2 February 2021

Ref: WTJ20-495
Contact: Eleisha Burton

Section 4.55(2) Application for Modification to SSD-4953

Dangerous Goods Facility

23 – 107 Erskine Park Road, Erskine Park
Lot 1 DP 1128233

Prepared by Willowtree Planning Pty Ltd
on behalf of DHL Supply Chain (Australia) Pty Ltd

February 2021

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Document Control Table			
Document Reference:	WTJ20-495 – SSD-4953 Modification Application		
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Version and Date	Prepared by	Checked by	Approved by
Version No. 1 – 03/11/2020 DRAFT	Eleisha Burton Senior Planner	Andrew Cowan Director	
Version No. 2 – 02/02/2021 FINAL	Eleisha Burton Associate	Andrew Cowan Director	Andrew Cowan Director
			

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PART A PRELIMINARY

1.1 INTRODUCTION

This Modification Application (MA) has been prepared by Willowtree Planning Pty Ltd (Willowtree Planning) on behalf of DHL Supply Chain (Australia) Pty Ltd (DHL), and is submitted to the NSW Department of Planning, Industry and Environment (DPIE) in support of the proposed modification to the approved Dangerous Goods (DGs) Facility at Building B1 of 23 – 107 Erskine Park Road, Erskine Park (subject site), legally described as Lot 1 DP 1128233.

The DGs Facility was approved as State Significant Development (SSD), granted by the Minister of Planning on 21 May 2012. The SSD (**SSD-4953**) concerned the use of an existing building (Building B1) at the Westpark Industrial Estate located at the subject site, to store DGs.

Modification 1 to **SSD-4953** was approved (with conditions) on 18 March 2013, which included the amendment of operating hours to consider the revised use for a 24-hour operational development, seven days per week. The DGs Facility as modified (**SSD-4953 MOD 1**) presently includes:

- 24 hours 7 days per week operation of a Dangerous Goods Facility – Building B1 (DHL)

This MA represents the **second** modification to **SSD-4953**, which seeks modify the classes of DGs stored at the subject site.

The amendments sought have been assessed against the original Secretary's Environmental Assessment Requirements (SEARs) throughout this MA.

The structure of the statement is as follows:

- **Part A** Preliminary
- **Part B** Site Analysis
- **Part C** Proposed Modification
- **Part D** Legislative and Policy Framework
- **Part E** Likely Impacts of the Development
- **Part F** Conclusion

1.2 DEVELOPMENT APPLICATION HISTORY

Consent was granted to **SSD-4953** on 21 May 2012 for the use of an existing building to store DGs within Building B1 of the identified land portion comprising Westpark Industrial Estate at 23-107 Erskine Park Road, Erskine Park (Lot 1 DP 1128233). **SSD-4953 MOD 1** was subsequently approved on 18 March 2013, which included the proposed amendment to the current operating hours to allow the revised use for a 24-hour operational development, seven days per week.

Review of the approval granted under **SSD-4953** indicates there is nothing which prevents the modifications sought under this MA.

The existing approved the DG products and quantities are outlined in the **Table 1** and **Figure 1**.

Table 1. Existing approved Classes and Quantities (maximum)

Class	Packing Group	Quantity (kg)
2.1	-	400,000 kg (100,000 kg of LPG) *
2.2	II & III	200,000
3	II & III	50,000
4.1	II & III	50,000
8	II & III	200,000
9	III	100,000

Figure 1. Existing DGs Storage Locations (Source: Riskcon, 2020)

1.3 SUMMARY OF PROPOSED MODIFICATIONS

DHL has proposed to store a new customer within their DGs Facility, which would result in exceedance of the approved DG classes and quantities; subsequently, it is necessary to review and update the DG quantities within a Preliminary Hazard Analysis (PHA) to reflect the anticipated quantities as part of this MA.

The proposed modifications do not include any significant changes to the built form or scale of the approved development and will not result in an increase in gross floor area (GFA).

The proposed modifications are further explained in the ensuing sections of this statement.

PART B SITE ANALYSIS

2.1 SITE LOCATION AND CHARACTERISTICS

The subject site is part of the Westpark Industrial Estate and is identified as Building B1, located in the south-western corner of the Estate. The Estate forms part of the wider 'Erskine Park Employment Lands Precinct' of the Western Sydney Employment Area (WSEA).

The subject site is within an established industrial area, surrounded by a number of other storage and distribution facilities.

Refer to **Figure 2** and **Figure 3** below.

Figure 2. Aerial Photo of the Site (Source: Nearmap, 2020)

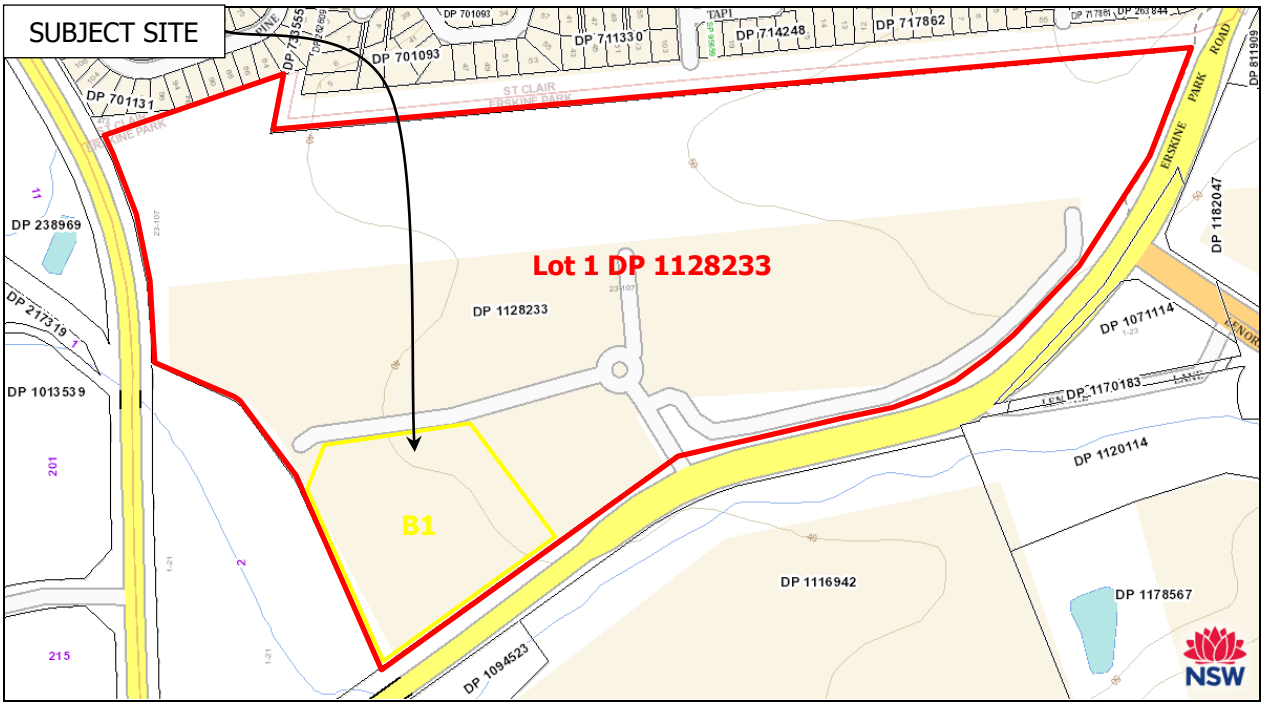


Figure 3. Cadastral of the Site (Source: SIX Maps, 2020)

The subject site is zoned IN1 General Industrial under the *State Environmental Planning Policy (Western Sydney Employment Area) 2009* (SEPP WSEA).

