released over 90 minutes.

In order to assess the toxic exposure criteria in airborne concentration that is capable of seriously injuring sensitive members of the community or cause acute physiological responses to sensitive members of the community an ERPG-3 for the combustion products was used. It was found that the toxic combustion product sulphur dioxide could travel 2,063 metres from the developing fire. This worst-case scenario occurs for wind conditions described by the stability Class F with a wind speed of 1.5 ms^{-1}. These wind conditions produce a long narrow cloud. The maximum width of a cloud with the stability Class F with a wind speed of 1.5 ms^{-1} is 45 metres wide. This is equivalent to approximately two (2) housing properties wide.

In order to assess the toxic exposure criteria for airborne concentration in residential areas, which could cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community the ERPG-2, has been used. It was found that the toxic combustion product sulphur dioxide could travel 701 metres from the developing fire with concentration levels of ERPG-2. This worst-case scenario occurs for wind conditions described by the stability Class F with a wind speed of 1.5 ms^{-1}. These wind conditions produce a long narrow cloud. The maximum width of a cloud with the stability Class F with a wind speed of 1.5 ms^{-1} is 19 metres wide. This is equivalent to approximately one (1) housing property wide.

D.6 Summary

The potentially hazardous events for Warehouse C3/C4 had their consequences determined for potential effects on surrounding land uses. This is summarised in Table. D.7.

Table. D.7 Summaries of Potentially Hazardous Consequences (Warehouse C3/C4)

Hazardous Event	Consequence Modelled	Effect on Surrounding Land Use
Fire in the Flammable Goods section of the Warehouse;	Pool fire	Radiant heat below 4.7 kWm^{-2} at surrounding land uses.
Fire, generating toxic combustion products for a fire in the resins, polymers, elastomers and plastics in the General Storage section of the warehouse;	Dispersion of gases	Potential effect on surrounding land uses. Frequency of the event must be established.
Fire in the Flammable Goods section of the Warehouse initiating in the Class 6.1 (sub-risk 8) material; and	Dispersion of gases	Potential effect on surrounding land uses. Frequency of the event must be established.
Fire in the General Storage section of the Warehouse involving Class 9 material	Dispersion of gases	Potential effect on surrounding land uses. Frequency of the event must be established.

Appendix E Likelihood Estimation Warehouse A2

E.1 Introduction

This section will examine of the frequency of those hazardous events identified in section 4 and requiring further quantification as determined by Section 5.

E.2 Frequency of Initiating Fire

Warehouse fires have a large variation in the estimates of their frequency. Some sources are referred to in the Table. E.1.

Table. E.1 Warehouse Fire Frequencies

Source	Estimate
HSE – Safety Report Assessment Guide: Chemical Warehouses – Hazards.	1 x 10^{-2} p.a.
Environmental Impact Assessment Report for the Commission of Inquiry into Proposed Manufacturing Plant by WR Grace Australia Ltd., Kurnell, Sydney, October 1987.	4.6 x 10^{-3} p.a.
Baldwin, Accident Analysis, and Prevention (Vol 6).	1 x10^{-3} p.a.
PHA – Intermodal Logistics Centre at Enfield Environmental Impact Statement, QEST Consulting Pty Ltd, 2005.	1 x 10^{-4} p.a. to 1x 10^{-3} p.a. for DG stores

The range of frequencies used is varied and represents an uncertainty in the estimation of the frequency. Many of these warehouses are used to store general chemicals and do not have the protection of control involved in a storage of flammable goods. In consideration of this, a figure of 5 x 10^{-4} p.a. for a fire initiating in the warehouse has been used. This represents a conservative figure and has been used in the generation of the frequency of incidents in the Warehouse A2.

E.3 Frequency of Fire Events and Smoke Plume (Class 2.1 Material)

The frequency of events in a Class 2.1 fire was examined using an event tree. The assumptions in this event tree are shown in Table. E.2.

Table. E.2 Probabilities Relating to Fire involving Class 2.1 Material

Event	Probability /Frequency	Basis
Frequency of Fire	5×10^{-4} p.a.	As previously discussed.
Fire developing in which aerosols. Based on storage mass per level.	0.08	Level 1 Aerosols NFPA 30B.
	0.53	Level 2 Aerosols NFPA 30B.
	0.40	Level 3 Aerosols NFPA 30B.
Activation of Automatic Sprinkler and control	0.98	Level 1 Aerosols have a tendency not to catch fire well.
	0.9	Level 2 Aerosols are predominated by those filled with butane or propane. Sprinkler system may suppress the fire by removal of heat.
	0.8	Level 3 Aerosols often contain flammable liquids resulting in pool fires as well as flammable gas releases. Reduced probability of successfully controlling the fire.
Manual Invention of Control of fire	0.9	Level 1 Aerosols have a tendency not to catch fire well. Manual intervention is possible.
	0.3	Level 2 Aerosols releases of flammable gas and potential propagation reduces the ability for manual intervention.
	0.3	Level 3 Aerosols releases of flammable gas and potential propagation reduces the ability for manual intervention.
Caging and walls prevent cans projecting into other storage areas within the warehouse	0.98	The protection for the aerosols is described as per FM 7-29 and will most likely contain these small packages.
Escalates in Flammables	0.9	The failure of the mechanical means for prevention of escalation means that escalation into flammables storage is likely.
Fire Controlled by Brigade	0.1	The NSWFB is unlikely to prevent loss of warehouse on escalation into areas.
	0.3	The NSWFB is likely to prevent loss of warehouse without escalation into areas.

Figure. E.1 Frequency Estimation for Fire in Class 2.1 Storage of Warehouse A2

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8056-200-01
Event Tree for Aerosol Fire

Frequency of Fire in Aerosol Section of Warehouse	Fire Develops in Which Area	Extinguished/ Controlled by fire Sprinkler System	Manual Control	Fire Contained within Aerosol Area by Mechanical Means	Fire escalates in Flammables area	Fire Controlled by Brigade	Frequency	Description of Result
5.00E-04	Level 1 0.08	Y 0.98					3.92E-05	Small Localised Fire
			0.9				7.20E-07	Small Localised Fire
		N 0.02	Y 0.98				7.84E-08	Loss of aerosols. Contained by Mechanical Means
				Y 0.1			1.44E-10	Large fire, but controlled to large damage by NSWFB
				N 0.9	Y 0.9		1.30E-09	Fire escalates into flammables area. Large Warehouse Fire.
					N 0.1	Y 0.3	4.80E-11	Large fire, but controlled to large damage by NSWFB
						N 0.7	1.12E-10	Fire escalates into flammables area. Large Warehouse Fire.
	Level 2 0.53	Y 0.9					2.39E-04	Small Localised Fire
			0.3				7.95E-06	Small Localised Fire
		N 0.1	Y 0.98				1.82E-05	Loss of aerosols. Contained by Mechanical Means
				Y 0.1			3.34E-08	Large fire, but controlled to large damage by NSWFB
				N 0.9	Y 0.9		3.01E-07	Fire escalates into flammables area. Large Warehouse Fire.
					N 0.1	Y 0.3	1.11E-08	Large fire, but controlled to large damage by NSWFB
						N 0.7	2.60E-08	Fire escalates into flammables area. Large Warehouse Fire.
	Level 3 0.39	Y 0.8					1.56E-04	Small Localised Fire
			0.3				1.17E-05	Small Localised Fire
		N 0.2	Y 0.98				2.68E-05	Loss of aerosols. Contained by Mechanical Means
				Y 0.1			4.91E-08	Large fire, but controlled to large damage by NSWFB
				N 0.9	Y 0.9		4.42E-07	Fire escalates into flammables area. Large Warehouse Fire.
					N 0.1	Y 0.3	1.64E-08	Large fire, but controlled to large damage by NSWFB
						N 0.7	3.82E-08	Fire escalates into flammables area. Large Warehouse Fire.

Table. E.3 Frequencies of Events from Aerosol fire.

Frequency Description	Discussion	Frequency
Fire producing a smoke plume capable of affecting surrounding uses.	All events other than those resulting in a fire controlled within a small area.	45.93×10^{-6} p.a.
Fire event producing entire warehouse fire event.	Events described as total warehouse fire.	0.81×10^{-6} p.a.
Propagation into Warehouse A1 or Warehouse A3.	Events described as total warehouse fire, multiplied by the failure of the firewall (0.02).	1.62×10^{-8} p.a.

E.3.1 Frequency of Irritating Effects to Sensitive Receptors (Class 2.1 Fire)

The consequence modelling for a smoke plume with un-reacted material from a Class 2.1 fire was undertaken in section Appendix C. This consequence modelling revealed that the smoke plume generated by a fire in the Class 2.1 material the can travel large distances and have the potential to impact on surrounding land uses.

This section will examine the likelihood (frequency) of a smoke plume occurring in a specific wind direction. The frequencies shown in Table. E.4 has been calculated for those conditions in which the smoke plume will extend beyond the limits of the WestPark Industrial Estate. If the smoke disperses below the airborne concentration of concern within the WestPark Industrial Estate boundary, the probability of that wind condition occurring has not been included.

Table. E.4 Frequency of Irritating Effects to Sensitive Receptors (Class 2.1 Fire)

Wind Direction (Wind coming from)	Distance to offsite	Wind Classes in which Smoke Plume will extend offsite	Probability of Wind Class and Wind Direction (%)	Frequency of Initiating event (x 10^{-6} p.a.)	Frequency of Event in Wind Direction (x 10^{-6} p.a.)
N	290	Concentration not exceed outside site boundary.			
NNE	410	Concentration not exceed outside site boundary.			
NE	400	Concentration not exceed outside site boundary.			
ENE	300	Concentration not exceed outside site boundary.			
E	260	Concentration not exceed outside site boundary.			
ESE	290	Concentration not exceed outside site boundary.			
SE	310	Concentration not exceed outside site boundary.			
SSE	550	Concentration not exceed outside site boundary.			
S	190	F1	3.4	45.93	1.56
SSW	210	F1	4.3	45.93	1.97
SE	270	Concentration not exceed outside site boundary.			
WSW	480	Concentration not exceed outside site boundary.			
W	700	Concentration not exceed outside site boundary.			
WNW	350	Concentration not exceed outside site boundary.			
NW	250	Concentration not exceed outside site boundary.			
NNW	250	Concentration not exceed outside site boundary.			

The frequency results shown in Table. E.4 reveals that the maximum frequency for Class 2.1 fire containing airborne concentrations that in residential areas should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community was 2.03 x 10^{-6} p.a. with a wind from the South South West.

E.3.2 Frequency of Airborne Concentrations Capable of Seriously Injury, Class 2.1Fire

The consequence analysis conducted in Appendix C revealed that the largest distance for an airborne concentration that is capable of seriously injuring sensitive members was 100 metres. This distance would remain within the site boundary. As such, no further Analysis has been conducted on surrounding land uses.

E.4 Fire in Class 3 Storage of the Warehouse

The frequencies of events in a Class 3 fire were examined using an event tree. The assumptions in this event tree are shown in Table. E.5.

The Class 3 storage within be protected by a Scheme A water sprinkler system. This system has been specifically chosen for the storage of flammable material. Automatic dial-out to a third party to contact the fire brigade will be initiated upon activation of the sprinkler system.

Table. E.5 Probabilities Relating to Fire in Class 3 Material

Event	Probability / Frequency	Basis
Frequency of Fire	5×10^{-4} p.a.	As previously discussed.
Activation of Automatic Sprinkler	0.9215	The material stored is an ethanol-based material will make fire control with water sprinklers likely. There will be Scheme A sprinkler system installed. The probability was estimated using Reference 10 and includes the detection and activation and control. For the purposes of this event, it will be sufficient to control the fire with this in-rack sprinkler method. This is the function of the probability of detection and activation 0.97 and the probability of control of the fire 0.95.
Successful manual Intervention of Control of Fire.	0.7	Manual intervention in the fire control would involve the use of fire extinguishers, fire hoses and hydrants. The relatively small quantity of material and the small packaging makes manual fire intervention possible, as the initial fire will most likely be small and take time to develop, as the initial release will be small.
Automatic Dial-Out	0.95	There will be an automatic dial-out to a third party for contact of the NSWFB. It would be expected that this would occur with 0.95.
Manual Dial Out	0.75	Even with automatic dial-out, there will still be manual contacting of the NSWFB. It was assumed that this would be available during 16 hours of the day.
NSWFB Brigade arrives before full bund fire or Flashover	0.75	The NSWFB is contacted by automatic dial-out. The local brigade will have a short response time and the small packaging will make intervention before rapid growth of the fire possible.
	0.6	The NSWFB is contacted by manual dial out. The local brigade will have a short response time and the small packaging will make intervention before rapid growth of the fire possible.
NSWFB arrive after the escalation	0.97	This is the probability that the NSWFB arrive after the escalation of the fire into the entirety of the flammable goods area.
Fire Controlled without escalation into other storage areas	0.9	Arrival of the NSWFB before escalation into a full bund fire makes the probability of confinement of the fire to the flammables storage area.
	0.6	Arrival of the NSWFB after escalation into a full bund fire makes the probability of confinement of the fire less likely.
	0.03	A very late arrival of the NSWFB makes escalation control unlikely.

Event	Probability /Frequency	Basis
Fire Controlled after escalation	0.1	After escalation, the control fire by brigades becomes difficult and there is a small chance that damage could be reduced by fire fighting actions.
	0.01	Late arrival of the NSWFB will most likely result in the loss of the entire warehouse contents, or severe damage to warehouse items.

This information is combined into a fault tree and is shown in Figure. E.2. The following frequencies were extracted from the event tree for use in further analysis.

Table. E.6 Frequencies of Events from Flammable Storage

Frequency Description	Discussion	Frequency
Fire producing a smoke plume capable of affecting surrounding uses	All events other than those resulting in a fire controlled within a small area.	15.7×10^{-6} p.a.
Fire event producing entire warehouse fire event	Events described as total warehouse fire.	2.94×10^{-6} p.a.
Propagation into Warehouse A1 or Warehouse A3	Events described as total warehouse fire, multiplied by the failure of the firewall (0.02).	5.88×10^{-8} p.a.

