Warehouse B1

Preliminary Hazard Analysis

WestPark Industrial Estate,

23-107 Erskine Park Road, Erskine Park, 2759, NSW.

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Requested by:	Daniel Swinnerton
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Executive Summary

The proposed development is for the construction of a warehouse (Warehouse B1) to be located at WestPark Industrial Estate (WestPark). WestPark is located at 23-107 Erskine Park Road, Erskine Park, 2759, New South Wales, Australia. WestPark is located on Lot 1 DP 1128233 within the suburb of Erskine Park and the local government area of Penrith. Warehouse B1 will be operated as a warehouse and distribution centre for household products.

Warehouse B1 will have 20,000 square metres of warehouse storage area. There will also be an office area of 650 square metres for Warehouse B1. The Warehouse will have 18 loading docks.

Warehouse B1 will be leased and operated by DHL Supply Chain (Australia) Pty Ltd (DHL), ACN 071 798 617. The operations will include the storage and handling of dangerous goods. The dangerous goods that are to be stored at Warehouse B1 include aerosols cans (Class 2.1 Dangerous Good), acidic solids (Class 8 Dangerous Good), acidic liquids (Class 8 Dangerous Good), and alkali liquids (Class 8 Dangerous Good). The warehouse will store other materials in Warehouse B1, including:

- Household cleaning agents;
- Dishwashing detergent;
- Laundry powder;
- Disinfectants;
- Pharmaceutical Products; and
- Consumer Health and Personal Care Products

These products will be in package sizes suitable for retail sale and in retail package sizes.

Findings and Recommendations

This section contains a summation of the findings and recommendations for Warehouse B1.

Findings

The quantity of dangerous goods to be stored at Warehouse B1 was found to exceed the screening threshold for "potentially hazardous" as described in the NSW State Environmental Planning Policy No.33 (SEPP 33). Where this threshold is exceeded, SEPP 33 requires that a Preliminary Hazard Analysis (PHA) be undertaken. This study undertakes that PHA for Warehouse B1 for storage and handling of dangerous goods.

The PHA was undertaken in accordance with Hazardous Industry Planning Advisory Paper (HIPAP) No.6. The hazards associated with the proposed development were identified. A qualitative risk assessment was undertaken and hazards found have a "low risk" were deemed to not require further development of the consequence or frequency of the hazard, given the implementation of the nominated controls. Hazards that were found to be "medium" or "high" risks were examined in more detail for both consequence and frequency to quantify the risk.

It was found that the aerosols (UN 1950) storage is predominantly for household products used for cleaning and pest control. The aerosols do not significantly increase the individual risks given the chemicals are suitable for retail sales and in low concentrations. The aerosol were examined as being potentially unreacted within a smoke plume and potentially causing serious injury or being potentially injurious to sensitive receptors. The frequency of aerosols within a smoke plume were below the criteria established in HIPAP No.4. The location of Warehouse B1 at the southern boundary of WestPark means that there is no increase in the frequency events causing serious injury or being potentially injurious to sensitive receptors in residential areas to the north of WestPark site.

The Class 8 material will be stored to meet the intentions and requirements of AS 3780, "The storage and handling of corrosive substances". The Class 8 material is unlikely to cause significant off-site effects for individuals or significant effect surrounding biophysical environment.

The risk to the biophysical environment from spills and potentially contaminated fire-fighting water was found to be very low for events associated with Warehouse B1.

The WestPark site has other warehouses that contain dangerous goods of notable quantities. These warehouses are Warehouse A1, Warehouse A2, and Warehouse C3/C4. The hazards associated with Warehouse B1 do not increase the risks associated with WestPark to levels above the risk criteria described in HIPAP No.4. It was found that the frequency of potentially causing serious injury or being potentially injurious to sensitive receptors was below the criteria established in the HIPAP No.4 for the storage of dangerous goods for all the warehouses within WestPark. It was also found that the risk of propagation between warehouses at WestPark was very low.

The development of Warehouse B1 is below the risk criteria described in HIPAP No.4 and would not pose a significant risk in the locality.

Recommendations

The recommendations for Warehouse B1 are used to control the risks associated with the storage of dangerous goods that could be potentially hazardous. This includes:

1) Storage of aerosols to be undertaken in accordance with Factory Mutual (FM) Global data sheet 7-31 and include:
    i. Caging;
    ii. Bunding; and
    iii. Storage as described by FM Global Data Sheet 7-31.
2) Fire separation from Warehouse B2;
3) Storage of the Acid solids and liquids in a separate bunded area to the Alkali liquids; and
4) Spill and contaminated firewater containment as described in the body of this report.

Glossary and Abbreviations

BAMA	British Aerosol Manufacturers' Association
DHL	DHL Supply Chain (Australia) Pty Ltd. ACN 071 798 617
DOP&I	NSW Department of Planning and Infrastructure (Formerly DOP)
DOP	NSW Department of Planning (Now DOP&I)
DUAP	Department of Urban Affairs and Planning (Now DOP&I)
EBP	Erskine Business Park
EIS	Environmental Impact Study
ESFR	Early Suppression, Fast Response
FGS	Flammable Goods Section for Warehouse C3/C4
FIP	Fire Indicator Panel
FM	Factory Mutual
FRNSW	Fire and Rescue NSW
Goodman	Goodman Industrial Funds Management Limited. ACN 147 891 487
GSS	General Storage Section for Warehouse C3/C4
HIPAP	Hazardous Industry Planning Advisory Paper
HSE	Health and Safety Executive, Great Britain
MC&E	Moore Consulting & Engineering Pty Ltd
PHA	Preliminary Hazard Analysis
PPE	Personal Protective Equipment
SEPP 33	State Environmental Planning Policy No.33
WestPark	WestPark Industrial Estate, 23-107 Erskine Park Road, Erskine Park, 2759

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Revision History					
Revision No	***Date of Issue***	***Amendment***		***Name***	***Initials***
1	05/09/11	Internal Review	*Prepared by*	John Marks	JGM
			Verified by	David Moore	DFM
			Approved for Release by		
2	07/09/11	Draft Release	*Prepared by*	John Marks	JGM
			Verified by	David Moore	DFM
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3	14/09/11	Final Draft Release	*Prepared by*	John Marks	JGM
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5	22/09/11	Final Release	*Prepared by*	John Marks	JGM
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6	14/11/11	Amended Warehouse Layout	*Prepared by*	John Marks	JGM
			Verified by	David Moore	DFM
			Approved for Release by	David Moore	DFM

Review Panel	
Division/Office	*Name*
Prime Construction	Scott Griffin
Prime Construction	Daniel Swinnerton

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 proposed development of Warehouse B1 located at WestPark Industrial Estate, Erskine Park, NSW, Australia.

Table of Contents

Appendices

Table of Tables

Table of Figures

1 Introduction

The proposed development is for the construction of a warehouse (Warehouse B1) to be located at WestPark Industrial Estate (WestPark). WestPark is located at 23-107 Erskine Park Road, Erskine Park, 2759, New South Wales, Australia. WestPark is located on Lot 1 DP 1128233 within the suburb of Erskine Park and the local government area of Penrith. Warehouse B1 will be operated as a warehouse and distribution centre for household products.

Warehouse B1 will have 20,000 square metres of warehouse storage area. There will be an office area of 650 square metres for Warehouse B1. The Warehouse will have 18 loading docks.

The Warehouse B1will be leased and operated by DHL Supply Chain (Australia) Pty Ltd (DHL), ACN 071 798 617. The operations will include the storage and handling of dangerous goods. The dangerous goods that are to be stored at Warehouse B1 include aerosols cans (Class 2.1 Dangerous Good), acidic solids (Class 8 Dangerous Good), acidic liquids (Class 8 Dangerous Good), and alkali liquids (Class 8 Dangerous Good). The warehouse will store other materials in Warehouse B1, including:

- Household cleaning agents;
- Dishwashing detergent;
- Laundry powder;
- Disinfectants;
- Pharmaceutical Products; and
- Consumer Health and Personal Care Products.

These products will be in package sizes suitable for retail sale.

The quantity of dangerous goods will be such that it exceeds the screening threshold for “potentially hazardous” as described in the NSW State Environmental Planning Policy No.33 (SEPP 33). SEPP 33 requires that a Preliminary Hazard Analysis (PHA) be undertaken where the screening threshold is exceeded. This study undertakes a PHA for Warehouse B1 for storage and handling of dangerous goods.

1.1 Project Background

Development consent (08/0435) was issued on 14 July 2008 for the construction of the Warehouse Building B at WestPark. This building comprises two (2) tenancies and is located at the southern site boundary. On 11 March 2011, a Section 96 modification was submitted to Penrith Council to modify the existing Development Application to meet the operational requirements of the proposed tenancy in Warehouse B1.

Goodman Industrial Funds Management Limited (ACN 147 891 487) (Goodman) owns WestPark. WestPark comprises a number of existing warehouses grouped together into Buildings. Building A consists of three (3) warehouses being Warehouse A1, Warehouse A2 and Warehouse A3. Building C consists of three (3) warehouses being Warehouse C1, Warehouse C2 and Warehouse C3/C4. The existing tenants at WestPark are described in Table 1.1.

Table 1.1 Tenants at WestPark

Warehouse	Owner	Brief Description of Storage
Warehouse A1	Kagan Logistics	Storage of paint, paint related products
Warehouse A2	Reckitt Benckiser	Storage of household chemicals and cosmetics
Warehouse A3	Sony DADC	Storage of digital equipment
Warehouse C1	Capral	Storage of aluminium products and systems
Warehouse C2	SCA Hygiene	Storage of household hygiene products
Warehouse C3/C4	Kagan Logistics	Storage of paint, paint related products, food additives and assorted agricultural chemicals

Some of these warehouses contain dangerous goods. The warehouses containing dangerous goods are examined in Section 2.2.

1.2 Objectives

The quantities of dangerous goods stored at the Warehouse B1 exceed the threshold limits established for *State Environmental Planning Policy No. 33 (SEPP 33)*, and a Preliminary Hazard Analysis (PHA) is 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;
- Assessment of 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”.

1.3 Study Scope

This study will be limited to the storage of goods, by DHL at the Warehouse B1, WestPark. The study has been prepared to be consistent with HIPAP No. 6, "Hazard Analysis Guidelines".

1.4 Methodology

The Warehouse B1 has been identified as potentially hazardous exceeding the threshold levels for dangerous goods stored within the warehouse. These threshold limits are set out in the *SEPP33. SEPP 33* requires that once quantities of dangerous goods exceed the threshold limits, a more detailed analysis needs to be undertaken. This more detailed analysis is described as a PHA.

The PHA is developed using the Department of Planning and Infrastructure (DOP&I), *Multi-Level Risk Assessment,* and DOP&I, *Guidelines for Hazard Analysis – 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;

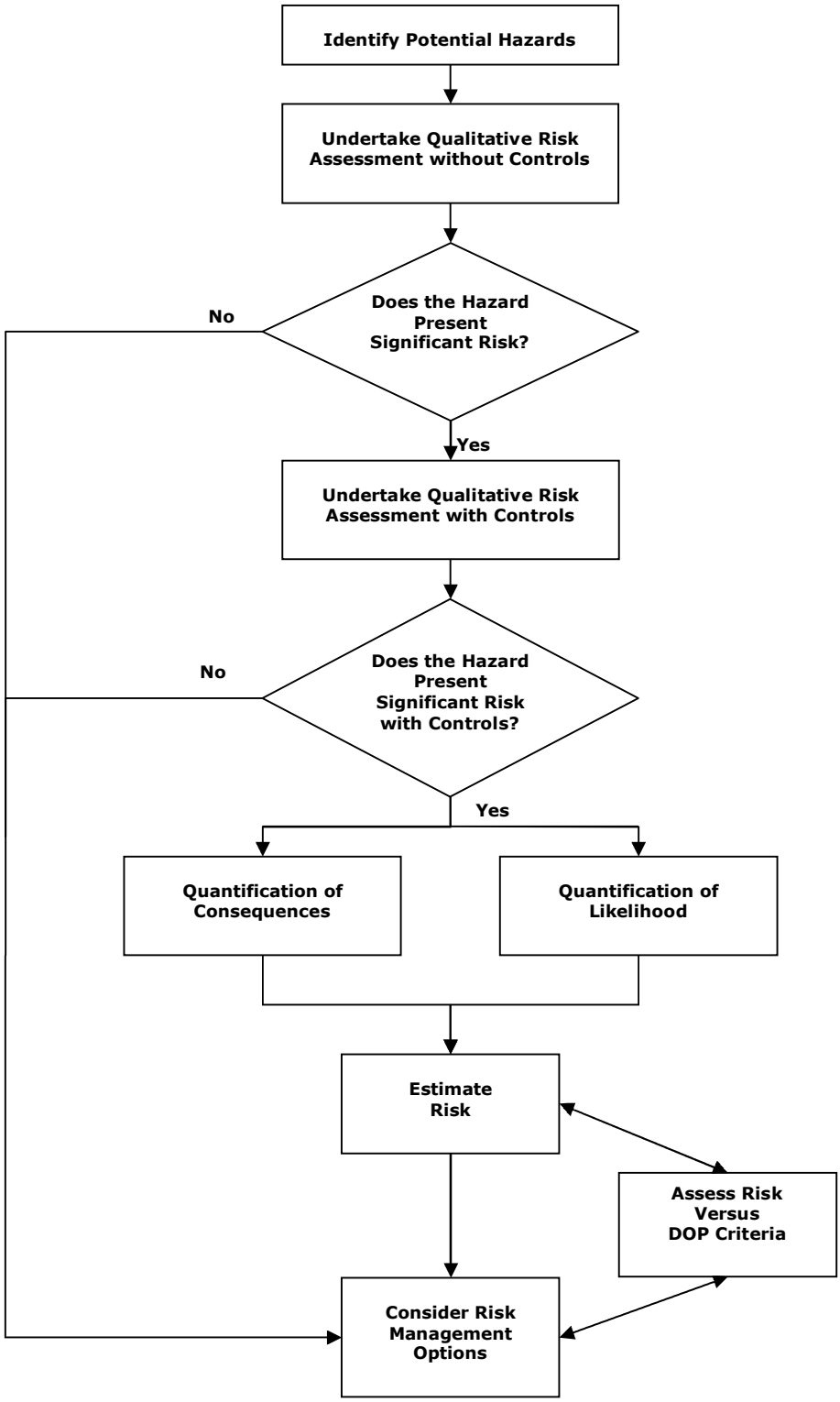
4. Estimation of the consequences of major hazardous events were determined quantitatively;

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&I *Risk Criteria from Land Use Safety Planning – HIPAP No.4.*

Figure 1.1 Methodology



2 Site Description

This section contains information on the Warehouse B1 layout and WestPark tenancies containing dangerous goods.

2.1 Warehouse B1 Development

The proposed development of the Warehouse B1 at WestPark will involve the receipt and storage of household goods. Some of the materials are defined as dangerous goods as per the Australian Transportation of Dangerous Goods Code. The layout of the warehouse is shown in Figure 2.1

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 material;
2. General storage area, containing a Class 8 material being acidic; and
3. General storage area, containing a Class 8 material being alkali.

2.2 Neighbouring Warehouses

The Warehouse B1 forms part of the tenant Block B at WestPark. This block has no occupants in Warehouse B1.

Three (3) warehouses at WestPark are presently storing dangerous goods. The warehouses that contain dangerous goods are:

- Warehouse A1;
- Warehouse A2; and
- Warehouse C3/C4.

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

2.2.1 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 area. There are 1,500 pallets of Class 2.1 (aerosols in package sizes of 150 grams to 300 grams). The aerosol cans are 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 at a temperature 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.

2.2.2 Warehouse A2

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 includes Class 2.1 (aerosols), Class 2.1 sub-risk 8, and Class 3 and Class 4.1 materials.

DHL operates the warehouse on behalf of Reckitt Benckiser (Australia) Pty Ltd (Reckitt Benckiser). Reckitt Benckiser leases the warehouse.

The quantities of dangerous goods to be stored in Warehouse A2 are shown in Table 2.1.

Table 2.1 Dangerous Goods at Warehouse A2

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 2.1 are maximum quantities to be stored at the warehouse. Stock variations will occur and the quantities presented in Table 2.1 are the maximum levels.

2.2.3 Warehouse C3/C4

Kagan Logistics operates Warehouse C3/C4 for the storage of paint, paint related products, food additives and assorted agricultural chemicals. The Warehouse C3/C4 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 wall 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.

2.3 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.

2.3.1 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. Empty containers are normally removed from site during nominated working hours.

Trucks will deliver incoming goods typically from 6:00am till 10:00pm. Containers will be unloaded by both hand and forklift unloading. The site is expected to receive up to 20 container loads on a daily basis, most of which are unloaded immediately. The unloading is undertaken via the recessed loading docks.

2.3.2 Outgoing Deliveries

Typically, semi-trailers and B-doubles will be used for the transportation of products to product retailers. Vehicles will be loaded between 6:00am and 4:00pm with an expectation that up to 40 vehicles will travel to and from the site on a daily basis.

2.4 Personnel Employed

The Warehouse B1 will operate from 6:00am till 10:00pm on a two-shift basis. Shifts will typically start at 6am, and 2pm but this may vary depending on seasonal requirements. The facility will employ up to 30 for day shift staff and 20 afternoon shift staff within the warehouse. Approximately 10 staff will be in the office during standard business hours.

2.5 Warehouse Security

The Warehouse B1 is to be fully electronically alarmed with 24/7 monitoring by a contracted 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 Warehouse B1 Layout

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See Next Page Drawing No. 11031-HAZ-LAY-FIG21

WAREHOUSE B1

ALKALIS DISPERSED

AEROSOL STORAGE
(CLASS 21)

ACIDS

DRAWING No.	TITLE
REFERENCE DRAWINGS	

No.		DRN	DATE	CHK	DATE	ENG	DATE
C	ALKALIS & ACIDS REVISED	DJT	14/11/2011	JGM			
B	NOTES REVISED	DJT	13/09/2011	JGM	13/09/2011	JGM	13/09/2010
A	FOR ASSESSMENT	DJT	05/09/2011				

DRAWING REVISIONS

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SIGNED APPROVAL		
ENG	JGM	
DRN	DJT	05/09/11
CHK	JGM	
APP		

DRAWING SIZE: A1

WAREHOUSE B1 LAYOUT
WESTPARK INDUSTRIAL ESTATE
23–107 ERSKINE PARK ROAD
ERSKINE PARK

SCALE	DRAWING NUMBER	REV
1:200	11031–HAZ–LAY–FIG 21	C

Figure 2.2 WestPark Layout

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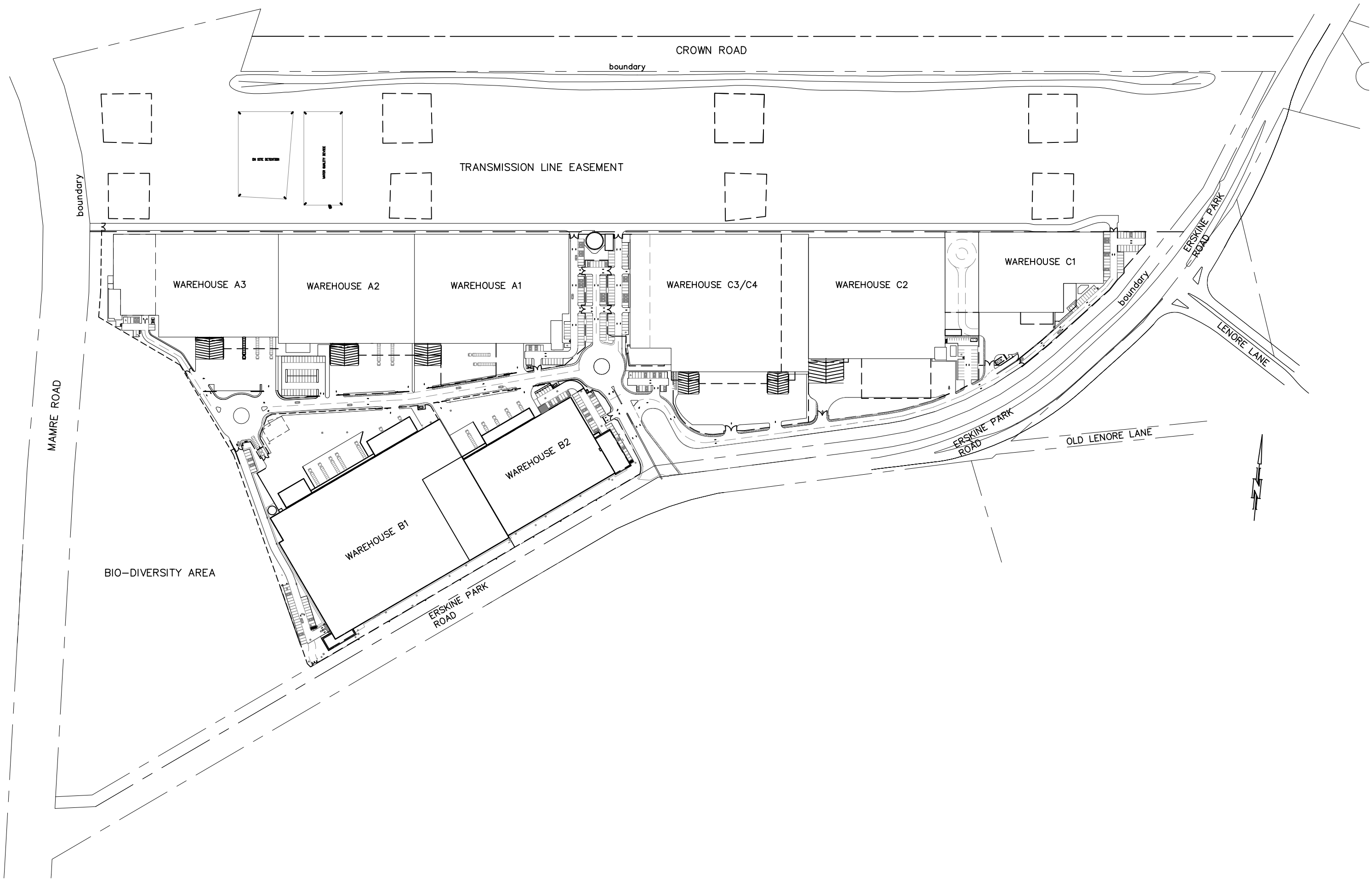
See Next Page Drawing No. 11031-HAZ-LAY-FIG22



DRAWING No.	TITLE	No.	DRAWING REVISIONS	DRN	DATE	CHK	DATE	ENG	DATE
		B	NOTES REVISED	DJT	13/09/2011	JGM	13/09/2011	JGM	13/09/2011
		A	FOR ASSESSMENT	DJT	05/09/2011				

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ENG	JGM	
DRN	DJT	05/09/11
CHK	JGM	
APP		

DRAWING SIZE: A1

SITE LAYOUT
WESTPARK INDUSTRIAL ESTATE
23–107 ERSKINE PARK ROAD
ERSKINE PARK

SCALE	DRAWING NUMBER	REV
1:1500	11031–HAZ–LAY–FIG 22	B

3 Location

The proposed development is for Warehouse B1, which forms part of WestPark. In Section 2 the facilities contained within WestPark were discussed. In this section, the areas surrounding WestPark will be examined.

3.1 Site Location

The proposed Warehouse B1 is located on the corner of Erskine Park Road and Mamre Road, Erskine Park, New South Wales, Australia and forms part of WestPark. The site entrance is on Erskine Park Road. The subject site is triangular with a frontage to Mamre Road of approximately 600 metres and a frontage along Erskine Park Road of approximately 1,150 metres. 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. The northern side of WestPark is bounded by transmission easement that runs along the boundary.

3.2 Adjacent Land Uses

The proposed Warehouse B1 is to be located in Erskine Park, in western Sydney. State Environmental Planning Policy (Western Sydney Employment Area) 2009 (Employment Area SEPP) applies to the site.

The zoning plan provided under the Employment Area SEPP zones almost all of the land as IN1 General Industrial, with only a small portion of the land as E2 Environmental Conservation.

The proposed Warehouse B1 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 following figures display the location of WestPark and the surrounding land uses.