In its existing state, the subject site comprises a warehouse (20,000m^2), offices (650m^2), car parking area (33 spaces), basement car parking area (60 spaces) and a hardstand area containing an entry and exit for B-Double trucks.

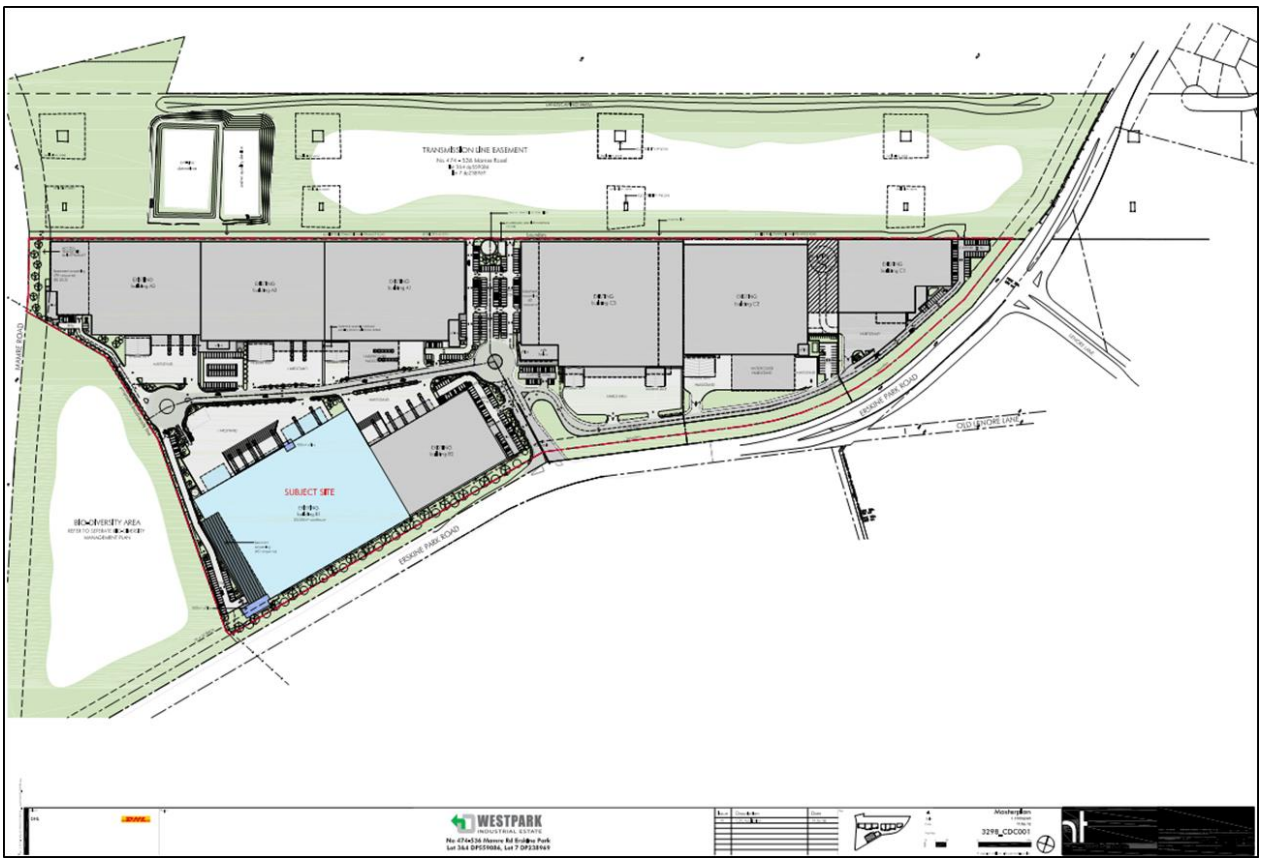


Figure 4. Masterplan for Westpark Industrial Estate (Source: Nettleton Tribe, 2018)

PART C PROPOSED MODIFICATION

3.1 OVERVIEW

This MA seeks consent to modify the approved DGs Facility to accommodate additional classes and quantities of DGs.

The proposed DGs classes to be stored within Building B1 include the following:

- Class 2;
- Class 3;
- Class 4.1;
- Class 5.1;
- Class 8; and,
- Class 9.

This MA provides a summary of the PHA undertaken by Riskon Engineering (20202), which analyses the proposed classes and quantities (refer to **Table 1**) of DGs and the thresholds (refer to **Table 2**) concerning each class proposed to be stored at the subject site.

3.1.1 DG Classes and Quantities Proposed

Table 2. Maximum Classes and Quantities of DGs proposed

Class	Packing Group	Quantity (kg)	Examples
2.1	-	600,000 (150,000kg of LPG) *	Aerosols
2.2	-	200,000	Aerosols
3	II & III	200,000	Hand sanitizer
4.1	II & III	50,000	Hand sanitizer
8	II & III	200,000	Cleaning products
9	III	500,000	Batteries

* Assuming density of 1,000 kg/m^3 and 25% of product weight is propellant

3.1.2 DG Thresholds Proposed

Where more than one class of DGs are stored and handled at the site an Aggregate Quantity Ratio (AQR) exists.

Where the ratio AQR exceeds a value of 1, the site would be considered a Major Hazard Facility (MHF). The threshold quantities for each class is taken from Schedule 15 of the *Work Health and Safety Regulation 2017* (WHS Regulation); these are summarised in **Table 3**.

Classes 2.2, 4.1(II & III), 8 and 9 are not subject to MHF legislation.

Table 3. Major Hazard Facility Thresholds

Class	Packing Group	Threshold (tonnes)	Storage (tonnes)
2.1	-	200	150
3	II & III	50,000	200

A review of the thresholds and the commodities and packing groups listed in **Table 3** indicates only Class 2.1 and 3 are assessable against the MHF thresholds. Applying the AQR ratio calculation, the resulting AQR is less than 1, hence the facility would not be classified as an MHF.