Figure. E.2 Frequency Estimation for Fire in Flammables Good Section of Warehouse

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See Drawing No. 8056-200-02 Next Page

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8056-200-02
Event Tree for Flammable Goods Fire

Frequency of Fire in Flammable Section of Warehouse	Activation of Automatic Sprinklers and Control of Fire	Manual Intervention and Control of Fire	Automatic Dial Out and Notification of NSWFB	Manual Dial Out and Notification of NSWFB	NSWFB arrives before full bund fire	NSWFB arrives after escalation to full bund fire	Fire Controlled without escalation into other storage areas	Fire Controlled after escalation to other internal Storage Areas	Frequency	Description of Result
5.00E-04	Yes 0.9215								4.61E-04	Controlled Fire within Small Area
	No 0.0785	Yes 0.6							2.36E-05	Controlled Fire within Small Area
		No 0.4	Yes 0.95		Yes 0.75		Yes 0.9		1.01E-05	Extensive Damage to Flammables Area . Slight Damage to other Area
							No 0.1	Yes 0.1	1.12E-07	Extensive Damage to Flammables Area and Other Areas in Warehouse.
								No 0.9	1.01E-06	Large Warehouse Fire. Involving Large Area, Total Loss of Warehouse
						Yes 0.97	Yes 0.6		2.17E-06	Extensive Damage to Flammables Area . Slight Damage to other Area
							No 0.4	Yes 0.01	1.45E-08	Extensive Damage to Flammables Area and Other Areas in Warehouse.
								No 0.99	1.43E-06	Large Warehouse Fire. Involving Large Area, Total Loss of Warehouse
					No 0.25	No 0.03	Yes 0.03		3.36E-09	Extensive Damage to Flammables Area . Slight Damage to other Area
							No 0.97	Yes 0.01	1.09E-09	Extensive Damage to Flammables Area and Other Areas in Warehouse.
								No 0.99	1.07E-07	Large Warehouse Fire. Involving Large Area, Total Loss of Warehouse
				Yes 0.6	Yes 0.75	Yes 0.97	Yes 0.9		3.18E-07	Extensive Damage to Flammables Area . Slight Damage to other Area
							No 0.1	Yes 0.1	3.53E-09	Extensive Damage to Flammables Area and Other Areas in Warehouse.
								No 0.9	3.18E-08	Large Warehouse Fire. Involving Large Area, Total Loss of Warehouse
						No 0.03	Yes 0.6		6.85E-08	Extensive Damage to Flammables Area . Slight Damage to other Area
							No 0.4	Yes 0.1	4.57E-09	Extensive Damage to Flammables Area and Other Areas in Warehouse.
								No 0.9	4.11E-08	Large Warehouse Fire. Involving Large Area, Total Loss of Warehouse
					No 0.25	Yes 0.97	Yes 0.03	Yes 0.01	1.06E-12	Extensive Damage to Flammables Area . Slight Damage to other Area
								No 0.99	1.05E-10	Large Warehouse Fire. Involving Large Area, Total Loss of Warehouse
							No 0.97	Yes 0.1	3.43E-10	Extensive Damage to Flammables Area and Other Areas in Warehouse.
								No 0.9	3.08E-09	Large Warehouse Fire. Involving Large Area, Total Loss of Warehouse
						No 0.03	Yes 0.03	Yes 0.01	9.42E-11	Extensive Damage to Flammables Area . Slight Damage to other Area
								No 0.99	9.33E-09	Large Warehouse Fire. Involving Large Area, Total Loss of Warehouse
				No 0.4				Yes 0.001	3.05E-10	Extensive Damage to Flammables Area and Other Areas in Warehouse.
							No 0.97	No 0.999	3.04E-07	Large Warehouse Fire. Involving Large Area, Total Loss of Warehouse

E.5 Frequency of Smoke Plume (Initiating in Class 3 Material)

E.5.1 Frequency of Plume (Class 3) Causing Irritation to Sensitive Receptors

The consequence modelling for a smoke plume with potentially hazardous decomposition products from a Class 3 fire, undertaken in Appendix C. This consequence modelling revealed that the smoke plume generated by fire in the Class 3 material could travel large distances and potentially affecting surrounding land uses.

This section will examine the likelihood (frequency) of a smoke plume occurring in a specific wind direction. The frequencies shown in Table. E.7 has been calculated for those conditions in which the smoke plume will extend beyond the limits of the WestPark Industrial Estate. If the smoke disperses below the airborne concentration of concern within the WestPark Industrial Estate boundary the probability of that wind condition occurring has not been included.

Table. E.7 Frequency of Plume being Potentially Irritating to Sensitive Receptor (Class 3 Fire)

Wind Direction (Wind coming from)	Distance to offsite	Wind Classes in which Smoke Plume will extend offsite	Probability of Wind Class and Wind Direction (%)	Frequency of Initiating event (x 10^{-6} p.a.)	Frequency of Event in Wind Direction (x 10^{-6} p.a.)
N	290	F1	1.7	15.6	0.27
NNE	410	Concentration not exceed outside site boundary.			
NE	400	Concentration not exceed outside site boundary.			
ENE	300	F1	1.2	15.6	0.19
E	260	F1	1.2	15.6	0.19
ESE	290	F1	1.2	15.6	0.19
SE	310	F1	2.5	15.6	0.39
SSE	550	Concentration not exceed outside site boundary.			
S	190	F1	3.4	15.6	0.53
SSW	210	F1	1.3	15.6	0.2
SE	270	F1	0.6	15.6	0.09
WSW	480	Concentration not exceed outside site boundary.			
W	700	Concentration not exceed outside site boundary.			
WNW	350	Concentration not exceed outside site boundary.			
NW	250	F1	1.5	15.6	0.23
NNW	250	F1	1.5	15.6	0.23

The frequency results shown in Table. E.7 reveals that the maximum frequency for Class 3 fire containing airborne concentrations that in residential areas should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community was 0.53 x 10^{-6} p.a. with a wind from the South.

E.5.2 Frequency of Plume (Class 3) being potentially Injurious to Sensitive Receptors (Class 3 Fire)

The consequence modelling for a smoke plume with potentially hazardous decomposition products from a Class 3 fire, undertaken in Appendix C. This consequence modelling revealed that the smoke plume generated by fire in the Class 3 material could travel large distances and potentially affecting surrounding land uses.

This section will examine the likelihood (frequency) of a smoke plume occurring in a specific wind direction. The frequencies shown in Table E8 have been calculated for those conditions in which the smoke plume will extend beyond the limits of the WestPark Industrial Estate. If the smoke disperses below the airborne concentration of concern within the WestPark Industrial Estate boundary, the probability of that wind condition occurring has not been included.

Table. E.8 Frequency of Plume being Potentially Injurious to Sensitive Receptors (Class 3 Fire)

Wind Direction (Wind coming from)	Distance to offsite	Wind Classes in which Smoke Plume will extend offsite	Probability of Wind Class and Wind Direction (%)	Frequency of Initiating event (x 10^{-6} p.a.)	Frequency of Event in Wind Direction (x 10^{-6} p.a.)
N	290	Concentration not exceed outside site boundary.			
NNE	410	Concentration not exceed outside site boundary.			
NE	400	Concentration not exceed outside site boundary.			
ENE	300	Concentration not exceed outside site boundary.			
E	260	Concentration not exceed outside site boundary.			
ESE	290	Concentration not exceed outside site boundary.			
SE	310	Concentration not exceed outside site boundary.			
SSE	550	Concentration not exceed outside site boundary.			
S	190	F1	3.4	15.6	0.53
SSW	210	Concentration not exceed outside site boundary.			
SE	270	Concentration not exceed outside site boundary.			
WSW	480	Concentration not exceed outside site boundary.			
W	700	Concentration not exceed outside site boundary.			
WNW	350	Concentration not exceed outside site boundary.			
NW	250	Concentration not exceed outside site boundary.			
NNW	250	Concentration not exceed outside site boundary.			

The frequency results shown in Table. E.8 reveals that the maximum frequency for a Class 3 fire containing airborne concentrations, that in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure, was 0.53 x 10^{-6} p.a. with a wind from the South.

E.6 Other Fire Event for Warehouse A2

The other fire events could include a fire in the Temperature-Controlled room, fire in the office, and fires from forklift battery charging. These fires will produce heat radiation and smoke. As discussed in Section 6, the production of smoke will be unlikely to have any effects on surrounding land uses. The materials being stored in general are solids and inside secondary packing and the behaviour of the fire would be expected to be no greater than any normal fire events from a warehouse storing general goods. As such, the frequency of these smoke plumes has not been combined with those identified as potentially containing chemicals, which may affect surrounding land uses.

There will be a frequency associated with a fire developing in the temperature-controlled storage area.

Table. E.9 Frequency of Events from Temperature-Controlled Storage

Frequency Description	Discussion	Frequency
Fire involving the entire contents of the temperature-controlled area.	All events other than those resulting in a fire controlled within a small area.	54.95×10^{-6} p.a.
Fire event producing entire warehouse fire event.	Events described as total warehouse fire.	2.75×10^{-6} p.a.
Propagation into Warehouse A1 or Warehouse A3.	Events described as total warehouse fire, multiplied by the failure of the firewall (0.02).	5.5×10^{-8} p.a.

Figure. E.3 Frequency Estimation for Fire in Temperature-controlled Area

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See Drawing No. 8056-200-03 Next Page

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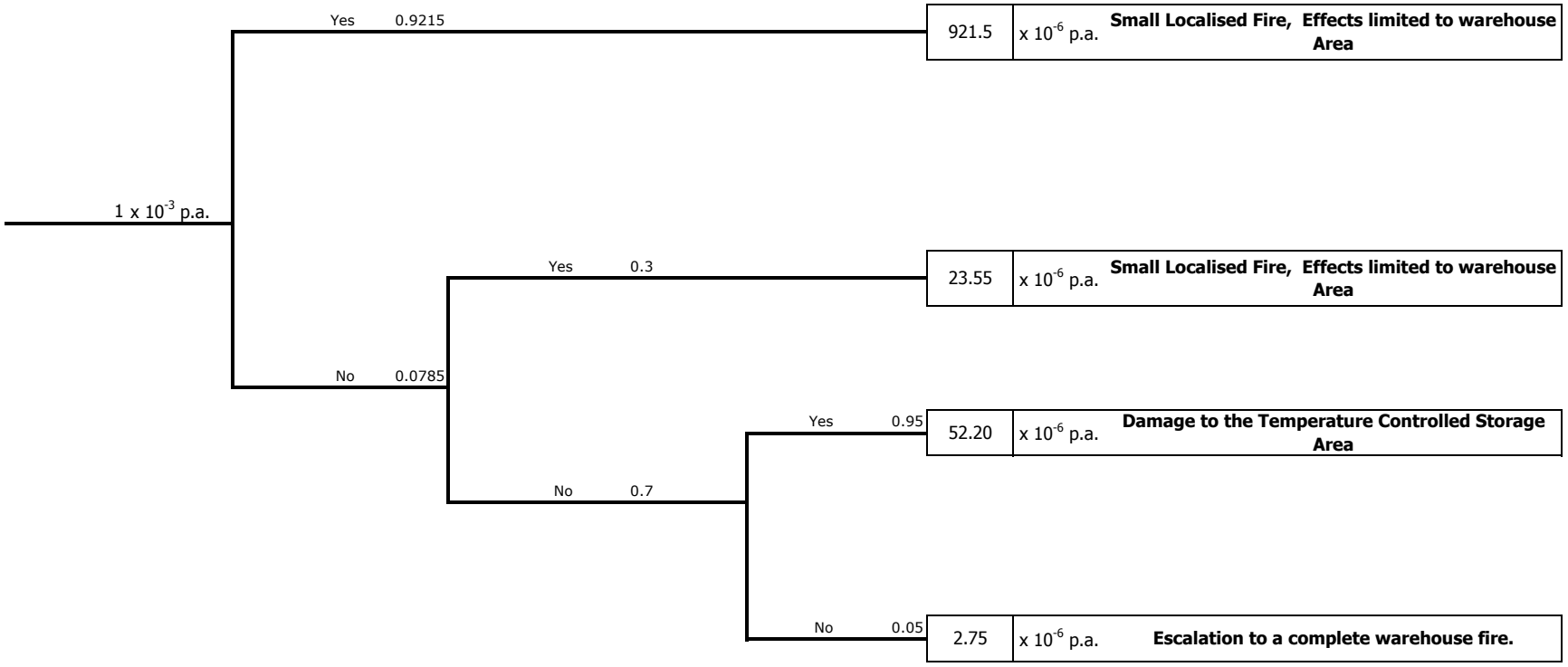
8056-200-03
Event Tree for Fire in Temperature Controlled Area

Frequency of Initiating Fire	Sprinklers control the Fire.	Manual Intervention and control of the Fire.	Control of Fire before entire Warehouse A2 is involved.

Frequency		Description of Result
921.5	x 10^{-6} p.a.	**Small Localised Fire, Effects limited to warehouse Area**
23.55	x 10^{-6} p.a.	**Small Localised Fire, Effects limited to warehouse Area**
52.20	x 10^{-6} p.a.	**Damage to the Temperature Controlled Storage Area**
2.75	x 10^{-6} p.a.	**Escalation to a complete warehouse fire.**



E.7 Total Frequency of Smoke Plume Events Towards Residents (Warehouse A2)

The analysis conducted in this section has identified events that could produce airborne concentrations that may affect surrounding land uses. These events include:

- A fire in the Class 2.1 material resulting in a smoke plume containing un-combusted products; and

- A fire in the Class 3 material resulting in a smoke plume containing potentially harmful combustion products.

Frequency of these events was established in all wind directions and wind conditions that extend beyond the boundary of the WestPark Industrial Estate.

The frequency results shown in Table. E.10 reveals that the maximum frequency for all smoke plumes containing airborne concentrations that in residential areas should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community was 2.23×10^{-6} p.a. with a wind from the South South West.

The frequency results shown in Table. E.10 reveals that the maximum frequency for all smoke plumes containing airborne concentrations that in residential areas, which would be seriously injurious to sensitive members of the community following a relatively short period of exposure, was 2.14×10^{-6} p.a. with a wind from the South.

Table. E.10 Total Frequencies for Smoke Plumes (Warehouse A2 Events)

Wind Direction (Wind coming from)	Frequency of Irritation to SR (x10 $^{-6}$ p.a.)	Frequency of Serious Injury to SR (x10 $^{-6}$ p.a.)
N	0.27	-
NNE	0	-
NE	0	-
ENE	0.19	-
E	0.19	-
ESE	0.19	-
SE	0.39	-
SSE	0	-
S	2.09	0.53
SSW	2.17	
SE	0.09	-
WSW	0	-
W	0	-
WNW	0	-
NW	0.23	-
NNW	0.23	-

Appendix F Cumulative Frequencies of Events

F.1 Introduction

This section examines the cumulative frequency of events that could potentially affect surrounding land uses.