Figure 3.1 WestPark Location

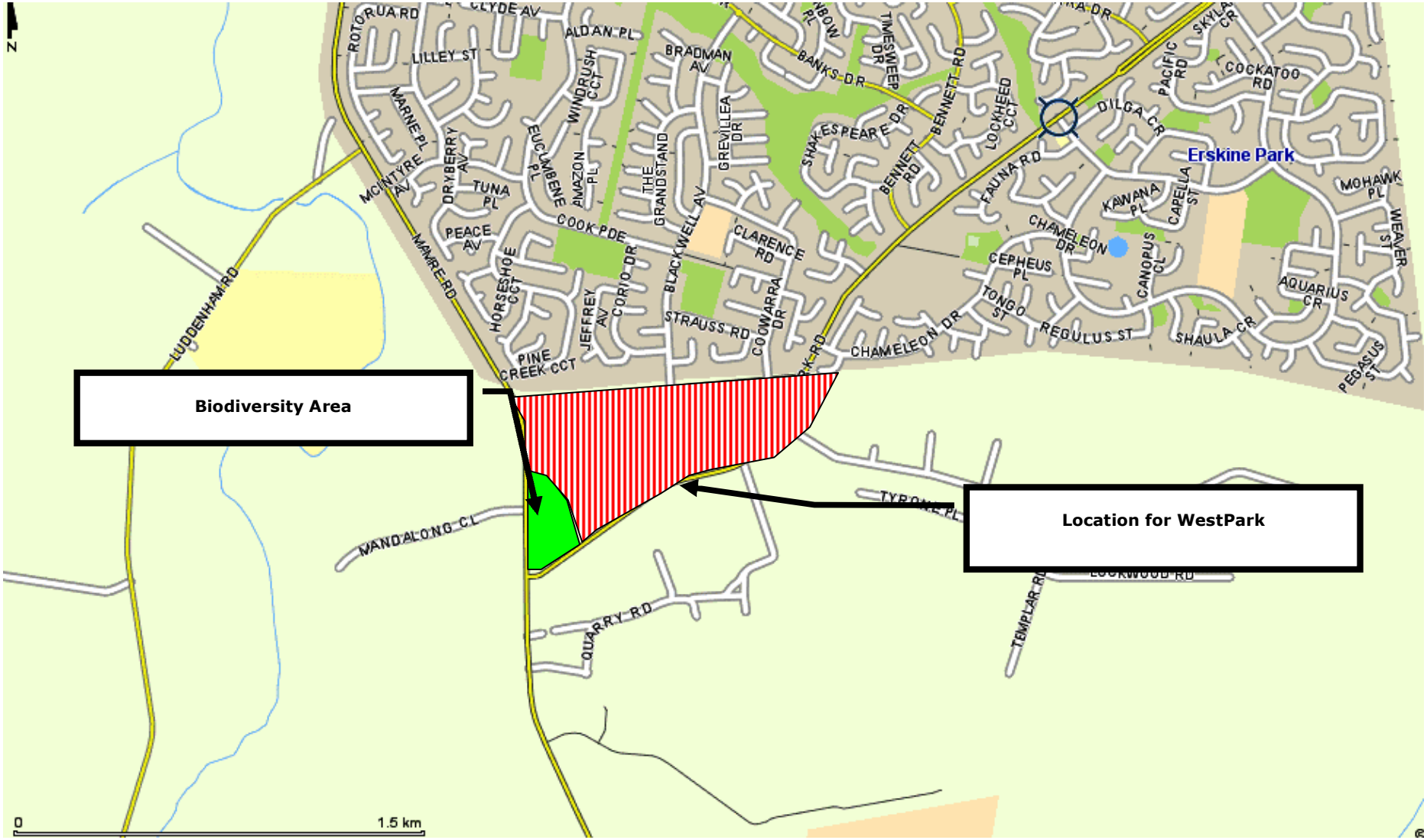


Figure 3.2 Land Uses from SEPP (Western Sydney Employment Area) 2009

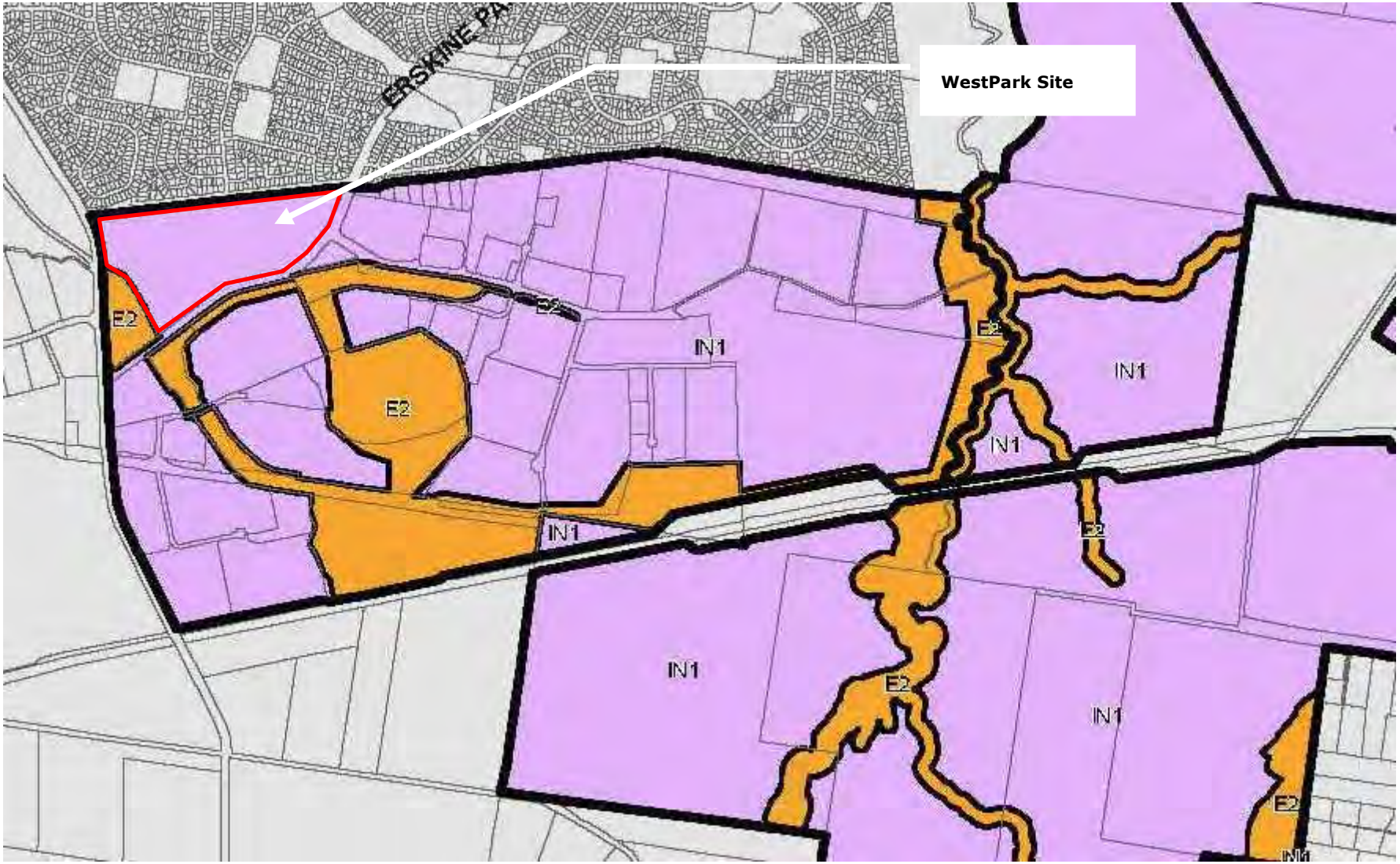


Figure 3.3 Surrounding Land Uses (Map 1)

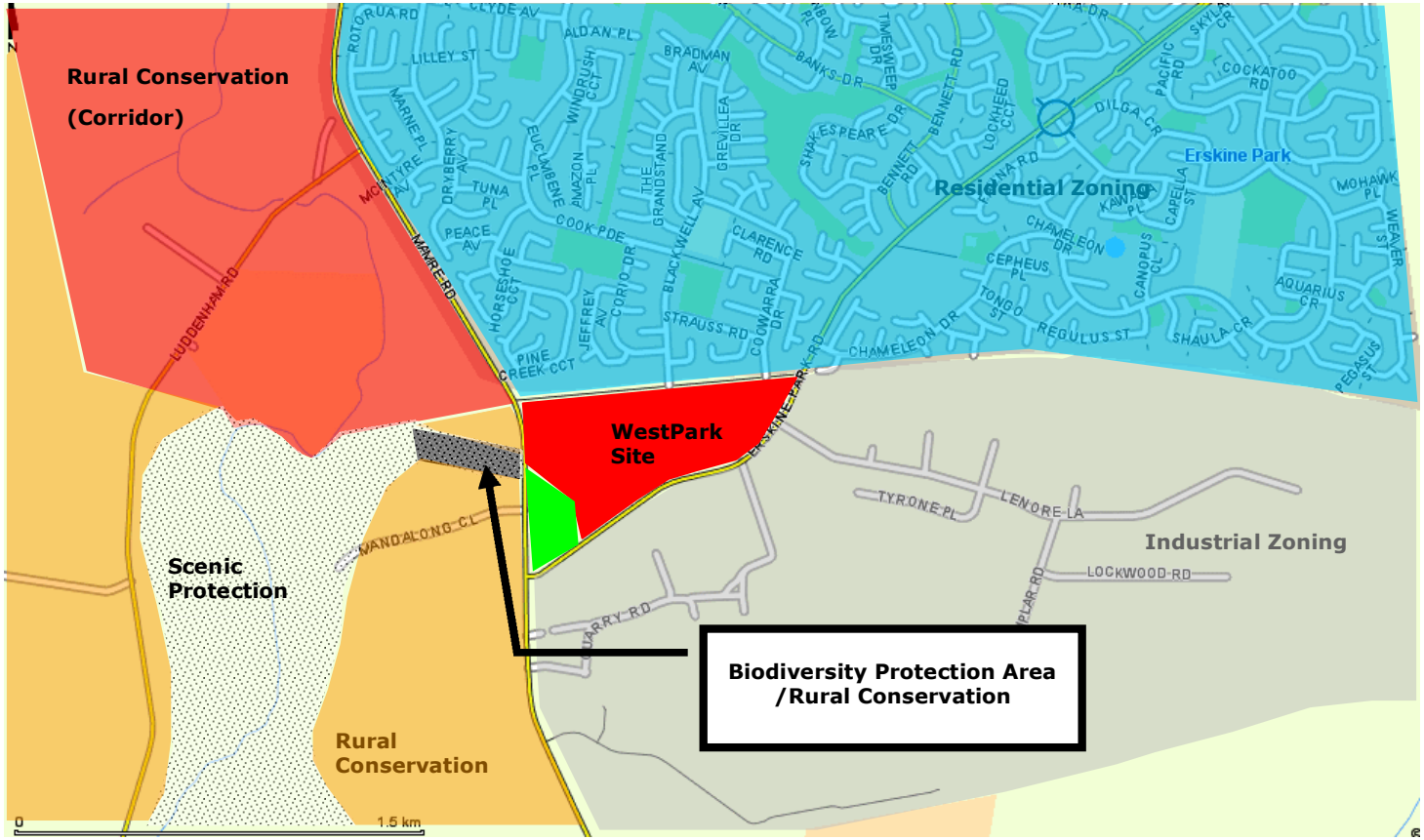


Figure 3.4 Surrounding Land Uses (Map 2)

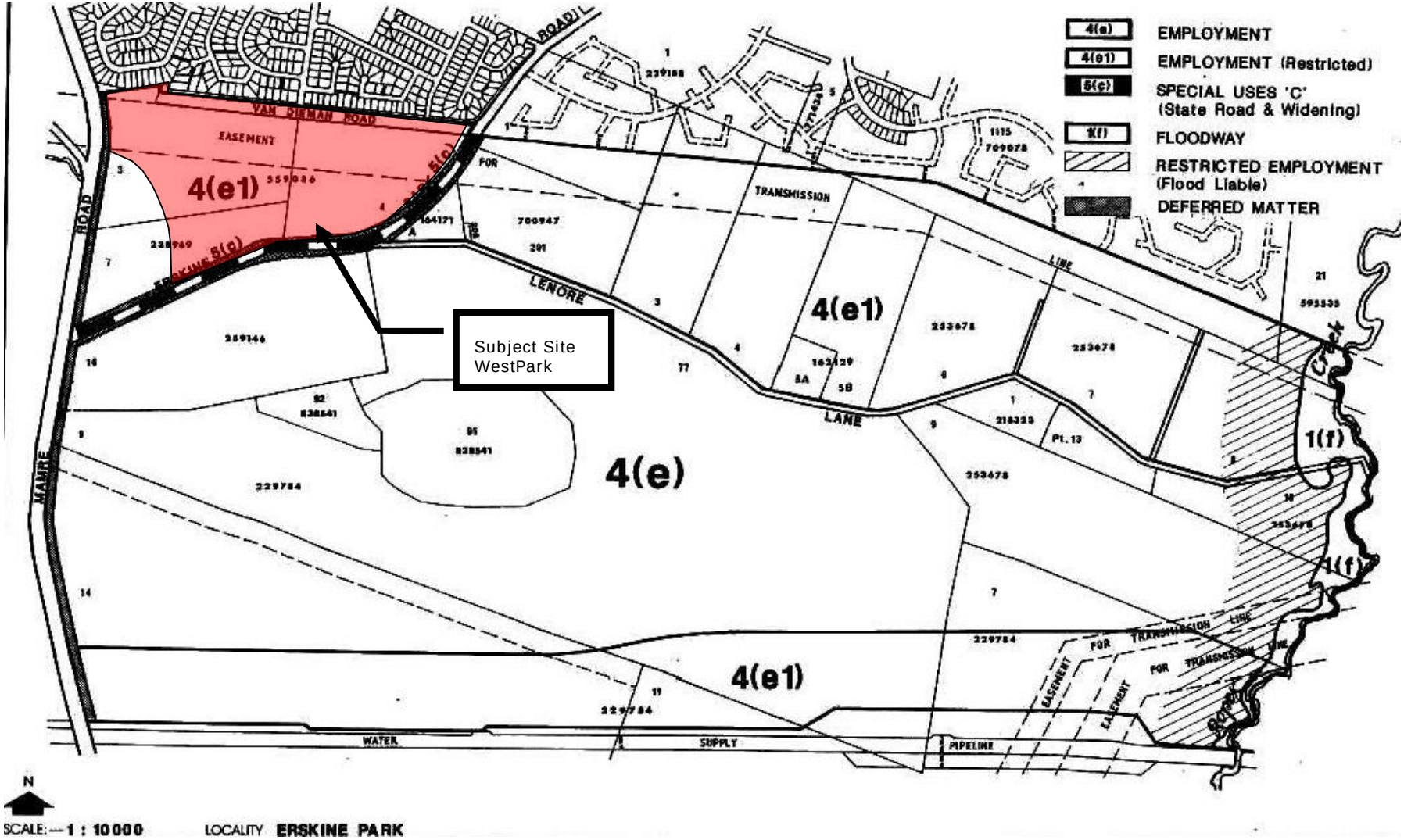
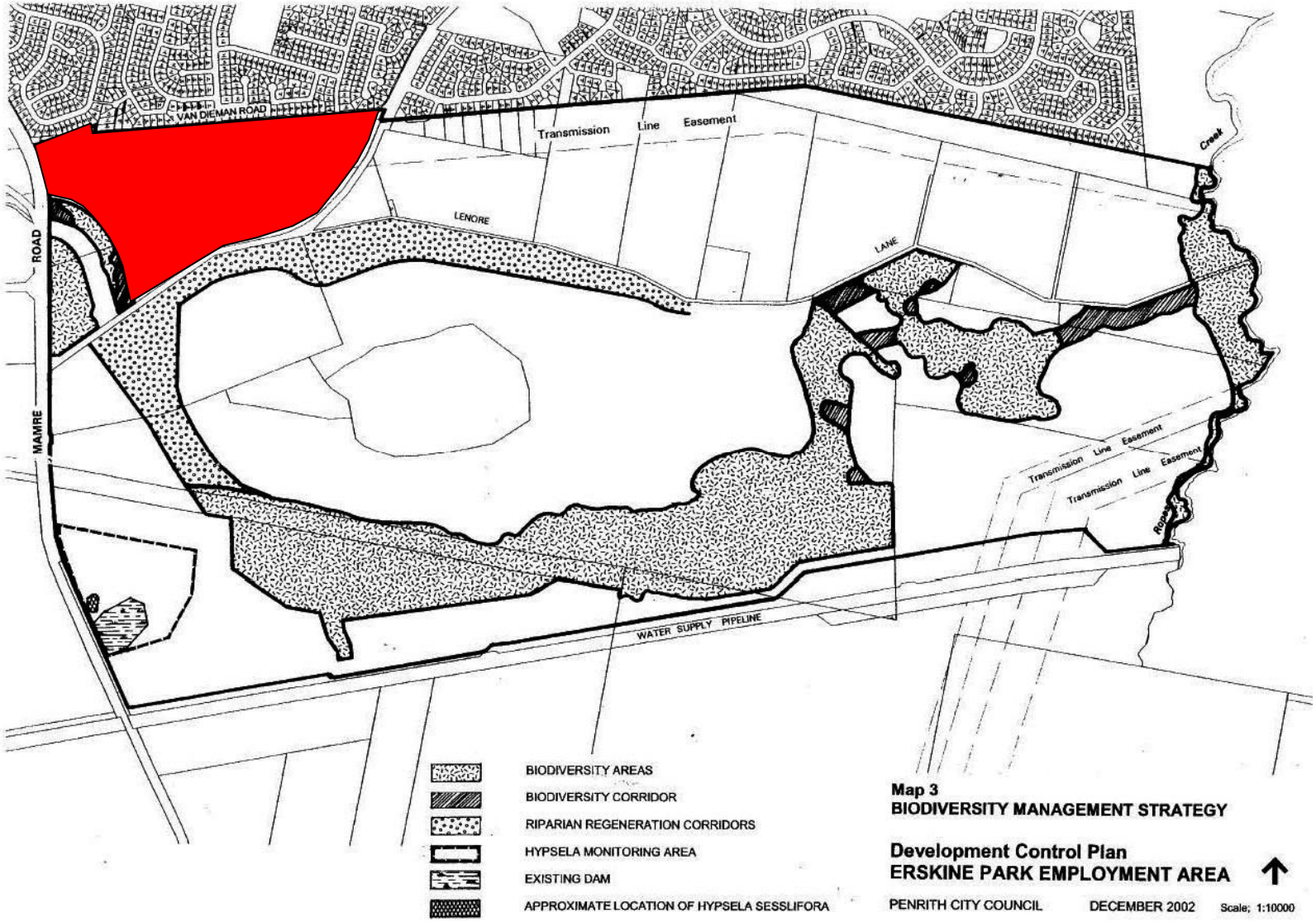


Figure 3.5 Surrounding Land Uses (Map 3)



4 Process

4.1 General Description

The Warehouse B1 will be operated by DHL as a warehouse and distribution centre for household cleaning and pest control products. The materials are contained with packages suitable for retail sale. These products include:

- Household cleaning agents;
- Dishwashing detergent;
- Laundry powder;
- Disinfectants;
- Pharmaceutical Products; and
- Consumer Health and Personal Care Products.

The products will include dangerous goods. These are described in Section 4.2.

4.2 Storage Quantities

The quantities of dangerous goods to be stored in Warehouse B1 are shown in Table 4.1. Further detailing of the quantities can be found in Appendix B.

Table 4.1 Dangerous Goods to be Stored

DG Class	Packing Group	Sub-risk	UN Numbers	Group Description	Maximum Quantity	Units
2.1			UN 1950	Aerosols	1,700,000	kg
8	PGII		UN 3260	Acidic Solids	101,100	kg
8	PGII		UN 3264	Acidic Liquids	44,700	kg
8	PGII		UN 1719 UN 3266	Alkali Liquids	989,700	kg

The quantities presented in Table 4.1 are maximum quantities to be stored at the warehouse. Stock variations will occur and the quantities presented in Table 4.1 are the maximum levels.

The Class 2.1 material is aerosol cans. The aerosol cans comply with the requirements of AS 2278.1, Aerosol Cans Part 1: Metal aerosol dispensers of capacity 50 millilitres to 1000 millilitres inclusive. 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 anti-perspirants. 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.

For Warehouse B1 the proportion of each material, as defined by NFPA 30B, is shown in Table 4.2.

Table 4.2 Proportion of Each Aerosol Can Contents Type

Aerosol Contents NFPA Level	Proportion of Stock
Level 1	10%
Level 2	50%
Level 3	40%

4.3 Materials Storage

The materials to be stored in Warehouse B1 will be racked storage for packaged goods, with the exception of aerosols. Aerosols will be block stacked and stored in accordance with the requirements of FM Global Data Sheet 7-31.

4.3.1 Aerosol Storage

There will be Aerosol cans stored in the Warehouse B1. Aerosol cans are a Class 2.1 dangerous good containing a flammable gas as the propellant. The aerosols have a total product weight of 1,700 tonnes. In order to further enhance the understanding of the aerosol, 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 this section. Representative products, for the aerosol material for each NFPA Level, are presented in Table 4.3 and MSDSs are shown in Appendix L.

Table 4.3 Representative Products (Aerosols)

Grouping	Typical Products
Aerosols Level 1	Over Cleaner Aerosol
Aerosols Level 2	Carpet Cleaner Aerosol
Aerosols Level 3	Fly Spray Aerosol

Controls

Mechanical Protection for Aerosols. Propagation within the warehouse and to other adjacent site by the means of rocketing aerosol cans 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 B1 reduce the likelihood of a fire escalation from the adjacent warehouse, or to adjacent warehouses. These firewalls will have a four-hour fire rating and 15 metres of extension to protect Warehouse B2.

Sprinkler System for Aerosols. 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 sprinklers provide cooling to any potential fire and are effective in controlling both fire development and propagation.

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

4.3.2 Acidic Solids

There will be acidic solids stored in the Warehouse B1. These solids are a Class 8 dangerous good. The acidic solids have a total product weight of 101,100 kilograms. The products are represented by the typical MSDS shown in Table 4.4.

Table 4.4 Representative Products (Class 8, Acidic Solids)

Grouping	Typical Products
UN 3260	Household Bleaching Agent

4.3.3 Acidic Liquids

There will be acidic liquids stored in the Warehouse B1. These liquids are a Class 8 dangerous good. The acidic liquids have a total product weight of 44,700 kilograms. This has an equivalent volume (based on average density of 42,775 litres). The products are represented by the typical MSDS shown in Table 4.5.

Table 4.5 Representative Products (Class 8, Acidic Liquids)

Grouping	Typical Products
UN 3264	Bathroom Cleaner

4.3.4 Alkali Liquid Storage

There will be alkali liquids stored in the Warehouse B1. These liquids are a Class 8 dangerous good. The alkali liquids have a total product weight of 989,700 kilograms. This has an equivalent volume (based on average density of 939,360 litres). The products are represented by the typical MSDS shown in Table 4.6.

Table 4.6 Representative Products (Class 8, Alkali Liquids)

Grouping	Typical Products
UN 1719	Hair Removal Clean
UN 3266	Floor Cleaner Bathroom Cleaning Gel

4.4 Activities to be Undertaken

The Warehouse B1 is proposed for the receipt, storage and dispatch of product, including some Dangerous Goods. Specific services to be conducted at Warehouse B1 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; and
- 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 for aerosol storage) and ride-on movers. The facility will include pallet stretch wrap machines, which are standard for most warehousing activities of this nature.

5 Hazard Identification

The quantities of dangerous goods that will be stored in Warehouse B1 are listed in Table 4.1 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.

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 5.1 Hazard Identification

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
1	Storage of 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. Bunding of the aerosol storage area. Spill kits.
2	Storage of Aerosols	Fire in the warehouse	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 B1.	Smoke generated in a building affecting operating personnel. Heat radiation projects off-site. Smoke generated and smoke plume affects adjacent residential area. Aerosol cans projecting 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 FRNSW. 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 Acidic Solids	Release of contents of packages	Release of packages contents through damaged packages in transportation to and from storage. Collision with forklift and damage to packages.	Inhalation of material, or skin contact with site personnel. Release into the environment of material contained within the package. Reactions with incompatible chemicals	Material is a solid and does not pool on release. Training of personnel. Emergency Response Plan. PPE supplied for personnel. Bunding of the aerosol storage area. Spill kits. Separation from incompatible chemicals
4	Storage of Acidic Solids	Fire in warehouse	Release of contents of package through fire commencing packages or escalation of other fire event.	Contamination of fire-fighting water and short term biophysical damage. Reactions with incompatible chemicals	First Aid Fire Fighting ESFR Sprinkler System installed in general warehouse. Household products that do not have flammable contents. Simple inorganic chemicals unlikely to have long-term effects on the environment Separate bunding for acids and alkalis. Hardstand containment tank. Training of personnel. Emergency Response Plan. Spill kits.
5	Storage of Acidic Liquids	Release of contents of package	Release of packages contents through damaged packages in transportation to and from storage. Collision with forklift and damage to packages.	Inhalation of material, or skin contact with site personnel. Release into the environment of liquid material contained within the package. Reactions with incompatible chemicals.	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Bunding of the acidic solids storage area. Spill kits. Separation from incompatible chemicals.

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
6	Storage of Acidic Liquids	Fire in warehouse	Release of contents of package through fire commencing packages or escalation of other fire event.	Contamination of fire-fighting water and short-term biophysical damage. Reactions with incompatible chemicals.	First Aid Fire Fighting ESFR Sprinkler System installed in general warehouse. Household products that do not have flammable contents. Simple inorganic chemicals unlikely to have long-term effects on the environment Separate bunding for acids and alkalis. Hardstand containment tank. Training of personnel. Emergency Response Plan. Spill kits.
7	Storage of Alkali Liquids	Release of contents of package	Release of packages contents through damaged packages in transportation to and from storage. Collision with forklift and damage to packages.	Inhalation of material, or skin contact with site personnel. Release into the environment of liquid material contained within the package. Reactions with incompatible chemicals.	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Bunding of the aerosol storage area. Spill kits. Separation from incompatible chemicals
8	Storage of Alkali Liquids	Fire in warehouse	Release of contents of package through fire commencing packages or escalation of other fire event.	Contamination of fire-fighting water and short-term biophysical damage. Reactions with incompatible chemicals.	First Aid Fire Fighting ESFR Sprinkler System installed in general warehouse. Household products that do not have flammable contents. Simple inorganic chemicals unlikely to have long-term effects on the environment Separate bunding for acids and alkalis. Hardstand containment tank. Training of personnel. Emergency Response Plan. Spill kits.

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 in the loading/unloading area	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 FRNSW.

6 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 *DOP&I Multi-Level Risk Assessment Guidelines* (page 13) 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 6.1.

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.

6.1 Risk Criteria

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

Table 6.1 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.

6.2 Qualitative Risk Assessment

The risk assessment undertaken in Table 6.2 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 6.2 Qualitative Risk Assessment

			Consequences						
Hazard ID	**Activity**	**Event**	**Onsite**	**Neighbours**	**Environment**	**Propagation**	**Risk without Controls**	**Controls**	**Risk with Controls**
1	Storage of Aerosols cans	Release of aerosol can contents	Inhalation of materials by operating personnel.	Unlikely to affect to neighbouring 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 Aerosols cans	Fire in storage area	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 FRNSW. Aerosols pallets to be within a caged area as per FM Global Data Sheet 7-31. Hardstand containment. Charging of forklifts to be undertaken remote area. Sprinklers to be provided as per FM 7-31 (NFPA 30B).	**Medium**
3	Storage of Acidic Solids	Release of packaged material contents	Contact with skin and chemical burns. Reaction with incompatible chemicals and release of potentially harmful fumes.	Unlikely to affect to neighbour land uses.	Release into the surrounding environment of inorganic chemicals having short term effect.	Unlikely to propagate into large event.	**Low**	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Bunding of the storage area and warehouse Household products. Spill kits. Separation from incompatible chemicals	**Low**
4	Storage of Acidic Solids	Fire in the warehouse escalating into the storage area	Reaction with incompatible chemicals and release of potentially harmful fumes.	Reaction with incompatible generates fumes unlikely to affect neighbouring land uses.	Firewater contaminated with inorganic chemicals.	Material unlikely to contribute to propagation of event.	**Medium**	First Aid Fire Fighting. ESFR sprinkler System installed in general warehouse. Household products that do not have flammable contents. Simple inorganic chemicals unlikely to have long term effects on the environment. Separate bunding for acids and alkalis. Hardstand containment. Training of personnel. Emergency Response Plan. Spill kits.	**Medium**
5	Storage of Acidic Liquids	Release of packaged material contents	Contact with skin and chemical burns. Reaction with incompatible chemicals and release of potentially harmful fumes.	Unlikely to affect to neighbouring land uses.	Release into the surrounding environment of inorganic chemicals having short term effect.	Unlikely to propagate into large event.	**Low**	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Bunding of the storage area and warehouse Household products. Spill kits. Separation from incompatible chemicals.	**Low**

			Consequences						
Hazard ID	**Activity**	**Event**	**Onsite**	**Neighbours**	**Environment**	**Propagation**	**Risk without Controls**	**Controls**	**Risk with Controls**
6	Storage of Acidic Liquids	Fire in the warehouse escalating into the storage area	Reaction with incompatible chemicals and release of potentially harmful fumes.	Reaction with incompatible generates fumes unlikely to affect neighbouring land uses.	Firewater contaminated with inorganic chemicals.	Material unlikely to contribute to propagation of even.	**Medium**	First Aid Fire Fighting. ESFR sprinkler system installed in general warehouse. Household products that do not have flammable contents. Simple inorganic chemicals unlikely to have long term effects on the environment. Separate bunding for acids and alkalis. Hardstand containment. Training of personnel. Emergency Response Plan. Spill kits.	**Medium**
7	Storage of Alkali Liquids	Release of packaged material contents	Contact with skin and chemical burns. Reaction with incompatible chemicals and release of potentially harmful fumes.	Unlikely to affect to neighbour land uses.	Release into the surrounding environment of inorganic chemicals having short-term effect.	Unlikely to propagate into large event.	**Low**	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Bunding of the storage area and warehouse Household products. Spill kits. Separation from incompatible chemicals	**Low**
8	Storage of Alkali Liquids	Fire in the warehouse escalating into the storage area	Reaction with incompatible chemicals and release of potentially harmful fumes.	Reaction with incompatible generates fumes unlikely to affect neighbouring land uses.	Firewater contaminated with inorganic chemicals.	Material unlikely to contribute to propagation of event.	**Medium**	First Aid Fire Fighting. ESFR sprinkler System installed in general warehouse. Household products that do not have flammable contents. Simple inorganic chemicals unlikely to have long term effects on the environment. Separate bunding for acids and alkalis. Hardstand containment. Training of personnel. Emergency Response Plan. Spill kits.	**Medium**
9	Unloading and Loading operations	Release of 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 into a larger event.	**Medium**	Training of personnel. Emergency Response Plan. PPE supplied for personnel. Hardstand 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**

6.3 Risk Screening

The risk assessment undertaken in Section 6.2 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 Aerosol storage;
- Fire in the general storage of the Warehouse B1;
- Containment of potentially contaminated fire-fighting water; and
- Escalation into a full warehouse fire, through the propagation of other fire events.