3.1.3 DG Storage Locations Proposed

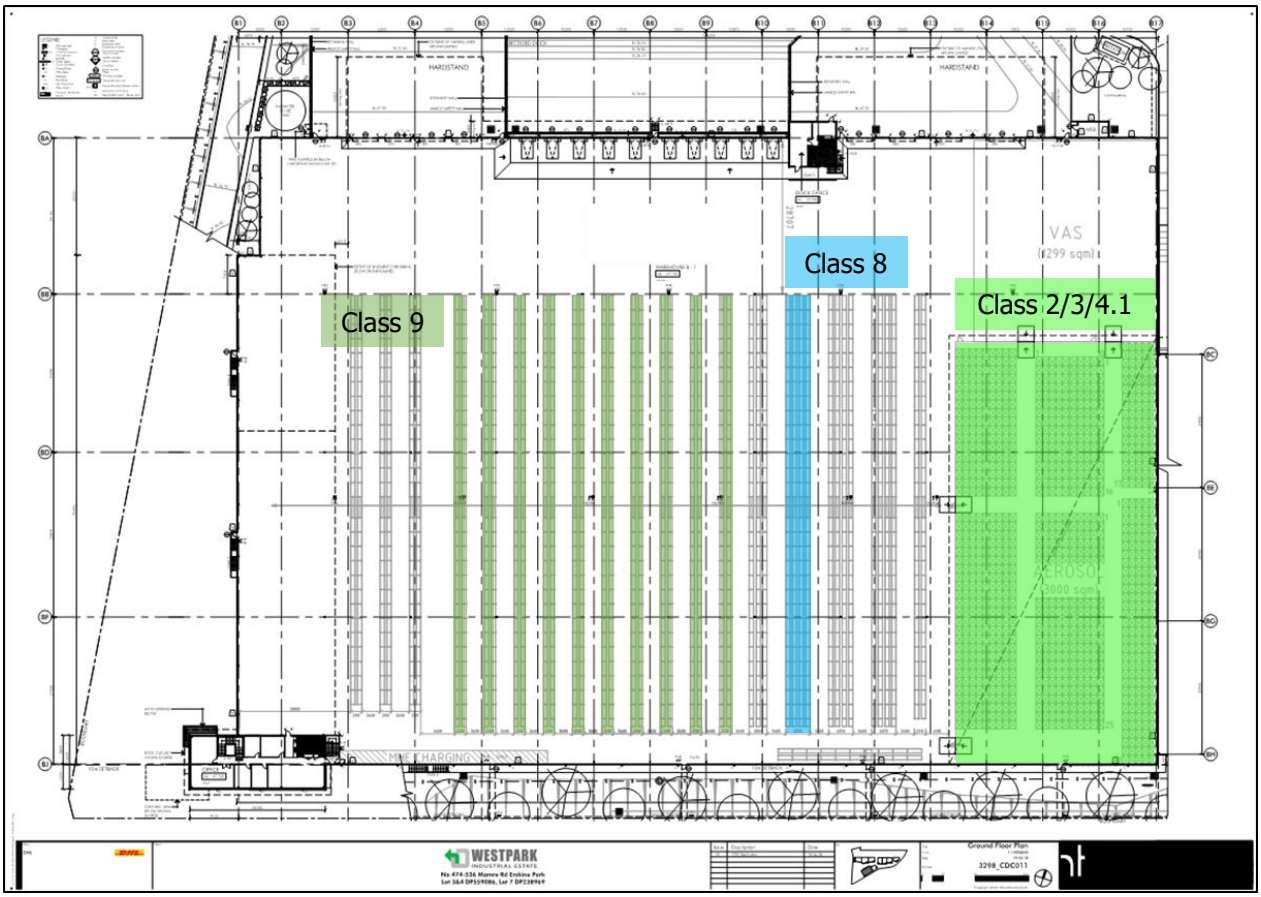


Figure 5. Proposed DGs Storage Locations (Source: Riskcon, 2020)

3.1.4 Operational Adjustments

The proposed modifications intend to rebalance product commodities, resulting in less non-DGs storage, to allow for more DG storage. As such, there is no increase in total goods stored on site, just a shift in quantities of non-DGs (less) and DGs (more).

It is noted that total DGs storage is less than when the site was an MHF; hence, it would be anticipated that operations would be similar or less than when the site was originally approved.

3.2 DEVELOPMENT CONSENT MODIFICATIONS

The proposed modifications do not require any conditions of consent to be modified.

PART D LEGISLATIVE AND POLICY FRAMEWORK

This Part of the statement addresses and responds to the legislative and policy requirements relevant to the proposed development at the site in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act). The statutory planning framework relevant to the proposed development at the site includes:

- *Environment Protection and Biodiversity Conservation Act 1999;*
- *Environmental Planning and Assessment Act 1979;*
- *Environmental Planning and Assessment Regulation 2000;*
- *Protection of the Environment Operations Act 1997;*
- *Rural Fires Act 1997;*
- *State Environmental Planning Policy No 33 – Hazardous and Offensive Development;*
- *State Environmental Planning Policy No 55 – Remediation of Land;*
- *State Environmental Planning Policy (Western Sydney Employment Area) 2009;*
- *Penrith Local Environmental Plan 2010;*
- *Penrith Development Control Plan 2014.*

4.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1979

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), any action (which includes a development, project or activity) that is considered likely to have a significant impact on Matters of National Environmental Significance (MNES) (including nationally threatened ecological communities and species listed migratory species) must be referred to the Commonwealth Minister for the Environment. The purpose of the referral is to allow a decision to be made about whether an action requires approval on a Commonwealth level. If an action is considered likely to have a significant impact on MNES, it is declared a "controlled action" and formal Commonwealth approval is required.

The DGs Facility and proposed amendment to the classes and quantities of DGs to be stored on-site would not have any impact on MNES listed under the EPBC Act.

4.2 ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979

The EP&A Act is the principle planning and development legislation in NSW. The modifications sought to development consent **SSD-4953** warrants consideration of the provisions of Section 4.55(2) of the EP&A Act. The provisions of Section 4.55(2) of the EP&A Act are provided in **Table 3** below and require consideration in this instance.

Table 4. Section 4.55 Assessment

Clause	Response
*(2) **Other modifications** A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if—*	
(a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and	Given the nature and extent of the changes proposed, the modifications sought would have limited undue environmental impacts. This is discussed further below. **Part E** of this statement considers the proposed modification's impacts on the immediate and surrounding environments. The proposed modification will result in the same ultimate development outcome to that previously approved as no changes to the overall built form and gross floor area is proposed. **Section 4.2.1** of this statement demonstrates that the development as modified would result in substantially the same development as the

Table 4. Section 4.55 Assessment	
Clause	**Response**
	development for which consent was granted under **SSD-4953**.
(b) it has consulted with the relevant Minister, public authority or approval body (within the meaning of Division 4.8) in respect of a condition imposed as a requirement of a concurrence to the consent or in accordance with the general terms of an approval proposed to be granted by the approval body and that Minister, authority or body has not, within 21 days after being consulted, objected to the modification of that consent, and	As the development is SSD, no concurrence is required, however the NSW DPIE will consult with stakeholders as part of the notification period.
(c) it has notified the application in accordance with— *(i) the regulations, if the regulations so require, or* *(ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and*	Pursuant to Clause 118 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) requires notification for a minimum period of 14 days.
(d) it has considered any submissions made concerning the proposed modification within the period prescribed by the regulations or provided by the development control plan, as the case may be.	It is acknowledged that consideration would be given to any submissions that are received concerning the proposed modifications.
(3) In determining an application for modification of a consent under this section, the consent authority must take into consideration such of the matters referred to in section 4.15(1) as are of relevance to the development the subject of the application. The consent authority must also take into consideration the reasons given by the consent authority for the grant of the consent that is sought to be modified.	The proposed modifications are consistent with the matters referred to in section 4.15(1) of the EP&A Act (refer to **Table 4**) and has considered the reasons given by the consent authority for original grant of consent. This is further described in **Section 4.2.2** below.

4.2.1 Section 4.55(2)(a) - Substantially the Same

The scope of a maximum modification of a consent without constituting assessment as a standalone application can be analysed through the ambit of *Michael Standley & Associates Pty Ltd v North Sydney Council [2005] NSWLEC 358*, whereupon Commissioner Mason P. found in relation to modification of development consents that the word "modify" was given the ordinary meaning of "to alter without radical transformation". Therefore, the extent to which a consent may be modified is that to which the consent, as modified, is as approved without radical transformation or alteration.