F.2 Frequency of Smoke Plumes from Warehouse A1

In Appendix D the consequences for potentially hazardous events for Warehouse A1 were examined. These were drawn from the PHA produced for the Warehouse A1. The consequence modelling conducted for the warehouse revealed, that the smoke plumes containing airborne concentrations that may cause irritation to sensitive receptors, or be potentially injurious to sensitive receptors were dispersed to levels unlikely to cause these effects within the limits of the site boundary. These results mean that the Warehouse A1 does not contribute to the frequency of containing airborne concentrations that may cause irritation to sensitive receptors, or be potentially injurious to sensitive receptors.

F.3 Frequency of Smoke Plumes from Warehouse C3/C4

In Appendix D the consequences for potentially hazardous events for Warehouse C3/C4 were examined. These were drawn from the PHA produced for the Warehouse C3/C4. The consequence modelling conducted for the warehouse revealed that the smoke plumes containing airborne concentrations that may cause irritation to sensitive receptors, or be potentially injurious to sensitive receptors could potentially affect surrounding land uses. The frequencies of these events are presented in Table. F.1.

Table. F.1 Frequency of Airborne Concentrations Potentially Irritating to Sensitive Receptors

Wind Direction (Wind coming from)	Warehouse C3/4	
	Frequency of Irritation to SR (x10 -6 p.a.)	Frequency of Serious Injury to SR (x10 -6 p.a.)
N	4.6	3.1
NNE	4.6	3
NE	2.7	0.8
ENE	1.5	0.4
E	1.2	0.6
ESE	1.9	0.3
SE	2.4	0.5
SSE	3.4	1.7
S	6.9	3.5
SSW	8.8	4.5
SW	5.1	1.6
WSW	2.0	0.7
W	2.6	0.8
WNW	2.5	0.8
NW	2.7	1.4
NNW	2.8	1.9

F.4 Combined Frequency of Smoke Plumes from All Warehouses

The consequence analysis has revealed that not all potentially hazardous incidents will produce consequences that will leave the site. This PHA is concerned with the effect of introducing the storage of dangerous goods in Warehouse A2. As such, the centre of the plumes will be considered as Warehouse A2. The Warehouse C3/C4 has consequences that intersect with those established for Warehouse A2. The result is regions where the risks must be the combined effect of Warehouse A2 and Warehouse C3/C4.

In Table. F.2 these intersections have been identified and the combined frequency evaluated for the cumulative off-site risks The results are conservative as not all the consequence distance established for events in Warehouse C3/C4 intersect with events established for Warehouse A2. In Appendix D it was established that only certain winds would produce off-site effects for Warehouse A2. Only these have been included in Table. F.2.

F.4.1 Frequency of Airborne Concentrations Irritating to Sensitive Receptors (Cumulative)

Table. F.2 reveals the frequency of events that could cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community. The maximum frequency was found to be 9.13×10^{-6} p.a. with the cumulative effect of potential events for Warehouse A2 with a South South West wind and potential events for Warehouse C3/C4 with a South wind.

F.4.2 Frequency of Airborne Concentrations Capable of Serious Injury (Cumulative)

Table. F.2 reveals the frequency of events that is capable of seriously injuring sensitive members of the community or causing acute physiological responses to sensitive members of the community. The maximum frequency was found to be 5.53×10^{-6} p.a. with the cumulative effect of potential events for Warehouse A2 with a South South West wind and potential events for Warehouse C3/C4 with a South wind.

Table. F.2 Frequency of Airborne Concentrations Irritating to Sensitive Receptors

Wind Direction (Wind coming from)	Frequency of Event Warehouse A2	Warehouse C3/4		Frequency of Potential Irritation to SR (x10 $^{-6}$ p.a.)
		Contributing Wind Direction	Frequency of Potential Irritation to SR (x10 $^{-6}$ p.a.)	
N	0.27	NNE	4.6	4.87
NNE	0	NE	2.7	2.70
NE	0	ENE	1.5	1.50
ENE	0.19	ENE	1.5	1.69
E	0.19	E	1.2	1.39
ESE	0.19	ESE	1.9	2.09
SE	0.39	None	-	0.39
SSE	0	SE	2.4	2.40
S	2.09	SE	2.4	4.49
S	2.09	SSE	3.4	5.49
SSW	2.17	SE	2.4	4.57
SSW	2.17	SSE	3.4	5.57
SSW	2.17	S	6.9	9.07
SW	0.09	SSE	3.4	3.49
SW	0.09	S	6.9	6.99
SW	0.09	SSW	8.8	8.89
WSW	0	SW	2.0	2.00
W	0	W	2.6	2.60
WNW	0	NW	2.7	2.70
NW	0.23	NNW	2.8	3.03
NNW	0.23	N	4.6	4.83
NNW	0.23	NNE	4.6	4.83

Table. F.3 Frequency of Airborne Concentrations Capable of Serious Injury

Wind Direction (Wind coming from)	Frequency of Event Warehouse A2	Warehouse C3/4		Frequency of Potential Injury to SR (x10 $^{-6}$ p.a.)
		Contributing Wind Direction	Frequency of Serious Injury to SR (x10 $^{-6}$ p.a.)	
S	0.53	SE	0.5	1.03
S	0.53	SSE	1.7	2.23

Appendix G Individual Risk Evaluation

G.1 Probits

A probit is defined as:

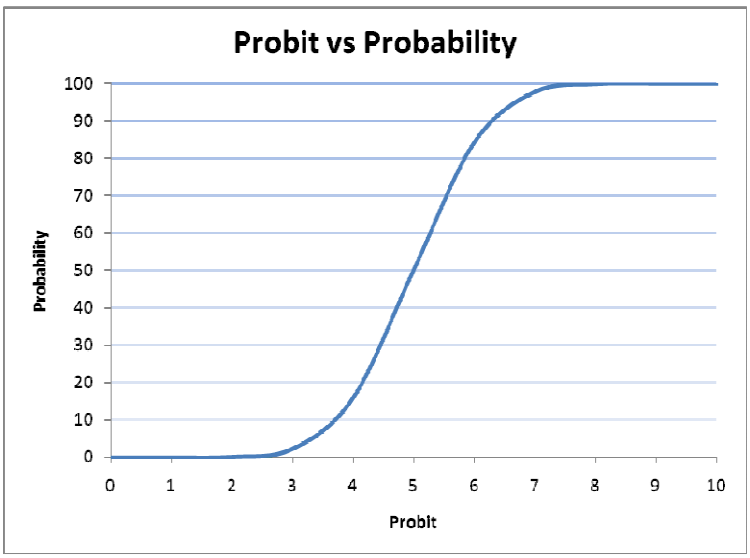
> ***Probit analysis**: A statistical transformation, which will make the cumulative normal distribution linear. In analysis of dose-response, when the data on response rate as a function of dose are given as probits, the linear regression line of these data yields the best estimate of the dose-response curve.*

$$y = 5 + Z(p)$$

Where *y* = *the value of the probit;*
p = *the prevalence of response at each dose level; and*
Z(p) = *the corresponding value of the standard cumulative normal distribution.*

Probit is transferred to probability using the graph as shown in Figure G.1.

Figure. G.1 Probit versus Probability



G.2 Probit for Airborne Concentrations

For the purposes of a risk assessment, it provides a methodology of converting a toxic load to a probability of fatality. The Probit for toxic loads is described in the general equation shown below:

$$Y = a + b \ln(C^n t_e)$$

Y	is the Probit
a, b, n	are constants
C	is the concentration in ppm by Volume
t_e	is the exposure time in minutes

G.2.1 Class 2.1 Fire

The hazard identification revealed that Class 2.1 material if involved in the early stage of a fire developing in the warehouse could produce a smoke plume containing un-combusted material. This un-combusted material could, affect surrounding land uses. The material selected to represent this un-combusted component is Bioallethrin, the active pesticide component of a large proportion of the Class 2.1 material.

The LD_{50} for Bioallethrin is 709mg.kg^{-1}. The average weight of an individual has been assumed to be 70 kg. This results in 56,730 mg to be given orally for a LD_{50} in humans. The modelling in this section requires inhalation, but in the absence of data, it has been assumed that if 56,720 mg of Bioallethrin were inhaled it would result in a mortality rate of 50% of the population. The average human typically inhales 400-500ml of air and each inhalation would be a volume of 450 ml. In one (1) minute, a typical person will inhale 15 times. This inhalation rate was increased due to the stress related to any dangerous situation and 18 inhalations per minute was assumed. This equated to 243 litres being inhaled in a 30-minute period by an average person and 56,720 mg of Bioallethrin must be included in this 243 litres. The Bioallethrin must therefore have a concentration of 233 mg per litre. This resulting concentration is converted to ppm by the formulae

ppm = (mg per cubic metre) x 24.5 ÷ Molecular weight Bioallethrin

The molecular weight for Bioallethrin is 302.41 grams per mole and the resulting concentration is 18,910 ppm for Bioallethrin. This estimation of the airborne concentration that will cause 50% mortality in individuals is conservative as:

- Inhalation does not directly correspond to oral dose, higher concentrations would be expected as not all the material would be absorbed by the lungs.

There is no probit equation data for Bioallethrin available and it has been assumed that the characteristics of benzene probit represent Bioallethrin .From the probit estimation for benzene a 50%, mortality over 30 minutes occurs with an air concentration of 17,928 ppm. As has been evaluated in this section a 50% mortality over 30 minutes for Bioallethrin was 18,910 ppm. This corresponds to a factor of 0.95.

Table. G.1 Probit Values Used for Toxic Exposure (Benzene)

		Probit Constants		
Chemical	**Source**	***a***	***b***	***c***
Benzene	US Coast Guard (1980)	-109.78	5.3	2

For all calculations, the time of exposure has been assumed to be 30 minutes. This time is considered conservative with emergency response possible to affected areas. It would be unlikely that any person standing or working on an adjacent site would remain in a smoke plume generated by this hazardous incident for 30 minutes.

G.2.2 Class 3 Fire

The hazard identification revealed that Class 3 material if involved in the early stage of a fire developing in the warehouse could produce a smoke plume containing combustion products. These combustion products l could, affect surrounding land uses. The material selected to was found to release nitrogen dioxide.

Table. G.2 Probit Values Used for Toxic Exposure (NO_2)

		Probit Constants		
Chemical	**Source**	***a***	***b***	***c***
Nitrogen Dioxide	US Coast Guard (1980)	-13.70	1.4	2

For all calculations, the time of exposure has been assumed to be 30 minutes. This time is considered conservative with emergency response possible to affected areas. It would be unlikely that any person standing or working on an adjacent site would remain in a smoke plume generated by this hazardous incident for 30 minutes.

G.2.3 Risk Calculation

The following table shows the probit values used in the determination of the probability of a fatality for the hazardous events quantified in this PHA.

In order to assess the individual risk from a toxic cloud, the following method was used for toxic clouds:

Individual Risk (at point A) = ***Frequency of Toxic Cloud being Generated*** X ***Probability of Wind Direction and Wind Class*** X ***Probability of Death (established by Toxic Load and Probit)***

The individual risk is then the sum of each wind Class in that direction. Meteorological Data for Penrith has been used and is shown in Appendix H.

The probability of death from a toxic release was established using probits. The methodology involved using the centreline concentration of the toxic cloud being representative of the entire sector being described by the available metrological data. As previously mentioned, the shape of the cloud is long and narrow. The cloud will not completely film the sector described by centreline concentrations. This will make the estimation of risk, calculated by the above-mentioned method, conservative in nature.

G.3 Probit for Heat Radiation

The hazard identification recognised that a fire in the petrol tank storage, unloading, and distribution points would result in heat radiation that may include heat radiation off-site. The probit for heat radiation is given by the following equation:

$$Y = -14.9 + 2.56 \ln(t_e I^{4/3})$$

Y	is the probit;
I	is the heat radiation in kilo watts per metre squared per second; and
t_e	is the exposure time in seconds (Ref 10).

In the calculations used in this study an exposure time of 30 seconds has been used. This is a conservative figure as it would be expected that all personnel would be evacuated well before the fire event could escalate.

The calculation of risk to an individual from a fire is then calculated using the method below:

Individual Risk at Point A = **Frequency of Fire** x **Probability of Death**[4]

[4] Probability of Death established by probit evaluation.

Appendix H Meteorological Data

H.1 Introduction

This section contains meteorological data used in the establishment of frequencies throughout this report.

H.2 Meteorological Data

Meteorological Data is required at two stages of the risk assessment. First, the wind speed and meteorological stability Class for modelling consequences must be established. Secondly, the impact (risk) calculations require the probability of wind direction and meteorological stability Class to be included to establish the frequency of the occurrence.

For dispersion modelling, suitable wind and stability Classes are chosen. The procedure used the combining of wind and stability Classes into six (6) wind and stability Classes that are differentiated to give sufficient variation in the dispersion modelling.

The data is shown in Table H.1 is for Penrith and was compiled by PDS Multimedia and Consultancy Service.

Table. H.1 Meteorological Data for Penrith

Stability Class	Wind Direction %															
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
A1.5	0.3	0.3	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.3	0.1	0.1	0.0	0.1	0.1	0.1
B3	1.0	1.3	0.7	0.5	0.3	0.4	0.5	0.6	0.9	0.7	0.5	0.4	0.2	0.2	0.2	0.6
C3	1.3	1.8	1.1	0.7	0.5	0.7	0.9	0.9	1.5	1.5	1.0	0.4	0.5	0.3	0.4	0.7
D3	1.8	1.8	1.3	1.1	1.0	1.6	2.6	2.6	4.1	5.4	3.9	1.7	2.5	2.2	1.7	1.0
E1.5	0.7	0.5	0.6	0.5	0.6	0.4	0.6	0.7	1.6	2.2	1.3	0.7	0.6	0.7	0.4	0.4
F1.5	1.7	1.5	1.5	1.0	0.8	0.7	0.6	1.3	3.4	4.3	2.5	1.2	1.2	1.2	1.5	1.2

Appendix I Transportation Risk Assessment

I.1 Introduction

This section examines the transportation of dangerous goods to and from the Warehouse A2. For this section, the dangerous goods examined are Class 2.1 and Class 3. The quantity of other dangerous goods received and dispatched are unlikely to contribute significantly to the risk posed by the transportation of dangerous goods.

The movement of dangerous goods to and from the warehouse was prepared from information supplied by the Reckitt Benckiser (Australia) Pty Ltd. Reckitt Benckiser (Australia) Pty Ltd use recognised transportation companies who have undertaken the appropriate training and are licensed to transport dangerous goods.