The storage of Class 8 materials is described by the DOP&I, Multi-level Risk Assessment Page 12. This states:

"***Dangerous Goods Classes 6.2-8***

> *These classes cover infectious, radioactive and corrosive substances to which the risk classification and prioritisation technique does not apply. Their storage and handling are generally either covered by stringent standards and codes (radioactive substances) or have limited potential for off-site harm (corrosive and infectious substances), provided appropriate technical and management controls are observed. Consequently, a qualitative analysis, which includes a demonstration of compliance with all relevant standards and codes, should normally suffice. In particular, adequate measures to protect the biophysical environment should be clearly demonstrated."*

The storage of Class 8 material within the Warehouse B1 will be undertaken in accordance with AS 3780 The Storage and Handling of Corrosive Substances. The products are also inorganic chemicals and in concentrations suitable for household use. The materials are unlikely to contribute to the individual risks for surrounding land uses, and no further quantification for individual risk is undertaken.

7 Consequence Analysis

This section contains analysis of the potential consequences for Warehouse B1 that were identified in Section 6 as requiring further analysis.

7.1 Fire in Aerosol Storage Warehouse B1

The potential consequences for a fire in Warehouse B1 will include the following:

1) Radiant Heat from a fire within the caged storage area of the aerosol storage; and
2) Potential unreacted chemicals within a smoke plume.

7.1.1 Radiant Heat from Aerosol Fire Warehouse B1

The consequences of a fire within the aerosol storage could result in the overheating and pressurisation of the aerosol storage cans. The aerosol undergoes 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;
- Producing a fireball approximately one (1) metre in diameter; and
- Projecting a stream of burning liquid up to two (2) metres to produce burning pools of liquid.

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 heat radiation level are described in Table 7.1

Table 7.1 Heat Radiation Levels Aerosol Can 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

Further details are shown in Appendix C. As Figure 7.1 reveals, the heat radiation does not extend to residential land uses.

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

Figure 7.1 Radiant Heat Effects (Aerosol Fires)

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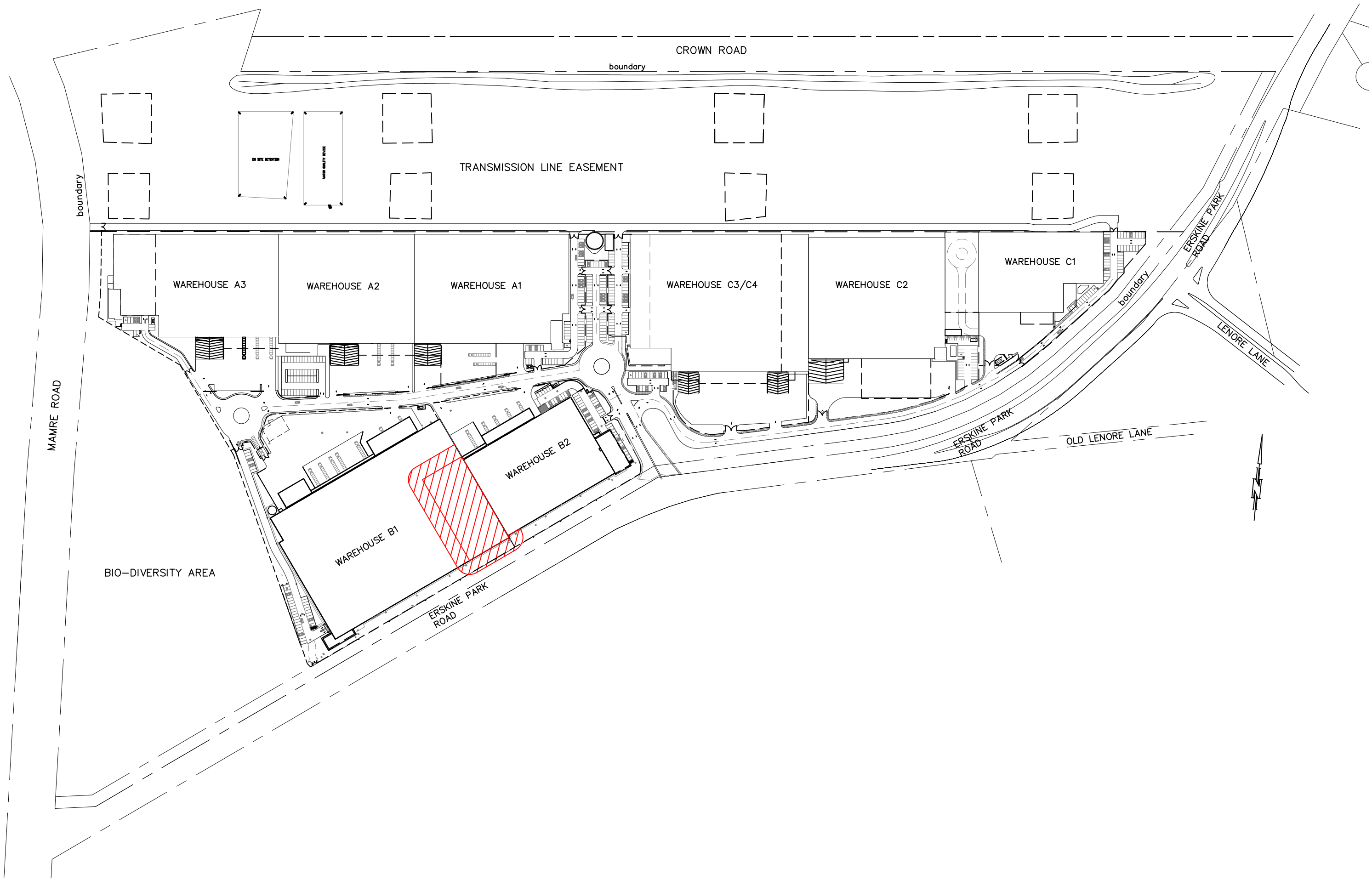
See Next Page Drawing No. 11031-HAZ-LAY-FIG71



DRAWING No.	TITLE	No.		DRN	DATE	CHK	DATE	ENG	DATE
		B	NOTES REVISED	DJT	13/09/2011	JGM	13/09/2011	JGM	13/09/2011
		A	FOR ASSESSMENT	DJT	05/09/2011				

REFERENCE DRAWINGS

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SIGNED APPROVAL		
ENG	JGM	
DRN	DJT	05/09/11
CHK	JGM	
APP		

DRAWING SIZE: A1

RADIANT HEAT LEVEL GREATER THAN 4.7 kW/sq m AEROSOL FIRE WAREHOUSE B1

SCALE	DRAWING NUMBER	REV
1:1500	11031-HAZ-LAY-FIG 71	B

7.1.2 Smoke from Aerosol Fire

The products identified as being stored in the aerosol storage 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 is 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 13ppm 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 of 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 was used to assess this.

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 40ppm 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. This low concentration being consistent with the material being suitable for retail sale to the general community.

7.2 Fire in General Storage Area Warehouse B1

Fire in general storage 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 Section C.4. The results are shown in Table 7.2. The radiant heat levels are shown Table 7.2.

Table 7.2 Radiant Heat from General Storage 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

7.3 Fire in Entirety of Warehouse B1

A fire event involving the entirety of the Warehouse B1 has been used by summation of the events described throughout this section. For the assessment of the fire within the front section of the warehouse, a steady state heat generation of 30 MW has been applied. This is shown in Figure 7.3.

Figure 7.2 Radiant Heat Effects (General Storage)

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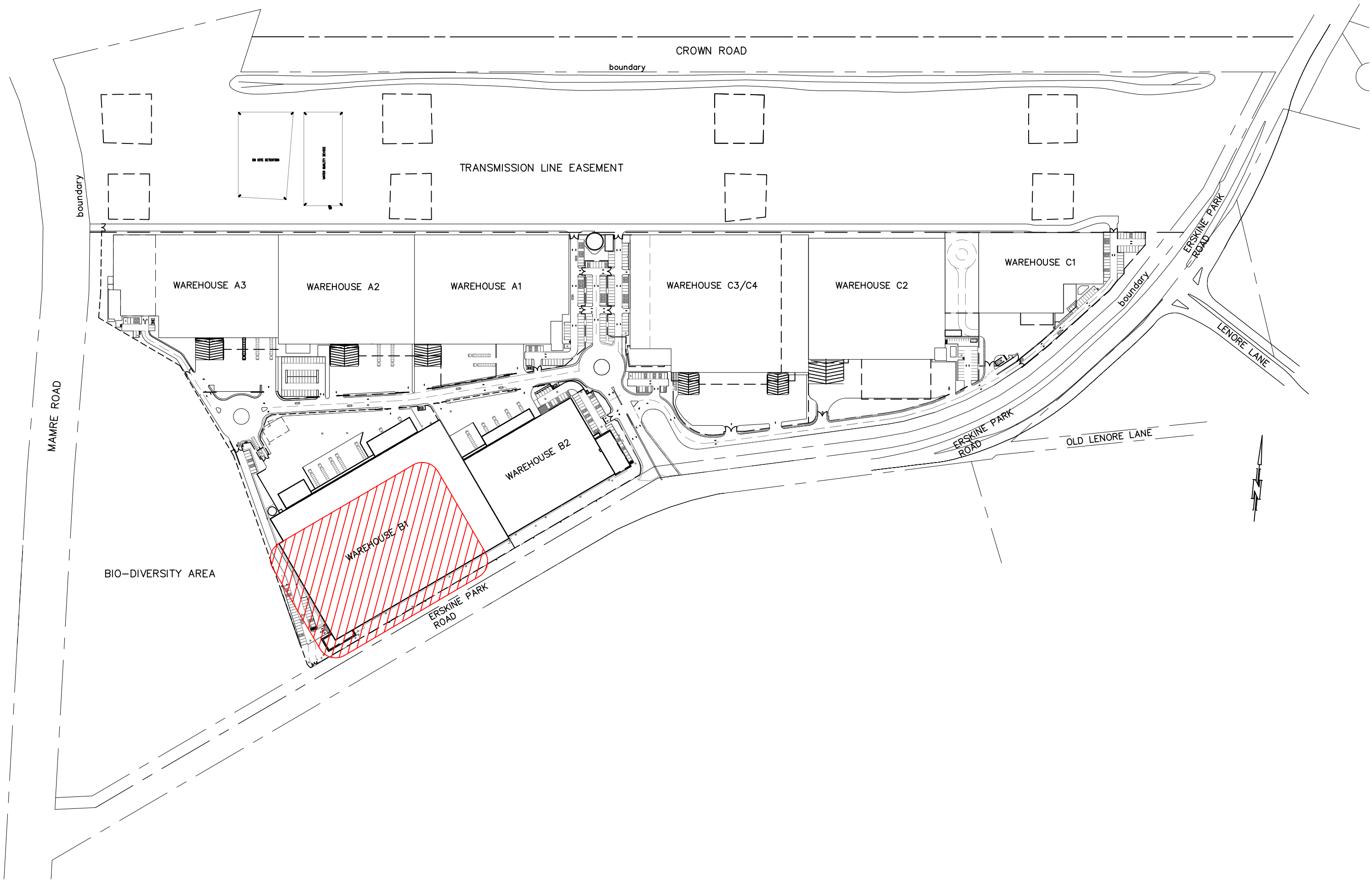
See Next Page Drawing No. 11031-HAZ-LAY-FIG72



DRAWING No.	TITLE	No.		DRN	DATE	CHK	DATE	ENG	DATE
		B	NOTES REVISED	DJT	13/09/2011	JGM	13/09/2011	JGM	13/09/2011
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APP		

DRAWING SIZE: A1

RADIANT HEAT LEVEL GREATER THAN 4.7 kW/sq m GENERAL STORAGE FIRE WAREHOUSE B1

SCALE	DRAWING NUMBER	REV
1:1500	11031-HAZ-LAY-FIG 72	B

Figure 7.3 Radiant Heat Effects (Warehouse Fire Total)

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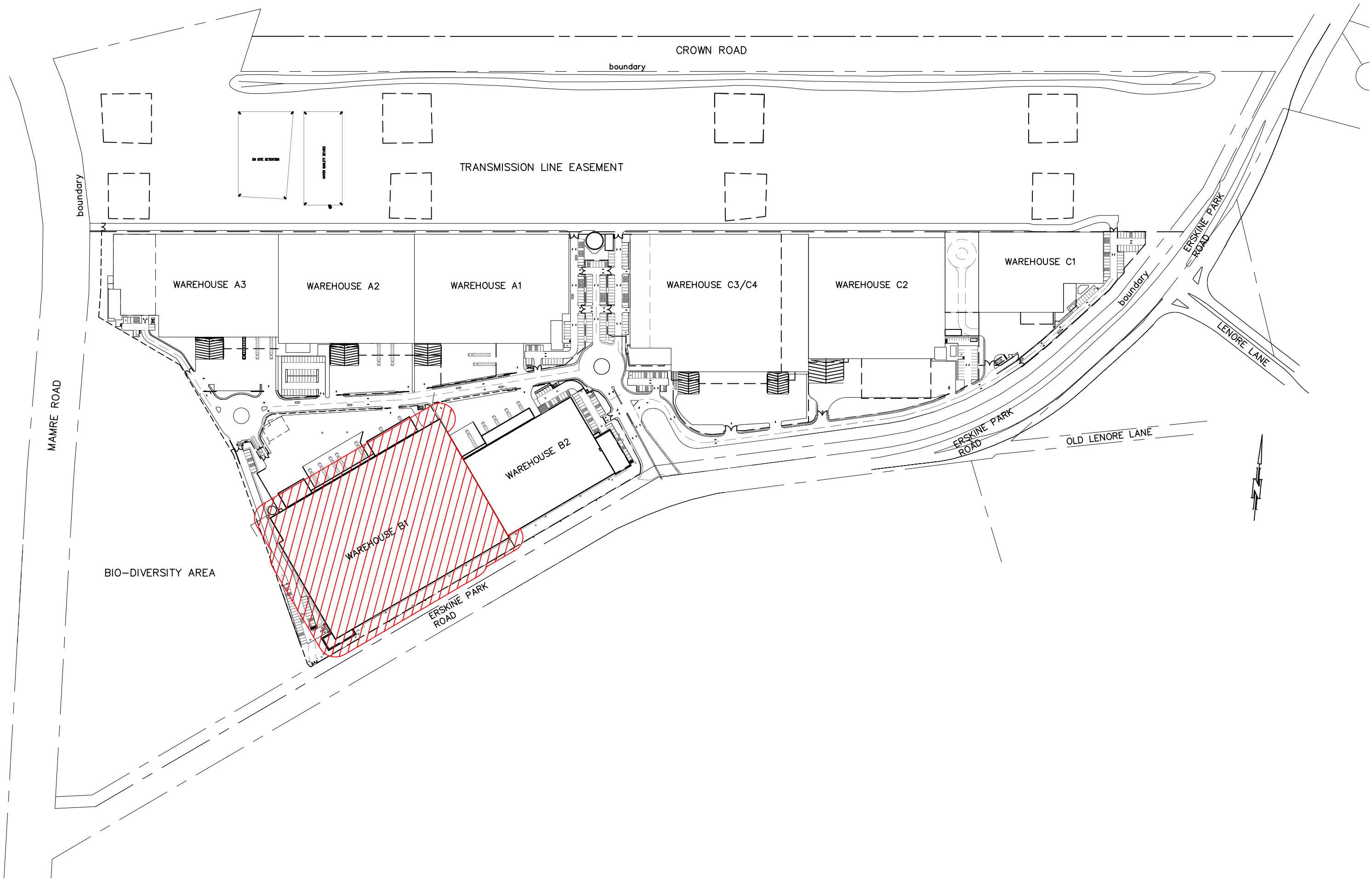
See Next Page Drawing No. 11031-HAZ-LAY-FIG73



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		B	NOTES REVISED	DJT	13/09/2011	JGM	13/09/2011	JGM	13/09/2011
		A	FOR ASSESSMENT	DJT	05/09/2011				

REFERENCE DRAWINGS

DRAWING REVISIONS

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DRAWING SIZE: A1

RADIANT HEAT LEVEL GREATER THAN 4.7 kW/sq m FULL WAREHOUSE FIRE WAREHOUSE B1

SCALE	DRAWING NUMBER	REV
1:1500	11031-HAZ-LAY-FIG 73	B

7.4 Consequences from Surrounding Warehouses

The consequences for surrounding Warehouse A1, Warehouse A2 and Warehouse C3/C4 have been drawn from previous PHAs produced for these individual warehouses. The major events for each of these warehouses is presented in Table 7.3. Quantification of these events is described in Appendix D.

Table 7.3 Consequences from Surrounding Warehouses

Event	Consequences
Warehouse A1	
Flammable Liquid Pool Fire	Radiant Heat
Fire in the Warehouse	Radiant Heat
Smoke from a Fire Event	Smoke and potential toxic constituents
Warehouse A2	
Fire in Aerosol Storage	Radiant Heat
Smoke from Fire in Aerosol Storage	Smoke and potential toxic constituents
Flammable Liquid Pool Fire	Radiant Heat
Smoke from Flammable Liquid Pool Fire	Smoke and potential toxic constituents
Fire in Temperature-controlled area	Radiant Heat
Warehouse C3/C4	
Fire in FGS of Warehouse C3/C4	Radiant Heat Smoke and potential toxic constituents
Fire in Resins, Polymer Elastomers or Plastic of Warehouse C3/C4	Radiant Heat Smoke and potential toxic constituents
Fire in FGS involving Class 6.1 Material of Warehouse C3/C4	Radiant Heat Smoke and potential toxic constituents
Fire in GSS involving Class 9 Material of Warehouse C3/C4	Radiant Heat Smoke and potential toxic constituents

7.5 Containment of Spills or Contaminated Fire Fighting Water

The spillage of a dangerous goods may result in material being released into the environment that could damage that environment. The containment of spill and potentially contaminated fire-fighting water for Warehouse B1 are described in this section.

7.5.1 Consequences of Spills

The dangerous goods to be stored in Warehouse B1 are aerosol, acids and alkalis. Aerosols contain materials used for household use and contain low concentrations of pesticides or cleaning agents. These products are unlikely to accumulate to a level where a significant spill could be released.

The acids and alkalis are predominantly inorganic and in lower concentrations consistent with household use. These chemicals would alter the pH of any aquatic environment. This effect would be short-term and they are very unlikely to have an accumulating effect in the environment.

7.5.2 Consequences of Contaminated Fire Fighting Water

A fire event in Warehouse B1 could result in the contamination of the fire-fighting water. The ingredients within aerosol cans could be released into the water. The ingredients of the aerosol cans may have an impact on the surrounding environment. The ingredients, typically have short half-lives, being consistent with household products, and are unlikely to accumulate in the environment. The aerosol ingredients would have a relatively short-term impact.

The acids and alkalis are predominantly inorganic and in lower concentrations consistent with household use. These chemicals would alter the pH of fire-fighting water. This effect would be short-term and they are very unlikely to have an accumulating effect in the environment.

7.5.3 Summary of Spills or Contaminated Fire Fighting Water Containment

The spill and potential fire-fighting water releases are examined in Table 7.4 against potential environmental hazards.

Table 7.4 Potential Environmental Consequences

Environmental Hazard	Potential Consequences
Fire in Aerosols	Sprinklers and firewater applied to fire generate contaminated fire-fighting water that could damage the environment
Spill of Class 8	Effects on waterways and other environmental impacts.
Fire in General Racked Storage	Sprinklers and firewater applied to fire generate contaminated fire-fighting water that could damage the environment.
Fire in Loading and Unloading Area	Firewater applied generating contaminated fire-fighting water that could damage the environment.

7.5.4 Spills or Fire Fighting Containment (Controls)

The controls for Warehouse B1 for the containment of spills or fire-fighting are:

- Internal bunding of 435,000 litres, as 180,000 litres for aerosol storage area and 255,000 litres for general racked storage;
- Recessed Dock containment of 840,000 litres;
- Hardstand interceptor of 500,000 litres; and
- Valves for isolating stormwater runoff.

These controls are examined against the potential environmental hazards in Table 7.5.

Table 7.5 Review of Containment of Spills or Contaminated Fire Fighting Water

Environmental Hazard	Control
Release Aerosols	180,000 litres bunded area separate to the general warehouse.
Fire in Aerosols	180,000 litres bunded area separate to the general warehouse. Capable of containing 30 minutes of sprinkler water.
Spill of Class 8 Acid	Part of 255,000 litres divided from the Class 8 Alkalis. Capable of containing at least 20 minutes of ESFR sprinkler application.
Spill of Class 8 Alkalis	Part of 255,000 litres divided from the Class 8 Acid. Capable of containing at least 20 minutes of ESFR sprinkler application.
Fire in General Racked Storage	255,000 litres as described above with overflow to recessed dock area. The recessed dock to have a capacity of 840,000 litres.
Fire in Loading and Unloading Area	The recessed dock to have a capacity of 840,000 litres. The hardstand area to have an additional 500,000 litres containment.
Large warehouse fire	Internal bunding of 435,000 litres; Recessed Dock of 840,000 litres; Hardstand interceptor of 500,000 litres; and Valves for isolating stormwater runoff from the site.

8 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 6 the following potentially hazardous incidents were identified that required further quantification of the risks:

- Fire in the Class aerosol storage;
- Fire in the general storage area of the Warehouse B1; and
- Escalation into a full warehouse fire, through the propagation of other fire events.

8.1 Frequency Controls

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

- Malfunctioning forklift trucks;
- Truck fires;
- Spillage of incompatible chemicals; and
- Storage of unstable compounds near to steam pipes and other similar sources of heat.

The operations at Warehouse B1 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 8.1.

Table 8.1 Control of Ignition Sources

Ignition Source	Control
Smoking	No smoking policy for the warehouse.
Vehicle Fire	Vehicles will not unload inside the warehouse; extinguishers available in the unloading area.
Forklifts	Forklifts suitable for Zone 2 will be used within the aerosol storage cage.
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.
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 aerosol storage area of the warehouse. The charging area has been allocated an area within the general storage area.

The Warehouse B1 will also have protection provided in the event of a fire. These protection methods are shown in Table 8.2.

Table 8.2 Fire Protection Methods in B1 Warehouse

Protection	Description
Sprinkler System	The aerosols will be protected by a sprinkler system designed to FM Global Standards. The remainder of the warehouse area will be protected by a ESFR sprinkler system.
Fire Fighting Arrangements	There will be staff training in the use of first aid fire-fighting equipment; and first aid fire-fighting will be available within the warehouse.
Firewalls	4-hour firewall (both ways) will be installed between Warehouse B1 and Warehouse B2.

8.2 Frequency of Fire and Smoke Events Warehouse B1

The effects of the Warehouse B1that could potentially affect surrounding land uses were examined in Section 6. In this section the frequency of these events, associated with Warehouse B1 will be evaluated.

8.2.1 Frequency of Aerosol Fires

The consequences of a fire in the aerosol storage area were examined in Section 7 . A fire in the aerosol storage could result in a fireball and the potential release of radiant heat energy. The frequency of the fire event involving the aerosol cans and producing heat radiation is examined in Appendix E, using an event tree. It was found that the frequency of a fire event was 40.6 x 10^{-6} p.a. This is a fire involving the entire area of the aerosol storage.

8.2.2 Frequency of Aerosol Fires Smoke Events

As discussed in Section 6, the consequences of fire in the aerosol storage area could result in the release of smoke containing unreacted chemicals in the smoke plume. The frequency of the fire event involving the aerosol cans and producing a smoke event is examined in Appendix E, using an event tree. It was found that the frequency of a fire event was 40.6 x 10^{-6} p.a. 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 unreacted 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 8.3 Smoke Plume containing Un-reacted Chemicals (Aerosols)

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.	0.28x10^{-6} p.a.	North
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.	0.43 x 10^{-6} p.a.	North North West

8.2.3 Fire in General Storage Racking

The general storage racking will contain acidic solids, acidic liquids and alkali liquids. The fire frequency for this general racked storage is described in Table 8.4.

Table 8.4 Frequency of Events from General Storage Racked

Frequency Description	Discussion	Frequency
Fire involving the some contents of the general storage area.	Sprinkler controls or early manual intervention.	486.1 x 10^{-6} p.a.
Fire event covering several thousand square metres but controlled within the warehouse.	Late control but restricted within the general storage racking.	13.2 x 10^{-6} p.a.
Fire event producing entire warehouse fire event.	Events described as total warehouse fire.	0.69x 10^{-6} p.a.

8.2.4 Large Warehouse Fire for Warehouse B1

A fire event frequency for a fire involving the entire contents of the Warehouse B1 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 B1 is 1.5 x 10^{-6} p.a.

8.2.5 Fire Propagation to Other Warehouses

The propagation from Warehouse B1 to adjacent Warehouse B2 was estimated from the events trees presented in Appendix E. It was found that the frequency of fire event propagating from Warehouse B1 to adjacent Warehouse B2 is 0.03 x 10^{-6} p.a.

8.3 Cumulative Frequency for Site

8.3.1 Fire Events

The fire events associated with activities undertaken in WestPark are presented in Appendix D. The fire events associated with Warehouse B1 are unlikely to affect present the activities being undertaken. The radiant heat from a fire event in Warehouse B1 will not have consequences that impact on Building A or on Building C. It is unlikely that the propagation from Warehouse B1 to other buildings (Building A and Building C) would occur. Likewise, propagation from fire events if Building A or Building C are unlikely to propagate into Warehouse B1.

8.3.2 Smoke Events

The smoke event associated with activities undertaken in WestPark are presented in Appendix D. These events have a cumulative frequency effect on surrounding land uses. The maximum frequency level, by combination with events from Warehouse B1 are shown in Table 8.5.