The development, as modified, is substantially the same development and will not result in a radical transformation of **SSD-4953** for the following reasons:

- The modification use of the subject site for warehousing and distribution, for the operative purposes of a DGs Facility, as approved;
- The modification would not alter the approved building bulk, scale, design or use;
- There are no detrimental quantitative changes to the approved building bulk and scale that will impact the environmental impact of the proposed development (as modified);

- The function, form, operations and importantly, public perception of the subject site, would remain unchanged.

In light of the above, the proposal as amended, is not considered to result in a "radical transformation" of the consent, as currently approved, satisfying the radical transformation test pursuant to *Michael Standley & Associates Pty Ltd v North Sydney Council [2005] NSWLEC 358*.

This is further analysed in *Moto Projects (No 2) Pty Ltd v North Sydney Council [1999] NSWLEC 280* which applies a quantitative and qualitative test to determined what qualifies a development as being "substantially the same", providing a comparison of the development as approved, and the development as proposed to be modified. The result of the comparison must be a finding that the modified development is "essentially or materially" the same as the approved development. The comparison involves an appreciation, qualitatively, as well as quantitatively, of the developments being compared in their proper contexts (including the circumstances in which the development consent was granted).

The proposal does not result in any quantitative changes to the approved development, therefore, from a qualitative perspective, the development retains its identity as warehousing and distribution development, for the operative purposes of a DGs Facility.

Therefore, the proposal as amended, will be substantially the same development as approved, and satisfies the requirements for the application to be assessed and approved pursuant to Section 4.55(2) of the EP&A Act.

4.2.2 Section 4.55(3) - Section 4.15 and Reasons given by the consent authority for the grant of consent

Section 4.15(1) of the EP&A Act specifies that matters which a consent authority must consider when determining a DA. The relevant matters for consideration under Section 4.15(1) of the EP&A Act are provided in **Table 4** below.

Table 5. Section 4.15(1)(A) Considerations

Section	Response
Section 4.15(1)(a)(i) any environmental planning instrument, and	Refer to **Section 4.4** to **Section 4.6** of this statement.
Section 4.15(1)(a)(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and	There are no applicable draft instruments for consideration.
Section 4.15(1)(a)(iii) any development control plan, and	Refer to **Section 4.7** of this statement.
Section 4.15(1)(a)(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and	There is no voluntary planning agreement that apply to the proposal.
Section 4.15(1)(a)(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),	There are no matters prescribed by the regulation that are relevant to the proposal.
Section 4.15(1)(b)-(c)	Refer to **Part E**

4.3 ENVIRONMENTAL PLANNING & ASSESSMENT REGULATION 2000

Pursuant to Clause 115 of the EP&A Regulation all appropriate documentation has been submitted as a part of this MA.

Clause 118(1)(a-c) of the EP&A Regulation applies to developments for which consent may have been issued for works to be carried out on of the following:

a) *designated development,*
b) *State significant development,*
c) *nominated integrated development, threatened species development or Class 1 aquaculture development where the application was made to a consent authority other than a council.*

The proposed modification relates to SSD, therefore the consent authority would need to take into account Clause 118, subclauses 2, 3, 4, 5 and 7, of EP&A Regulation.

Clause 118 of the EP&A Regulation calls for the MA to be notified or advertised for the minimum period specified in Clause 10 of Schedule 1 to the Act. In this case the minimum public exhibition period is 14 days.

4.4 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT 1997

Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act) contains a core list of activities that require a licence before they may be undertaken or carried out. The definition of an 'activity' for the purposes of the POEO Act is:

> *"an industrial, agricultural or commercial activity or an activity of any other nature whatever (including the keeping of a substance or an animal)."*

Under the subject MA, the DGs Facility would include proposed changes to the classes and quantities of applicable DGs to be stored at the subject site.

4.4.1 Schedule 1 Schedule Activities

Part 1 of the POEO Act establishes provisions for Premises-based Activities, of which the proposal is subject to item 9:

> ***9 Chemical storage***
>
> *(1) This clause applies to the following activities:*
>
> *general chemicals storage, meaning the storage or packaging in containers, bulk storage facilities or stockpiles of any chemical substance classified as a dangerous good in the Transport of Dangerous Goods Code, other than the following:*
> *(a) petroleum or petroleum products,*
> *(b) radioactive substances within the meaning of the Radiation Control Act 1990.*
>
> *on-site generated chemical waste storage means the storage of any chemical substance produced on site that is prescribed waste (that is, hazardous waste, restricted solid waste or liquid waste, or any combination of them).*
>
> *petroleum products storage, meaning the storage or packaging of petroleum or petroleum products in containers, bulk storage facilities or stockpiles.*
>
> *(2) Each activity referred to in Column 1 of the Table to this clause is declared to be a scheduled activity if it meets the criteria set out in Column 2 of that Table.*

Table	
Column 1	***Column 2***
Activity	***Criteria***
General chemicals storage	*capacity to store more than 20 tonnes (pressurised gases), 200 tonnes (liquefied gases) or 2,000 tonnes (chemicals in any other form)*
On-site generated chemical waste storage	*involves storing on site at any time more than 5 tonnes of any chemical substance produced on site that is prescribed waste, not including excluded material (where 1,000 litres of liquid is taken to weigh 1 tonne)*
Petroleum products storage	*capacity to store more than 200 tonnes (liquefied gases) or 2,000 tonnes (chemicals in any other form)*

The PHA (Riskcon Engineering, 2020), dated 26 October 2020 (refer to **Appendix 3**), concludes that *the risks at the site boundary are not considered to exceed the acceptable risk criteria; hence, the facility would only be classified as potentially hazardous and would be permitted within the current land zoning for the site*.

The Riskcon Engineering review of the cumulative risk profiles in the area indicate two major hazard facilities have been relocated from the area; hence, the cumulative risk profile is likely to be less than the existing profile for the area and would thus be considered acceptable.

Furthermore, DHL currently possess an Environmental Protection Licence (EPL), issued by the Environmental Protection Authority, which enables chemical storage. Considerations of consent to amend the existing EPL would be taken into account as part of this MA to allow for a change with regard to DGs storage.

4.5 RURAL FIRES ACT 1997

The DGs Facility associated with the proposed modification is situated / mapped within bushfire prone land; however, although mapped as bushfire prone land, the DGs Facility is surrounded by land that is consistent with land that can be described as being actively grazed and well-maintained paddocks and yards – meaning that there is minimal fuel requirement to allow for the spread of fire and cause any impacts of fire to with regard to identified DGs Facility.

4.6 STATE ENVIRONMENTAL PLANNING POLICY NO 33 – HAZARDOUS AND OFFENSIVE DEVELOPMENT

State Environmental Planning Policy No 33 – Hazardous and Offensive Development (SEPP 33) aims to determine whether a development is a hazardous or offensive industry and if so ensures that appropriate mitigation measures are implemented for those applicable activities.

The PHA (Riskcon Engineering, 2020), is prepared in accordance with SEPP 33 and provides an assessment of the proposed amendment to store different classes and quantities of DGs within the approved DGs Facility. It is proposed to store a new customer within the Warehouse B1 of the subject site, which would result in exceedance of the approved DG quantities; subsequently, it is necessary to review and update the DG quantities within a PHA to reflect the anticipated quantities as part of this MA.