The transportation will be undertaken on major arterial roads. These routes will been chosen in accordance with *Final Draft, Guidelines for Land Use and Environmental Safety Planning for Hazardous Materials, Road Transportation Considerations, DUAP, 1995.*

I.2 Summary of Traffic Movements

The number of transport movements for dangerous goods Class 3 and Class 2.1 are presented in Table. I.1.

Table. I.1 Rationalised Transportation Movements

Class	Type of Movement	Number of Movements (Annual)
2.1	Inbound	1,300
3	Inbound	1,300
2.1 & 3	Outbound	1,300

I.3 Hazard Identification (Transportation)

Having quantified the number of trafficable movements, this section will undertake hazard identification, for the transportation of hazardous material. This hazard identification identifies the potential hazardous events associated with each dangerous good and its transportation. The potential cause of the hazardous event is identified and the consequences of that event qualitatively described. The controls applied to the design of the warehouse and management controls are then identified.

The hazards identification associated with the transportation of the material to and from the warehouse is shown in Table. I.2.

Table. I.2 Hazard Identification (Transportation)

Hazard ID	Activity	Event	Cause	Possible Consequence	Proposed Prevention and Mitigation/Control Measures
A	Transportation of Class 2.1 Material.	Fire involving transported packages.	Loss of Vehicle control, breakage of packaged goods and ignition of material.	Rocketing of the aerosol can. Produce a fireball approximately one (1) metre in diameter. Project stream of burning liquid up to two (2) metres to produce burning pools of liquid.	Driver Training. First aid fire-fighting equipment. Emergency response planning. Maximise transportation to be via main thoroughfares and not through residential areas.
B	Transportation of Class 3 Material.	Loss of containment of materials.	Vehicle Accident. Loss of vehicle control. Loss of unsecured material in transit.	Release of material into watercourses or affecting land.	Maximise transportation to be via main thoroughfares and not through residential areas. Training of drivers. Appropriate spill containment kits. Identification of material.
C	Transportation of Class 3 Material.	Fire involving transported packages.	Loss of vehicle control, breakage of packaged goods and ignition of material.	Pool fire from ignition of flammable goods.	Driver training. First aid fire-fighting equipment. Emergency response planning. Maximise transportation to be via main thoroughfares and not through residential areas.

I.4 Transportation Consequences

The consequences of an event involving the transportation of dangerous goods are discussed in this section.

I.4.1 Fire involving Class 2.1

The consequences of a fire involving the Class 2.1 storage may result in the overheating, and pressurisation of the aerosol storage cans. The aerosol undergoing dome aversion (swelling and bulging outwards). Finally, the seams of the aerosol can unwrap at either the top or bottom resulting in the ends of the can blowing off. Occasionally the middle of the can may fail, again instantaneously releasing the entire contents of the aerosol. The failure of an aerosol can could have the following consequences:

- Rocketing of the aerosol can;
- Produce a fireball approximately one (1) metre in diameter; or
- Project stream of burning liquid up to two (2) metres to produce burning pools of liquid.

I.4.2 Fire involving Class 3 Material

In the event of an accident involving the transport, Class 3 material could be released. If this Class 3 material was able to find a source of ignition, a fire could result. Modelling of the fire was undertaken using Trace 9.0 and assuming a pool fire with a diameter 2.3 metre was formed. The wind speed was using at 1.5 ms^{-1} and a tilted flame model was used. The material selected for the release was ethanol. The resulting heat radiation distances for 23 kWm^{-2}, 12.6 kWm^{-2} and 4.7 kWm^{-2} are presented in Table. I.3. It was assumed that in the event of a pallet of the container is damaged, releasing material and creating a pool fire adjacent to/and around the vehicle. This fire could propagate to include the entire contents of the vehicle. This would lead to a continuing duration of the fire as more contents of the vehicle become involved.

The duration of the pool fire will depend on the depth of the pool formed by the flammable liquid. If the pool is large, the fire will consume all the available material quickly. For the purposes of this study, it has been assumed that a pool will form a depth of 30mm for a release of 1000 litres of flammable material with a density of 800 $kg.m^{-3}$. The resulting spill will form a pool with diameter of 2.3 metres.

Table. I.3 Pool Fire for Transportation

	Distance to Heat Radiation Level		
Hazardous event	**23 kWm^{-2}**	**12.6 kWm^{-2}**	**4.7 kWm^{-2}**
Release of Flammable in Truck Accident and Fire	4.6	6.0	8.9

The resulting flame is tilted at 36 degrees to the vertical and is approximately 2.8 metres high. As Table. I.3 shows, the effects of a pool fire resulting from a transportation incident are small and limited to the localised area around the pool fire.

I.5 Controls for Transportation of Dangerous Goods

The transportation to and from the warehouse will be undertaken by transport companies that comply with the *Australian Code for the Transportation of Dangerous Goods by Road and Rail.* The controls used in the transportation of dangerous goods will include:

- Driver training;
- Identification of consignment and control of loads;
- Supply of PPE;
- Placarding of vehicles;
- Spill Containment equipment suitable for material;
- Emergency response procedures; and
- Accident investigation.

I.6 Frequency

This section discusses the transport frequency of hazardous incident occurring. There are a number of source that can be used for the establishment of the road accident frequency. Some of these frequencies are listed in Table. I.4.

Table. I.4 Frequencies of Transportation Accidents

Source	Estimate
DUAP (1988), City South Freight Strategy	8×10^{-7} km^{-1}
UK, M5 East Motorway Environmental Impact Study (EIS)	5.4×10^{-6} km^{-1}

For the basis of this study, geometric average has been used of these two (2) estimates (i.e. 2.1×10^{-6} km^{-1}).

In order to assess the frequency a road frontage of 20 metres has been assumed. This is consistent with the radius of the largest fire effect (4.7 kWm^{-2}). The frequency of an accident occurring in that Section of road is found by:

Frequency of Transport Accident	=	Frequency per km	x	Frontage to road (km)	x	Number of movements (p.a.)
	=	2.1×10^{-6}	x	0.02	x	3,900
	=	1.64×10^{-4} p.a.				

That is, an accident could occur in front of a residential property (20-metre frontage) along the transport route with a frequency of 1.64×10^{-4} p.a.

The probability of release after an accident was found to have a relationship to the type of road. As this PHA is concerned with the risk to surrounding land use, urban area two-lane has been used to evaluate the probability of a release. This figure was based on overseas data and it could be expected that the actual probability for Australia, given its controls, may be an order of magnitude lower.

Table. I.5 Probability of Release of Dangerous Goods Given an Accident has occurred (ref 13)

Area Type	Roadway Type	Probability of Dangerous Goods release given an accident has occurred
Rural	Two-lane	0.086
Rural	Multi-laned undivided	0.081
Rural	Multi-laned divided	0.082
Rural	Freeway	0.090
Urban	Two-lane	0.069
Urban	Multi-laned undivided	0.055
Urban	Multi-laned divided	0.062
Urban	Freeway	0.056

The frequency of a release in the distance of concern (20m) can be calculated by:

Frequency of Release	=	Frequency	x	Probability of release
		1.64×10^{-4}	X	0.069
		1.13×10^{-5} p.a.		

No every release will lead to a fire event. For a fire the release must be substantial and be ignited. The probability has been assumed to be 0.1. Therefore, the probability of a fire involving a release of ethanol from the transport can be estimated as:

Frequency Fire from Transport Accident	=	Frequency of Release after accident	x	Probability of Fire
		1.13×10^{-5} p.a.	x	0.1
		1.13×10^{-6} p.a.		

As these frequencies reveal there is a 1.13×10^{-6} p.a. of a fire occurring in a 20-metre section of road. This incident frequency is low and would result in risk levels being contained to a small area around the incident vehicles.

I.7 Risk Assessment (Proposed Transportation)

I.7.1 Risk to Individuals

The very low frequency of a hazardous event means that individual risks, both the 0.5 $x10^{-6}$p.a. and the 1 $x10^{-6}$p.a. levels, are associated with to an area surrounding the hazardous event. This is consistent with the consequences being associated around the vehicle with limited surrounding land use impacts.

I.7.2 Risk to the Environment

It is considered that this frequency is at an acceptable level, the risk of a significant adverse impact on the biophysical environment is low.

I.7.3 Conclusion

The analysis calculated the risk level to be significantly below the average road fatality rate in NSW and generally below the acceptable limit for risk exposures to the public in residential areas from fixed installations. Currently there are no quantitative risk criteria for the assessment of the risk to the public from transportation activities in New South Wales. Based on the relatively low risk levels, the risk to the public from the road transportation of dangerous goods should be considered acceptable.

The proposed transportation was examined against the risk criteria in DOP Risk Criteria from Land Use Safety Planning – HIPAP No. 4. This criteria is for fixed facilities and has been applied to transportation for the purposes of comparison. It was found that the transportation of goods to Warehouse A2 did not exceed any established criteria for individual, societal or bio-physical risk for fixed facilities.

Appendix J Material Safety Data Sheets

J.1 Introduction

This Section contains the Material Safety Data Sheets (MSDS) for a series of typical products has been included in this appendix.

J.2 MSDS

The following MSDSs have been included;

1. Airwick Air Freshener Aerosol
2. Mortein Ultra Low Allergenic Fly and Insect Killer
3. Mortein Fast Knockdown Fly and Insect Killer
4. Veet Hair Removal Mousse
5. Aerogard Personal Insect Repellent Tropical Strength Pump Spray
6. Clearasil Ultra Deep Pore Face Wipes

RECKITT BENCKISER

Product Safety Data Sheet

Document Code: 31080	**Version:** 14.0
Description: Airwick Air Freshener Aerosol	**Status:** Published
Revision Reason: Update Product Codes	**Issue Date:** 13 Nov 2008

PSDS

1. PRODUCT and COMPANY IDENTIFICATION

Product Name: Air Wick Air Freshener Aerosol

Other Names: None

Product Code(s):

008059	Lavender	175g	
008279	Sparkling Citrus	175g	
008501	Crisp Breeze	175g	
0005615	Vanilla	175g	
0010856	Purity Oxygen Burst		175g
0010857	Purity Mountain Breeze		175g
0008858	Green Apple & Honeysuckle		175g
0073036	Lotus Flower & Orchid		175g
0073038	Magnolia & Cherry Blossom		175g
0174269	Crisp Breeze	200g	
0174267	Sparkling Citrus	200g	
0174268	Lavender	200g	
0174243	Vanilla	200g	
0174270	Green Apple & Honeysuckle		200g
0174265	Lotus Flower & Orchid		200g
0174266	Magnolia & Cherry Blossom		200g

Recommended Use: Air freshener

Supplier

AUSTRALIA
COMPANY: Reckitt Benckiser (Australia) Pty Limited
ABN: 17 003 274 655
ADDRESS: 44 Wharf Road
West Ryde NSW 2114
TELEPHONE: (02) 9857 2000

AFTER HOURS EMERGENCY TELEPHONE
(5pm to 8am EST Australia): (02) 9857 2444

NEW ZEALAND

COMPANY:	Reckitt Benckiser (New Zealand) Limited
ADDRESS:	Lincoln Manor 289 Lincoln Road Henderson Auckland 1231
TELEPHONE:	(09) 839 0200

Poisons Centre Information

AUSTRALIA	13 1126
NEW ZEALAND	0800 764 766 or 0800 POISON

2. HAZARD(S) IDENTIFICATION

NON-HAZARDOUS ACCORDING TO NOHSC CRITERIA
DANGEROUS ACCORDING TO ADG CODE (See Section 14)

RISK PHRASE(S) (See Section 15) R12 Extremely Flammable

ENVIRONMENTAL RISK PHRASE None

SAFETY PHRASE(S)
S2 Keep out of the reach of children
S16 Keep away from sources of ignition - No smoking.
S23 Do not breathe aerosol
S25 Avoid contact with eyes
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S28 After contact with skin, wash with plenty of soap and warm water
S46 If swallowed, seek medical advice immediately and show this container or label
S51 Use only in well-ventilated areas

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS No	Proportion (%w/w)
Hydrocarbon propellant[1]	106-97-8/74-98-6	10 - <30
Perfume[2]		<10
Sodium borate	1303-96-4	<1
Other ingredients classified as not hazardous according to NOHSC		to 100

[1] Our supplier of butane has provided documentation stating that the butane component contains less than 0.1%w/w 1,3 butadiene.

[2] The perfume for each variant may contain the following ingredients at less than 10%.

Benzoic acid, 2-hydroxy-, phenylmethyl ester	118-58-1
2,6 Octadien-1-ol, 3,7-dimethyl-, (E)-	106-24-1
2H-1-Benzopyran-2-one-	91-64-5
Eugenol	97-53-0
Citral	5392-40-5
Benzenepropanal, 4-(1,1-dimethylethyl)-.alpha.-methyl-	80-54-6
6-octen-1-ol, 3,7-dimethyl-	106-22-9
Octanal, 2-(phenylmethylene)-	101-86-0
3-cyclohexene-1-carboxaldehyde,4-(4-hydroxy-4-methylpentyl)-	31906-04-4
Benzenepropanal, 4-(1,1-dimethylethyl)-alpha-methyl-	80-54-6
3-cyclohexene-1-carboxaldehyde,2,4-dimethyl-	68039-49-6
Alpha-n-hexylcinnamicaldehyde	101-86-0
3-(p-t.butylphenyl)-2-methyl-propionaldehyde	80-54-6
2,6 Octadienal, 3,7-dimethyl-	5392-40-5
Limonene	138-86-3

4. FIRST AID MEASURES

Eye Contact	Wash eyes with a large quantity of water. If irritation occurs and persists, contact a doctor.
Skin Contact	Wash off skin with water and soap. If irritation occurs and persists, contact a doctor.
Inhalation	Remove to fresh air. If breathing difficulties are experienced, seek medical attention.
Ingestion	Give 2 glasses of water to drink. Contact a doctor or a Poisons Information Centre.
Advice to Doctor:	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Specific Dangers	Aerosol cans may explode and rocket with extreme heat.
Flammability	Extremely flammable. Propellant gases are extremely flammable.
Extinguisher Type	Water, foam, carbon dioxide.
Hazchem code	None allocated.