Table 8.5 Seriously Injurious or Irritation Cumulative Maximums (WestPark)

Assessment Description	Frequency Maximum
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.	The maximum frequency of 3.36×10^{-6} p.a. with a wind direction from the North
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.	The maximum frequency of 5.26×10^{-6} p.a. with the wind from the North North West. (Site maximum 9.07×10^{-6} p.a. remains unaltered as established in the PHA for Warehouse A2).

9 Risk Assessment

The risk assessment for Warehouse B1 and for the cumulative risks for WestPark are examined in this section.

9.1 Individual Risk Assessment for Warehouse B1

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

Table 9.1 DOP&I Risk Criteria

Description/Risk Criteria	Criteria
Fatality risk to sensitive uses, including hospitals, schools, aged care	0.5 x 10^{-6} per year
Fatality risk to residential and hotels	1 x 10^{-6} per year
Fatality risk to commercial areas, including offices, retail centres and entertainment centres	5 x 10^{-6} per year
Fatality risk to sporting complexes and active open spaces	10 x 10^{-6} per year
Fatality risk contained to within the boundary of an industrial site	50 x 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 x 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 x 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 x 10^{-6} per year
Propagation due to Fire and Explosion – exceed radiant heat levels of 23 kW/m^2 or explosion overpressures of 14kPa in adjacent industrial facilities	50 x 10^{-6} per year

This report presents an individual risk level for 0.5 x10^{-6} p.a. and is shown in Figure 9.1. 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&I Criteria, then the criteria has been met.

The DOP&I 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 B1 development. As revealed by Table 9.2 the risks for proposed development, being Warehouse B1, at WestPark do not exceed the DOP&I criteria for Land Use Safety Planning.

The risks associated with Warehouse B1 present in Figure 9.1. As Figure 9.1 reveals, the risk level of 0.5 x10^{-6} do not contain adjacent land uses where 0.5 x 10^{-6} p.a. is the criteria level for risk.

Figure 9.1 Risk Contour 0.5 x 10^{-6} (Warehouse B1)

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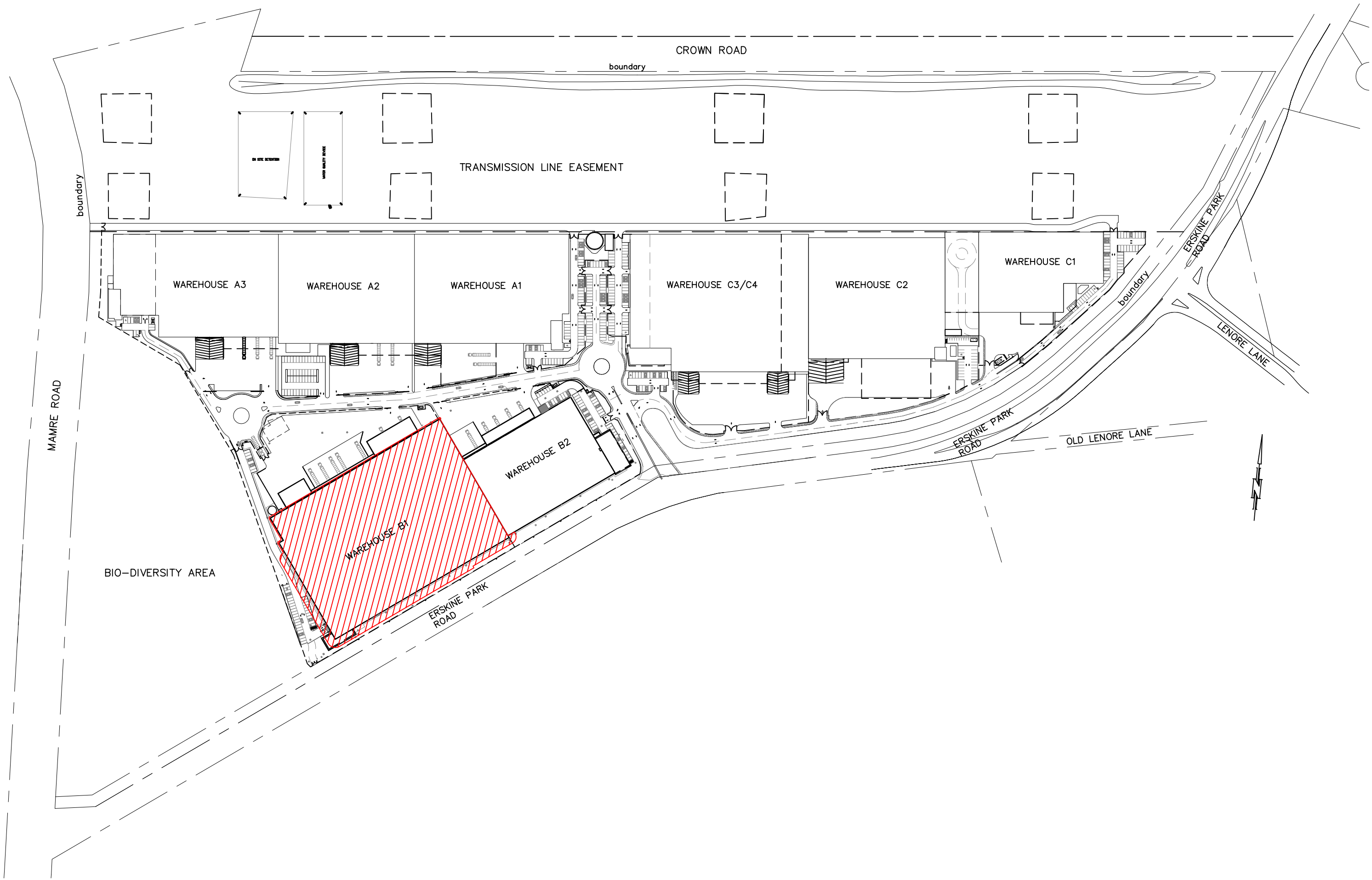
See Next Page Drawing No. 11031-HAZ-LAY-FIG91



		B	NOTES REVISED	DJT	13/09/2011	JGM	13/09/2011	JGM	13/09/2011
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DRAWING SIZE: A1

INDIVIDUAL RISK LEVEL EQUAL TO OR GREATER THAN 0.5 PER MILLION YEARS WAREHOUSE B1 WESTPARK INDUSTRIAL ESTATE

SCALE	DRAWING NUMBER	REV
1:1500	11031-HAZ-LAY-FIG 91	B

9.2 Comparison with DOP&I Criteria for Warehouse B1

A comparison with the criteria described in the HIPAP No.4 for the Warehouse B1 is made in Table 9.2.

Table 9.2 DOP&I Risk Criteria for Proposed Activities (Warehouse B1)

Description/Risk Criteria	Criteria	Results	Risk Criteria
Fatality risk to sensitive uses, including hospitals, schools, aged care	0.5 x 10^{-6} per year	The risks from Warehouse B1 are shown in Figure 9.1 and do not exceed the site boundaries.	**YES**
Fatality risk to residential areas and hotels	1 x 10^{-6} per year	The risks from Warehouse B1 are shown in Figure 9.1 and do 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 B1 are shown in Figure 9.1 and do 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 are shown in Figure 9.1 and do 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 B1 are shown in Figure 9.1 and do 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 4.7kWm^{-2} and overpressure of 7kPa 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 from the North at a frequency of 0.28x10^{-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 from the North North West at 0.43 x 10^{-6} p.a.	**YES**
Propagation due to Fire and Explosion exceed radiant heat levels of 23kW/m^2 or explosion overpressures of 14kPa in adjacent industrial facilities	50 x 10^{-6} per year	The propagation of fire events were effectively controlled by firewalls and separation from Building A and Building C.	**YES**

9.3 Risk Evaluation of Cumulative Activities

There are other warehouses at WestPark storing dangerous goods that could have potential off-site effects. In Appendix D the consequences of potentially hazardous incidents associated with the storage of dangerous goods at Warehouse A1, Warehouse A2 and Warehouse C3/C4 were examined. The risks of the storage of dangerous goods at Warehouse A1, Warehouse A2 and Warehouse C3/C4 have been combined with the risks associated with storage of dangerous goods at Warehouse B1 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 9.2. 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&I Criteria, then the criteria has been met.

The risks associated with cumulative risk associated with all on site activities are present in Figure 9.2. As this figure reveals the risk level of 0.5 $x10^{-6}$ p.a. is contained within the site boundaries of the WestPark site. These risks have been compared to the DOP&I criteria for Land Use Safety Planning in Table 9.3. As revealed by Table 9.3, the cumulative risks for all activities storing dangerous goods at WestPark do not exceed the DOP&I criteria for Land Use Safety Planning.

The cumulative effect of potential smoke events containing unreacted chemicals increased for land uses to the south. The location of the Warehouse B1 is at the most southerly side of WestPark. This increase does not increase the frequencies above the criteria established in HIPAP No.4. Warehouse B1 is located 300 metres from residential areas in the north and the risks to this land uses does not increase significantly by the proposed storage of dangerous goods in Warehouse B1.

Figure 9.2 Risk Contour 0.5 x 10^{-6} (WestPark)

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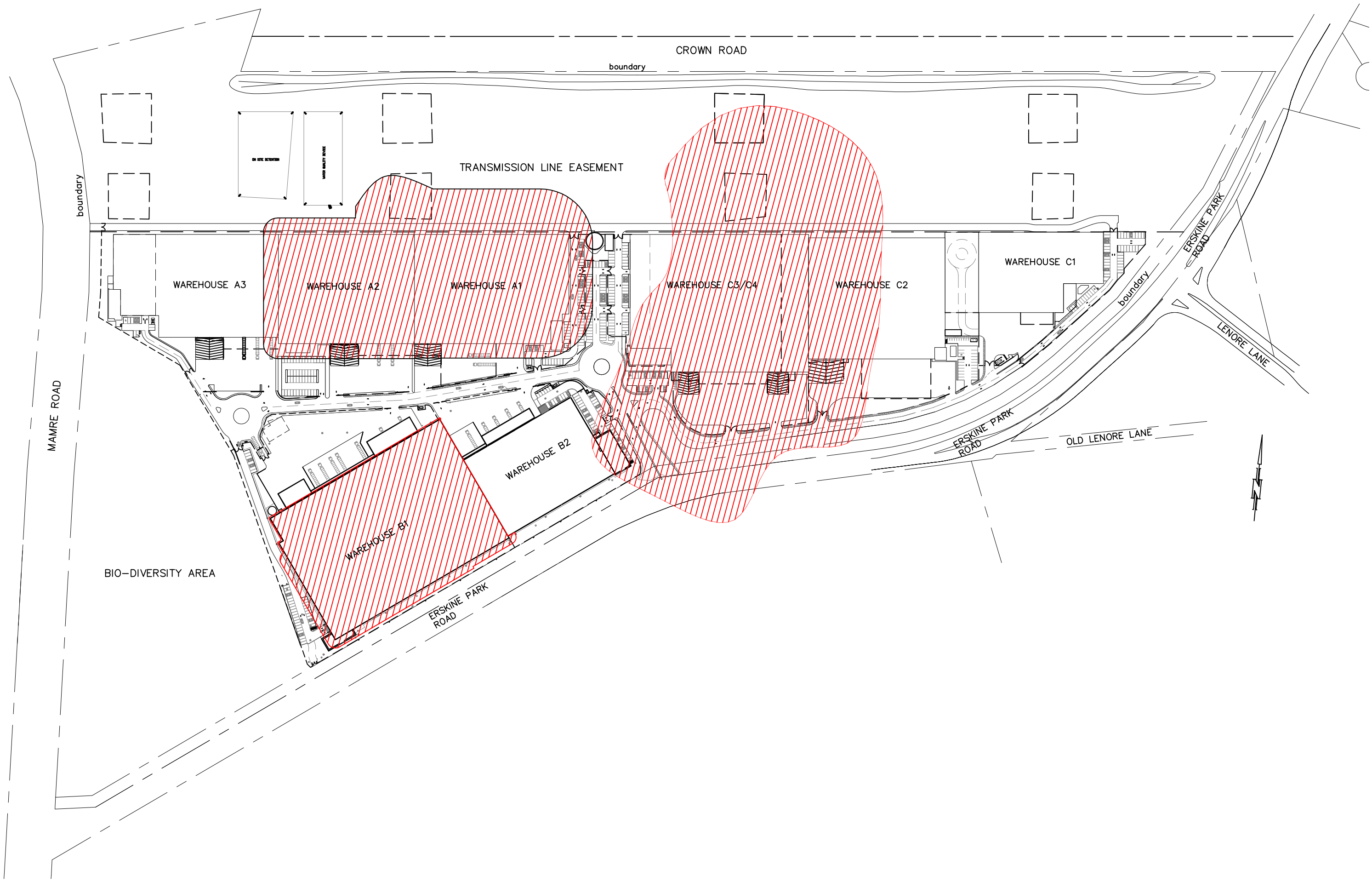
See Next Page Drawing No. 11031-HAZ-LAY-FIG92



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DRN	DJT	05/09/11
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DRAWING SIZE: A1

INDIVIDUAL RISK LEVEL EQUAL TO OR GREATER THAN 0.5 PER MILLION YEARS TOTAL SITE WESTPARK INDUSTRIAL ESTATE

SCALE	DRAWING NUMBER	REV
1:1500	11031-HAZ-LAY-FIG 92	B

9.4 Comparison with DOP&I Criteria for Combined Warehouses

A comparison with the criteria described in the HIPAP No.4 for the Warehouse B1 is made in Table 9.3.

Table 9.3 DOP&I Risk Criteria for Proposed Activity and Existing Activities (WestPark)

Description/Risk Criteria	Criteria	Results	Risk Criteria
Fatality risk to sensitive uses, including hospitals, schools, aged care	0.5 x 10^{-6} per year	As shown by Figure 9.2 the fatality risk of 0.5 x 10^{-6} p.a. does not occur on sensitive land uses.	**YES**
Fatality risk to residential areas and hotels	1 x 10^{-6} per year	As shown by Figure 9.2 the fatality risk of 1 x 10^{-6} p.a. does not occur on residential land uses.	**YES**
Fatality risk to commercial areas, including offices, retail centres and entertainment centres	5 x 10^{-6} per year	As shown by Figure 9.2 the fatality risk of 5 x 10^{-6} p.a. does not occur on residential land uses.	**YES**
Fatality risk to sporting complexes and active open spaces	10 x 10^{-6} per year	As shown by Figure 9.2 the fatality risk of 10 x 10^{-6} p.a. does not occur on residential land uses.	**YES**
Fatality risk contained to within the boundary of an industrial site	50 x 10^{-6} per year	As shown by Figure 9.2 the fatality risk of 50 x 10^{-6} p.a. does within the boundary of the industrial 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 4.7kWm^{-2} and overpressure of 7kPa 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 combined toxic was found to be 3.36 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 5.26 x 10^{-6} p.a. (site maximum 9.07 x 10^{-6} p.a. remains unaltered for residential properties to the north of WestPark)	**YES**
Propagation due to Fire and Explosion–exceed radiant heat levels of 23kW/m^2 or explosion overpressures of 14kPa in adjacent industrial facilities	50 x 10^{-6} per year	The propagation of fire events were effectively controlled by firewalls and large separation distances to other warehouse.	**YES**

9.5 Risk to the Biophysical Environment

Some materials handled at Warehouse B1 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.

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

9.5.1 Release of Aerosols Contents

Aerosols contain materials used for household use and contain low concentrations of pesticides or cleaning agents. These products are unlikely to accumulate to a level where a significant spill would be released. The warehouse will contain over 180,000 litres of material in the aerosols bunded area and any spill is unlikely to reach the surrounding environment.

9.5.2 Release of Acids/Alkalis Spills

The acids and alkalis are predominantly inorganic and in lower concentrations, consistent with household use. These chemicals would alter the pH of any aquatic environment. This effect would be short-term and they are very unlikely to have an accumulating effect in the environment. The warehouse will contain over 255,000 litres of material in the general warehouse and any spill is unlikely to reach the surrounding environment.

9.5.3 Unloading/Loading Operations

There is the potential for a release of material from unloading and loading operations. As described in Section 9.5.1 and Section 9.5.2 the spill events are unlikely to have long-term effects on the environment. The recessed loading dock will contain over 845,000 litres of material and any spill in unloading activity is unlikely to reach the surrounding environment.

9.5.4 Release of Contaminated Fire Fighting Water

A fire event in Warehouse B1 could result in the contamination of the fire-fighting water. The ingredients within an aerosol can could be released into the water. The ingredients of the aerosol cans may have an impact on the surrounding environment. The ingredients of aerosols, inorganic acids and alkalis, typically have short half-lives, being consistent with household products and are unlikely to accumulate in the environment. The aerosol ingredients would have a relatively short-term impact.

In Appendix K the frequency of a potential release of fire-fighting water into the surrounding biophysical environment was examined. The frequency was found to be 0.7×10^{-6} p.a. This is a very low event frequency and does not significantly increase the risk to the surrounding biophysical environment.

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Appendix A Risk in Context

A.1 Introduction

The following tables are published in HIPAP No.4 and 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 Risks to Individuals in NSW

	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

A.3 Heat Radiation

The values of interest for radiant heat as indicated in HIPAP No. 4 are shown Table. A.2.

Table. A.2 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 15-20 seconds and injury after 30 seconds exposure (at least second degree burns will occur)
12.6	• Significant chance of fatality for extended exposure. High chance of injury • Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure • Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
23	• Likely fatality for extended exposure and chance of fatality for instantaneous exposure • Spontaneous ignition of wood after long exposure • Unprotected steel will reach thermal stress temperatures which can cause failure • Pressure vessel needs to be relieved or failure would occur
35	• Cellulosic material will pilot ignite within one minute's exposure • Significant chance of fatality for people exposed instantaneously

Appendix B Hazardous Inventory

B.1 Introduction

This section presents the identification of the dangerous goods[2] to be stored at the Warehouse B1 at WestPark. The materials have been presented according to their UN number.

B.2 Dangerous Goods Inventory

The dangerous goods inventory is presented Table. B.1.

[2] *Dangerous Goods have been identified by their MSDS and through reference to the Australian Transportation of Dangerous Goods Code.*

Table. B.1 Dangerous Goods Inventory

UN Number	Correct Shipping Name	Class	Packing Group	Subsidiary Risk	HAZCHEM Code	Quantity	Units	Other Comments
1950	Aerosols, flammable (each not exceeding 1 L capacity)	2.1	N/A			1,700,000	kg	
1719	Caustic alkali liquid, n.o.s.	8	III		2R	175,500	kg	Density of 1.07 kg/l Volume of 164,020 litres
3260	Corrosive solid, acidic, inorganic, n.o.s.	8	II		2X	101,100	kg	
3264	Corrosive liquid, acidic, inorganic, n.o.s.	8	III		2X	44,700	kg	Density of 1.045 kg/l Volume of 42,775 litres
3266	Corrosive liquid, basic, inorganic, n.o.s.	8	III		2X	814,200	kg	Density of 1.05 kg/l Volume of 775,430 litres

These materials are further grouped based on products that will have no significant interaction if mixed. This shown in Table. B.2.

Table. B.2 Hazardous Inventory (Grouped)

DG Class	Packing Group	Sub-risk	UN Numbers	Group	Maximum Quantity	Units
2.1			UN 1950	Aerosols	1,700,000	kilogram
8	PGII		UN 3260	Acidic Solids	101,100	kilogram
8	PGII		UN 3264	Acidic Liquids	44,700	kilogram
8	PGII		UN 1719 UN 3266	Alkali Liquids	989,700	kilogram

Appendix C Consequence Analysis Warehouse B1

C.1 Introduction

This Appendix describes the assumptions and models developed to assess the consequences of the hazard identified with dangerous goods stored at Warehouse B1.

C.2 Fire in Aerosol Storage Area of the Warehouse B1

A fire event within Warehouse B1 can be associated with the aerosol storage or in the general storage area. The following consequences have been assessed for the Warehouse B1. These include:

- Radiant Heat from an aerosol fire;
- Unreacted product in smoke from an aerosol fire; and
- Radiant heat from a general storage area fire.

These consequences have been assessed in this Appendix. The storage of inorganic acids and alkali materials are unlikely to increase the consequences of a fire above those of a normal warehouse fire.

C.2.1 Radiant Heat from an Aerosol Can Fire

The consequences of fire in the aerosol storage area can include:

- Fireball;
- Projection of a can into other areas; and
- Smoke released containing unreacted 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.3 Smoke Plume Containing Unreached Chemicals from an Aerosol Can Fire

A fire event within the aerosol storage area 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 aerosol storage area is Fly Spray Aerosol. This material contains Bioallethrin. This material has been assumed to be uncombusted 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 uncombusted material within the smoke cloud. For the aerosols cans, it has been assumed that uncombusted 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 Fly Spray Aerosol burns per minute in this initial stage of the fire. The material being released proportional to a burn rate of 400 kg/min of product. This equates to approximately 1 kg/min being consumed into the early stages of a fire. It has been assumed that 20 percent of the Bioallethrin does not combust and is transported in the smoke plume. This results in a release rate of uncombusted Bioallethrin, in the smoke plume of 0.2 kilograms per minute.

C.3.1 Consequence Distances from Aerosol Fire Smoke

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 13ppm of Bioallethrin.

The data for Bioallethrin relates to TWA (8 hours exposure). In a concentration level of three (3) times (i.e. 40ppm) 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

These results are consistent with the materials being stored. All the aerosols are for household products and have small concentrations of pesticides. This limits the potential effects to any surrounding land users.

C.4 Fire in General Storage Area of the Warehouse B1

The fire in the contents in the general storage area of Warehouse B1 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

C.4.1 Radiant Heat from a Fire in General Storage

The radiant heat generated by a heat generation of 40MW is shown in Table. C.3.

Table. C.3 Radiant Heat Levels from General Storage 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 B1

The distance for a full warehouse fire is considered as the largest distance of the radiant heat levels determined in previous sections of this appendices. This level of radiant heat is used in any risk assessment undertaken. Areas for transit storage have been calculated at 30 MW.

Appendix D Consequences from Existing Warehouses

D.1 Introduction

The WestPark site contains a number of other facilities that contain dangerous goods and potentially hazardous materials. Three (3) warehouses are identified as containing dangerous goods and potentially hazardous materials. These warehouses are:

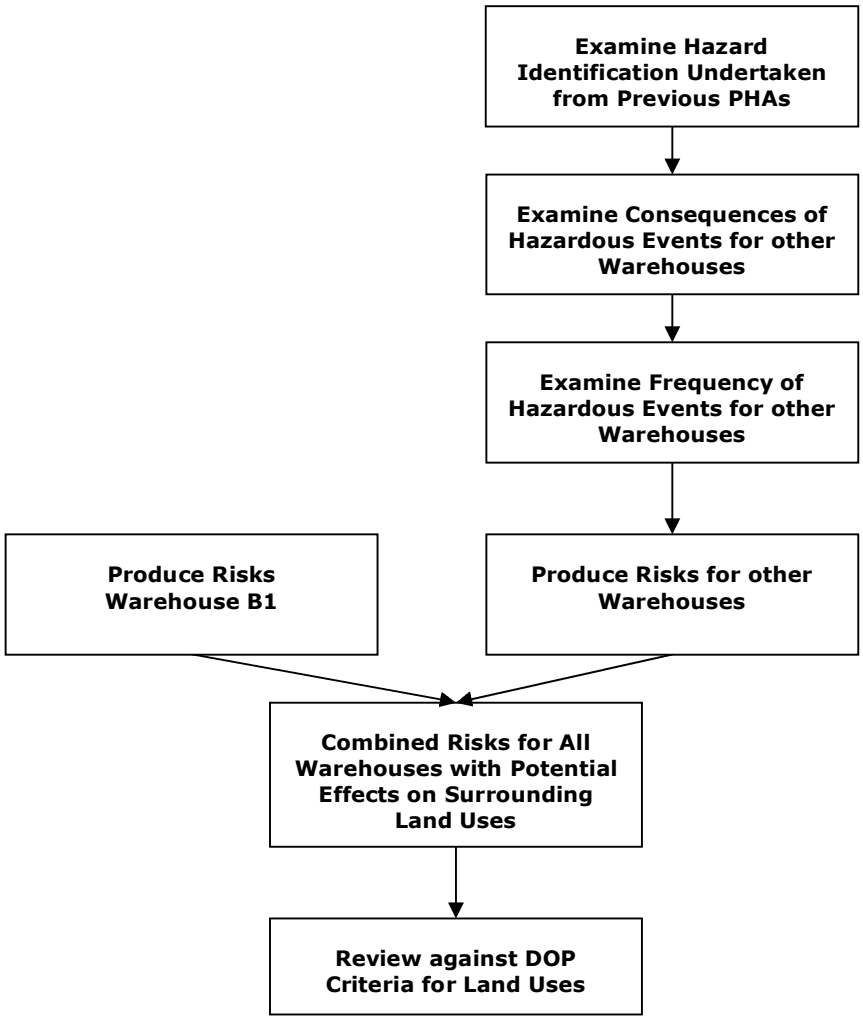
1. Warehouse A1;
2. Warehouse A2; and
3. Warehouse C3/C4.

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 established by the NSW Department of Planning.

D.2 Methodology

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

Figure. D.1 Flowchart for Cumulative Risk for WestPark



D.3 Hazard Identification for Warehouse A1

The hazard identification for Warehouse A1 was undertaken in the PHA for that development. The hazards identification is presented in Table. D.1. The hazards that were identified as having potential off-site consequences were evaluated. This evaluation of the hazards is shown in Appendix D.4.

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.
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.

Hazard ID	Activity and DG Class Area	Event	Causes	Possible Consequences	Controls
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.
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.

D.4 Consequences of Potentially hazardous Events for Warehouse A1

The hazard identification undertaken in Table. D.1 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 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. D.2.

Table. D.2 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.3

Table. D.3 Explosive Overpressures (Warehouse A1)

Radiant Heat Level	Distance to Radiant Heat Level
7kPa	143 metres
14kPa	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.4.

Table. D.4 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 Hazard Identification for Warehouse A2

The hazard identification for Warehouse A2 was undertaken in the PHA for that development. The hazards identification is presented in Table. D.5. The hazards that were identified as having potential off-site consequences were evaluated. This evaluation of the consequences of theses hazards is shown in Appendix D.6.

Table. D.5 Hazard Identification (Warehouse A2)

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 aerosol can rockets 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 FRNSW. 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 FRNSW. 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.
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 FRNSW. 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.

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 FRNSW. ESFR Sprinklers. Separation from other dangerous goods as per AS 3833. Site handling procedures and processes 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 FRNSW. ESFR Sprinklers.

D.6 Consequences of Potentially Hazardous Events for Warehouse A2

The hazard identification undertaken in Appendix D.5 identified potentially hazardous events that may occur with the storage of dangerous goods in Warehouse A2. The potentially hazardous events consequences were examined in Moore Consulting and Engineering, Preliminary Hazard Analysis (Ref 8056-10 PHA 29_R6 110609). 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 A2 were examined qualitatively to determine which potentially hazardous event required further analysis. The events identified as requiring further analysis were:

- 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.