Riskcon Engineering have carried out a review of the classes and quantities of DGs proposed to be stored within Building B1, pursuant to development consent being obtained. The information yielded following the review was compared to the threshold quantities outlined within Schedule 15 of the WHS Regulation, which provides guidelines on specific DGs and whether the applicable DGs are subject to any State Policies, i.e. SEPP 33, and maximum permissible threshold quantities.

In their PHA, Riskcon Engineering outline that the quantity of all potential DGs to be stored on-site, would not exceed the threshold quantities assessed (refer to **Section 3.1.1** and **Section 3.1.2** of this statement). Riskcon Engineering therefore conclude that the risks at the site boundary are not considered

to exceed the acceptable risk criteria; hence, the facility would only be classified as potentially hazardous and would be permitted within the current land zoning for the site.

The full PHA is included at **Appendix 3** and should be referred to for further details analysis.

4.7 STATE ENVIRONMENTAL PLANNING POLICY NO 55 – REMEDIATION OF LAND

Under the provisions of *State Environmental Planning Policy No 55 – Remediation of Land* (SEPP 55), where a MA is made concerning land that is contaminated, the consent authority must not grant consent unless:

> *(a) it has considered whether the land is contaminated, and*
> *(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and*
> *(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose*.

The proposed MA relates to the amended use of DGs stored within an existing industrial warehouse, which is approved for operation as of a DGs Facility. As such, no earthworks are proposed. The identified warehouse (Building B1) is located within an existing industrial estate – Westpark Industrial Estate. The subject site would continue to be utilised for industrial-related purposes as the existing site conditions are considered suitable, with no further investigation required.

4.8 STATE ENVIRONMENTAL PLANNING POLICY (WESTERN SYDNEY EMPLOYMENT AREA) 2009

The subject site forms part of the WSEA and is subject to the provisions of SEPP WSEA, within which it is zoned IN1 General Industrial (refer to **Figure 5**).

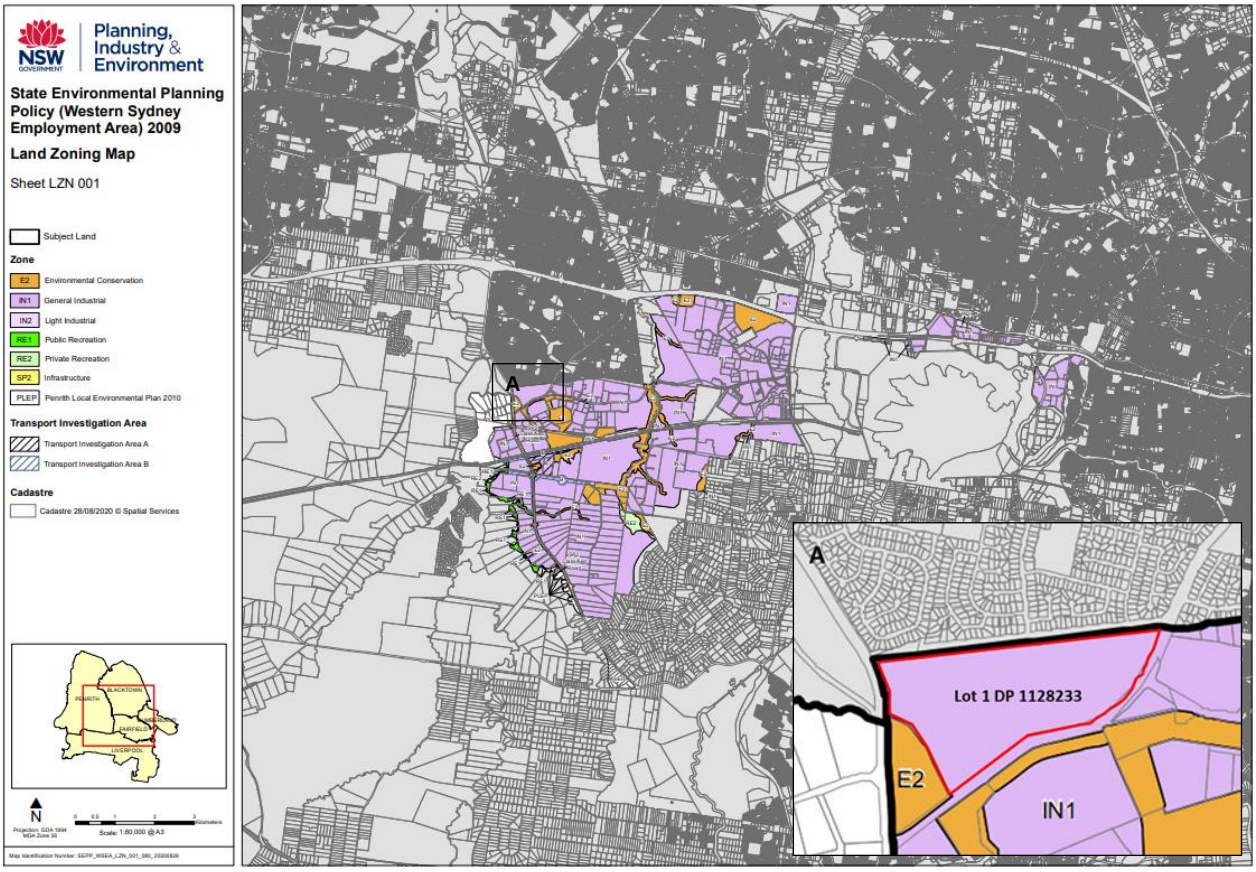


Figure 6. Land Zoning Map (Source: NSW Legislation, 2020)

Permissibility

The objectives of the IN1 General Industrial zone are as follows:

- *To facilitate a wide range of employment-generating development including industrial, manufacturing, warehousing, storage and research uses and ancillary office space;*
- *To encourage employment opportunities along motorway corridors, including the M7 and M4;*
- *To minimise any adverse effect of industry on other land uses;*
- *To facilitate road network links to the M7 and M4 Motorways;*
- *To encourage a high standard of development that does not prejudice the sustainability of other enterprises or the environment; and,*
- *To provide for small-scale local services such as commercial, retail and community facilities (including child care facilities) that service or support the needs of employment-generating uses in the zone.*

Within the IN1 General Industrial zone the following are permissible without consent:

- *Nil.*

Within the IN1 General Industrial zone the following are permissible with consent:

- *Depots; Food and drink premises; Freight transport facilities; Industrial retail outlets; Industrial training facilities; Industries (other than offensive or hazardous industries); Neighbourhood shops; Roads; Service stations; Transport depots; Truck depots;* ***Warehouse or distribution centres****.*

Within the IN1 General Industrial zone the following are prohibited:

- *Any development not specified in item 2 or 3.*

In accordance with the above, the proposed amendment and continued operation as a DGs Facility (Warehouse or Distribution Centre) would be permissible subject to development consent.

Subdivision

No subdivision is proposed.

Height of Buildings

No maximum building height has been adopted under SEPP WSEA.

However, the consent authority must be satisfied that:

> *(a) building heights will not adversely impact on the amenity of adjacent residential areas, and,*
> *(b) site topography has been taken into consideration.*

This MA does not propose any amendments to the recognised built-form characteristics; hence, the proposed modifications to the DGs Facility would utilise the existing built-form characteristics, which are consistent with the other built forms encountered throughout the WSEA and are considered appropriate given the characteristics of the subject site, including topography and the surrounding context.