6. ACCIDENTAL RELEASE MEASURES

Emergency and Evacuation Procedures	Ensure adequate ventilation. Remove all sources of ignition and avoid generating sparks or static discharge. Use personal protective equipment. See section 8.
Minor Spills	Mop up spill and wash residues away with soap and water.
Major Spills	Contain spill. Collect product using a suitable absorbent material such as vermiculite. Shovel into a clean, dry, labelled container and close lid. Do not allow product to enter waterways.

7. HANDLING AND STORAGE

Handling	Dangerous Good Class 2.1 (AEROSOLS). Handle accordingly. Avoid contact with eyes. Do not pierce or burn can after use. Do not spray onto a naked flame or any incandescent material.
Storage	Dangerous Good Class 2.1 (AEROSOLS). Store accordingly. Pressurised container: protect from sunlight and do not expose to temperatures exceeding 50°C.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Standards - Australia ingredients:	Exposure Standards[1] have been set for the following

Ingredient	CAS No.[a]	TWA ppm[b]	TWA mg/m3[c]	STEL ppm[b]	STEL mg/m3[c]	Carcinogen Category	Notices
Butane	106-97-8	800	1900	-	-	-	-
Propane	74-98-6	-	asphyxiant	-	-	-	-
Borates, tetra, sodium salts (decahydrates)	1303-96-4	-	5	-	-	-	-

Exposure Standards - New Zealand ingredients: Exposure Standards[2] have been set for the following

Ingredient	CAS No.[a]	TWA ppm[b]	TWA mg/m3[c]	STEL ppm[b]	STEL mg/m3[c]
Butane	106-97-8	800	1900	-	-
Propane	74-98-6	Simple asphyxiant - may present an explosion hazard -			
Borates, tetra, sodium salts (decahydrates)	1303-96-4		5	-	-

TWA = Time Weighted Average
STEL= Short Term Exposure Limit
[1] Worksafe Australia Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003 1995)]
[2] Workplace Exposure Standards endorsed by the Occupational Safety and Health Service (OSH) of the Department of Labour; Revised: January 2002
[a] CAS #, Chemical Abstracts Service Registry. A unique numbering identifier is assigned to each individual chemical.
[b] Parts of vapour or gas per million of contaminated air by volume at 25°C and 760 torr.
[c] Milligrams of substance per cubic metre of air.

Engineering Controls: Ensure adequate ventilation. Maintain air concentrations below exposure standards.

Personal Protection: When handling bulk quantities, wear suitable gloves, safety glasses and protective clothing. If ventilation is insufficient, a suitable respirator should be worn.

Work/Hygienic Practices: Wash thoroughly with soap and water after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Aerosol

Appearance: Fine mist

Colour: White

Boiling Point: 0°C (butane)

Vapour Pressure	240 kPa @ 16°C (butane)
Density	Not determined
Flashpoint	-60°C (butane)
Solubility in Water	Partially miscible

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Dangerous Reactions	Aerosol cans may explode and rocket when subjected to extreme heat or pressure.
Conditions to Avoid	Prolonged exposure to high temperatures.
Decomposition Products	Products may include oxides of carbon.

11. TOXICOLOGICAL INFORMATION

Product Toxicity	The toxicity of this product has not been determined.
Component Toxicity	The hazard identifications in Section 2 were derived from the known effects of the individual ingredients and their concentrations in the product.

Summary of Product Toxicity Effects

Acute Effect(s)

Eye	May cause irritation to the eye.
Skin	May cause irritation to the skin with repeated/prolonged contact.
Inhaled	Mists may cause irritation to the upper respiratory tract.
Swallowed	Not likely to be swallowed.
CHRONIC	The chronic toxicity of this product has not been determined.

12. ECOLOGICAL INFORMATION

Product Ecotoxicity	The ecotoxicity of this product has not been determined.
Component Ecotoxicity	Based on component ecotoxicity data the product is not an environmental hazard.

13. DISPOSAL CONSIDERATIONS

Disposal Method	Product should be treated according to the instructions given under sections 6,7 and 8 above. Dispose of according to Local, State and Federal regulations. Contact relevant authority for details.

14. TRANSPORT INFORMATION

Road Transport Regulations (ADG 6 Aust.)

UN number:	1950
Proper shipping name:	AEROSOLS
DG class:	2.1
Subsidiary risk:	None allocated
Packing group:	None allocated
Hazchem code:	None allocated

Maritime Transport Regulations (IMDG)

UN number:	1950
Proper shipping name:	AEROSOLS
DG class:	2.1
Subsidiary risk:	None allocated
Packing group:	None allocated
Marine Pollutant:	Not a Marine Pollutant

Air Transport Regulations (IATA)

UN number:	1950
Proper shipping name:	AEROSOLS, FLAMMABLE
DG class:	2.1
Subsidiary risk:	None allocated
Packing group:	None allocated

15. REGULATORY INFORMATION

AUSTRALIA

Regulatory Status: Not applicable.

Hazardous Substances Regulation: Not hazardous

Risk Phrase: R12 Extremely flammable

Environmental Risk Phrase: None

Safety Phrase(s):
S2 Keep out of the reach of children.
S16 Keep away from sources of ignition - No smoking.
S23 Do not breathe aerosol.
S25 Avoid contact with eyes.
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S28 After contact with skin, wash with plenty of soap and warm water.
S46 If swallowed, seek medical advice immediately and show this container or label.
S51 Use only in well-ventilated areas

Additional Safety Phrase(s): Do not spray on a naked flame or any incandescent material
Pressurised container; protect from sunlight and do not expose to temperatures exceeding 50°C.
Do not pierce or burn even after use.

SUSDP: Not scheduled

NEW ZEALAND

Regulatory Status: This product has been approved under HSNO covered by Aerosols (Subsidiary Hazard) Group Standard 2006
HSR002519.

Approved Handler: Not required

Tracking: Not required

16. OTHER INFORMATION

CONTACT POINT

AUSTRALIA and NEW ZEALAND

Regulatory, Safety & Environmental Services

From outside Australia Ph: (61) (2) 9857 2000

From within Australia Ph: (02) 9857 2000

The information contained in this MSDS was compiled using the latest and most reliable information available to Reckitt Benckiser. The information is provided without any warranty, expressed or implied regarding its correctness or accuracy. Similarly no warranty expressed or implied regarding the product described herein shall be created by or inferred from any statement or omission from this MSDS nor will Reckitt Benckiser assume any liability for any loss or damage arising out of the use of this information. It is solely the responsibility of the user to determine safe conditions for use of this product and to assume liability for any loss, damage or expense whatsoever arising out of the product's improper use.

KEY/LEGEND
ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail
IATA = International Air Transport Association
IMDG = International Maritime Dangerous Goods
HSNO = Hazardous Substances and New Organisms Act 1996
NOHSC = National Occupational Health and Safety Commission (Australia)
SUSDP = Standard for the Uniform Scheduling of Drugs and Poisons (Australia)

RECKITT BENCKISER

Product Safety Data Sheet

Document Code:	30490 - SD AU	**Version :**	5.0
Description:	Mortein Ultra Low Allergenic Fly and Insect Killer Aerosol	**Status:**	Published
Project Name:		**Project Number :**	
Category:	PEST CONTROL	**Segment:**	
Formula Type:	Fill Formula		

PSDS

PRODUCT NAME : **Mortein Ultra Low Allergenic Fly and Insect Killer Aerosol**

OTHER NAMES : None

NOT CLASSIFIED AS HAZARDOUS ACCORDING TO CRITERIA OF NATIONAL OCCUPATIONAL HEALTH AND SAFETY COMMISSION

COMPANY DETAILS

AUSTRALIA

COMPANY: Reckitt Benckiser (Australia) Pty Limited
ABN: 17 003 274 655
ADDRESS: 44 Wharf Road
West Ryde NSW 2114

TELEPHONE: (02) 9857 2000

AFTER HOURS EMERGENCY TELEPHONE
(5pm to 8am EST Australia): (02) 9857 2444

NEW ZEALAND

COMPANY: Reckitt Benckiser (New Zealand) Limited
ADDRESS: Lincoln Manor

289 Lincoln Road
Henderson Auckland 1231

TELEPHONE: (09) 839 0200

1. PRODUCT

PRODUCT NAME : **Mortein Ultra Low Allergenic Fly and Insect Killer Aerosol**

OTHER NAMES : None

PRODUCT CODES : 00139 (250g)
007776 (350g)

MANUFACTURER'S CODE: 19971AE/4

UN NUMBER : 1950 (aerosols)

DANGEROUS GOODS CLASS : 2.1

SUBSIDIARY RISK : None allocated

HAZCHEM CODE : None allocated

PACKAGING GROUP : None allocated

POISONS SCHEDULE NUMBER : Not scheduled

USE : Household insecticide

2. COMPOSITION

Chemical Name	CAS No	Proportion (%w/w)
Bioallethrin	584-79-2	0.241
Bioresmethrin	28434-01-7	0.046
Butylated hydroxy toluene	128-37-0	<10
Hydrocarbon solvent	64771-72-8	<10
Hydrocarbon propellant[1]	106-97-8/74-98-6	30-60
Other ingredients classified as not hazardous according to NOHSC		to 100

[1]Our supplier of butane has provided documentation stating that the butane component contains less than 0.1%w/w 1,3 butadiene.

3. HAZARDS IDENTIFICATION

Eye Contact None

Skin Contact None

Inhalation	None
Ingestion	None
HEALTH EFFECTS	
ACUTE	
Swallowed	Not likely to be a route of exposure.
Eye	May cause irritation to the eyes.
Skin	May cause irritation to the skin with repeated/prolonged contact.
Inhaled	Mists may cause irritation to the upper respiratory tract.
CHRONIC	The chronic toxicity of this product has not been determined.

4. FIRST AID MEASURES

Eye Contact	Wash eyes with a large amount of water. If irritation occurs and persists, contact a doctor.
Skin Contact	Wash off skin with warm water and soap. If irritation occurs and persists contact a doctor.
Inhalation	Remove to fresh air. If breathing difficulties are experienced, seek medical attention.
Advice to Doctor:	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Specific Dangers	Aerosol cans may explode with extreme heat and become projectiles.
Extinguisher Type	Water, foam, carbon dioxide.

6. ACCIDENTAL RELEASE MEASURES

SPILLS	Keep area well ventilated. Remove sources of ignition.
Minor Spills	Wipe up spills with a clean dry cloth. Wash away residues with water.
Major Spills	Contain spill and collect using a suitable absorbent material such as vermiculite. Shovel material into labelled containers and close lids. Do not allow product to enter waterways.

7. HANDLING AND STORAGE

Handling	This is a Class 2.1 dangerous good. Handle accordingly.
Storage	This is a Class 2.1 dangerous good. Store accordingly.

8. EXPOSURE AND PERSONAL PROTECTION

Exposure Standards Exposure Standards[1] have been set for the following ingredients:

Ingredient	CAS No.	TWA mg/m³	TWA ppm	STEL mg/m³	STEL ppm	Carcinogen Category	Notices
Butane	106-97-8	1900	800	-	-	-	-
Propane	74-98-6	asphyxiant	-	-	-	-	-
Butylated hydroxy toluene	128-37-0	10	-	-	-	-	-

TWA = Time Weighted Average
STEL= Short Term Exposure Limit
[1] Worksafe Australia Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003 1995)]

Engineering Controls Keep areas well ventilated. Maintain air concentrations below exposure standards.

Personal Protection When handling bulk quantities, wear suitable gloves, protective clothing and safety glasses.

Flammability Flammable.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State Aerosol

Appearance Fine mist

Colour Colourless

Boiling Point 0°C (butane)

Vapour Pressure 240 kPa at 16°C (butane)

Specific Gravity 0.96 g/mL at 25°C (concentrate)

Flashpoint -60°C (butane)

Solubility in Water Miscible

10. STABILITY AND REACTIVITY

Stability Stable under normal conditions.

Dangerous Reactions	Avoid extreme heat and pressures. Do not incinerate or puncture cans.
Decomposition Products	Products may include oxides of carbon.

11. TOXICOLOGICAL INFORMATION

Toxicity	The toxicity of this product has not been determined. The hazard identifications in Section 3 were derived from the known effects of the individual ingredients and their concentrations in the product.

12. ECOLOGICAL INFORMATION

Ecotoxicity	The ecotoxicity of this product has not been determined.

13. DISPOSAL CONSIDERATIONS

Bulk Quantities	Dispose of according to Local, State and Federal regulations. Contact relevant authority for details.

14. TRANSPORT INFORMATION

Road Transport Regulations	Class 2.1 dangerous good.
Maritime Transport Regulations	Class 2.1 dangerous good.
Air Transport Regulations	Class 2.1 dangerous good.

15. REGULATORY INFORMATION

Regulatory Approvals	This product has been approved by the Australian Pesticides and Veterinary Medicines Authority (APVMA) (formerly known as National Registration Authority (NRA)).
Hazardous Substances Regulation	Not hazardous.

16. OTHER INFORMATION

CONTACT POINT

AUSTRALIA & NEW ZEALAND:

Regulatory, Safety & Environmental Services

Within Australia	Ph: (02) 9857 2000
Outside Australia	Ph: 61(02) 9857 2000

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RECKITT BENCKISER

Product Safety Data Sheet

Document Code:	30770 - SD AU	**Version:**	8.0
Description:	Mortein Fast Knockdown Fly and Insect Killer Aerosol	**Status:**	Published
Revision Reason:	Replace formula, Amend Sections 2 & 3 as per NOHSC requirement.	**Issue Date:**	27 June 2007

PRODUCT NAME : Mortein Fast Knockdown Fly and Insect Killer Aerosol

OTHER NAMES : None

HAZARDOUS ACCORDING TO CRITERIA OF NATIONAL OCCUPATIONAL HEALTH AND SAFETY COMMISSION

COMPANY DETAILS

AUSTRALIA

COMPANY: Reckitt Benckiser (Australia) Pty Limited
ABN: 17 003 274 655
ADDRESS: 44 Wharf Road
West Ryde NSW 2114

TELEPHONE: (02) 9857 2000

AFTER HOURS EMERGENCY TELEPHONE
(5pm to 8am EST Australia): (02) 9857 2444

NEW ZEALAND

COMPANY: Reckitt Benckiser (New Zealand) Limited
ADDRESS: Lincoln Manor
289 Lincoln Road
Henderson Auckland 1231

TELEPHONE: (09) 839 0200

1. PRODUCT

PRODUCT NAME :	Mortein Fast Knockdown Fly and Insect Killer Aerosol
OTHER NAMES :	None
PRODUCT CODE :	0102666 (300g) 0102667 (200g)
UN NUMBER :	1950 (AEROSOLS)
DANGEROUS GOODS CLASS :	2.1
SUBSIDIARY RISK :	None allocated
HAZCHEM CODE :	None allocated
PACKAGING GROUP :	None allocated
POISONS SCHEDULE NUMBER :	Not scheduled
USE :	Household insecticide aerosol spray.