D.6.1 Radiant Heat from a Class 2.1 Storage Fire (Warehouse A2)

The consequences of fire in the Class 2.1 (aerosol) storage area can include:

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

The radiant heat released from an aerosol can has been modelled and the results are shown in Table. D.6.

Table. D.6 Heat Radiation from Fireball from Aerosol Can (Warehouse A2)

	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.

D.6.2 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. An unreacted contents of the can was considered to be contained within the smoke plume. The results are shown in Table. D.7.

Table. D.7 Consequence Distance Class 2.1 Fire (Warehouse A2)

Wind Velocity and Stability Class	Plume Characteristics	Distance to ERPG-3	Distance to ERPG-2
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

D.6.3 Fire in Class 3 Storage Area of the Warehouse A2

A fire can occur in the Class 3 storage area of Warehouse A2. Modelling was undertaken and heat radiation levels were estimated. These are presented in Table. D.8.

Table. D.8 Heat Radiation from Fire in Flammable Storage Area (Warehouse A2)

	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

D.6.4 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. The consequence distances are shown in Table. D.9.

Table. D.9 Consequence Distance to ERPG-2 and ERPG-3 Combustion Products (Warehouse A2)

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	10.0	7.8

D.6.5 Fire in Temperature Controlled Storage Area of the Warehouse A2

The fire in the contents in the Temperature-controlled area of Warehouse A2 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 was used to estimate the distance to heat radiation levels of concern and the results are in Table. D.10.

Table. D.10 Radiant Heat Levels from Temperature Controlled Room Fire (Warehouse A2)

	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.

D.6.6 Summary for Warehouse A2

The potentially hazardous events for Warehouse A2 had their consequences determined for potential effects on surrounding land uses. This is summarised in Table. D.11.

Table. D.11 Summaries of Potentially Hazardous Consequences (Warehouse A2)

Hazardous Event	Consequence Modelled	Effect on Surrounding Land Use
Fire in Class 2.1 Storage Area	Fireball	Radiant heat below 4.7 kWm^{-2} at surrounding land uses.
Fire in Class 2.1 Storage Area	Dispersion of gases	Potential effect on surrounding land uses. Frequency of the event must be established.
Fire in Flammable Storage Area	Pool Fire	Radiant heat below 4.7 kWm^{-2} at surrounding land uses.
Fire in Flammable Storage Area	Dispersion of gases	Potential effect on surrounding land uses. Frequency of the event must be established.
Fire in Temperature Controlled Area	Point Source	Radiant heat below 4.7 kWm^{-2} at surrounding land uses.

D.7 Hazard Identification for Warehouse C3/C4

The hazard identification for Warehouse C3/C4 was undertaken in the PHA for that development. The hazards identification is presented in Table. D.12. The hazards that were identified as having potential off-site consequences were evaluated. This evaluation of the potential hazards is shown in Appendix D.8.

Table. D.12 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 affects 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.
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.

Hazard ID	Activity and DG Class	Event	Causes	Possible Consequences	Controls
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.
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 water 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 FRNSW. 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 uncombusted 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.
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 action. ESFR water sprinkler and fire detection within the general warehouse.

D.8 Consequences of Potentially hazardous Events for Warehouse C3/C4

The hazard identification undertaken in D.7**Error! Reference source not found.** 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 MC&E, 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.8.1 Fire in FGS Warehouse C3/C4

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

Table. D.13 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.8.2 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 a period of 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.8.3 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 uncombusted toxic material. It was assumed that 5 percent 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 causing acute physiological responses to sensitive members of the community TEEL-3. It was found that the uncombusted 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 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 TEEL-2 for cresol had been used. It was found that the uncombusted Class 6.1 material could travel 198 metres to TEEL-2 from the developing fire involving Class 6.1 materials.

D.8.4 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 percent 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 3,532kilograms 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.8.5 Summary of Events Warehouse C3/C4

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.14.

Table. D.14 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	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 of Events for Warehouse B1

E.1 Introduction

This section will examine of the frequency of those hazardous events identified in section 5 and requiring further quantification as determined by Section 6.

E.2 Frequency of Warehouse Fires

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.	1×10^{-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.	4.6×10^{-3} p.a.
Baldwin, Accident Analysis, and Prevention (Vol 6).	1×10^{-3} p.a.
PHA – Intermodal Logistics Centre at Enfield Environmental Impact Statement, QEST Consulting Pty Ltd, 2005.	1×10^{-4} p.a. to 1×10^{-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 the storage of dangerous goods. In consideration of this, a figure of 5×10^{-4} p.a. for a fire initiating in the Warehouse B1 has been used. This represents a conservative figure and has been used in the generation of the frequency of incidents in the Warehouse B1.

E.3 Frequency of Fire Events for Aerosol Storage

The frequency of events in an aerosol 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 Aerosols

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.	0.1	Level 1 Aerosols NFPA 30B.
	0.5	Level 2 Aerosols NFPA 30B.
	0.4	Level 3 Aerosols NFPA 30B.
Activation of Automatic Sprinkler and control	0.98	Level 1 Aerosols have a tendency not to catch fire easily.
	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 easily. Manual intervention is possible.
	0.5	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 7-31 and will most likely contain these small packages.
Escalates in General Warehouse	0.9	The failure of the mechanical means for prevention of escalation means that escalation into general storage is likely.
Fire Controlled by Brigade	0.4	The FRNSW is unlikely to prevent loss of warehouse on escalation into areas.
	0.7	The FRNSW is likely to prevent loss of warehouse without escalation into areas.

Figure. E.1 Frequency Estimation for Fire in Aerosol Storage of Warehouse B1

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Event Tree for Aerosol Fire

Frequency of Fire in Aerosol Section of Warehouse	Fire Develops in which level of aerosol can storage	Extinguished/ Controlled by fire Sprinkler System	Manual Control of small fire	Fire Contained within Aerosol Area by Mechanical Means	Fire escalates in General Warehouse	Fire Controlled by FRNSW within restricted area	Frequency	Description of Result
500 x10^{-6} p.a.	**Level 1** 0.1	Y 0.98					49.00 x10^{-6} p.a.	Small Fire Controlled by Sprinklers
		N 0.02	Y 0.9				0.90 x10^{-6} p.a.	Small Fire Controlled by Sprinklers and Manual Intervention
			N 0.1	Y 0.98			0.10 x10^{-6} p.a.	Loss of aerosols storage area. Fire Restricted to Aerosol Storage
				N 0.02	Y 0.9	Y 0.4	0.0007 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area
						N 0.6	0.0011 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area
					N 0.1	Y 0.7	0.0001 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area
						N 0.3	0.0001 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area
	Level 2 0.5	Y 0.9					225.00 x10^{-6} p.a.	Small Fire Controlled by Sprinklers
		N 0.1	Y 0.5				12.50 x10^{-6} p.a.	Small Fire Controlled by Sprinklers and Manual Intervention
			N 0.5	Y 0.98			12.25 x10^{-6} p.a.	Loss of aerosols storage area. Fire Restricted to Aerosol Storage
				N 0.02	Y 0.9	Y 0.4	0.09 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area
						N 0.6	0.14 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area
					N 0.1	Y 0.7	0.02 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area
						N 0.3	0.01 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area
	Level 3 0.4	Y 0.8					160.00 x10^{-6} p.a.	Small Fire Controlled by Sprinklers
		N 0.2	Y 0.3				12.00 x10^{-6} p.a.	Small Fire Controlled by Sprinklers and Manual Intervention
			N 0.7	Y 0.98			27.44 x10^{-6} p.a.	Loss of aerosols storage area. Fire Restricted to Aerosol Storage
				N 0.02	Y 0.9	Y 0.4	0.20 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area
						N 0.6	0.30 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area
					N 0.1	Y 0.7	0.04 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area
						N 0.3	0.02 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area

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.	40.6×10^{-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 B1 or Warehouse B2.	Events described as total warehouse fire, multiplied by the failure of the firewall (0.02).	0.016×10^{-6} p.a.

E.3.1 Frequency of Irritating Effects to Sensitive Receptors

The consequence modelling for a smoke plume with un-reacted material from an aerosol fire was undertaken in Appendix C. This consequence modelling revealed that the smoke plume generated by a fire in the Aerosol material that 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 have been calculated for those conditions in which the smoke plume will extend beyond the limits of the WestPark site. If the smoke disperses below the airborne concentration of concern within the WestPark site boundary, the probability of that wind condition occurring has not been included.

Table. E.4 Frequency of Irritating Effects to Sensitive Receptors (Aerosol 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	55	E1.5, F1.5	0.97	40.6	0.39
NNE	80	E1.5, F1.5	0.81	40.6	0.33
NE	165	F1.5	0.61	40.6	0.25
ENE	370	Concentration not exceeded outside site boundary.			
E	330	Concentration not exceeded outside site boundary.			
ESE	350	Concentration not exceeded outside site boundary.			
SE	500	Concentration not exceeded outside site boundary.			
SSE	385	Concentration not exceeded outside site boundary.			
S	360	Concentration not exceeded outside site boundary.			
SSW	400	Concentration not exceeded outside site boundary.			
SE	515	Concentration not exceeded outside site boundary.			
WSW	685	Concentration not exceeded outside site boundary.			
W	680	Concentration not exceeded outside site boundary.			
WNW	90	E1.5, F1.5	0.77	40.6	0.31
NW	57	E1.5, F1.5	0.77	40.6	0.31
NNW	47	D3, E1.5, F1.5	1.05	40.6	0.43

E.3.2 Frequency of Airborne Concentrations Capable of Being Seriously Injurious

The consequence analysis conducted in Appendix C revealed that the largest distance for an airborne concentration that is capable of seriously injuring sensitive members is 100 metres.

Table. E.5 Frequency of Serious Injurious to Sensitive Receptors (Aerosol 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	55	F1.5	0.69	40.6	0.28
NNE	80	F1.5	0.61	40.6	0.25
NE	165	Concentration not exceeded outside site boundary.			
ENE	370	Concentration not exceeded outside site boundary.			
E	330	Concentration not exceeded outside site boundary.			
ESE	350	Concentration not exceeded outside site boundary.			
SE	500	Concentration not exceeded outside site boundary.			
SSE	385	Concentration not exceeded outside site boundary.			
S	360	Concentration not exceeded outside site boundary.			
SSW	400	Concentration not exceeded outside site boundary.			
SE	515	Concentration not exceeded outside site boundary.			
WSW	685	Concentration not exceeded outside site boundary.			
W	680	Concentration not exceeded outside site boundary.			
WNW	90	F1.5	0.49	40.6	0.20
NW	57	F1.5	0.61	40.6	0.25
NNW	47	E1.5, F1.5	0.65	40.6	0.26

The location of Warehouse B1 is at the southern most boundary of the WestPark site. This location is consistent with winds from the north having off-site effects, and those winds from the south having been contained within the WestPark site.

E.4 Other Fire Events for Warehouse B1

The other fire events could include a fire in the general racked storage, 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 above normal warehouse fires. The materials being stored in general are not flammable liquids 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 general storage area. The assumptions are shown in Table. E.6.

Table. E.6 Probabilities used for fire Events in General Racked Storage

Event	Probability /Frequency	Basis
Frequency of Fire	$5x10^{-4}$ p.a.	Assumed frequency for warehouse storing dangerous goods
Sprinkler control of the Fire	0.9603	Taken as the 0.97 for activation and 0.99 for successful suppression. The materials being stored are not flammable liquids and are non-combustible liquids.
Manual Intervention of with the fire event	0.3	The fire growth rate could be combatable by trained employees and suppressed
FRNSW intervention before large area of the warehouse is involved.	0.95	FRNSW are considered likely to control the fire developing in general racked storage before large escalation of the fire

Figure. E.2 Event Tree for General Storage

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Event Tree for Fire Racked Storage

Frequency of Initiating Fire	Sprinklers control the Fire	Manual Intervention and control of the Fire	Control of Fire before entire Warehouse B1 is involved	Frequency	Description of Result
5×10^{-4} p.a.	Yes 0.9603			480.15 x 10^{-6} p.a.	**Small Localised Fire, Effects limited to warehouse area**
	No 0.0397	Yes 0.3		5.955 x 10^{-6} p.a.	**Small Localised Fire, Effects limited to warehouse area**
		No 0.7	Yes 0.95	13.20 x 10^{-6} p.a.	**Escalation of Fire Involving larger Area and release of 25% of stored Class 8 Material**
			No 0.05	0.69 x 10^{-6} p.a.	**Large Warehouse Fire, multiple hydrant attack, 50% stock released from Class 8 Material**

The results for the event tree for the general storage racked (Figure. E.2) are shown in Table. E.7.

Table. E.7 Frequency of Events from General Storage Racked

Frequency Description	Discussion	Frequency
Fire involving some contents of the general storage area.	Sprinkler controls or early manual intervention.	486.1 x 10^{-6} p.a.
Fire event covering several thousand square metres but controlled within the warehouse.	Late control but restricted within the general storage racking.	13.2 x 10^{-6} p.a.
Fire event producing entire warehouse fire event.	Events described as total warehouse fire.	0.69x 10^{-6} p.a.

Appendix F Cumulative Frequencies for WestPark

F.1 Introduction

WestPark has other warehouses that contain dangerous goods. The additional risks associated with Warehouse B1 could have a cumulative effect on the surrounding land uses. In this section the frequencies for hazardous events for Warehouse A1, Warehouse A2 and Warehouse C3/C4 are presented.

F.2 Frequency of Events for 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 Events for Warehouse A2

In Appendix D the consequences for potentially hazardous events for Warehouse A2 were examined. These were drawn from the PHA produced for the Warehouse A2. The PHA conducted for Warehouse A2 revealed, that the smoke plumes containing airborne concentrations of chemicals that may cause irritation to sensitive receptors, or be potentially injurious to sensitive receptors. The total frequencies for these events are shown in Table. F.1.

Table. F.1 Frequencies for Irritation to Sensitive Receptors and Potential Serious Injurious (Warehouse A2)

Wind Direction (Wind coming from)	Frequency of Irritation to SR (x 10^{-6} p.a.)	Frequency of Serious Injury to SR (x10^{-6} p.a.)
N	0.27	Consequences within WestPark Boundaries
NNE	Consequences within WestPark Boundaries	Consequences within WestPark Boundaries
NE	Consequences within WestPark Boundaries	Consequences within WestPark Boundaries
ENE	0.19	Consequences within WestPark Boundaries
E	0.19	Consequences within WestPark Boundaries
ESE	0.19	Consequences within WestPark Boundaries
SE	0.39	Consequences within WestPark Boundaries
SSE	Consequences within WestPark Boundaries	Consequences within WestPark Boundaries
S	2.09	0.53
SSW	2.17	Consequences within WestPark Boundaries
SE	0.09	Consequences within WestPark Boundaries
WSW	Consequences within WestPark Boundaries	Consequences within WestPark Boundaries
W	Consequences within WestPark Boundaries	Consequences within WestPark Boundaries
WNW	Consequences within WestPark Boundaries	Consequences within WestPark Boundaries
NW	0.23	Consequences within WestPark Boundaries
NNW	0.23	Consequences within WestPark Boundaries

F.4 Frequency of Events for 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.

Table. F.2 Frequencies for Irritation to Sensitive Receptors and Potential Serious Injurious (Warehouse AC3/C4)

Wind Direction (Wind coming from)	Warehouse C3/C4	
	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	3.0
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.5 Previous Frequency of Events Combined (PHA Warehouse A2)

For the PHA undertaken for Warehouse A2, these are shown in Table. F.3.

Table. F.3 Frequency of Airborne Concentrations Irritating to Sensitive Receptors

Wind Direction (Wind coming from)	Frequency of Event Warehouse A2	Warehouse C3/C4		Frequency of Potential Irritation to SR (x 10^{-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.4 Frequency of Airborne Concentrations Capable of Serious Injury

Wind Direction (Wind coming from)	Frequency of Event Warehouse A2	Warehouse C3/C4		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

F.6 Frequency of Events Combined (Warehouse A1, A2, C3/C4 and B1)

The proposed development of Warehouse B1 can generate smoke plumes that could potentially cause irritation to sensitive receptors or be seriously injurious to sensitive receptors. The combined effects of all the warehouses must be examined to establish the frequency of these events for surrounding land uses.

F.6.1 Combined Frequency for Irritation to Sensitive Receptors

The proposed development of Warehouse B1 could produce a smoke event containing unreacted chemicals that could be potentially irritating to sensitive receptors. The frequency of this event is combined with hazardous events from Warehouses A1, A2 and C3/C4 that could also be potentially irritating to sensitive receptors. This has been undertaken in Table. F.5.

Table. F.5 Frequency of Airborne Concentrations Irritating to Sensitive Receptors

Warehouse B1		Warehouse A2		Warehouse C3/C4		Total
Wind Direction (Wind coming from)	**Frequency of Potential Irritation to SR (x10 $^{-6}$ p.a.)**	**Contributing Wind Direction**	**Frequency of Potential Irritation to SR (x10 $^{-6}$ p.a.)**	**Contributing Wind Direction**	**Frequency of Potential Irritation to SR (x10 $^{-6}$ p.a.)**	**Frequency of Potential Irritation to SR (x10 $^{-6}$ p.a.)**
N	0.39	N	0.27	NNE	4.6	5.26
NNE	0.33	NNE	0	NE	2.7	3.03
NE	0.25	NE	0	ENE	1.5	1.75
ENE	-	ENE	0.19	ENE	1.5	1.69
E	-	E	0.19	E	1.2	1.39
ESE	-	ESE	0.19	ESE	1.9	2.09
SE	-	SE	0.39	None	-	0.39
SSE	-	SSE	0	SE	2.4	2.40
S	-	S	2.09	SE	2.4	4.49
S	-	S	2.09	SSE	3.4	5.49
SSW	-	SSW	2.17	SE	2.4	4.57
SSW	-	SSW	2.17	SSE	3.4	5.57
SSW	-	SSW	2.17	S	6.9	9.07
SW	-	SW	0.09	SSE	3.4	3.49
SW	-	SW	0.09	S	6.9	6.99
SW	-	SW	0.09	SSW	8.8	8.89

Warehouse B1		Warehouse A2		Warehouse C3/C4		Total
Wind Direction (Wind coming from)	**Frequency of Potential Irritation to SR (x10 $^{-6}$ p.a.)**	**Contributing Wind Direction**	**Frequency of Potential Irritation to SR (x10 $^{-6}$ p.a.)**	**Contributing Wind Direction**	**Frequency of Potential Irritation to SR (x10 $^{-6}$ p.a.)**	**Frequency of Potential Irritation to SR (x10 $^{-6}$ p.a.)**
WSW	-	WSW	0	SW	2.0	2
W	-	W	0	W	2.6	2.6
WNW	0.31	WNW	0	NW	2.7	3.01
NW	0.31	NW	0.23	NNW	2.8	3.34
NNW	0.31	NNW	0.23	N	4.6	5.14
NNW	0.43	NNW	0.23	NNE	4.6	5.26

As Table. F.5 reveals, the frequency of potentially irritations events to sensitive receptors from fumes and smoke increases for locations to the south of the site. This is consistent with the location of the Warehouse B1 being on the most southerly boundary of WestPark. Previous combined effects of warehouse, affected areas to the north of the site, with warehouses A1, Warehouse A2 and C3/C4 being located on the northern edge of the WestPark site.

The criterion for potential irritation to sensitive receptor is established in HIPAP N.4, Risk Criteria for Land Use Planning (January 2011) as 50 in a million per year (page 9). The maximum frequency for potential irritation to sensitive receptor with the storage undertaken in the proposed Warehouse B1 is 5.26×10^{-6} p.a. This is below the threshold indicated by HIPAP No.4.

The area affected is to the south of WestPark and this area is zoned for industrial developments. It is considered unlikely that sensitive receptor would be in this area for extended periods of time and no schools, hospitals or aged cares facilities are within this area.

As Table. F.5 shows there is an increase to the frequency of events that could be potentially irritating to sensitive receptors to the south of the site (from Northerly winds). The maximum off-site frequency is experienced to the north of the site and remains unaltered by the Warehouse B1 events. This frequency is 9.07×10^{-6} p.a.

The proposed development of Warehouse B1 does not increase the risk of potential irritation to sensitive receptors beyond the threshold value established by HIPAP No.4 and occurs to the south of WestPark where there are no permanent sensitive receptors identified.

F.6.2 Combined Frequency for Potential Injurious to Sensitive Receptors

The proposed development of Warehouse B1 could produce a smoke event containing unreacted chemicals that could be potentially injurious to sensitive receptors. The frequency of this event is combined with hazardous events from Warehouses A1, A2 and C3/C4 that could also be potentially injurious to sensitive receptors. This has been undertaken in Table. D.7.

Table. F.6 Frequency of Airborne Concentrations Seriously Injurious to Sensitive Receptors

Warehouse B1		Warehouse A2		Warehouse C3/4		Overall Site
Wind Direction (Wind coming from)	**Frequency of Potential Injurious to SR (x10 $^{-6}$ p.a.)**	**Contributing Wind Direction**	**Frequency of Potential Injurious to SR (x10 $^{-6}$ p.a.)**	**Contributing Wind Direction**	**Frequency of Potential Injurious to SR (x10 $^{-6}$ p.a.)**	**Frequency of Potential Injurious to SR (x10 $^{-6}$ p.a.)**
N	0.20	No Contribution offsite		NNE	3.0	3.20
NNW	0.26	No Contribution offsite		NNE	3.0	3.26
NW	0.25	No Contribution offsite		NNE	3.0	3.25
WNW	0.20	No Contribution offsite		NNE	3.0	3.20
NNW	0.26	No Contribution offsite		N	3.1	3.36
NW	0.25	No Contribution offsite		N	3.1	3.35
WNW	0.20	No Contribution offsite		N	3.1	3.30

As Table. F.6 reveals the risk of potential serious events from fumes and smoke increases for locations to the south of the site. This is consistent with the location of the Warehouse B1 being on the most southerly boundary of the WestPark site. Previous combined effects of warehouses at WestPark, affected areas to the north of the site, with warehouses A1, Warehouse A2 and Warehouse C3/C4 being located on the northern edge of the WestPark site.

The criteria for potential serious injurious to sensitive receptors is established in HIPAP No.4, Risk Criteria for Land Use Planning (January 2011) 10 in a million per year (page 9). The maximum frequency for potential serious injurious to sensitive receptor with the storage undertaken in the proposed Warehouse B1 is 3.36×10^{-6} pa. This is below the threshold indicated by HIPAP No.4.

The area affected is to the south of WestPark and this area is zoned for industrial developments. It is considered unlikely that sensitive receptor would be in this area for extended periods of time and no schools, hospitals or aged cared facilities are within this area.

The proposed development of Warehouse B1 does not increase the risk of potential serious injury to sensitive receptors beyond the threshold value established by HIPAP No.4 and occurs to the south of WestPark where there are no permanent sensitive receptors identified.

Appendix G Individual Risk Evaluation

G.1 Probits

A probit is defined as:

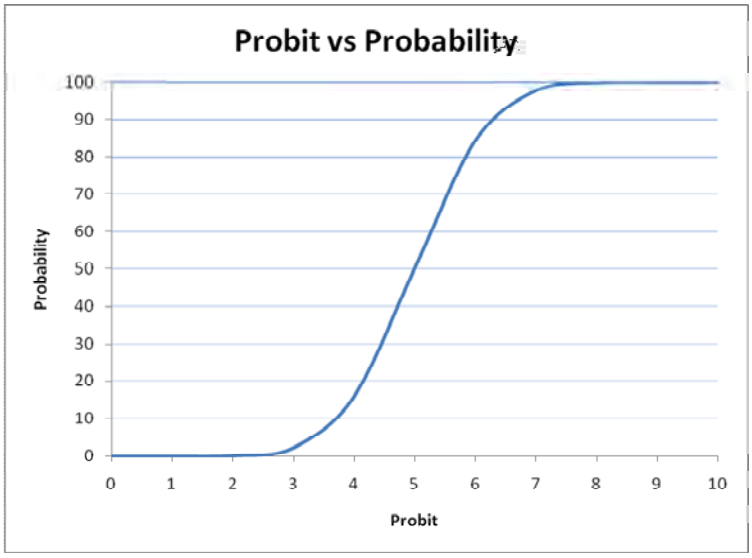
> ***Probit analysis**: A statistical transformation, which will make the cumulative normal distribution linear. In analysis of dose-response, when the data on response rate as a function of dose are given as probits, the linear regression line of these data yields the best estimate of the dose-response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

The hazard identification revealed aerosol, if involved in the early stage of a fire developing in the warehouse, could produce a smoke plume containing uncombusted material. This uncombusted material could affect surrounding land uses. The material selected to represent this uncombusted component is Bioallethrin, the active pesticide component of a large proportion of the aerosols. Other pesticides are used in other products and in similar proportions.

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 percent, mortality over 30 minutes occurs with an air concentration of 17,928 ppm. As has been evaluated in this section a 50 percent 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 for 30 minutes in a smoke plume generated by this hazardous incident.

G.2.2 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 meteorological 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 Probits for Heat Radiation

The hazard identification recognised that the warehouse could experience a fire event. A fire would result in heat radiation and this heat radiation may have effects 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 kilowatts per metre squared per second; and
t_e	is the exposure time in seconds.

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**[3]

[3] *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 shown in 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 Transport Risk Assessment

I.1 Introduction

This section examines the transportation of dangerous goods to and from the Warehouse B1. For this section, the dangerous goods examined are aerosols (UN 1950) and Class 8 Liquids. The movement of dangerous goods to and from the warehouse was prepared from information supplied by the DHL who 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.

I.2 Summary of Traffic Movements

The number of transport movements for dangerous goods Aerosols and Class 8 are presented in Table. I.1.

Table. I.1 Rationalised Transportation Movements

Class	Type of Movement	Number of Movements (Annual)
Aerosols (UN 1950)	Inbound	1,300
Aerosols (UN 1950)	Outbound	800
8	Inbound	1,300
8	Outbound	800

I.3 Hazard Identification for 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 Aerosols 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 a 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 8 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. Local injury drivers or others involved in the accident. Reaction of incompatible chemicals.	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 8 Material	Fire involving transported packages. Loss of containment of materials.	Loss of vehicle control, breakage of packaged goods and ignition of material.	Release of material into watercourses or affecting land. Local injury drivers or others involved in the accident. Reaction of incompatible chemicals.	Driver training. First aid fire-fighting equipment. Emergency response planning. Maximise transportation to be via main thoroughfares and not through residential areas.

I.4 Consequences of Transportation Events

The consequences of an event involving the transportation of dangerous goods to and from Warehouse B1 are discussed in this section.

I.4.1 Fire Involving Aerosol Cans

The consequences of a fire involving the aerosol cans may result in the overheating, and pressurisation of the storage cans. The aerosol can undergo 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 a stream of burning liquid up to two (2) metres to produce burning pools of liquid.

I.4.2 Release of Class 8 Liquids

The consequences of a vehicle accident could involve the release of Class 8 material. The Class 8 material being transported is in small packages and is comprised predominantly of inorganic chemicals. These inorganic chemicals would not have any long-term effects on the environment and are unlikely to significantly the surrounding ecosystem.