Development On or In Vicinity of Proposed Transport Infrastructure Routes

At present, the subject site is not directly adjoined by any proposed transport infrastructure and therefore is not considered to require referral to the Secretary-General of the Department of Planning under Clause 26 of SEPP WSEA.

Industrial Release Area - Satisfactory Arrangements for the Provision of Regional Transport Infrastructure and Services

As the subject site is used for existing industrial purposes, Clause 29 does not apply.

Design Principles

The proposal relates to the existing industrial warehouse (DGs Facility), therefore further consideration in not required.

There are no provisions within SEPP WSEA which prevent the subject MA from proceeding.

4.9 PENRITH LOCAL ENVIRONMENTAL PLAN 2010

As discussed is **Section 4.8** above, the subject site falls within the application area of SEPP WSEA – zoned General Industrial (IN1) – which takes precedence as the overarching legislative control concerning the MA.

4.10 PENRITH DEVELOPMENT CONTROL PLAN 2014

The *Penrith Development Control Plan 2014* (PDCP2014) provides a non-statutory instrument to guide development throughout the Penrith Local Government Area (LGA), including land that is covered by SEPP WSEA. The MA relates solely to an existing DGs Facility, with no external works proposed. Thus, the provisions of PDCP2014 do not require further consideration.

PART E LIKELY IMPACTS OF THE DEVELOPMENT

This section identifies and assesses the impacts of the development with specific reference to the heads of consideration under Section 4.15(1) of the EP&A Act.

5.1 CONTEXT AND SETTING

The proposed amendment regarding the classes and quantities of DGs proposed to be stored within the existing DGs Facility (warehousing and distribution) is consistent with the intended development of land within the WSEA. The proposed modification would continue to enable the efficient and sustainable use of such designated employment areas via adherence to the provisions, overarching aims, and objectives set out in SEPP WSEA that allows for the construction and operation of warehouse and distribution centres, for which the MA is made with regard to the ongoing operation of a DGs Facility. The proposed modification, specifically the continued use of the DGs Facility, would beneficially contribute to both the regional and local economies, and population groups positioned in the wider locality.

The proposed amendment to the classes and quantities of DGs proposed to be stored at the subject site is considered compatible with surrounding land uses, including established warehouses located within the same existing precinct as the identified DGs Facility, as-well-as other facilities (i.e. Warehouse and Logistics Hubs) located in close proximity that constitute a similar and parallel nature. The subject site is not located in proximity of any residential development (~480 m south of St Clair) or any other sensitive land uses; therefore, would not exhibit any adverse amenity impacts.

The site layout and building design (utilisation of the existing industrial building) would ensure the functional operation of the DGs Facility in accordance with the needs of the end user (DHL), whilst not impacting on any other operations. Similarly, the subject site and built form have been designed in respect of the planned / existing road infrastructure – noting the Erskine Park Road interface that the site is strategically positioned adjacent to.

The proposed modification amendment regarding the classes and quantities of DGs proposed to be stored within the approved DGs Facility would not exhibit any significant environmental impacts and would not adversely impact on the amenity or operations of adjoining, existing and / or proposed development sites within the vicinity. Therefore, the proposed modification would be considered compatible with the site context.

5.2 DESIGN AND APPEARANCE

No changes proposed to the existing built form. The proposed modification relates to internal operations only.

5.3 TRAFFIC AND TRANSPORT

The proposed modification amendment regarding the classes and quantities of DGs proposed to be stored within the DGs Facility, would not increase car and heavy vehicle (B-Double) movements to and from the subject site. Furthermore, **SSD-4953 MOD 1** mentions that the associated road network is capable of supporting the traffic generated in the peak hours and would be able to accommodate off-peak traffic generated during the window 10 pm and 6 pm without any significant impact. As a result, no adverse impacts are likely to occur from the proposed modification.

5.4 NOISE

SSD-4953 and **SSD-4953 MOD 1** have previously assessed the potential noise and vibration impacts anticipated with the proposed development. The noise and vibration impacts would remain unchanged, and as a result would not have a significant impact on receivers within the immediate vicinity of the identified DGs Facility.

5.5 HAZARD AND RISK

The PHA (Riskcon Engineering, 2020) considers the hazards and risks identified with regard to the proposed MA for the purposes of an amendment to the classes and quantities of DGs permitted to be stored within the existing DGs Facility (refer to **Appendix 3**).

The subsequent information is based on proposed concept designs and inventories and is a conservative estimate of the hazardous risk associated with the amendments proposed within this MA.

The overall objectives of the PHA include:

- Complete the PHA according to the Hazardous Industry Planning Advisory Paper (HIPAP) No.
- – Hazard Analysis;
- Assess the PHA results using the criteria in HIPAP No. 4 – Risk Criteria for Land Use Planning; and
- Demonstrate compliance of the site with the relevant codes, standards and regulations.

The Multi-Level Risk Assessment approach (NSW DPIE) has been used as the basis for the study to determine the level of risk assessment required. The approach considered the development in context of its location, the quantity and type (i.e. hazardous nature) DGs stored and used, and the facility's technical and safety management control. The Multi-Level Risk Assessment Guidelines are intended to assist industry, consultants and the consent authorities to carry out and evaluate risk assessments at an appropriate level for the facility being studied.

Based on the type of DGs to be used and handled at the proposed facility, a Level 2 Assessment was selected for the site. This approach provides a qualitative assessment of those DGs of lesser quantities and hazard, and a quantitative approach for the more hazardous materials to be used on-site. This approach is commensurate with the methodologies recommended in "Applying SEPP 33's" Multi Level Risk Assessment approach.

5.5.1 Quantities of Dangerous Goods Stored and Handled

The classes and quantities to be approved in the facility are summarized **Section 3.1.1** of this statement.

5.5.2 Aggregate Quantity Ratio

Where more than one class of dangerous goods are stored and handled at the site an AQR exists, and where the ratio AQR exceeds a value of 1, the site would be considered an MHF.

A review of the thresholds and the commodities and packing groups outlined in **Section 3.1.2** of this statement, indicates only Class 2.1 and 3 are assessable against the MHF thresholds. Applying the AQR ratio calculation, the resulting AQR is less than 1, hence the facility would not be classified as an MHF.

5.5.3 Hazard Identification

A hazard identification table has been developed by Riskcon Engineering (refer to **Appendix 3**), which provides a summary of the potential hazards, consequences and safeguards at the site. The table has been used to identify the hazards for further assessment in this section of the study. Each hazard is identified in detail and no hazards have been eliminated from assessment by qualitative risk assessment prior to detailed hazard assessment.

In order to determine acceptable impact criteria for incidents that would not be considered for further analysis, due to limited impact offsite, the following approach has been applied:

- **Fire Impacts:**
  - It is noted in HIPAP No. 4 that a criterion is provided for the maximum permissible heat radiation at the site boundary (4.7 kW/m^2) above which the risk of injury may occur and

therefore the risk must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk, for this study, incidents that result in a heat radiation less that at 4.7 kW/m^2, at the site boundary, are screened from further assessment.

- Those incidents exceeding 4.7 kW/m^2 at the site boundary are carried forward for further assessment (i.e. frequency and risk). This is a conservative approach, as HIPAP No. 4 indicates that values of heat radiation of 4.7 kW/m^2 should not exceed 50 chances per million per year at sensitive land uses (e.g. residential). It is noted that the closest residential area is over 220 m from the site, hence, by selecting 4.7 kW/m^2 as the consequence impact criteria (at the adjacent industrial site boundary) the assessment is considered conservative.