2. HAZARDS IDENTIFICATION

Eye Contact	None
Skin Contact	Irritant
Inhalation	None
Ingestion	None
HEALTH EFFECTS	
ACUTE	
Eye	May cause transient irritation to the eyes.
Skin	Will cause irritation to the skin with repeated/prolonged contact.
Inhaled	Mist / vapours may cause irritation to the upper respiratory tract.
Swallowed	Unlikely to be a route of exposure.
CHRONIC	The chronic toxicity of this product has not been determined.

3. COMPOSITION

Chemical Name	CAS No	Proportion (%w/w)
Hydrocarbon propellant[1]	106-97-8 / 74-98-6	>60
Hydrocarbon solvent	64771-72-8	10 - <30

Butylated hydroxytoluene	128-37-0	<1
Esbiothrin	84030-86-4	<1 (1.26g/kg)
Permethrin	52645-53-1	<1 (0.5g/kg)
Other ingredients classified as not hazardous according to NOHSC		to 100

[1]Our supplier of butane has provided documentation stating that the butane component contains less than 0.1%w/w 1,3 butadiene.

4. FIRST AID MEASURES

Eye Contact	Wash eyes with a large quantity of water. If irritation occurs and persists, contact a doctor.
Skin Contact	Wash off skin with water and soap. If irritation persists, contact a doctor.
Inhalation	Remove to fresh air. If breathing difficulties are experienced, seek medical attention.
Ingestion	Give 2 glasses of water to drink. Contact a doctor or a Poisons Information Centre (Australia 13 11 26; New Zealand 0800 764 766 or 0800 POISON).
Advice to Doctor:	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Specific Dangers	Aerosol cans may explode and rocket when subjected to extreme heat or fire.
Extinguisher Type	Water, foam, carbon dioxide.

6. ACCIDENTAL RELEASE MEASURES

SPILLS	Keep area well ventilated. Remove sources of ignition.
Minor Spills	Mop up spill with water and detergent.
Major Spills	Contain spill. Collect product using a suitable absorbent material such as vermiculite. Shovel material into labelled containers and close lids. Do not allow product to enter waterways.

7. HANDLING AND STORAGE

Handling	Dangerous Good class 2.1 (AEROSOLS). Handle accordingly.
Storage	Dangerous Good class 2.1 (AEROSOLS). Store accordingly.

8. EXPOSURE AND PERSONAL PROTECTION

Exposure Standards	Exposure Standards[1] have been set for the following ingredients:

Ingredient	CAS No.	TWA		STEL		Carcinogen Category	Notices
		mg/m^3	ppm	mg/m^3	ppm		
Butane	106-97-8	1900	800	-	-	-	-
Propane	74-98-6	asphyxiant					
Butylated hydroxytoluene	128-37-0	10	-	-	-	-	-

TWA = Time Weighted Average
STEL= Short Term Exposure Limit
[1] Worksafe Australia Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003 1995)]

Engineering Controls	Ensure adequate ventilation. Maintain air concentrations below exposure standards.
Personal Protection	When handling bulk quantities, wear suitable safety glasses, protective clothing and impervious gloves. When ventilation is insufficient, a suitable respirator should be worn.
Flammability	Flammable.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Aerosol
Appearance	Fine mist
Colour	Colourless
Boiling Point	0°C (butane)
Vapour Pressure	240 kPa @ 16°C (butane)
Specific Gravity	0.70 - 0.80 @ 25°C (Concentrate)
Flashpoint	-60°C (butane)
Solubility in Water	Immiscible

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Dangerous Reactions	Aerosol cans may explode and rocket when subjected to extreme heat or fire.
Decomposition Products	Products may include oxides of carbon and nitrogen.

11. TOXICOLOGICAL INFORMATION

Toxicity	Toxicological testing of the concentrate of this product has been undertaken and the following results were found: Oral LD50 (rat): >2000mg/kg Dermal LD50 (rat): >2000mg/kg Eye irritancy (rabbit): Not an irritant Skin irritancy (rabbit): Irritant Skin sensitisation (guinea pig): Non sensitiser Inhalation LC50 (rat) 4 hours: >5.67 mg/L The other hazard identifications in Section 3 were derived from the known effects of the individual ingredients and their concentrations in the product.

12. ECOLOGICAL INFORMATION

Ecotoxicity	The ecotoxicity of this product has not been determined. Based on the component ecotoxicology, it is toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

13. DISPOSAL CONSIDERATIONS

Bulk Quantities	Dispose of according to Local, State and Federal regulations. Contact relevant authority for details.

14. TRANSPORT INFORMATION

Road Transport Regulations	Dangerous Good class 2.1 (AEROSOLS).
Maritime Transport Regulations	Dangerous Good class 2.1 (AEROSOLS). This product is not classified as a marine pollutant as defined by section 2.10.3 of the IMDG Code Edition 2004.
Air Transport Regulations	Dangerous Good class 2.1 (AEROSOLS).

15. REGULATORY INFORMATION

Regulatory Approvals	This product has been approved by the Australian Pesticides and Veterinary Medicines Authority (APVMA) [APVMA No . 60630]
Hazardous Substances Regulation	Hazardous. R38 Irritating to skin. R51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

16. OTHER INFORMATION

CONTACT POINT

AUSTRALIA and NEW ZEALAND

Regulatory, Safety & Environmental Services

From outside Australia	Ph: (61) (2) 9857 2000
From within Australia	Ph: (02) 9857 2000

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RECKITT BENCKISER

Product Safety Data Sheet

Document Code:	31406 - SD AU	Version:	3.0
Description:	Veet Hair Removal Mousse	Status:	Published
Project Name:		Project Number:	
Category:	DEPILATORIES	Segment:	
Formula Type:	Fill Formula		

PSDS

PRODUCT NAME : **Veet Hair Removal Mousse**

OTHER NAMES : None

HAZARDOUS ACCORDING TO CRITERIA OF NATIONAL OCCUPATIONAL HEALTH AND SAFETY COMMISSION

COMPANY DETAILS

AUSTRALIA

COMPANY: Reckitt Benckiser (Australia) Pty Limited
ABN: 17 003 274 655
ADDRESS: 44 Wharf Road
West Ryde NSW 2114

TELEPHONE: (02) 9857 2000

AFTER HOURS EMERGENCY TELEPHONE
(5pm to 8am EST Australia): (02) 9857 2444

NEW ZEALAND

COMPANY: Reckitt Benckiser (New Zealand) Limited
ADDRESS: Lincoln Manor
289 Lincoln Road
Henderson Auckland 1231

TELEPHONE:	(09) 839 0200

1. PRODUCT

PRODUCT NAME :	**Veet Hair Removal Mousse**
OTHER NAMES :	None
PRODUCT CODE :	044658 Aloe Vera 189g / 200mL
MANUFACTURER'S CODE :	155817/2 EUR Aloe Vera
UN NUMBER :	1950 (aerosol)
DANGEROUS GOODS CLASS :	2.1
SUBSIDIARY RISK :	8
HAZCHEM CODE :	2R
PACKAGING GROUP :	III
POISONS SCHEDULE NUMBER :	S5 (Sodium hydroxide, Alkaline salts)
USE :	Hair removal mousse

2. COMPOSITION

Chemical Name	CAS No	Proportion (% w/w)
Sodium hydroxide	1310-73-2	<10
Sodium silicate	1344-09-8	<10
Potassium thioglycolate	34452-51-2	<10
Hydrocarbon propellants	106-97-8/74-98-6/72-28-5	10 - <30
Other non-hazardous ingredients		to 100

3. HAZARDS IDENTIFICATION

Eye Contact	Corrosive
Skin Contact	None if used according to directions included with the product but, corrosive if exposure is prolonged.
Inhalation	None
Ingestion	Corrosive to mucous membranes

HEALTH EFFECTS

ACUTE

Eye	Will cause burns to the eye.
Skin	No effects likely if instructions are followed
Inhaled	Not likely to be a route of exposure as it is applied as a foam
Swallowed	Will cause burns to the upper gastrointestinal tract.
CHRONIC	The chronic toxicity of this product has not been determined.

4. FIRST AID MEASURES

Eye Contact	Wash eyes immediately with a large quantitiy of water. Contact a doctor.
Ingestion	Give 2 glasses of water to drink. Contact a doctor or a Poisons Information Centre (Australia 13 1126, New Zealand 0800 764 766 or 0800 POISON).
Advice to Doctor:	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Specific Dangers	Aerosol cans may explode and rocket when subjected to extreme heat.
Extinguisher Type	Water, foam, carbon dioxide.

6. ACCIDENTAL RELEASE MEASURES

SPILLS	Keep area well ventilated. Remove sources of ignition.
Minor Spills	Mop up spill with water and detergent.
Major Spills	Contain spill. Collect product using a suitable absorbent material such as vermiculite. Shovel material into clean, dry, labelled containers and close lids. Do not allow product to enter waterways.

7. HANDLING AND STORAGE

Handling	Dangerous good class 2.1 (aerosol). Handle accordingly.
Storage	Dangerous good class 2.1 (aerosol). Store accordingly.

8. EXPOSURE AND PERSONAL PROTECTION

Exposure Standards Exposure Standards[1] have been set for the following ingredients:

Ingredient	CAS No.	TWA		STEL		Carcinogen Category	Notices
		mg/m^3	ppm	mg/m^3	ppm		
Butane	106-97-8	1900	800	-	-	-	-
Propane	74-98-6	asphyxiant					
Sodium hydroxide	1310-73-2	2	-	peak limitation	-	-	-

TWA = Time Weighted Average
STEL= Short Term Exposure Limit
[1] Worksafe Australia Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003 1995)]

Engineering Controls Keep area well ventilated. Maintain air concentrations below exposure standards.

Personal Protection When handling bulk quantities, wear suitable gloves, safety glasses and protective clothing. If ventilation is insufficient, a suitable respirator should be worn

Flammability Propellant gases are flammable.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State Foam

Appearance Opaque

Colour Off-white

Boiling Point 100°C (water)

Vapour Pressure 240 kPa @ 21°C (Butane)

Specific Gravity 0.990 @ 20°C (Concentrate)

Flashpoint Not flammable

Solubility in Water Miscible

pH 12.1 - 12.4 neat @30°C (Concentrate)

10. STABILITY AND REACTIVITY

Stability Stable under normal conditions.

Dangerous Reactions	Cans may explode and become projectiles if subject to extreme heat.
Decomposition Products	Products may include oxides of carbon, sulphur and nitrogen.

11. TOXICOLOGICAL INFORMATION

Toxicity	Clinical testing of this product has been undertaken for skin irritancy. It was found that this product was not a skin irritant if used in accordance to directions. However, if contact is allowed to continue, the skin reaction will increase with time to the point of a corrosive effect. The other hazard identifications in Section 3 were derived from the known effects of the individual ingredients and their concentrations in the product.

12. ECOLOGICAL INFORMATION

Ecotoxicity	The ecotoxicity of this product has not been determined.

13. DISPOSAL CONSIDERATIONS

Bulk Quantities Contact relevant authority for details.	Dispose of according to Local, State and Federal regulations.

14. TRANSPORT INFORMATION

Road Transport Regulations	Dangerous Good Class 2.1
Maritime Transport Regulations	Dangerous Good Class 2.1
Air Transport Regulations	Dangerous Good Class 2.1

15. REGULATORY INFORMATION

Regulatory Approvals	Not applicable
Hazardous Substances Regulation	Hazardous R34 (Causes burns)

16. OTHER INFORMATION

CONTACT POINT

AUSTRALIA and NEW ZEALAND

Regulatory, Safety & Environmental Services

From outside Australia Ph: (61) (2) 9857 2000

From within Australia Ph: (02) 9857 2000

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RECKITT BENCKISER

Product Safety Data Sheet

Document Code:	D0106360	**Version:**	1.0
Description:	Aerogard PIR Tropical Strength Pump Spray	**Status:**	Published
		Issue Date:	11 Apr 2007

PRODUCT NAME : Aerogard Personal Insect Repellent Tropical Strength Pump Spray

OTHER NAMES : None

HAZARDOUS ACCORDING TO CRITERIA OF NATIONAL OCCUPATIONAL HEALTH AND SAFETY COMMISSION

COMPANY DETAILS

AUSTRALIA

COMPANY: Reckitt Benckiser (Australia) Pty Limited
ABN: 17 003 274 655
ADDRESS: 44 Wharf Road
West Ryde NSW 2114

TELEPHONE: (02) 9857 2000

AFTER HOURS EMERGENCY TELEPHONE
(5pm to 8am EST Australia): (02) 9857 2444

NEW ZEALAND

COMPANY: Reckitt Benckiser (New Zealand) Limited
ADDRESS: Lincoln Manor
289 Lincoln Road
Henderson Auckland 1231

TELEPHONE: (09) 839 0200

1. PRODUCT

PRODUCT NAME : Aerogard Personal Insect Repellent Tropical Strength Pump Spray

OTHER NAMES : None

PRODUCT CODE: 0103887

UN NUMBER : 1170 (ETHANOL SOLUTION)

DANGEROUS GOODS CLASS : 3

SUBSIDIARY RISK : None allocated

HAZCHEM CODE : 2[Y]

PACKAGING GROUP : III

POISONS SCHEDULE NUMBER : Not scheduled

USE : Personal insect repellent

2. COMPOSITION

Chemical Name	CAS No	Proportion (%w/w)
Ethanol	64-17-5	30 - 60
N-N-diethyl-n-toluamide	134-62-3	10 - <30 (170.9 g/L)
N-octyl bicycloheptene dicarboximide	113-48-4	<10 (35.8 g/L)
Isopropyl myristate	110-27-0	<10
Other ingredients classified as not hazardous according to NOHSC		to 100

3. HAZARDS IDENTIFICATION

Eye Contact Irritant

Skin Contact None

Inhalation None

Ingestion None

HEALTH EFFECTS

ACUTE

Eye Will cause irritation to the eyes.

Skin No effects likely to occur.

Inhaled	Mists/vapours may cause irritation to the upper respiratory tract and may cause depression of the central nervous system.
Swallowed	May cause irritation to the upper gastrointestinal tract and may cause depression of the central nervous system.
CHRONIC	The chronic toxicity of this product has not been determined.