The DOP&I, HIPAP No.4, Table 3, describes the environmental risk using Wright's criteria. The consequences of releasing household chemicals during transportation would be "not detectable" to "moderate". This is consistent with the consequences being small. These small and local consequences are very unlikely to contribute to the risk of surrounding residents around the transport route. This event has not been carried forward for any frequency analysis, consistent with the small consequences.

I.4.3 Fire Involving Class 8 Liquids

The Class 8 materials are not flammable, are predominately inorganic and would not contribute material a fire event. Some of the materials is stored in plastic containers which may be fail in the event of fire. The material itself would not contribute in any meaningful way to the fire's growth or intensity.

I.5 Controls for the 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 of Transportation Events

This section discusses the transport frequency of hazardous incident occurring. There are a number of sources that can be used for the establishment of the road accident frequency. Some of these frequencies are listed in Table. I.3.

Table. I.3 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.4 Probability of Release of Dangerous Goods Given an Accident has occurred

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.		

Not every release will lead to a fire event. For a fire to be sustained the release must be substantial and must be ignited. The probability has been assumed to be 0.05. Therefore, the probability of a fire involving a release from aerosol containers 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	0.05
		0.6×10^{-6} p.a.		

As these frequencies reveal there is a 0.6×10^{-6} p.a. of a aerosol 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 for Transportation Events

This section contains the examination of the risks of proposed transportation.

I.7.1 Risk to Individuals

The low frequency of a hazardous event means that individual risks, both the 0.5×10^{-6}p.a. and the 1×10^{-6}p.a. levels, are associated with 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, and that 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 from fixed installations to the public in residential areas. 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&I 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 B1 did not exceed any established criteria for individual, societal or biophysical risk for fixed facilities

Appendix J BAMA

J.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.

J.2 Results

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

Table. J.1 BAMA Check sheet

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 B1.
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.
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.

BAMA Ref	Area	Protection	Implementation at Warehouse A2
L10	Design	Aerosols shall be stored in dry, well-ventilated warehouses and not in basements.	The warehouse will be ventilated to meet the intent of AS 3883.
		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 Aerosol 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 BCA and additional ventilation supplied for 25 metres around the aerosol storage at low level.
		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.
		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 of dangerous goods within the warehouse.

BAMA Ref	Area	Protection	Implementation at Warehouse A2
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 area away from aerosol material.
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.	

BAMA Ref	Area	Protection	Implementation at Warehouse A2
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 the warehouse.
		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 in the warehouse
		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 B1 to prevent propagation into Warehouse B2.
		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.
		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. Fire Safety Study to be undertaken.
		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 and containment is available.

Appendix K Spill Retention

K.1 Introduction

This section investigates the frequency of events in which contaminated fire-fighting water could be released into the surrounding land uses. WestPark is bounded by bio-protection areas and it is important that events that could damage these areas are examined and their frequencies established to ensure that the risk to these areas remains low.

There are a number of scenarios that will be analysed in this section as potentially having an impact, through spillage or through contaminated fire-fighting water. These scenarios will include:

- A fire in the aerosol storage of the warehouse;
- A fire in the racked storage of the warehouse;
- A fire involving the entire warehouse floor area; and
- Release of material from unloading and loading of transportation.

There are other potential fires but these are unlikely to result in the level of contamination and acute or long term effects on the environment than the events listed above may have.

K.2 Frequency of Contaminated Fire Fighting Water from Aerosol Storage

The frequency of initiating fire in the aerosol storage area is estimated to be $5x10^{-4}$ p.a. for the Warehouse B1. An event tree has been used to establish the frequencies and the potential volume of contaminated fire-fighting water that could be generated. The assumptions used in the event tree for a fire in the aerosol storage are shown in Table. K.1.

Table. K.1 Frequencies and Probabilities for Aerosol Fires

Event	Probability /Frequency	Basis
Frequency of Fire	5×10^{-4} p.a.	As previously discussed.
Fire developing in storage of aerosol. Based on storage mass per level.	0.1	Level 1 Aerosols NFPA 30B.
	0.5	Level 2 Aerosols NFPA 30B.
	0.4	Level 3 Aerosols NFPA 30B.
Activation of Automatic Sprinkler and control	0.98	Level 1 Aerosols have a tendency not to catch fire easily.
	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 Intervention of Control of fire	0.9	Level 1 Aerosols have a tendency not to catch fire easily. Manual intervention is possible.
	0.5	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 7-31 and will most likely contain these small packages.
Escalates in general storage area	0.9	The failure of the mechanical means for prevention of escalation means that escalation into flammables storage is likely.
Fire Controlled by FRNSW	0.4	The FRNSW is unlikely to prevent loss of warehouse on escalation into areas.
	0.7	The FRNSW is likely to prevent loss of warehouse without escalation into areas.

Figure. K.1 Event Tree for Aerosol Fires

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11031-205-02

Event Tree for Aerosol Fire

Frequency of Fire in Aerosol Section of Warehouse	Fire Develops in which level of aerosol can storage	Extinguished/ Controlled by fire Sprinkler System	Manual Control of small fire	Fire Contained within Aerosol Area by Mechanical Means	Fire escalates in General Warehouse	Fire Controlled by FRNSW within restricted area	Frequency	Description of Result	Volume of Fire Fighting Water (Litres)	Basis
500 x10^{-6} p.a.	**Level 1** 0.1	Y 0.98					49.00 x10^{-6} p.a.	Small Fire Controlled by Sprinklers	345000	Sprinkler Volume contianed without entry into stormwater.
		N 0.02	Y 0.9				0.90 x10^{-6} p.a.	Small Fire Controlled by Sprinklers and Manual Intervention	363000	Sprinkler plus 1 hoses, 30 minutes
			N 0.1	Y 0.98			0.10 x10^{-6} p.a.	Loss of aerosols storage area. Fire Restricted to Aerosol Storage	453000	Sprinkler plus 2 hoses, 90 minutes
				N 0.02	Y 0.9	Y 0.4	0.0007 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area	561000	Sprinkler plus 4 hoses, 90 minutes
						N 0.6	0.0011 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area	669000	Sprinkler plus 6 hoses, 90 minutes
					N 0.1	Y 0.7	0.0001 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area	561000	Sprinkler plus 4 hoses, 90 minutes
						N 0.3	0.0001 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area	669000	Sprinkler plus 6 hoses, 90 minutes
	Level 2 0.5	Y 0.9					225.00 x10^{-6} p.a.	Small Fire Controlled by Sprinklers	345000	Sprinkler Volume contianed without entry into stormwater.
		N 0.1	Y 0.5				12.50 x10^{-6} p.a.	Small Fire Controlled by Sprinklers and Manual Intervention	363000	Sprinkler plus 1 hoses, 30 minutes
			N 0.5	Y 0.98			12.25 x10^{-6} p.a.	Loss of aerosols storage area. Fire Restricted to Aerosol Storage	453000	Sprinkler plus 2 hoses, 90 minutes
				N 0.02	Y 0.9	Y 0.4	0.09 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area	561000	Sprinkler plus 4 hoses, 90 minutes
						N 0.6	0.14 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area	669000	Sprinkler plus 6 hoses, 90 minutes
					N 0.1	Y 0.7	0.02 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area	561000	Sprinkler plus 4 hoses, 90 minutes
						N 0.3	0.01 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area	669000	Sprinkler plus 6 hoses, 90 minutes
	Level 3 0.4	Y 0.8					160.00 x10^{-6} p.a.	Small Fire Controlled by Sprinklers	345000	Volume Cotnained within Warehouse Bund
		N 0.2	Y 0.3				12.00 x10^{-6} p.a.	Small Fire Controlled by Sprinklers and Manual Intervention	363000	Sprinkler plus 1 hoses, 30 minutes
			N 0.7	Y 0.98			27.44 x10^{-6} p.a.	Loss of aerosols storage area. Fire Restricted to Aerosol Storage	453000	Sprinkler plus 2 hoses, 90 minutes
				N 0.02	Y 0.9	Y 0.4	0.20 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area	561000	Sprinkler plus 4 hoses, 90 minutes
						N 0.6	0.30 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area	669000	Sprinkler plus 6 hoses, 90 minutes
					N 0.1	Y 0.7	0.04 x10^{-6} p.a.	Fire escalates into General warehousing but controlled within small area	561000	Sprinkler plus 4 hoses, 90 minutes
						N 0.3	0.02 x10^{-6} p.a.	FRNSW attack from external to Warehouse. Extensive warehouse damage to large floor area	669000	Sprinkler plus 6 hoses, 90 minutes

The event tree shown in Figure. K.1 establishes that not all fires will generate a volume of contaminated fire-fighting water that would require examination for prior restriction. These are discussed in Table. L.2. The volume of internal retention proposed is 363,000 litres.

Table. K.2 Results for Aerosol Storage Fires

Scenario Description	Frequency	Examination for Prior Restriction in Site Containment
Fire in aerosol storage controlled by sprinklers.	434 x 10^{-6} p.a.	Generation of contaminated fire-fighting water is controlled within the warehouse. Volume 345,000 litres. Contained within warehouse having 180,000 litres for the aerosol area and 255,000 litres in general storage area.
Fire in aerosol storage controlled by early manual intervention.	25.4 x 10^{-6} p.a.	Generation of contaminated fire-fighting water in excess of internal bunding. This was assumed as one additional hose at 10 litres per second over 30 minutes. Volume 363,000 litres. Contained within warehouse having 180,000 litres for the aerosol area and 255,000 litres in general storage area.
Fire in aerosol storage controlled by mechanical controls requiring FRNSW intervention.	39.8 x 10^{-6} p.a.	Generation of contaminated fire-fighting water in excess of internal bunding. This was assumed as two additional hoses at 10 litres per second over 90 minutes. Volume 453,000 litres. Some overflow into the recessed loading dock area. Examine for prior restriction.
Escalation of the fire event from the aerosol storage into other areas of the warehouse.	0.35 x 10^{-6} p.a.	Large fire with multiple hydrants in use. Large volume of contaminated fire-fighting water. Volume proceeds to site containment. This was assumed as four additional hoses at 10 litres per second over 90 minutes Requires examination for prior restriction. Minimum Volume 561,000 litres. Overflow into the recessed loading dock area. Examine for prior restriction or bypassing.
Large fire with large amount of contents of the warehouse lost.	0.46 x 10^{-6} p.a.	Large fire with multiple hydrants in use. Large volume of contaminated fire-fighting water. Volume proceeds to site containment. This was assumed as six additional hoses at 10 litres per second over 90 minutes. Volume 669,000 litres. Fire attack from various locations. Examine for prior restriction or bypassing.

K.3 Frequency of Contaminated Fire Fighting Water from Racked Storage

The warehouse will undertake racked storage, including the storage of Class 8 dangerous goods. The materials being stored in the racked storage could release materials contained within the packages. The materials could, if released to the environment, resulting in the short-term pH modification of water, leading to a short-term impact.

An event tree has been used to establish the potential frequencies and volumes associated with the fires developing within the racked storage. The assumptions in the event tree are shown in Table. K.3. It is proposed to have internal capacity within the Warehouse B1 of 255,000 litres.

Table. K.3 Frequency and Probabilities used for General Warehouse Fire

Event	Probability /Frequency	Basis
Frequency of Fire	$5x10^{-4}$ p.a.	Assumed frequency for warehouse storing dangerous goods.
Sprinkler control of the fire	0.9603	Taken as the 0.97 for activation and 0.99 for successful suppression. The materials being stored are not flammable liquids and are non-combustible liquids.
Manual control of with the fire event	0.3	The fire growth rate could be combatable by trained employees and suppressed
FR NSW intervention before large area of the warehouse is involved.	0.95	FRNSW are consider likely to control the fire developing in racked storage before large escalation of the fire .

Figure. K.2 Event Tree for Fire in General Storage

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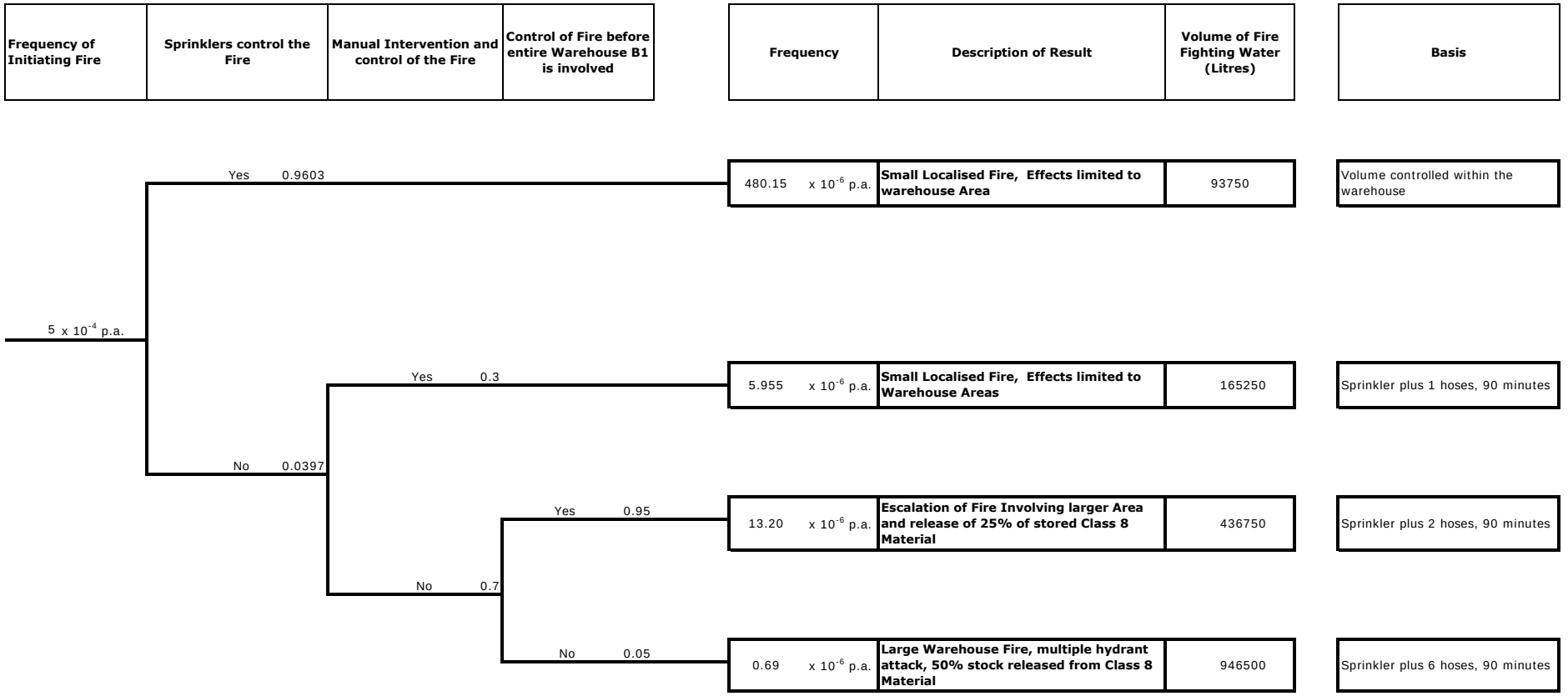
Event Tree for Fire Racked Storage



Frequency	Description of Result	Volume of Fire Fighting Water (Litres)	Basis
480.15 x 10^{-6} p.a.	**Small Localised Fire, Effects limited to warehouse Area**	93750	Volume controlled within the warehouse
5.955 x 10^{-6} p.a.	**Small Localised Fire, Effects limited to Warehouse Areas**	165250	Sprinkler plus 1 hoses, 90 minutes
13.20 x 10^{-6} p.a.	**Escalation of Fire Involving larger Area and release of 25% of stored Class 8 Material**	436750	Sprinkler plus 2 hoses, 90 minutes
0.69 x 10^{-6} p.a.	**Large Warehouse Fire, multiple hydrant attack, 50% stock released from Class 8 Material**	946500	Sprinkler plus 6 hoses, 90 minutes

Table. K.4 Results of Fire Events Racked Storage event tree

Scenario Description	Frequency	Examination for Prior Restriction in Site Containment
Fire in racked storage controlled by sprinklers	480.15 x 10^{-6} p.a.	Generation of contaminated fire-fighting water is predominantly sprinkler water. 5% of Class 8 volumes assumed lost. Volume 93,750 litres.
Fire in racked storage controlled by early manual intervention	5.96 x 10^{-6} p.a.	Generation of contaminated fire-fighting water is predominantly sprinkler water and the application of one (1) hydrant hose over 90 minutes. 10% of Class 8 volumes assumed lost. Volume 165,250 litres
Extensive damage to racked storage and some escalation. Controlled within Warehouse B1	13.20 x 10^{-6} p.a.	Larger fire with two hydrant in use. 25% of the Class 8 product is lost. Volume 463,750 litres
Large fire with entire contents of the warehouse lost	0.69 x 10^{-6} p.a.	Large developed fire with six hydrants points in use with 50% of stock contributing to liquids lost. Volume 946,500 litres

K.4 Frequency of Contaminated Fire fighting water from Unloading/Loading Area Fire

The unloading and loading activities undertaken at Warehouse B1 represent a risk of a release and a fire occurring in the loading and unloading areas of the warehouse. An event tree has been used to establish the frequencies and the potential volume of contaminated fire-fighting water that could be generated.

The assumptions used in the event tree for a fire for loading and unloading activities are shown in Table. K.5.

Table. K.5 Frequencies and Probabilities used for Unloading/Loading Event Tree (Aerosols)

Event	Probability /Frequency	Basis
Frequency of Activity	43,800	Estimation on 120 movements per day
Droppage/incident that leads to a release of materials	0.0001	This is a routine activity conducted by trained personnel. Incident is very unlikely to occur. Based on 1 incident per 10,000 movements. This has been drawn from incidents from container movements, which has been estimated by DNV, 1982 at 1 in 100,000. It is considered that a forklift is more likely to damage packages than container lifts due to the nature of the movement required and the equipment being used.
Volume Significant enough to ignite	0.001	Not all incidents will provide enough volume to find an ignition source. A significant release or incident is required.
Ignition of material	0.01	It is considered consistent with Lee's and other sources that volume that is significant will have this probability of ignition of aerosols in a substantial quantity,
Fire fighting is effective with extinguisher	0.95	There is a reasonable chance of success that the fire, being small and easily accessible, the fire could be adequately brought under control with the use of hand held extinguishers. Training is provided on the site on the use of hand-held extinguisher.
Spill containment, before entering site drainage system is effective	0.99	It is considered likely that local control and management would be successful containment of spills and fire extinguisher events.

Figure. K.3 Event Tree for Aerosol Loading/Unloading (Aerosols)

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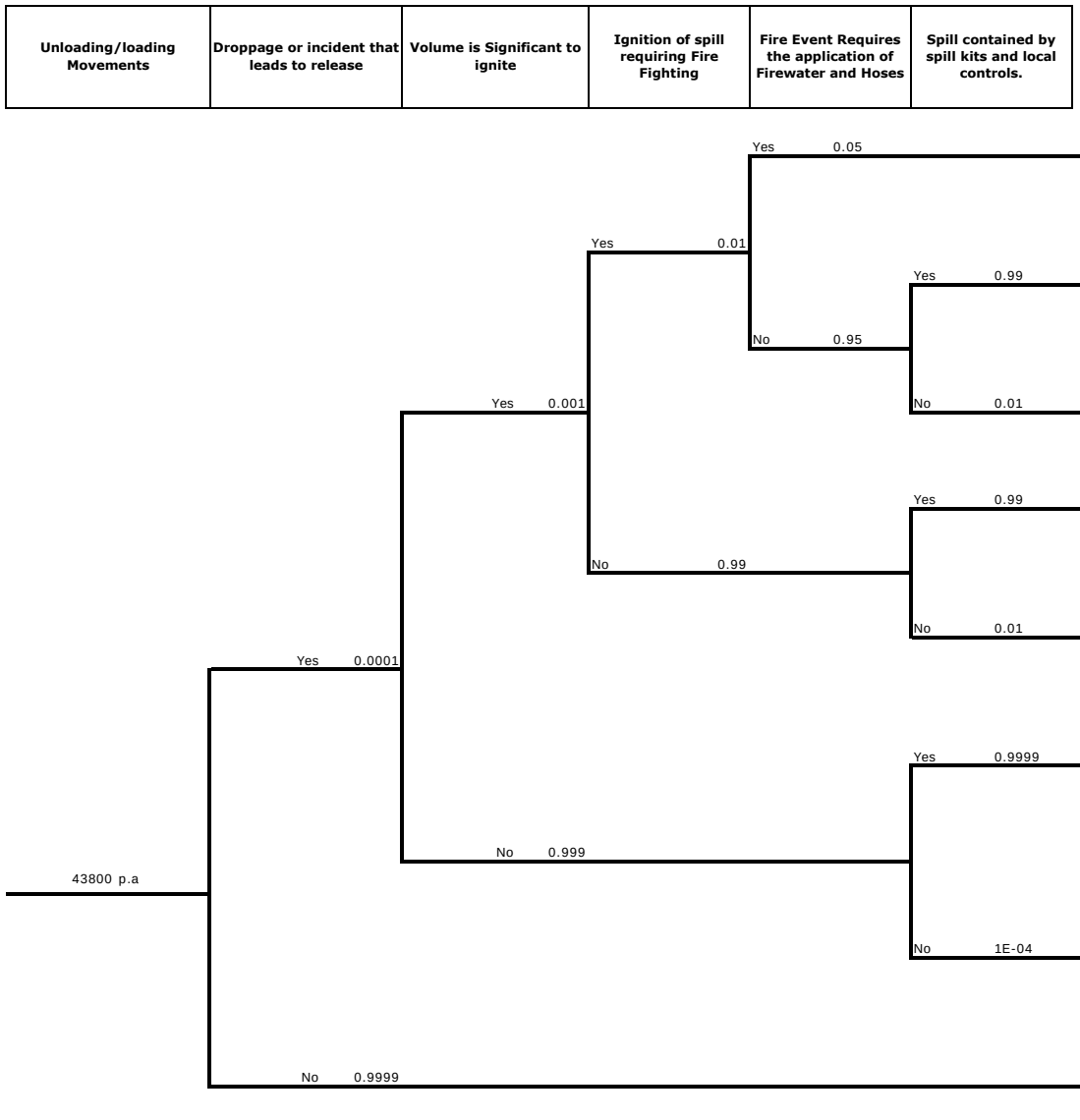
Event Tree for Accidental Fire for Unloading/Loading Activities (Aerosols)



Frequency	Description of Result	Volume Generated
2.19E-06 p.a.	Fire Invovling application of fire fighting water. Application of two hoses for 1.5 hours. Plus Contents.	108,000
4.16E-05 p.a.	Material contained to local vicinity.	Nil
4.16E-07 p.a.	Spill and first aid fire fighting material move to spill containment	Contained in Recess Dock Area
4.29E-03 p.a.	Spill of material contained to local vicinity.	Nil
4.34E-05 p.a.	Spilled material move to spill containment.	Contained in Recess Dock Area
4.38E+00 p.a.	Spill of material contained to local vicinity.	Nil
4.38E-04 p.a.	Spill and first aid fire fighting material move to spill containment.	Contained in Recess Dock Area
43796 p.a.	No Spillage of Material.	Nil

The results from the event tree (see Figure. K.3) are shown in Table. K.6. The recessed dock will have spill containment of 840,000 litres and events that are small and not requiring the application of water will be controlled within that area. This is also consistent with the material being a flammable gas which disperses quickly and is unlikely to pool.

Table. K.6 Summary of Events for Aerosol Loading and Unloading (Aerosols)

Scenario Description	Frequency	Examination for Prior Restriction in Site Containment
Release of material of substantial quantity, and ignition that requires application of fire-fighting hoses	2.19×10^{-6} p.a.	The scenario where firewater is applied to the potentially hazardous event will be examined for containment on site.

The recessed dock will have spill containment of 840,000 litres and events that are small and not requiring the application of water will be controlled within that area. This is also consistent with the material being a flammable gas which disperses quickly and is unlikely to pool.

K.5 Spills from Acid and Alkali Movements

The acids and alkalis are stored in Warehouse B1. These are in small household packages with contents of less than 5 litres. The acids and alkalis are inorganic and are likely to have only short-term effects on the environment. The spill volumes will be limited by the container sizes, and large releases (greater than 1000 litres) are considered very unlikely. These limiting factors mean that further analysis for the acids and alkalis movements is not undertaken.

K.6 Bypassing of Recessed Dock Spill Containment

In the previous sections, frequencies have been estimated for events that could result in material being released from the warehouse internal bunding. These events include:

- Fire in the Warehouse B1 where a volume of fire-fighting water is in excess of internal storage or a failure to retain the volume; and
- Fire involving loading or unloading of aerosols.

There is potential that the recessed dock does not contain all firewater escaping from the internal bunding. This could be due to prior blockages of the drainage system or debris being generated by the incident blocking the site drainage. As such, the probability of these problems occurring has been estimated at 0.01 for blockages prior to the event and 0.05 for debris-caused blockages.

The frequencies used for initiating potential bypassing of the recessed dock spill containment are shown in Table. K.7.

Table. K.7 Bypassing of Site Containment (Initiating)

Event	Initiating Frequency
Fire in the warehouse with volumes in excess of those contained by internal bunding.	54.04×10^{-6} p.a.
Fire involving loading and unloading activities. Requiring the use of fire hoses.	2.19×10^{-6} p.a.

An event tree (see Figure. K.4) has been used to establish the frequency of events that could bypass the recessed dock area. This has been evaluated at 3.34×10^{-6} p.a. This will proceed to the hardstand spill retention of 500,000 litres. The volume for all these events has been assumed to be 100,000 litres of contaminated fire-fighting water.