- **Explosion:**
  - It is noted in HIPAP No. 4 that a criterion is provided for the maximum permissible explosion over pressure at the site boundary (7 kPa) above which the risk of injury may occur and therefore the risk must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk, for this study, incidents that result in an explosion overpressure less than 7 kPa, at the site boundary, are screened from further assessment. Those incidents exceeding 7 kPa, at the site boundary, are carried forward for further assessment (i.e. frequency and risk). Similarly, to the heat radiation impact discussed above, this is conservative as the 7 kPa value listed in HIPAP No. 4 relates to residential areas, which are over 220 m from the site.
- **Toxicity:**
  - Toxic products are not anticipated to be stored; hence, have not been assessed.
- **Property Damage and Accident Propagation:**
  - It is noted in HIPAP No. 4 that a criterion is provided for the maximum permissible heat radiation/explosion overpressure at the site boundary (23 kW/m^2/14 kPa) above which the risk of property damage and accident propagation to neighbouring sites must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk to incident propagation, for this study, incidents that result in a heat radiation heat radiation less than 23 kW/m^2 and explosion over pressure less than 14 kPa, at the site boundary, are screened from further assessment. Those incidents exceeding 23 kW/m^2 at the site boundary are carried forward for further assessment with respect to incident propagation (i.e. frequency and risk).
- **Societal Risk:**
  - HIPAP No. 4 discusses the application of societal risk to populations surrounding the proposed potentially hazardous facility. It is noted that HIPAP No. 4 indicates that where a development proposal involves a significant intensification of population, in the vicinity of such a facility, the change in societal risk needs to be taken into account. In the case of the facility, there is currently no significant intensification of population around the proposed site; however, the adjacent land has been rezoned residential; hence, there will be housing located approximately 220 m from the site. Therefore, societal risk has been considered in the assessment.

5.5.4 Properties of Dangerous Goods

A description of the DGs stored and handled at the site, including the Class and the hazardous material properties of the DG Class, is provided as follows.

Table 6. Properties of the DGs and Materials Stored at the Site

Class	Hazardous Properties
2.1 – Flammable Gases	Class 2.1 includes flammable gases which are ignitable when in a mixture of 13 per cent or less by volume with air or have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit. Ignited gas may result in explosion or flash fire.
3 – Flammable Liquids	Class 3 includes flammable liquids which are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc.) which give off a flammable vapour at temperatures of not more than 60^{o}C closed-cup test or not

Table 6. Properties of the DGs and Materials Stored at the Site	
Class	**Hazardous Properties**
	more than 65.6°C open-cup test. Vapours released may mix with air and if ignited, at the right, concentration will burn resulting in pool fires at the liquid surface.
4.1 – Flammable Solids	Flammable solid materials are materials that may burn when exposed to an ignition source, examples of flammable solids include matches and some waxes.
8 – Corrosive Substances	Class 8 substances (corrosive substances) are substances which, by chemical action, could cause damage when in contact with living tissue (i.e. necrosis), or, in case of leakage, may materially damage, or even destroy, other goods which come into contact with the leaked corrosive material. Releases to the environment may cause damage to sensitive receptors within the environment.
9 – Miscellaneous DGs	Class 9 substances and articles (miscellaneous dangerous substances and articles) are substances and articles which, during transport present a danger not covered by other classes. Releases to the environment may cause damage to sensitive receptors within the environment.

5.5.5 Hazard Identification, Consequence and Frequency Analysis

Based on the hazard identification table, developed by Riskcon Engineering, the following hazardous scenarios have been developed:

- LPG release, delayed ignition and flash fire or explosion.
- LPG release (from aerosol), ignition and racking fire.
- Flammable material spill, ignition and racking fire.
- Forklift loading/unloading, damaged packaged, flammable liquid or aerosol release, ignition and pallet fire.
- Full warehouse fire and radiant heat.
- Full warehouse fire and smoke emission.
- Dangerous goods liquid spill, release and environmental incident.
- Warehouse fire, sprinkler activation and potentially contaminated water release.

Each identified scenario is discussed in further detail in the following sections.

5.5.5.1 LPG Release, Delayed Ignition and Flash Fire or Explosion

Hazard Identification:

Aerosols will be held at the site for storage and distribution. There is potential for a LPG release to occur from an aerosol in the warehouse area due to an accident (packages dropped from forklift, punctured by forklift tines) or deterioration of packaging. If a gas release occurred a flammable atmosphere may form which if ignited would immediately flash back to the source of release which may form into a fire. Due to the low confinement of the area and the volumes likely to be released from such a scenario, an explosion is not considered a credible scenario.

It is noted that the potential for a release of LPG is low as aerosol canisters are pressure tested during manufacture and filling, hence, release would predominately result from damaged product rather than deterioration.

Aerosols typically hold <500 g of total product with the quantity of the LPG propellant being approximately 25% of the weight of the product hence, for a 500 g product approximately 125 g of LPG would be released.

Packages are inspected for damage upon receipt at the loading dock before they are transported into the warehouse. This minimises the likelihood that a damaged package is incorrectly stored. Once stored inside the warehouse, deterioration or damage are unlikely to occur.

To minimise the likelihood that a flammable vapour cloud may contact an ignition source, the electrical equipment within the aerosol store will be installed according to the requirements of AS/NZS 60079.14:2017.

Based on the warehouse design operation practices and the storage of small packages, the risk of a vapour cloud being generated that is large enough to ignite and have a substantial impact by way of a vapour cloud explosion or a flash fire, is considered to be low (if not negligible); hence, this hazard has not been carried forward for further analysis.

Consequence Analysis:

This hazard has not been carried forward for further analysis.

Frequency Analysis:

This hazard has not been carried forward for further analysis.

5.5.5.2 LPG Release (From Aerosol), Ignition and Racking Fire

Hazard Identification:

The potential for release of LPG from an aerosol is considered low due to the quality assurance testing on aerosol canisters during the filling process. The release of LPG would likely result from damage to aerosols during transport and storage rather than from deterioration. Packages are inspected upon delivery and an accident involving aerosols would trigger an additional inspection to verify that damage had not occurred prior to storage within the warehouse.

Notwithstanding this, there is the potential for a release of LPG to occur within the storage racking. Due to the hazardous area rating of the area, it is considered unlikely for an ignition to occur; however, in the event an ignition of an LPG release did occur a fire could result.

The fire would consume the packaging with the generated heat impacting the adjacent aerosols. As the LPG within the adjacent aerosols expands the canisters may rupture releasing LPG which would ignite and rocket the canister throughout the aerosol cage potentially spreading the fire.

As the fire grows, the ceiling mounted sprinklers will activate to suppress the fire and cool adjacent packages to minimise the potential for aerosol rupture and rocketing. Activation of this system would control the fire within the sprinkler array as specified by testing conduct by FM Global in Data Sheet 7-31.

Though the fire will be controlled, there is the potential for radiant heat to impact over the site boundary. Therefore, this incident has been carried forward for further analysis.

Consequence Analysis:

There is the potential for a fire to develop involving aerosols stored within the warehouse resulting in a racking fire. As the fire grows the SMSS would activate suppressing and controlling the fire while cooling adjacent packages minimising the potential for lateral spread due to radiant heat. A detailed analysis has been conducted in the PHA (**Appendix 3**).