4. FIRST AID MEASURES

Eye Contact	Wash eyes with a large quantity of water. If irritation persists, contact a doctor.
Skin Contact	Wash off skin with water and soap. If irritation occurs and persists, contact a doctor.
Inhalation	Remove to fresh air. If breathing difficulties are experienced, seek medical attention.
Ingestion	Give 2 glasses of water to drink. Contact a doctor or a Poisons Information Centre (Australia 13 1126, New Zealand 0800 764 766 or 0800 POISON).
Advice to Doctor:	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Specific Dangers	Flammable.
Extinguisher Type	Foam, carbon dioxide, dry powder. Use waterspray to cool fire only.

6. ACCIDENTAL RELEASE MEASURES

SPILLS	Keep area well ventilated. Remove sources of ignition.
Minor Spills	Mop up spill and wash area with water and detergent.
Major Spills	Contain spill. Collect product using a suitable absorbent material such as vermiculite. Shovel material into clean, dry, labelled containers and close lids. Do not allow product to enter waterways.

7. HANDLING AND STORAGE

Handling	Product is regulated as a Dangerous Goods Class 3 when handled in volumes exceeding 300 mL. Handle accordingly.
Storage	Product is regulated as a Dangerous Goods Class 3 when stored in volumes exceeding 300 mL. Store accordingly.

8. EXPOSURE AND PERSONAL PROTECTION

Exposure Standards

Exposure Standards[1] have been set for the following ingredients:

Ingredient	CAS No.	TWA mg/m^3	TWA ppm	STEL mg/m^3	STEL ppm	Carcinogen Category	Notices
Ethanol	64-17-5	1880	1000	-	-	-	-

TWA = Time Weighted Average
STEL= Short Term Exposure Limit
[1] Worksafe Australia Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003 1995)]

Engineering Controls: Use in well ventilated areas. Maintain air concentrations below exposure standards.

Personal Protection: When handling bulk quantities, wear suitable safety glasses, protective clothing and impervious gloves. Where ventilation is insufficient, a suitable respirator should be worn.

Flammability: Flammable.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid

Appearance: Clear

Colour: Colourless

Boiling Point: 78°C (Ethanol)

Vapour Pressure: 5.7 kPa @ 20°C (Ethanol)

Specific Gravity: 0.84 - 0.95 @ 25°C

Flashpoint: 13°C (Ethanol)

Solubility in Water: Miscible

10. STABILITY AND REACTIVITY

Stability: Stable under normal use conditions.

Dangerous Reactions: May develop static charge when poured and ignite vapours.

Decomposition Products: Products may include oxides of nitrogen and carbon.

11. TOXICOLOGICAL INFORMATION

Toxicity: The toxicity of this product has not been determined. Clinical testing on a similar product indicates that the product is not irritating to the skin. The hazard identifications in Section 3 were derived from the known

effects of the individual ingredients and their concentrations in the product.

12. ECOLOGICAL INFORMATION

Ecotoxicity	The ecotoxicity of this product has not been determined.

13. DISPOSAL CONSIDERATIONS

Bulk Quantities	Dispose of according to Local, State and Federal regulations. Contact relevant authority for details.

14. TRANSPORT INFORMATION

Road Transport Regulations	Dangerous Goods Class 3.
Maritime Transport Regulations	Dangerous Goods Class 3.
Air Transport Regulations	Dangerous Goods Class 3.

15. REGULATORY INFORMATION

Regulatory Approvals	Registration pending approval.
Hazardous Substances Regulation	Hazardous R36 Irritating to eyes.

16. OTHER INFORMATION

CONTACT POINT

AUSTRALIA and NEW ZEALAND

Regulatory, Safety & Environmental Services

From outside Australia	Ph: (61) (2) 9857 2000
From within Australia	Ph: (02) 9857 2000

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RECKITT BENCKISER

Product Safety Data Sheet

Document Code:	D0061610	**Version:**	4.0
Description:	CLRSL,AZ,ULTRA FACE WIPES	**Status:**	Published
Revision Reason:	New Customer code .	**Issue Date:**	4 July 2008

1. PRODUCT and COMPANY IDENTIFICATION

Product Name: Clearasil Ultra Deep Pore Face Wipes

Other Names: Clearasil Ultra Wipes

Product Code(s): 0149209 65s

Recommended Use: Consumer product for Skincare

Supplier
AUSTRALIA
COMPANY: Reckitt Benckiser (Australia) Pty Limited
ABN: 17 003 274 655
ADDRESS: 44 Wharf Road
West Ryde NSW 2114
TELEPHONE: (02) 9857 2000

AFTER HOURS EMERGENCY TELEPHONE
(5pm to 8am EST Australia): (02) 9857 2444

NEW ZEALAND
COMPANY: Reckitt Benckiser (New Zealand) Limited
ADDRESS: Lincoln Manor
289 Lincoln Road
Henderson Auckland 1231
TELEPHONE: (09) 839 0200

Poisons Centre Information
AUSTRALIA 13 1126
NEW ZEALAND 0800 764 766 or 0800 POISON

2. HAZARD(S) IDENTIFICATION

NON-HAZARDOUS ACCORDING TO NOHSC CRITERIA
DANGEROUS GOODS ACCORDING TO ADG CODE (See Section 14)

RISK PHRASE(S) (See Section 15) None

ENVIRONMENTAL RISK PHRASE None

SAFETY PHRASE(S) S2 Keep out of the reach of children.
S25 Avoid contact with eyes.
S16 Keep away from sources of ignition.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Round white pads impregnated with an aqueous/ethanolic solution containing:

Component	Cas no.	% w/w
Hydrogen Peroxide	7722-84-1	1-5
Ethanol	64-17-5	30-60
Salicylic Acid	130296-87-6	1-5
Other ingredients classified as not hazardous according to NOHSC		to 100

4. FIRST AID MEASURES

Eyes	Remove contact lenses if present. Flush immediately with large amounts of water, especially under lids for at least 15 minutes. If irritation or other effects persist, seek medical advice.
Skin	May cause irritation on broken skin. An excessive amount may cause irritation and should be washed off with soap and water.
If Swallowed	If swallowed in quantity DO NOT INDUCE VOMITING. Rinse mouth thoroughly and seek medical attention.
If Inhaled	Remove to fresh air if inhalation causes eye watering, headaches, dizziness, or other discomfort.

5. FIRE-FIGHTING MEASURES

Specific Dangers	Appropriate self-contained breathing apparatus may be required as the product contains organic substances that will produce smoke and fumes if in contact with a fire.
Flammability	Flammable.
Extinguisher Type	Water spray, foam, dry chemicals, sand, dolomite etc.
Hazchem code	None allocated

6. ACCIDENTAL RELEASE MEASURES

Emergency and Evacuation Procedures	Ensure adequate ventilation. Area may become slippery. Do not let product enter drains or natural waterways. Use personal protective equipment. See section 8.
Minor Spills	Scoop up spill and wash area with water.
Major Spills	Contain spill. Collect product using a suitable absorbent material such as vermiculite. Shovel material into labelled containers. Do not allow product to enter waterways.

7. HANDLING AND STORAGE

Handling	In case of accidental discharge avoid eye contact. Keep away from heat, sparks and open flame. Ventilate well, avoid breathing vapours.
Storage	Flammable/combustible - Keep away from oxidizers, heat and flames. Keep in cool, dry, ventilated storage. Keep in original container. Keep from freezing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Standards — Exposure Standards[1] have been set for the following ingredients:

Ingredient	CAS No.	TWA mg/m^3	TWA ppm	STEL mg/m^3	STEL ppm	Carcinogen Category	Notices
Ethanol	64-17-5	1880	1000	-	-	-	-

TWA = Time Weighted Average
STEL= Short Term Exposure Limit
[1] Worksafe Australia Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003 1995)]
sen=sensitiser
sk= absorption through the skin may be a significant source of exposure.
[2] Produced during the decomposition of

Engineering Controls	Ensure adequate ventilation.
Personal Protection	When handling bulk quantities, wear suitable gloves, safety glasses and protective clothing. If ventilation is insufficient, a suitable respirator should be worn. DO NOT SMOKE IN WORK AREA. Wash at the end of each work shift and before eating, smoking. Wash promptly with soap & water if skin becomes irritated if in prolonged contact with the product and promptly remove any contaminated clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	White, wet pad

Odour	Perfumed
pH	2.6-3.6 (Solution)
Flashpoint	23ºC (Solution)
Boiling Point:	Not Applicable
Melting Point	Not Applicable
Solubility	Soluble in water

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Dangerous Reactions	None
Conditions to Avoid	Avoid heat. Sources of ignition, sunlight and temperatures exceeding 50°C. Avoid contact with oxidisers or reducing agents.
Decomposition Products	Fire creates: Toxic gases/vapours/fumes of: Carbon monoxide (CO). Carbon dioxide.

11. TOXICOLOGICAL INFORMATION

Product Toxicity	The formulation has has been reviewed and determined to produce no effect.
Component Toxicity	Other hazard identifications in Section 2 were derived from the known effects of the individual ingredients and their concentrations in the product.

Summary of Product Toxicity Effects

Acute Effect(s)	
Eye	May cause irritation to the eye.
Skin	May cause irritation to the skin with prolonged/repeated contact.
Inhaled	Vapours/mists may cause irritation to the respiratory system.
Swallowed	Not likely to be a route of exposure.
Chronic Effect(s)	The chronic toxicity of this product has not been determined.

12. ECOLOGICAL INFORMATION

Product Ecotoxicity	The ecotoxicity of this product has not been determined.
Component Ecotoxicity	Based on component ecotoxicity data the product is not an environmental hazard

13. DISPOSAL CONSIDERATIONS

Disposal Method	Product should be treated according to the instructions given under sections 6,7 and 8 above. Dispose of according to Local, State and Federal regulations. Contact relevant authority for details.

14. TRANSPORT INFORMATION

Road Transport Regulations (ADG 6)

UN number:	3175

Proper shipping name:	Solids containing Flammable Liquid, NOS (ETHANOL)
DG class:	4.1
Subsidiary risk:	None allocated
Packing group:	II

Maritime Transport Regulations (IMDG)

UN number:	3175
Proper shipping name:	Solids containing Flammable Liquid, NOS (ETHANOL)
DG class:	4.1
Subsidiary risk:	None allocated
Packing group:	II
Marine Pollutant:	Not a Marine Pollutant

Air Transport Regulations (IATA)

UN number:	3175
Proper shipping name:	Solids containing Flammable Liquid, NOS (ETHANOL)
DG class:	4.1
Subsidiary risk:	None allocated
Packing group:	II

15. REGULATORY INFORMATION

Regulatory Status	This product is regulated as a Cosmetic in the EU and complies with all the requirements of the Cosmetic Directive.
Hazardous Substances Regulation	Not hazardous
RISK PHRASE(S)	None
ENVIRONMENTAL RISK PHRASE	None
SAFETY PHRASE(S)	S2 Keep out of the reach of children. S25 Avoid contact with eyes. S16 Keep away from sources of ignition.
SUSDP	Not scheduled

16. OTHER INFORMATION

References: The Cosmetic Products (Safety) Regulations 2004, SI2004 No. 2152

CONTACT POINT

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Regulatory, Safety & Environmental Services

From outside Australia Ph: (61) (2) 9857 2000
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is solely the responsibility of the user to determine safe conditions for use of this product and to assume liability for any loss, damage or expense whatsoever arising out of the product's improper use.

KEY/LEGEND
NOHSC = National Occupational Health and Safety Commission (Australia)
ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG = International Maritime Dangerous Goods
IATA = International Air Transport Association
SUSDP = Standard for the Uniform Scheduling of Drugs and Poisons (Australia)
HSNO = Hazardous Substances and New Organisms Act 1996

Appendix K Site Containment.

K.1 Introduction

The containment of materials that are spilled or generated through the actions of fire fighting is addressed by the use of onsite containment ponds. These ponds are shown in Figure. K.1. These detention ponds are located in the north-western corner of the WestPark Industrial Estate.

In Section 6.3 the containment of spills and contaminated fire fighting water was discussed. This section revealed that the on-site spill containment would provide capture of anticipated quantities of contaminated water generated.

K.2 Details

The ponds have a total capacity of 11 million litres with the second site detention pond isolated. The A2 Warehouse storm-water drain proceeds to the first detention pond. In the event of a fire event the outlet valve of the second pond will be closed. The closure of the second detention pond is initiated by a interlock with the site fire indicator panel. The valve is electrically actuated and has the facility to be closed manually in the event of automatic fire detection failing. The total capacity of the detection ponds being 11 million litres is anticipated to be in excess of any fire event for the Warehouse A2. The large volume of site detection will reduce the risk to local fauna and flora surrounding the estate from a spill or contaminated fire fighting water.