Figure. K.4 Event Tree for Bypassing Recessed Dock Spill Containment

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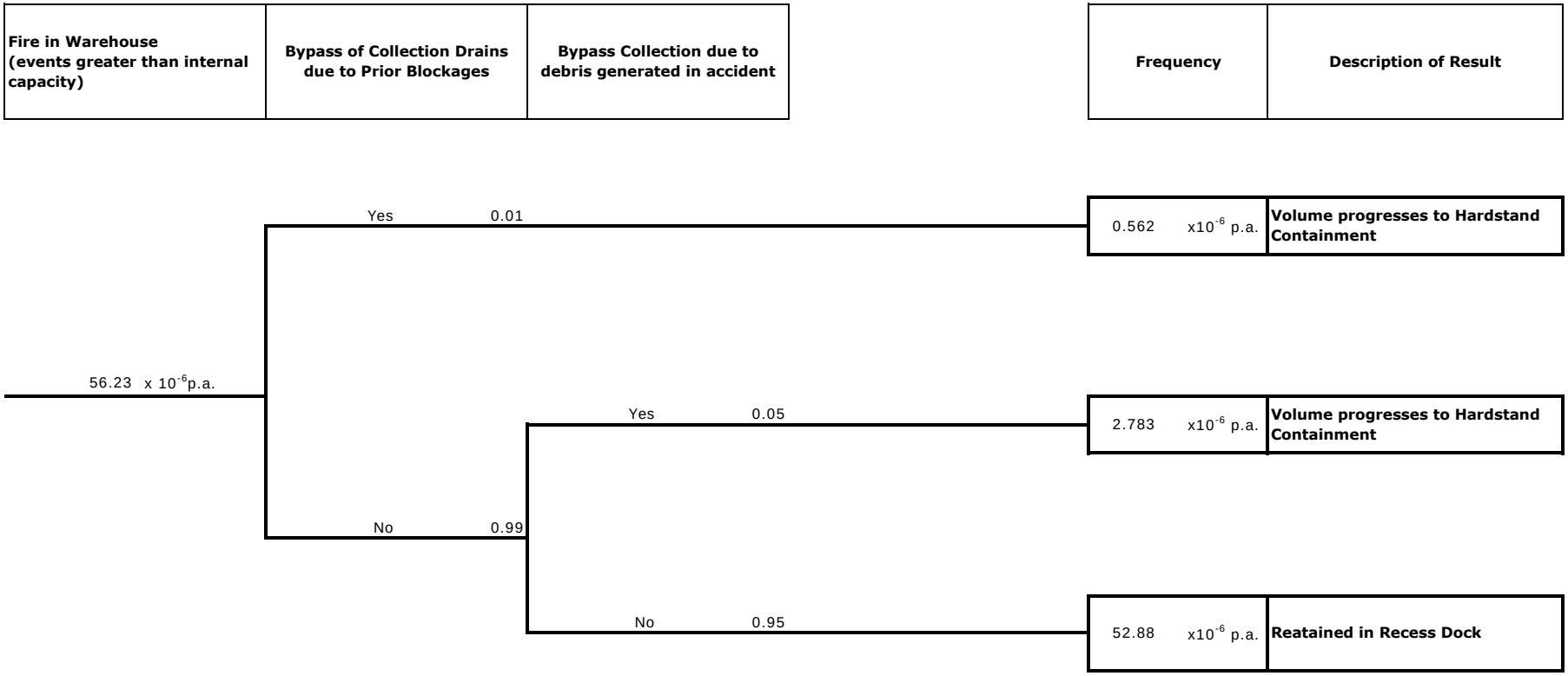
Event Tree for Events Bypassing Containment (Recessed Dock)

Recessed Dock Containment



K.7 Bypassing of Hardstand Spill Containment

The hardstand spill containment has a capacity to retain 500,000 litres and all stormwater exits surrounding Warehouse B1 have isolation valves. The containment in the hardstand tank will be in excess of 500,000 litres as the isolation valves will result in any liquid backing up into the hardstand. For the evaluation of the frequencies of off-site releases, 500,000 litres as been assumed.

K.7.1 Prior Restriction

The events highlighted in this appendix could generate significant quantities of contaminated fire-fighting water, or as highlighted by the consequence analysis, quantities of spilled material during unloading and loading operations could contribute to water that could have an acute short-term effect on the surrounding land use. The hardstand containment of 500,000 litres could, in the event of a rainfall, be exceeded. This section examines the probability of the site containment being exceeded by rainfall following an incident that has contaminated the water retained within this site containment pond. The process used in this section is described in "Best Practice Guidelines for Contaminated Water Retention and Treatment Systems" NSW Government, Hazardous Materials Policy Coordinating Committee, 1994.

The hardstand spill containment will potentially receive contaminated water from events that bypass the recessed dock area (see Appendix K.6) and a proportion of the water that would be applied to a large fire event in Warehouse B1.

The events of interest are presented in Table. K.8. These events are examined to establish the frequency of rain events that could result in the release of contaminated fire-fighting water.

Table. K.8 Scenarios considered for Prior Restriction

Scenario Description	Area of Concern
Large Warehouse Fire	A large developed warehouse fire would have firewater applied that would not flow through the internal bunding or through the recessed dock area. The volume varies throughout this report and for the purposes of evaluating prior restriction of the hardstand containment, a volume of four (4) hoses being applied for 90 minutes has been used. This will generate 216,000 litres.
Bypassing of recessed dock area	As identified in Appendix K.6 material could bypass the recessed dock spill area. This volume is assumed as 100,000 litres.

Retained Volume

The calculation of the retained volume within the site containment ponds has been based on the volumes of contaminated fire-fighting water that may be generated during a fire event or as a result of an incident that would exceed the capacity within the warehouse. These have been presented in Table. K.9. It has been assumed that following an incident, 50,000 litres per day of material could be removed from the site containment for off-site treatment.

Table. K.9 Retained Volumes with Time

Ref	Scenario Description	Days Post incident	Maximum Volume Available
1	Events bypassing recessed dock	0 0+ 1 2	V V-100,000 V-(100,000-50,000) V-(50,000-50,000)
2	Large warehouse fires	0 0+ 1 2 3 4 5 5.5	V V-(216,000) V-(216,000-50,000) V-(166,000-50,000) V-(116,000-50,000) V-(66,000-50,000) V-(216,000-50,000) V-(16,000-16,000)

Probability of Loss of Retention

The probability of loss of retention is estimated using the graph presented in Figure. K.5. This graph is specific to the collection of rainfall surrounding Warehouse B1. The results are presented in Table. K.10.

Table. K.10 Probabilities of Prior Restriction

ID	Scenario Description	(T) Total Time Elapsed to End of Clean up	(S) Run-off Required to Exceed Containment	(P) Probability that Containment is Breached
1	Events bypassing recessed dock	1	400,000	0.025
		2	450,000	0.07
2	Large warehouse fires	1	284,000	0.027
		2	334,000	0.072
		3	384,000	0.083
		4	434,000	0.09
		5	484,000	0.1

Frequency of Restricted Prior Retention

The frequency is estimated by multiplying the frequency of the initiating event by the probability that containment is breached. This is shown in Table. K.11.

Table. K.11 Frequency of Off-Site Discharge through Prior Retention

ID	Scenario Description	Incident Frequency Per Year	Total Probability Containment is breached	Frequency of Discharge Offsite (per year)
1	Events bypassing recessed dock	3.34 x 10^{-6} p.a.	0.07	0.23 x 10^{-6} p.a.
2	Large warehouse fires	1.15 x 10^{-6} p.a.	0.1	0.12 x 10^{-6} p.a.
Total				**0.35 x 10^{-6} p.a.**

As revealed by Table. K.11. The frequency of release due to prior retention is 0.35 x 10^{-6} p.a. This frequency is very low and consistent with a large internal bunded area that will contain the sprinkler action, large additional capacity provided by the recessed dock area and capture in the hardstand tank.

Figure. K.5 Probability Containment is Exceeded by Rainfall

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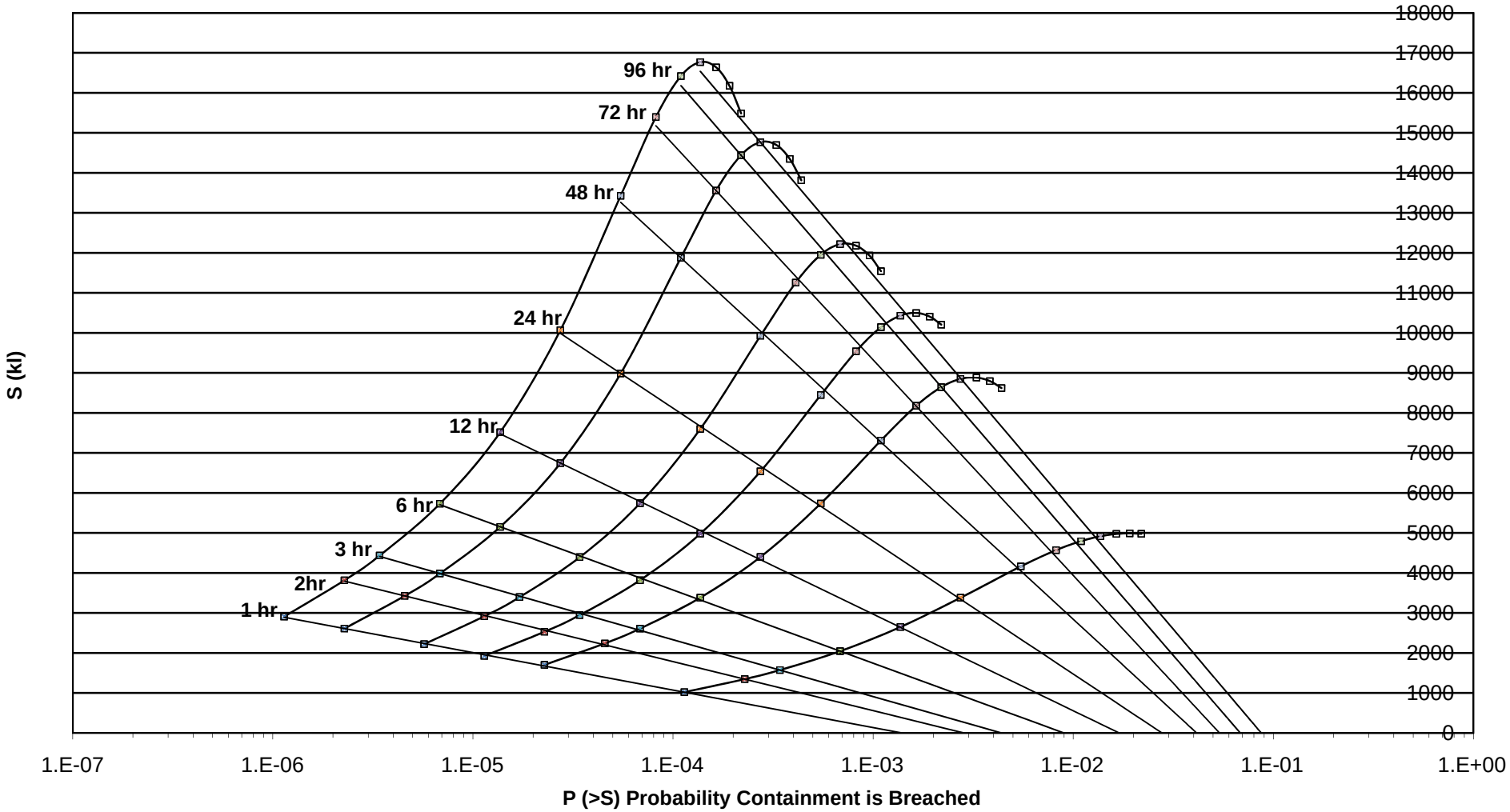
See Next Page

11031-209-02
Probability Containment is Exceeded by Rainfall



K.7.2 Bypassing

The events that lead to the potentially contaminated firewater run-off could proceed to the hardstand containment tank. There is potential that these could be bypassed due to prior blockages of the drainage system or debris being generated by the incident blocking the site drainage. . As such, the probability of these problems occurring has been estimated at 0.01 for blockages prior to the event and 0.05 for debris caused blockages.

To evaluate the risk of bypassing the hardstand storage tank an event tree has been used. This is shown in Figure. K.6. As Figure. K.6 reveals the frequency of contaminated water bypassing the hardstand containment and escaping into the environment is 0.25×10^{-6} p.a.

K.8 Totalising Spill and Contaminated Fire Fighting Water Events

This Appendix has examined the potential consequences and frequencies of spill and contaminated fire-fighting water for Warehouse B1. The potential frequency releases to the environment is shown in Table. K.12. It has been evaluated that the total likelihood of an escape to the environment is 0.7×10^{-6} p.a. This very low likelihood is consistent with the controls implemented for the Warehouse B1.

Table. K.12 Total Release Frequency

ID	Scenario Description	Incident Frequency Per Year
1	Events escaping due to prior restriction	0.35×10^{-6} p.a.
2	Bypassing of hardstand containment	0.25×10^{-6} p.a.

Figure. K.6 Event tree for Bypassing Hardstand Storage

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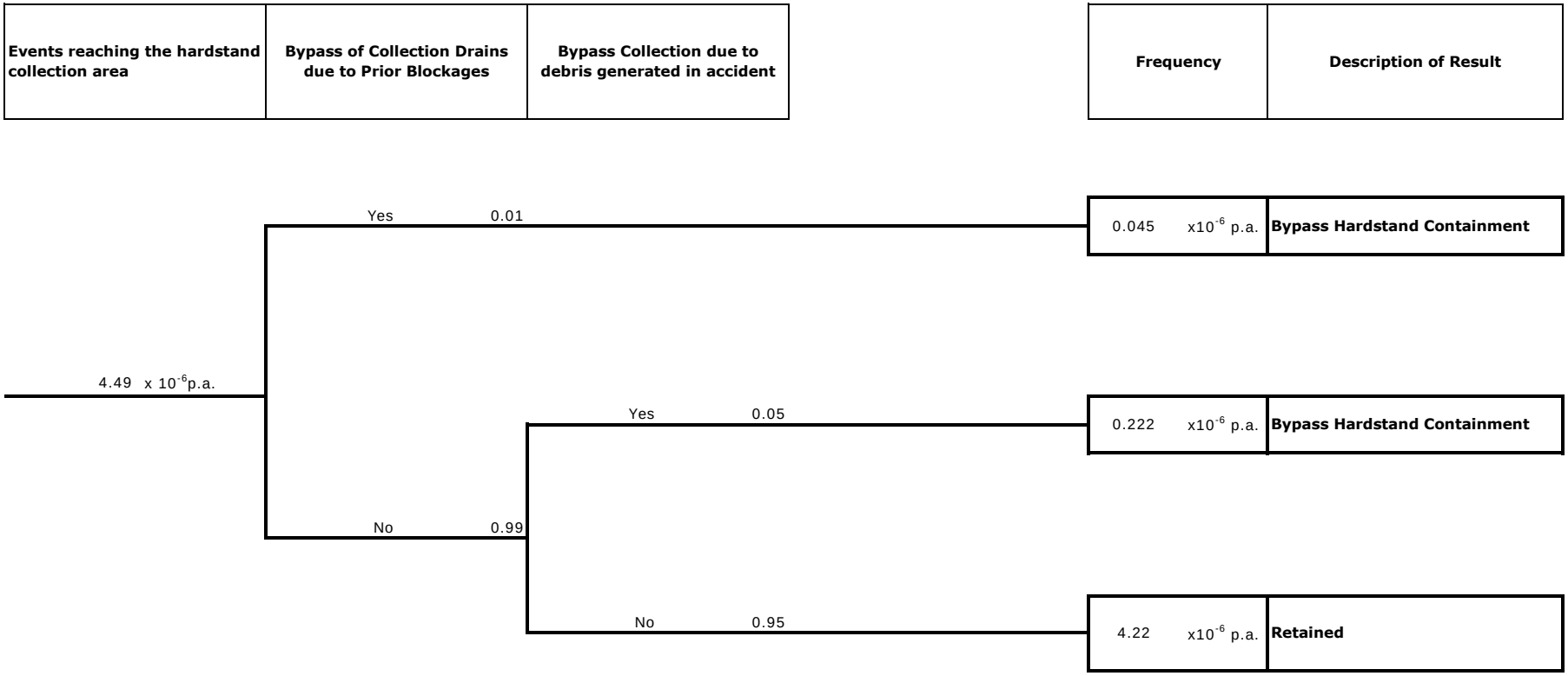
See Next Page

11031-210-02

Event Tree for Events Bypassing Containment (Hardstand Collection)



Appendix L MSDS

L.1 Introduction

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

L.2 MSDS

The following MSDSs have been included:

1 Over Cleaner Aerosol

2 Carpet Cleaner Aerosol

3 Fly Spray Aerosol

4 Household Bleaching Agent

5 Bathroom Cleaner

6 Hair Removal Clean

7 Floor Cleaner

8 Bathroom Cleaning Gel

The MSDSs included are for the purposes of the PHA only. The details of the supplier, for the purposes of the PHA, have been held as commercial in confidence and have been removed from the MSDSs. The information contained within the MSDS other than supplier details and branding has not been altered.

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Safety Data Sheet

Foam Cleaner (Aerosol)

1. PRODUCT and COMPANY IDENTIFICATION

2. HAZARD(S) IDENTIFICATION

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

RISK PHRASE(S) (See Section 15)	R12 Extrememly Flammable R36 Irritating to eyes
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. S46 If swallowed, seek medical advice immediately and show this container or label.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS No	Proportion (%w/w)
Diethylene glycol monobutyl ether	112-34-5	9.5
Potassium carbonate	584-08-7	<10 (4.75% Alkaline salts)
Monoethanolamine	141-43-5	<10
Surfactants [1]		<10
n-Butane[2]	106-97-8	<10
Other ingredients classified as not hazardous according to NOHSC		to 100

[1] One of the surfactants is being introduced under a Low Volume Chemical Permit granted under section 21U(2) of the Industrial Chemicals (Notification and Assessment) Act 1989.
[2] 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 immediately with a large amount of water. If irritation persists, contact a doctor.
Skin Contact	Wash off with soap and water. 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 with extreme heat and become projectiles.
Flammability	Propellant gases are flammable.
Extinguisher Type	Water, foam or carbon dioxide.
Hazchem code	2YE

6. ACCIDENTAL RELEASE MEASURES

Procedures Keep area well ventilated. Avoid contact with skin and eyes.

Minor Spills Wipe up spills with a clean dry cloth. Wash residues away with water.

Major Spills Contain spill. Collect using a suitable absorbing 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 DG 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 DG 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

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

Ingredient	CAS No.[a]	TWA		STEL		Carcinogen Category	Notes
		ppm[b]	mg/m^3[c]	ppm[b]	mg/m^3[c]		
Butane	106-97-8	800	1900	-	-	-	-
Ethanolamine	141-43-5	3	7.5	6	15	-	-

Exposure Standards - New Zealand

Exposure Standards[3] have been set for the following ingredients:

Ingredient	CAS No.[a]	TWA		STEL	
		ppm[b]	mg/m^3[c]	ppm[b]	mg/m^3[c]
Butane	106-97-8	800	1900	-	-
Ethanolamine	141-43-5	3	7.5	6	15

TWA = Time Weighted Average
STEL= Short Term Exposure Limit
[1] Worksafe Australia Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003 1995)]
[3] 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 Keep area well ventilated.Maintain air concentration 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	Liquid
Appearance	Fine mist
Colour	Beige
Boiling Point	0°C (butane)
Vapour Pressure	240 kPa at 16°C (butane)
Specific Gravity	1.03 at 25°C (concentrate)
Flashpoint	-60°C (butane)
Solubility in Water	Soluble
pH	12.0 - 13.5 neat at 25°C (concentrate)

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions of use.
Dangerous Reactions	Cans may explode when subjected to extreme heat or pressure.
Conditions to Avoid	Avoid extreme heat and pressures. Do not incinerate or puncture cans.
Decomposition Products	Products may include oxides of carbon and nitrogen

11. TOXICOLOGICAL INFORMATION

Product Toxicity Testing of a near identical product has been undertaken for acute oral and inhalation toxicity and for skin and eye irritancy. It was found that this product was an eye irritant only.

Acute Effect(s)

Eye	Will cause irritation to the eye.
Skin	May cause irritation to the skin.
Inhaled	Mists/vapours may cause irritation to the respiratory tract.
Swallowed	May cause irritation to the gastrointestinal tract.
Sensitisation	Not expected to be a skin sensitiser.
Chronic Effect(s)	The chronic toxicity of this product has not been determined.
Toxicity Information	Information is based on available component data and toxicity result of a similar product.

12. ECOLOGICAL INFORMATION

Ecotoxicity Based on component ecotoxicity data the product may cause long-term adverse effects in the aquatic environment. This classification applies to bulk quantities only.

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 7)

UN number:	UN 1950
Proper shipping name:	AEROSOLS
DG class:	2.1
Subsidiary risk:	None allocated
Packing group:	None allocated
Hazchem code:	2YE

Maritime Transport Regulations (IMDG)

UN number:	UN 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:	UN 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 Hazardous

Risk Phrase(s)

R12 Extrememly Flammable
R36 Irritating to eyes

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.

S46 If swallowed, seek medical advice immediately and show this container or label.

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 S5 (Alkaline salts)

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

KEY/LEGEND

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

Safety Data Sheet

Carpet Cleaner (Aerosol)

1. PRODUCT and COMPANY IDENTIFICATION

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

2. HAZARDS IDENTIFICATION

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

RISK PHRASE(S) (See Section 15)	None
ENVIRONMENTAL RISK PHRASE	Not applicable
SAFETY PHRASE(S)	S2 Keep out of reach of children. S16 Keep away from sources of ignition - No smoking.

3. COMPOSITION

Chemical Name	CAS no	Proportion (%w/w)
Ethanol	64-17-5	<10
Non-ionic Surfactant	-	<1
Anionic Surfactant	-	<1
Perfume	-	<1
Antioxidant	-	<1
Hydrocarbon propellant[1]	74-98-6/106-97-8	10 - <30
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 amount of water. If irritation occurs and persists, contact a doctor.
Skin Contact	Wash off skin with soap and water. 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.
Extinguisher Type	Water, carbon dioxide, dry chemical or foam.

Flammability	Propellant gases are flammable.
HazChem Code	None allocated.

6. ACCIDENTAL RELEASE MEASURES

Emergency and Evacuation Procedures	Keep area well ventilated. Remove sources of ignition.
Minor Spills	Mop up spill and wash area with detergent. and water.
Major Spills	Contain spill. Collect product using a suitable adsorbent material such as vermiculite. Shovel material into a clean, dry, labelled container and close lid tightly. 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 mg/m^3	TWA ppm	STEL mg/m^3	STEL ppm	Carcinogen Category	Notices
Butane	106-97-8	1900	800	-	-	-	-
Propane	74-98-6	asphyxiant	-	-	-	-	-
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	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.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Aerosol
Appearance	Powdery foam aerosol when sprayed

Colour	Colourless
Boiling Point	0°C (butane)
Vapour Pressure	240 kPa @ 16°C (butane)
Specific Gravity	0.97 - 1.0 @ 25°C (concentrate)
Flashpoint	-60°C (butane)
Solubility in Water	Miscible

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Dangerous Reactions	Aerosol cans may explode and rocket when subjected to extreme heat.
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 eyes.
Skin	May cause irritation to the skin with prolonged/repeated contact.
Inhaled	Mists/vapours 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 points 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:	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

Air Transport Regulations (IATA)

UN Number:	1950
Proper shipping name:	AEROSOLS
DG Class:	2.1
Subsidiary risk:	None allocated
Packing group:	None allocated

15. REGULATORY INFORMATION

Regulatory Approvals	This product has been approved by HSNO NZ , Approval No. HSR002519.
Hazardous Substances Regulation	Not Hazardous.
RISK PHRASE(S)	None.
ENVIRONMENTAL RISK PHRASE	Not applicable
SAFETY PHRASE(S)	S2 Keep out of reach of children. S16 Keep away from sources of ignition - No smoking.
SUSDP	Not Scheduled

16. OTHER INFORMATION

CONTACT POINT

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 Organization Rules
IATA = International Air Transport Association
SUSDP = Standard for the Uniform Scheduling of Drugs and Poisons (Australia)

Safety Data Sheet

Fly Spray (Aerosol)

1. PRODUCT and COMPANY IDENTIFICATION

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)	R12 Extremely Flammable R50/53 Very toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment
SAFETY PHRASE(S)	S2 Keep out of the reach of children S16 Keep away from sources of ignition, no smoking S23 Do not breath gas/fumes/vapours/spray (appropriate wording to be specified by the manufacturer) S25 Avoid contact with eyes S26 In case of contact with eyes rinse immediately with plenty of water and seek medical advice S46 If swallowed seek medical advice immediately and show this container or label

3. COMPOSITION / INFORMATION ON INGREDIENTS

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.

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.
Flammability	Flammable.
Extinguisher Type	Water, foam, carbon dioxide,
Hazchem code	2YE

6. ACCIDENTAL RELEASE MEASURES

Emergency and Evacuation Procedures	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 DG 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 DG 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

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

Ingredient	CAS No.[a]	TWA		STEL		Carcinogen Category	Notes
		ppm[b]	mg/m³[c]	ppm[b]	mg/m³[c]		
Butane	106-97-8	800	1900	-	-	-	-
Propane	74-98-6	-	-	-	-	-	asphyxiant
Butylated hydroxytoluene	128-37-0	-	10	-	-	-	-

Exposure Standards - New Zealand

Exposure Standards[3] have been set for the following ingredients:

Ingredient	CAS No.[a]	TWA		STEL	
		ppm[b]	mg/m³[c]	ppm[b]	mg/m³[c]
Butane	106-97-8	800	1900	-	-
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)]
[3] 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 Keep areas well ventilated. Maintain air concentrations below exposure standards.

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

safety glasses.

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

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.
Conditions to Avoid	Prolonged exposure to high temperatures. Avoid extreme heat and pressures. Do not incinerate or puncture cans.
Incompatible Materials (If known)	Avoid oxidising materials. Oxidizing agents.
Decomposition Products	Products may include oxides of carbon.

11. TOXICOLOGICAL INFORMATION

Acute Effect(s) **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.
Sensitisation	Not expected to be a skin sensitiser.
Chronic Effect(s)	The chronic toxicity of this product has not been determined.
Toxicity Information	Information is based on available component data and their concentrations in the product.

12. ECOLOGICAL INFORMATION

Ecotoxicity Based on component ecotoxicity data the product is very toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment. This classification applies to bulk quantities only.

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 7)

UN number:	UN 1950
Proper shipping name:	AEROSOLS
DG class	2
Division	2.1
Subsidiary risk:	None allocated
Packing group:	None allocated
Hazchem code:	2YE

Maritime Transport Regulations (IMDG)

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

15. REGULATORY INFORMATION

AUSTRALIA

Regulatory Status This product has been registered by APVMA, Australia ; APVMA No . 54137

Hazardous Substances Regulation Not Hazardous

Risk Phrase(s)
R12 Extremely Flammable
R50/53 Very toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment

Safety Phrase(s)
S2 Keep out of the reach of children
S16 Keep away from sources of ignition, no smoking
S23 Do not breath gas/fumes/vapours/spray (appropriate wording to be specified by the manufacturer)
S25 Avoid contact with eyes
S26 In case of contact with eyes rinse immediately with plenty of water and seek medical advice
S46 If swallowed seek medical advice immediately and show this container or label

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 - ERMA Approval Number HSR000309
Approved Handler	Approved handler required when greater than 3000L (aggregate water capacity) of 2.1.2A substances are present
Tracking	Not required

16. OTHER INFORMATION

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

Safety Data Sheet

Household Bleaching Agent

PRODUCT NAME :

OTHER NAMES :

HAZARDOUS ACCORDING TO CRITERIA OF NATIONAL OCCUPATIONAL HEALTH AND SAFETY COMMISSION

COMPANY DETAILS

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1. PRODUCT

UN NUMBER : 3260 (Corrosive solid, acidic, inorganic, N.O.S. Contains Sodium bisulphate)

DANGEROUS GOODS CLASS : 8

SUBSIDIARY RISK : None allocated

HAZCHEM CODE : 2X

PACKAGING GROUP : II

POISONS SCHEDULE NUMBER : S5 (Potassium peroxymonosulphate triple salt, Sulphamic acid)

USE : Toilet cleaner

2. COMPOSITION

Chemical Name	CAS No	Proportion (%w/w)
Sodium bisulphate	7681-38-1	30 - 60
Sodium chloride	7647-14-5	30 - 60
Sodium bicarbonate	144-55-8	10 - <30
Potassium peroxymonosulphate sulphate	70693-62-8	<10
Sulphamic acid	5329-14-6	<10
Sodium dodecyl benzene sulphonate	68081-81-2	<10
Other ingredients classified as not hazardous according to NOHSC		to 100

3. HAZARDS IDENTIFICATION

Eye Contact Corrosive

Skin Contact Corrosive

Inhalation Irritant

Ingestion Corrosive

HEALTH EFFECTS

ACUTE

Eye	Will cause burns to the eye.
Skin	Will cause burns to the skin.
Inhaled	Will cause irritation to upper respiratory tract.
Swallowed	Will cause burns to the 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 amount of water and seek immediate medical attention.
Skin Contact	Wash off skin with water and seek immediate medical attention.
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	Product will release small amount of chlorine gas when wet.
Extinguisher Type	Water, foam, carbon dioxide.