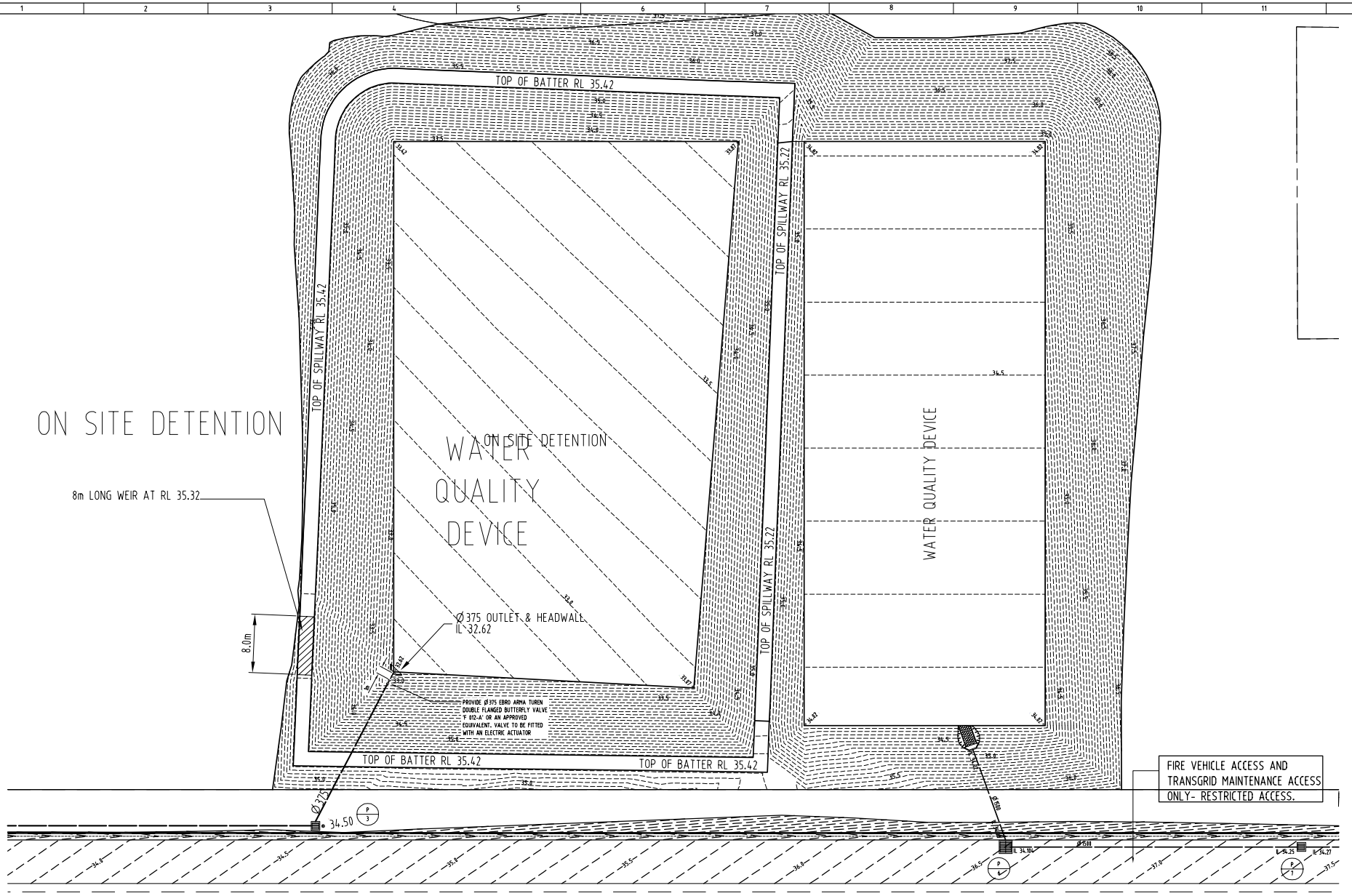
All rain events proceed to the detention ponds, and testing of the water is carried out before release into stormwater. This minimises the risk to local fauna and flora through contaminated rainwater.

Post any event where the detention ponds are filled with contaminated water, the water present in the detention pond would be pumped out and disposed/treated by an EPA approved contractor, with any local contamination to the base of the basins, treated, and or removed/replaced.

Figure. K.1 Site Containment Ponds

[Page Intentionally Left Bank]

See Next Page Drawing No. 24691 1-0 H14



DETENTION TANK LAYOUT

REFERENCE DOCUMENT REGISTER Q.A.

BUCKTON LYSENKO REV	1-0
DISCIPLINE DRAWING NO.	REVISION OR DATE
ARCH	
STRUCT	
MECH	
ELECT	
SURVEY	

DRAWING STATUS LEGEND

0 PRELIMINARY DESIGN DRAWING
1 DEVELOPMENT APPLICATION
2 AUTHORITY APPROVAL
3 TENDER PURPOSES
C CONTRACT PURPOSES

NOTE: DRAWINGS ISSUED FROM STATUS 0 TO 3 SHALL NOT BE USED FOR CONTRACT PURPOSES

STATUS/ REVISION	DESCRIPTION	DRAWN	DATE
1-0	DA SUBMISSION	SL	28.6.07

ARCHITECT
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PROJECT
BUILDING C3 & C4
WESTPARK
No. 474-536 Mamre Road
Erskine Park NSW 2759

DRAWING TITLE
HYDRAULIC SERVICES
DETENTION TANK,
BUTTERFLY VALVE &
HEADWALL DRAINAGE LAYOUT

DESIGNER	DRAWN	SCALE	CAD FILE
GC	SL	AS SHOWN	24691H014_10

PROJECT	STATUS	REVISION	DRAWING No.
24691	1	– 0	H14

Appendix L BAMA Guidelines

L.1 Introduction

The following is a brief summary of the guidelines under the British Aerosol Manufacturers Association (BAMA) for the storage of aerosol cans. This summary does not present all the information required under the guidelines but highlights the key elements. Implementation of the guidelines is accepted by the Health and Safety Executive, UK as a method of reducing the risk associated with the storage of aerosols.

L.2 Results

The summary of the guidelines under the British Aerosol Manufacturers Association (BAMA) for the storage of aerosol cans is presented in Table. L.1.

Table. L.1 BAMA Checksheet

BAMA Ref	Area	Protection	Implementation at Warehouse A2
L1	Inspections	Minimum suggestions for regular inspections are: Daily inspection of fork lift trucks; Weekly inspection and test of fire sprinkler pumps and hydrants; Standards of housekeeping; Condition of pallets, pallet racking and shelving; Fire exits, signs and emergency lights; Fire extinguishers; and Safety equipment (e.g. showers, eyewash bottles, spill control).	Regular inspections will form part of the regular activities of the warehouse. Key items as described by L1 will be inspected and controlled through the quality management system.
L2	Security	The warehouse shall have security (e.g. fencing) that is adequate to guard against intruders on to the site to prevent the threat of malicious fire raising (i.e. arson).	Security will be reviewed and installed and be suitable for the materials and quantities being stored.
L3	No Smoking Policy	Smoking in warehouses gives rise to major fire hazards.	No smoking policy in place.
L4	Fire Detection	Measures shall be provided for detecting a fire.	Fire detection will be installed in Warehouse A2.
L5	Fire Alarm	Measures shall be provided for raising an alarm in the event that fire is detected. The alarm should alert all persons, including disabled or sensory impaired persons, to the danger. Fire detection and alarm systems shall be subject to a specified regular test and maintenance program.	Alarms and third party notification will form part of the fire system.
L6	Means of Escape	Measures shall be provided for the safe evacuation of all buildings in the event of fire. Emergency and fire exit routes shall be clearly signed. Clear access to, from, and along emergency and fire exit routes shall be maintained at all times. No emergency door shall be locked in a way, which prevents immediate exit from the hazardous side. Pedestrian evacuation routes shall be given priority over vehicle routes and storage of materials and finished goods. Priority routes shall be maintained through the site for access by the emergency services.	Means of escape will be provided and meet Australian standards. Reviewed as part of the Fire Safety Study and Fire Engineering Report.

BAMA Ref	Area	Protection	Implementation at Warehouse A2
L7	Fire Systems	Two independent water sources should be provided which are capable of delivering the maximum firewater demand. The water sources should be independent at time of need, therefore a suitably sized storage tank filled from the mains and the mains supply would be acceptable as long as the storage tank is kept full. Water used in the event of a fire shall be retained so that it does not constitute a threat to the environment.	The sprinkler system and hydrant system are independent and will be reviewed as part of the Fire Safety Study.
L8	Fire Fighting Teams	Where a trained fire fighting team exists, they shall have equipment, protective clothing, and training to keep them safe whilst engaged in an emergency response.	Training will be provided to on-site personnel and an emergency plan will be provided.
L9	Contact with the Fire Services	Emergency plans should be drawn up in consultation with the local community, local authority, and local fire service	Undertaken as part of the Development Application.
L10	Design	Aerosols shall be stored in dry, well-ventilated warehouses and not in basements.	The warehouse will be ventilated as per AS 3833.
		If the warehouse is a large open plan building, the aerosol storage area should have wire mesh caging as a means to control rocketing aerosols from spreading the fire to stock in other parts of the warehouse. Connecting doors in fire compartment walls shall be of a self-closing type held open with a fusible link or other 'fail safe' device, which can operate in the absence of external power supplies and have a minimum fire resistance of 2 hours.	Wire mesh will be installed around the Class 2.1 storage and doors provide (mesh) that will close on activation of the FIP.
		Ventilation: The ventilation in the warehouse shall be sufficient to prevent any build-up of flammable gas due to slow seepage from stored aerosols.	Ventilation as per AS 3833.
		Sources of Ignition include: Hot surfaces or radiant heat; Smoking materials (e.g. cigarettes, matches, lighters, etc.); Sources of static electricity (e.g. flooring, clothes, mobile phones, etc.); Faulty electrical installations; Hot works, e.g. open flame cutting or welding; Faulty mechanical handling equipment; Friction caused by careless handling; and Electrical socket outlets and switches should be installed above one metre in height from the floor. This is to prevent accidental damage by mechanical handling devices (e.g. fork lift trucks).	Sources of ignition will be controlled to minimise the risk of fire.
L11	Aerosol Storage Protocol	Aerosols shall be stacked in racks or block stacked. Pallets and packs of aerosols should not be stored in aisles, even on a temporary basis.	Block Storage will be employed.
		Pallets of stacked aerosols shall not be inter-weaved. Interleaving of pallets in warehouses can result in collapse of the stack if a pallet is inadvertently moved from the storage in the wrong order.	Pallets will not be inter-weaved.

BAMA Ref	Area	Protection	Implementation at Warehouse A2
		The maximum height of block stacks of aerosols shall be 3 metres. Exceeding the maximum safe top-loading value for the bottom pallet in a stack may lead to collapse, distortion, and/or accidental actuation of aerosols and a release of large quantities of flammable material. The maximum stack height for storage purposes should always be calculated for each product and product variable. Parameters to take into account include cap strength and the type of packaging material used. For contract warehouse operations, the supplier should provide advice on the maximum stack height for each product type.	The storage height will be accessed given present operating experience and suitable for the sprinkler system to be installed.
		The overall stacking height should also take account of the height, positioning, and operation of the sprinkler system.	The storage height will be accessed given present operating experience and suitable for the sprinkler system to be installed.
		Empty pallets and other combustible materials shall be stored in an area separate from aerosols or other flammable products, preferably in another building.	Separation and storage as per AS 3833.
L12	Goods In	Aerosols shall be examined for damage upon receipt. Pallet loads should be visually inspected on entry into the warehouse to ensure that aerosols are not damaged.	Inspection of delivered aerosols will take place before the storage of materials.
		Records of unsatisfactory deliveries should be made and the matter reported to the supplier for investigation.	Incident report forms are available and will be used for tracking of these incidents.
		Aerosols shall be stretch-wrapped securely onto pallets to minimise handling and to avoid falls of loose containers.	Protection (wrapping) or boxes is undertaken to prevent falls.
		Where pallets of aerosols are broken down at the warehouse into packages for onward delivery into the supply chain, the supplier should be consulted about the gauge of shrink-wrap and quality of trays used.	No breakdown occurs within the warehouse.
		Fork tips should be rounded rather than sharp to minimise the possibility of piercing of aerosols and clad in stainless steel to reduce the risk of sparks caused by friction between rust on the forks and aluminium can (thermite reaction).	Forklift design will be for handling dangerous goods.
		Forklift and pallet truck drivers shall be licensed to operate their trucks.	Forklift drivers will be licensed.
		Staff using mechanical handling devices shall be trained to avoid damaging aerosols.	Training will be conducted for all personnel.
		Battery chargers used for forklift and pallet trucks shall be located and used in an area ruled safe by the risk assessment. Battery-operated truck charging can give rise to incendiary sparks and hydrogen. Therefore, truck-charging points should be in an area remote from the aerosol storage area and assessed as safe.	Battery charging located in separate room from Class 2.1 material.

BAMA Ref	Area	Protection	Implementation at Warehouse A2
L13	Housekeeping	All relevant staff including temporary staff should be trained in the correct handling techniques, emergency procedures, and procedures for dealing with damaged or leaking stock. Contractors informed of the person with accountability for their safety.	Leaking stock procedure to be developed.
		Good standards of housekeeping shall be maintained at all times.	Good standards will be employed.
		All staff involved in the movement and storage of aerosols shall be trained about aerosol hazards. Engineering staff should also be instructed in the correct maintenance procedures and written permit systems.	Training will be conducted for all personnel. Permits to work will be employed at the warehouse.
		Empty pallets shall be stored in an area separate from the aerosols.	No empty pallets will be stored at the warehouse.
		Combustible waste shall be removed without undue delay.	Waste disposal is available.
L14	Disposal of Aerosols	Damaged or leaking aerosols should be removed immediately to a safe secure well-ventilated place (in the open air preferably). In all cases, it will be necessary for a risk assessment of the nature of the hazard (i.e. flammable, toxic, harmful, corrosive, Dangerous to the Environment, etc.) and to be performed by a competent person.	Any damaged containers will be separated to a well ventilated area.
		Leaking Aerosols: All leaking aerosols shall be placed in a well-ventilated area until all leakage has ceased and then disposed of appropriately.	
L15	Design Considerations for Aerosol Storage	Segregation-This is where a clear space in all directions segregates aerosols from other products and packaging, empty pallets, etc. by a clear space in all directions. The distance from the other products will depend on the nature of those products.	Separation of goods is designed to AS 3833.
		Radiant heating-Burning empty pallets will produce intense heat, which will cause exposed aerosols to burst.	No radiant heat sources available in the storage area.
		Flammable liquids-will flow, taking the fire with them. The segregation distance will depend on the number and quantity of flammable liquids stored.	Separation of goods is designed to AS 3833.
		Fragile products-Those products that could be damaged by rocketing or bursting aerosols should be relocated so that they are not in the direct line of sight of stored aerosols.	Only aerosols will be stored in the caged area.
		Fire Separation and Compartmentation-Firewalls and separations have a specific fire rating.	Firewall at the end of the Warehouse A2 to prevent propagation into Warehouse A1 and warehouse A3
		Wire Mesh (Caging)-Where aerosols cannot be segregated from other stock, wire mesh caging is recommended around aerosol storage, so far as is practical, to limit rocketing aerosols in a fire. Open mesh caging should be used, as it will allow water to be directed through the mesh at the fire.	Wire Mesh will be used for the segregation of aerosol containers.

BAMA Ref	Area	Protection	Implementation at Warehouse A2
		Methods for Controlling Fire - Hose Pipes - Sprinklers Ceiling Sprinklers fall into many categories; different orifice of sprinkler head, early suppression fast response (ESFR); large drop sprinklers and fast response. All of these types give different water spray patterns and coverage areas (per sprinkler head).	Sprinkler System as per FM 7-31 to be employed in the caged area.
		Smoke Vents-Smoke venting systems help prevent smoke build-up and can be installed in warehouses for both life and property protection purposes.	Smoke vents will be accessed as part of the Fire Engineering Study.
		Environmental Issues-Water used to fight or suppress a fire should be retained so that it does not constitute a threat to the environment.	Local Bunding (20 minutes sprinkler water) and site containment is available.