6. ACCIDENTAL RELEASE MEASURES

SPILLS	Keep area well ventilated. Avoid generation of dusts.
Minor Spills	Sweep up product and wash area with a large amount of water.
Major Spills	Contain spill. Do not wet. Sweep up spill and shovel material into clean, dry, appropriately labelled containers and close lids tightly. Do not allow material to enter waterways.

7. HANDLING AND STORAGE

Handling	Dangerous goods class 8. Handle accordingly.
Storage	Dangerous goods class 8. 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
Chlorine[2]	7782-50-5	3	1	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)]
[2] Chlorine is a decomposition product.

Engineering Controls

Use in well ventilated areas. 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

Not flammable.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Solid
Appearance	Powder
Colour	White
Melting Point	Not available
Vapour Pressure	Not available
Bulk Density	approx 1.120 g/mL (untapped)
Flashpoint	Not flammable.
Solubility in Water	Soluble
pH	1 - 2.5 (2%aqueous) at 25°C
Available Chlorine	0.5 % w/w

10. STABILITY AND REACTIVITY

Stability

Stable under normal storage conditions.

Dangerous Reactions

Incompatible with alkaline material.
If exposed to water, develops chlorine and sulphuric acid.
Contact with combustible material may cause a fire.
Dusts may form explosive mixtures in air.

Decomposition Products	Products may include oxides of carbon, nitrogen & sulphur and hydrogen chloride and chlorine gas.

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	Dangerous goods class 8.
Maritime Transport Regulations	Dangerous goods class 8.
Air Transport Regulations	Dangerous goods class 8.

15. REGULATORY INFORMATION

Regulatory Approvals	Not applicable.
Hazardous Substances Regulation	Hazardous R34 Causes burns R37 Irritating to respiratory system

16. OTHER INFORMATION

CONTACT POINT

Safety Data Sheet

Bathroom Cleaner

1. PRODUCT and COMPANY IDENTIFICATION

Poisons Centre Information

AUSTRALIA	13 1126
NEW ZEALAND	0800 764 766 or 0800 POISON

2. HAZARD(S) IDENTIFICATION

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

RISK PHRASE(S) (See Section 15) R36/38 Irritating to eyes and skin.

ENVIRONMENTAL RISK PHRASE None

SAFETY PHRASE(S)
S2 Keep out of the reach of children
S23 Do not breathe spray
S24/25 Avoid contact with skin and eyes.
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S28 After contact with skin, wash immediately with plenty of water.
S35 This material and its container must be disposed of in a safe way.
S46 If swallowed, seek medical advice immediately and show this container or label.
S50 Do not mix with bleach, or other household products.
S51 Use only in well-ventilated areas

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS No	Proportion (%w/w)
Nonionic surfactants	Mixture	<10
Sulfamic acid	5329-14-6	<10
Formic acid	64-18-6	<10
Other ingredients classified as not hazardous according to NOHSC		to 100

4. FIRST AID MEASURES

Eye Contact If in eyes, hold eyelids apart and flush the eyes continuously with running water. Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.

Skin Contact If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water.

Inhalation Remove to fresh air. If breathing difficulties are experienced, seek medical attention.

Ingestion If swallowed, dot NOT induce vomiting. 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 None known.

Flammability Not flammable.

Extinguisher Type Water, carbon dioxide, dry chemical or foam.

Hazchem code 2X

6. ACCIDENTAL RELEASE MEASURES

Emergency and Evacuation Procedures Avoid contact with skin and eyes.
Ensure adequate ventilation.
Area may become slippery.
Use personal protective equipment. See section 8.

Minor Spills Soak up product with a wet cloth and wash area with water.

Major Spills Contain spill. Collect with a suitable absorbent such as sand. Shovel into clean, dry, labelled containers and close lids tightly. Do not allow material to enter waterways.

7. HANDLING AND STORAGE

Handling Dangerous Good class 8. Handle accordingly.

Storage Dangerous Good class 8. Store accordingly.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Standards - Australia

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

Ingredient	CAS No.[a]	TWA		STEL		Carcinogen Category	Notices
		ppm[b]	mg/m^3[c]	ppm[b]	mg/m^3[c]		
Formic acid	64-18-6	5	9.4	10	19	-	-

Exposure Standards - New Zealand

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

Ingredient	CAS No.[a]	TWA		STEL	
		ppm[b]	/m^3[c]	ppm[b]	mg/m^3[c]
Formic acid	64-18-6	5	9.4	10	19

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

Personal Protection When handling bulk quantities, wear suitable gloves, overalls and protective eye wear. If ventilation is insufficient, an appropriate respirator should be worn.

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

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State Liquid

Appearance Clear

Colour Pink red

Boiling Point 100°C (water)

Vapour Pressure 2.3 kPa (water)

Specific Gravity 1.035-1.055

Flashpoint Not determined

pH < 1.0

Solubility in Water Miscible

10. STABILITY AND REACTIVITY

Stability Stable under normal use conditions.

Dangerous Reactions Avoid alkalis, oxidizing and reducing agents.
Product is corrosive to metals such as steel and aluminium.

Decomposition Products Products may include oxides of carbon and sulphur.

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 Will cause irritation to the eye.

Skin Will cause irritation to the skin with prolonged/repeated contact.

Inhaled Vapours/mists may cause irritation to the upper respiratory tract.

Swallowed May cause irritation to the upper gastrointestinal tract.

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. Adverse effects to the aquatic environment are possible due to the pH of water being decreased by the addition of this product.

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 Australia)

UN number:	UN 3264
Proper shipping name:	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (Sulfamic acid and Formic acid)
DG class:	Class 8
Subsidiary risk:	None allocated
Packing group:	III
Hazchem code:	2X

Maritime Transport Regulations (IMDG)

UN number:	UN 3264
Proper shipping name:	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (Sulfamic acid and Formic acid)
DG class:	Class 8
Subsidiary risk:	None allocated
Packing group:	III
Marine Pollutant:	Not a Marine Pollutant

Air Transport Regulations (IATA)

UN number:	UN 3264
Proper shipping name:	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (Sulfamic acid and Formic acid)
DG class:	Class 8
Subsidiary risk:	None allocated
Packing group:	III

15. REGULATORY INFORMATION

AUSTRALIA
Regulatory Status Not applicable

Hazardous Substances Regulation Hazardous.

RISK PHRASE(S) R36/38 Irritating to eyes and skin.

ENVIRONMENTAL RISK PHRASE None

SAFETY PHRASE(S) S2 Keep out of the reach of children
S23 Do not breathe spray
S24/25 Avoid contact with skin and eyes.
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S28 After contact with skin, wash immediately with plenty of water.
S35 This material and its container must be disposed of in a safe way.
S46 If swallowed, seek medical advice immediately and show this container or label.
S50 Do not mix with bleach, or other household products.
S51 Use only in well-ventilated areas

SUSDP	S5 (Sulfamic acid & Formic acid)
NEW ZEALAND Regulatory Status	This product has been approved under HSNO covered by Cleaning Products (Corrosive) Group Standard 2006 HSR002526.
Approved Handler	Not required
Tracking	Not required

16. OTHER INFORMATION

CONTACT POINT

KEY/LEGEND

ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail
HSNO = Hazardous Substances and New Organisms Act 1996 (New Zealand)
IATA = International Air Transport Association
IMDG = International Maritime Dangerous Goods
N.O.S. = Not otherwise specified
NOHSC = National Occupational Health and Safety Commission (Australia)
SUSDP = Standard for the Uniform Scheduling of Drugs and Poisons (Australia)

Safety Data Sheet

Hair Removal Cream

1. PRODUCT and COMPANY IDENTIFICATION

Poisons Centre Information

AUSTRALIA	13 1126
NEW ZEALAND	0800 764 766 or 0800 POISON

2. HAZARD(S) IDENTIFICATION

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

RISK PHRASE(S) (See Section 15) R34 Causes burns

ENVIRONMENTAL RISK PHRASE None

SAFETY PHRASE(S) S2 Keep out of reach of children
S25 Avoid contact with eyes
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS No	Proportion (% w/w)
Potassium thioglycolate	34452-51-2	<10
Calcium hydroxide	1305-62-0	<10
Talc	14807-96-6	<10
Titanium dioxide	13463-67-7	<1
Other ingredients classified as not hazardous according to NOHSC		to 100

4. FIRST AID MEASURES

Eye Contact Wash eyes immediately with a large quantitiy of water. Contact a doctor.

Skin Contact If you experience any smarting/tingling feeling during use, remove the cream immediately and rinse thoroughly with water. If this sensation persists, seek medical advice.

Inhalation Remove to fresh air if inhalation causes eye watering, headaches, dizziness, or other discomfort.

Ingestion If swallowed in quantity DO NOT INDUCE VOMITING. Rinse mouth thoroughly and contact a doctor or a Poisons Information Centre.

Advice to Doctor: Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Specific Dangers The product is not flammable and will not support combustion, ie it will not burn.

Flammability Not flammable.

Extinguisher Type Water, foam, carbon dioxide.

Hazchem code 2R

6. ACCIDENTAL RELEASE MEASURES

Emergency and Evacuation Procedures Exclude non-essential personnel. Floors may become slippery.

Minor Spills Mop up spill and wash area with detergent and water.

Major Spills Contain spill. Collect product using a suitable adsorbent material such as vermiculite. Shovel material into a clean, dry, labelled container and close lid tightly. Do not allow product to enter waterways.

7. HANDLING AND STORAGE

Handling Dangerous Good Class 8. Handle accordingly.

Storage Dangerous Good Class 8. Store accordingly.
Protect from sunlight. Do not expose to temperatures exceeding 40°C.
Store preferably between 5°C and 25°C.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Standards - Australia

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

Ingredient	CAS No.[a]	TWA		STEL		Carcinogen Category	Notices
		ppm[b]	mg/m³[c]	ppm[b]	mg/m³[c]		
Calcium hydroxide	1305-62-0	-	5	-	-	-	-
Titanium dioxide	13463-67-7	-	10	-	-	-	-
Talc	14807-96-6	-	2.5	-	-	-	-

Exposure Standards - New Zealand

Exposure Standards[3] have been set for the following ingredients:

Ingredient	CAS No.[a]	TWA		STEL	
		ppm[b]	mg/m³[c]	ppm[b]	mg/m³[c]
Calcium hydroxide	1305-62-0	-	5	-	-
Titanium dioxide	13463-67-7	-	10[d]	-	-
Talc (containing no asbestos fibres)	14807-96-6	-	2 Respirable dust		

TWA = Time Weighted Average
STEL = Short Term Exposure Limit
[1] Worksafe Australia Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003 1995)]
[3] 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.
[d] The value is for inspirable dust containing no asbestos and less than 1% free silica.

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	Cream
Appearance	Smooth, opaque, viscous
Colour	White
Boiling Point	100°C (water)
Vapour Pressure	2.3 kPa (water)
Density	1.04 - 1.10 g/mL at 20°C
Flashpoint	Not flammable
Solubility in Water	Miscible
pH	12.2 - 12.5 (neat) at 30°C
Viscosity	60000 - 150000 centipoise (at 20°C, spindle E, 5 rpm)

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Conditions to Avoid	Temperatures below 5°C and greater than 40°C.
Incompatible Materials	Do not let product touch any other materials in case of damage or discoloration. If the product is in contact with any household surface, clean immediately. Avoid contact with materials which may be attacked by alkalis.
Decomposition Products	Carbon dioxide, and small quantities of Sulphur dioxide and Dihydrogen sulphide may be produced in the event of a fire.

11. TOXICOLOGICAL INFORMATION

Product Toxicity	Testing of this product has been undertaken for skin irritancy and found not to be 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.
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	Will cause burns to the eye.
Skin	No effects likely if instructions are followed.
Inhaled	Not likely to be a route of exposure.

Swallowed Will cause burns to the upper gastrointestinal tract.

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)

UN number:	UN 1719
Proper shipping name:	CAUSTIC ALKALI LIQUID N.O.S. (Potassium thioglycolate, Calcium hydroxide)
DG class:	8
Subsidiary risk:	None allocated
Packing group:	III
Hazchem code:	2R

Maritime Transport Regulations (IMDG)

UN number:	UN 1719
Proper shipping name:	CAUSTIC ALKALI LIQUID N.O.S. (Potassium thioglycolate, Calcium hydroxide)
DG class:	8
Subsidiary risk:	None allocated
Packing group:	III
Marine Pollutant	Not a Marine Pollutant

Air Transport Regulations (IATA)

UN number:	UN 1719
Proper shipping name:	CAUSTIC ALKALI LIQUID N.O.S. (Potassium thioglycolate, Calcium hydroxide)
DG class:	8
Subsidiary risk:	None allocated
Packing group:	III

15. REGULATORY INFORMATION

AUSTRALIA
Regulatory Status Not applicable.

Hazardous Substances Regulation Hazardous

Risk Phrase(s) R34 Causes burns

Environmental Risk Phrase None

Safety Phrase(s)	S2 Keep out of reach of children S25 Avoid contact with eyes S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
SUSDP	S5 (Potassium hydroxide)
NEW ZEALAND Regulatory Status	This product has been approved under HSNO covered by Cosmetics Group Standard 2006 HSR002552.
Approved Handler	Not required
Tracking	Not required

16. OTHER INFORMATION

CONTACT POINT

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

Safety Data Sheet

Floor Cleaner

1. PRODUCT and COMPANY IDENTIFICATION

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

2. HAZARD(S) IDENTIFICATION

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

RISK PHRASE(S) (See Section 15)	R41	Risk of serious damage to eyes
	R38	Irritating to skin

SAFETY PHRASE(S)

S2 Keep out of the reach of children
S23 Do not breathe spray
S24/25 Avoid contact with eyes and skin
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S28 After contact with skin, wash immediately with plenty of water
S39 Wear eye/face protection
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)
Sodium lauryl sulphate	151-21-3	<10
Sodium hypochlorite (as available chlorine)	7681-52-9	<5
Sodium hydroxide	1310-73-2	<2
Lauryldimethylamine, oxide	1643-20-5	<1
Other ingredients classified as not hazardous according to NOHSC		to 100

4. FIRST AID MEASURES

Eye Contact	If in eyes, hold eyelids apart and flush the eye continuously with running water. Continue flushing until advised to stop by the Poison Information Centre or a doctor, or for at least 15 minutes.
Skin Contact	If skin contact, remove contaminated clothing and flush skin with running water.
Inhalation	Remove person to fresh air. If breathing difficulties are experienced, seek medical attention.
Ingestion	If swallowed, do NOT induce vomiting. 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	May release hydrochloric acid and chlorine fumes with decomposition.
Flammability	Not flammable.
Extinguisher Type	Water, foam, carbon dioxide or dry chemical.
Hazchem code	2X

6. ACCIDENTAL RELEASE MEASURES

Emergency and Evacuation Procedures	Ensure adequate ventilation.
Minor Spills	Soak up product with a wet cloth and wash area with water.
Major Spills	Contain spill. Collect with a suitable absorbent such as sand. Shovel into clean, dry, labelled containers and close lids tightly. Do not allow material to enter waterways.

7. HANDLING AND STORAGE

Handling	Avoid contact with skin and eyes. Wear eye/face protection.
Storage	Store in a cool dry area out of direct sunlight.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

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

Ingredient	CAS No.[a]	TWA		STEL		Carcinogen Category	Notices
		ppm[b]	mg/m3[c]	ppm[b]	mg/m3[c]		
Sodium hydroxide	1310-73-2	-	2 peak limitation	-	-	-	-
Chlorine[2]	7782-50-5	1	3 peak imitation	-	-	-	-

Exposure Standards - New Zealand following ingredients: Exposure Standards[3] have been set for the

Ingredient	CAS No.[a]	TWA		STEL	
		ppm[b]	mg/m3[c]	ppm[b]	mg/m3[c]
Sodium hydroxide	1310-73-2	Ceiling	2	-	-
Chlorine[2]	7782-50-5	0.5	1.5	1	2.9

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] Chlorine is a decomposition product from hypochlorite only after strong acidification. Under normal conditions minimal hazardous decomposition products are released.
[3] 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	Liquid
Appearance	Clear, chlorine odour
Colour	Pale yellow
Boiling Point	100°C (water)
Vapour Pressure	2.3 kPa (water)
Specific Gravity	1.05 - 1.07 at 25°C
Flashpoint	Not flammable
Solubility in Water	Miscible
pH	12.8 - 13.5 (neat) at 25°C
Available Chlorine (as Cl_2)	2.5 - 2.9 % (w/w)

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Dangerous Reactions	Will react with acids to release chlorine gas. Product is corrosive to aluminum.
Decomposition Products	Products may include oxides of carbon, chlorine and hydrogen chloride.

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	Will cause severe irritation to the eye. Risk of serious damage to eyes.
Skin	Will cause irritation to the skin with prolonged/repeated contact.
Inhaled	If chlorine vapours are released, may cause irritation to the respiratory system.
Swallowed	May cause irritation to the upper gastrointestinal tract.

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. However, the alkalinity of the product would result in adverse effects, especially in aquatic environments.

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

Metal corrosivity of a similar product has been tested and was found to corrosive to aluminium.

Road Transport Regulations (ADG 6 Aust.)

UN number:	UN 3266
Proper shipping name:	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (Sodium hypochlorite, Sodium hydroxide)
DG class:	8
Subsidiary risk:	None allocated
Packing group:	II
Hazchem code:	2X

Maritime Transport Regulations (IMDG)

UN number:	UN 3266
Proper shipping name:	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (Sodium hypochlorite, Sodium hydroxide)
DG class:	8
Subsidiary risk:	None allocated
Packing group:	II
Marine Pollutant:	Not a Marine Pollutant

Air Transport Regulations (IATA)

UN number:	UN 3266
Proper shipping name:	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (Sodium hypochlorite, Sodium hydroxide)
DG class:	8
Subsidiary risk:	None allocated
Packing group:	II

15. REGULATORY INFORMATION

AUSTRALIA

Regulatory Status	Not applicable.

Hazardous Substances Regulation Hazardous

Risk Phrase(s)	R41	Risk of serious damage to eyes
	R38	Irritating to skin

Environmental Risk Phrase None

Safety Phrase(s)	S2 Keep out of the reach of children S23 Do not breathe spray S24/25 Avoid contact with eyes and skin S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice S28 After contact with skin, wash immediately with plenty of water S39 Wear eye/face protection S46 If swallowed seek medical advice immediately and show this container or label S51 Use only in well-ventilated areas
SUSDP	S5 (Sodium hypochlorite, Sodium hydroxide)
NEW ZEALAND Regulatory Status	This product has been approved under HSNO covered by Cleaning Products Group Standard 2006 HSR002526.
Approved Handler	Not required
Tracking	Not required

16. OTHER INFORMATION

CONTACT POINT

KEY/LEGEND
ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail
HSNO = Hazardous Substances and New Organisms Act 1996 (New Zealand)
IATA = International Air Transport Association
IMDG = International Maritime Dangerous Goods
N.O.S. = Not otherwise specified
NOHSC = National Occupational Health and Safety Commission (Australia)
SUSDP = Standard for the Uniform Scheduling of Drugs and Poisons (Australia)

Safety Data Sheet

Bathroom Cleaning Gel

1. PRODUCT and COMPANY IDENTIFICATION

Poisons Centre Information

AUSTRALIA	13 1126
NEW ZEALAND	0800 764 766 or 0800 POISON

2. HAZARD(S) IDENTIFICATION

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

RISK PHRASE(S) (See Section 15)
R31 Contact with acids liberates toxic gas
R36/38 Irritating to eyes and skin

SAFETY PHRASE(S)
S2 Keep out of reach of children
S24/25 Avoid contact with skin and eyes
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S28 After contact with skin, wash immediately with plenty of water
S46 If swallowed, seek medical advice immediately and show this container or label

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS No	Proportion (% w/w)
Sodium hypochlorite (Available chlorine 2.1 %w/v)	7681-52-9	<10 (21.8g/L)
Sodium hydroxide	1310-73-2	<10 (10g/L)
Sodium laureth sulfate	68585-34-2	<10
Lauryl dimethyl amine oxide	1643-20-5	<10
Ethoxylated alcohol	68439-46-3	<1
Alkaline salt		<1 (7.4g/L)
Other ingredients classified as not hazardous according to NOHSC		to 100

4. FIRST AID MEASURES

Eye Contact If in eyes, hold eyelids apart and flush the eye continuously with running water. Continue flushing until advised to stop by a Poison Information Centre (phone Australia 131 126; New Zealand 0800 764 766) or a doctor at once, or for at least 15 minutes.

Skin Contact If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. If irritation persists contact a doctor.

Inhalation Remove to fresh air. If breathing difficulties are experienced, seek medical attention.

Ingestion If swallowed, Do NOT induce vomiting. 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 May release HCl fumes and toxic fumes of chlorine when heated.

Flammability Not flammable.

Extinguisher Type Water, foam, carbon dioxide.

Hazchem code 2X

6. ACCIDENTAL RELEASE MEASURES

Emergency and Evacuation Procedures Keep area well ventilated.
Do not let product enter drains or natural waterways.
Use personal protective equipment. See section 8.

Minor Spills Mop up spills with water and detergent.

Major Spills Contain spill. Collect product using a suitable absorbent material such as vermiculite. Shovel into clean, dry, labelled containers and close lids. Do not allow material to enter waterways.

7. HANDLING AND STORAGE

Handling Class 8 DG. Handle accordingly.
Avoid contact with skin and eyes.

Storage Class 8 DG. Store accordingly.

8. EXPOSURE AND PERSONAL PROTECTION

Exposure Standards Chlorine is a decomposition product from Hypochlorite only after strong acidification. Under normal conditions no hazardous decomposition products are released.

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

Ingredient	CAS No.[a]	TWA ppm[b]	TWA mg/m³[c]	STEL ppm[b]	STEL mg/m³[c]	Carcinogen Category	Notes
Sodium hydroxide	1310-73-2	-	2 peak limitation	-	-	-	-
Chlorine[2]	7782-50-5	1	3 peak imitation	-	-	-	-

New Zealand Exposure Standards[3] have been set for the following ingredients:

Ingredient	CAS No.[a]	TWA ppm[b]	TWA mg/m³[c]	STEL ppm[b]	STEL mg/m³[c]
Sodium hydroxide	1310-73-2	Ceiling	2	-	-
Chlorine[2]	7782-50-5	0.5	1.5	1	2.9

TWA = Time Weighted Average
STEL= Short Term Exposure Limit
[1] Worksafe Australia Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003 1995)]
[3] 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.
[2] Chlorine is a decomposition product from hypochlorite only after strong acidification. Under normal conditions minimal hazardous decomposition products are released.
Ceiling = (WES - Ceiling) = A concentration that should not be exceeded during any part of the working day.

Engineering Controls Use in well ventilated areas. 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	Liquid
Appearance	Viscous
Colour	Milky White
pH	12.5 - 13.5 (neat) at 25°C
Vapour Pressure	2.3 kPa (water)
Vapour Density	Not available
Boiling Point	100°C (water)
Freezing Point	Not available
Solubility in Water	Soluble
Specific Gravity	1.0 - 1.1 at 25°C
Flashpoint	Not flammable
Viscosity	300 - 500 cps at 25ºC (RVT spindle 2, 50 rpm)
Available Chlorine	1.9 - 2.2% w/w

10. STABILITY AND REACTIVITY

Stability Stable under normal conditions.

Dangerous Reactions Will react with acids to release chlorine gas. Product is corrosive to aluminium.

Decomposition Products Products may include oxides of carbon, sulphur and hydrogen chloride.

11. TOXICOLOGICAL INFORMATION

Acute Effect(s)

Eye	Will cause irritation to the eye.
Skin	Will cause irritation to the skin with prolonged/repeated contact.
Inhaled	May cause irritation to the upper respiratory tract.
Swallowed	May cause irritation to the gastrointestinal tract.
Sensitisation	Not expected to be a skin sensitiser.

Chronic Effect(s) The chronic toxicity of this product has not been determined.

Toxicity Information Information is based on available component data and their concentrations in the product.

12. ECOLOGICAL INFORMATION

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 7)

UN number:	*UN 3266
Proper shipping name:	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (Sodium hypochlorite, Sodium hydroxide)
DG class:	8
Subsidiary risk:	None allocated
Packing group:	III
Hazchem code:	2X

Maritime Transport Regulations (IMDG)

UN number:	*UN 3266
Proper shipping name:	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (Sodium hypochlorite, Sodium hydroxide)
DG class:	8
Subsidiary risk:	None allocated
Packing group:	III
Marine Pollutant:	Not a Marine Pollutant

Air Transport Regulations (IATA)

UN number:	*UN 3266
Proper shipping name:	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (Sodium hypochlorite, Sodium hydroxide)
DG class:	8
Subsidiary risk:	None allocated
Packing group:	III

* Corrosive to aluminium.

15. REGULATORY INFORMATION

AUSTRALIA

Regulatory Status This product has been approved by TGA Australia, AUST L 60115.

Hazardous Substances Regulation Hazardous

Risk Phrase(s)

R31	Contact with acids liberates toxic gas
R36/38	Irritating to eyes and skin

Safety Phrase(s)	S2 Keep out of reach of children S24/25 Avoid contact with skin and eyes S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice S28 After contact with skin, wash immediately with plenty of water S46 If swallowed, seek medical advice immediately and show this container or label
SUSDP	S5 (Alkaline salt, Sodium hydroxide, Sodium hypochlorite)
NEW ZEALAND Regulatory Status	This product has been approved under HSNO covered by Cleaning Products (Corrosive) Group Standard 2006 HSR002526.
Approved Handler	Not required
Tracking	Not required

16. OTHER INFORMATION

CONTACT POINT

KEY/LEGEND

ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail
DG = Dangerous Goods
HSNO = Hazardous Substances and New Organisms Act 1996 (New Zealand)
IATA = International Air Transport Association
IMDG = International Maritime Dangerous Goods
N.O.S. = Not otherwise specified
NOHSC = National Occupational Health and Safety Commission (Australia)
SUSDP = Standard for the Uniform Scheduling of Drugs and Poisons (Australia)
TGA = Therapeutic Goods Administration (Australia)