The blocked stacked aerosol storage is located 6 m from the wall which is an additional 6.5 m from the closets site boundary. Therefore, 4.7 kW/m^2 radiant heat would not impact over the site boundary in the base case, only impacting over the site boundary in the sensitivity case. A review of the 23 kW/m^2 impact

distance indicates an offsite impact would not occur in neither the base case nor sensitivity case. The impact contours for both the base and sensitivity case fires are illustrated in the PHA (**Appendix 3**).

As an offsite impact may occur at the 4.7 kW/m^2 radiant heat levels, this incident has been carried forward for further analysis.

Frequency Analysis:

The frequency of a warehouse fire at the site can be estimated from a number of sources (e.g. general warehouse fire frequencies or the summation of individual fire frequencies for each of the initiating fire events). As this is a preliminary hazard analysis, the fire frequency has been selected from general fire frequency data.

A detailed fire frequency analysis has been conducted as part of the PHA. The results of this analysis indicates an initiating fire frequency would be in the order of 1x10^{-3} p.a. based on a review of large fires, with an assumed fatality risk of 0.44 chances per million per year (pmpy).

Further details are included in Section 6.2 of the PHA (**Appendix 3**).

5.5.5.3 Flammable Material Spill, Ignition and Racking Fire

Hazard Identification:

There is the potential for flammable material products to be damaged (i.e. punctured by forklift tynes, dropped package, etc.) or deteriorate resulting in a release of flammable liquid. All products are inspected prior to storage within the warehouse; hence, if a leak has occurred it would be identified and would be managed to ensure that it was not stored in the warehouse. Once stored, deterioration of the packaging is unlikely to occur.

If a flammable material spill did occur (e.g. dropped pallet or package during handling) it would be unlikely that it would ignite due to the controlled ignition sources and ventilation systems. Notwithstanding this, there is the potential for the spill to ignite.

Upon ignition, the heat emitted will impact the bulbs which when heated to the activation temperature will break the bulbs discharging water to suppress and control the fire within the sprinkler array.

Although a fire is likely to be controlled within the sprinkler array there may be the potential for an offsite impact to occur; hence, this incident has been carried forward for further analysis.

Consequence Analysis:

There is the potential for a fire to develop involving flammable materials stored within the warehouse resulting in a racking fire. As the fire grows the SMSS would activate suppressing and controlling the fire while cooling adjacent packages minimising the potential for lateral spread due to radiant heat. A detailed analysis has been conducted in the PHA (**Appendix 3**).

The blocked stacked flammable material storage is located 6 m from the wall which is an additional 6.5 m from the closets site boundary. Therefore, 4.7 kW/m^2 radiant heat would not impact over the site boundary in the base case, only impacting over the site boundary in the sensitivity case. A review of the 23 kW/m^2 impact distance indicates an offsite impact would not occur in neither the base case nor sensitivity case. The impact contours for both the base and sensitivity case fires are illustrated in the PHA (**Appendix 3**).

As an offsite impact may occur at the 4.7 kW/m^2 radiant heat levels, this incident has been carried forward for further analysis.

Frequency Analysis:

Only the flammable material sensitivity scenario impacted over the site boundary; hence, this has been reviewed in the following subsection.

As with the aerosol sensitivity scenario, this scenario only occurs when the primary array ceiling mounted sprinklers fail to control the fire. Therefore, the calculated frequency for the aerosol sensitivity scenario has been taken for the flammable material fire scenario. Thus the selected frequency of the combustible liquid sensitivity case fire scenario is $1.77x10^{-6}$ p.a. and an assumed fatality risk of 0.14 pmpy.

Further details are included in Section 6.3 of the PHA (**Appendix 3**).

5.5.5.4 Forklift Loading/Unloading, Damaged Packaged, Flammable Liquid or Aerosol Release, Ignition and Pallet Fire

Hazard Identification:

Pallets will be loaded and unloaded via forklift outside of the warehouse. Delivered products may be temporarily stored on pallets in a transit area prior to relocation into the warehouse. Conversely, pallets may be located temporarily during dispatch operations.

During relocation of pallets there is the potential for forklift tines to puncture the product or for the pallets to be dropped resulting in damage. If the packages are damaged they may release flammable liquid or gases which could ignite resulting in a pallet fire.

The potential for a fire to occur within the transit area is considered to be low and based on the quantity of material on a pallet the impact is unlikely to impact off site. As an offsite impact is unlikely to occur, this incident has not been carried forward for further analysis.

Consequence Analysis:

This hazard has not been carried forward for further analysis.

Frequency Analysis:

This hazard has not been carried forward for further analysis.

5.5.5.5 Full Warehouse Fire and Radiant Heat

Hazard Identification:

There is potential that if a fire occurred and the fire protection systems failed to activate, a small fire may escalate as radiant heat impacts adjacent packages resulting in deterioration and release of additional fuel. While it is considered unlikely for a fire to occur simultaneously with the sprinkler system failing to operate there is the potential for this scenario to occur which may result in offsite impacts. Therefore, this incident has been carried forward for further analysis.

Consequence Analysis:

If a fire occurs within the warehouse and the sprinkler systems fail to activate, the fire will spread throughout the warehouse and is unlikely to be contained and would likely consume the entire warehouse. A detailed analysis has been conducted in in the PHA (**Appendix 3**).

The radiant heat impacts at 4.7 kW/m^2 extend over the site boundary; hence, there is the potential for a fatality at the site boundary to occur. Therefore, this incident has been carried forward for further analysis.

It is noted that due to the fire size there will be considerable smoke emitted which would obscure the flame surface reducing the average surface emissive power (SEP) and subsequently it would not exceed 23 kW/m^2. In addition, the distance to the closest buildings is 23 m which would allow attenuation of radiant heat from of luminous spots and would not result in sustained radiant heat such that propagation to adjacent facilities would not occur.

Frequency Analysis:

A full warehouse fire will only occur if both sprinkler systems fail to contain the fire and would be considered a catastrophic event. The frequency of a full warehouse fire is 3.53x10^{-6} p.a. and an assumed fatality rate of 100%.

Further details are included in Section 6.4 of the PHA (**Appendix 3**).

5.5.5.6 Full Warehouse Fire and Smoke Emission

Hazard Identification:

There is the potential for a full warehouse fire to occur in the event of sprinkler failure. As products are burned they will emit toxic products of combustion (i.e. carbon monoxide) which may have substantial downwind impacts. Depending on the concentration of the toxic bi-products, this may result in injury or fatality. Therefore, this incident has been carried forward for further analysis.

Consequence Analysis:

A detailed analysis has been performed to estimate the impact of toxic products of combustion on the surrounding area.

Several toxic products of combustion which may be present in the smoke plume and their acceptable concentration of exposure for the Acute Exposure Guideline Levels (AEGL) have been investigated. These levels provide guidance on exposure concentrations for general populations, including susceptible populations over a range of exposure times to assist in the assessment of releases which may result in a toxic exposure.

Provided below is a summary of the AEGL tiers of exposure:

- AEGL-3 is the airborne concentration, expressed as parts per million (ppm) or milligrams per cubic meter (mg/m^3), of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.
- AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
- AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

Riskcon Engineering's analysis indicates all quantities are below the AEGL-3 values. It is noted the analysis conducted is based on the primary toxic bi-product (carbon monoxide) which forms at rates higher than other toxic bi-products. Therefore, application of this result to other components is considered conservative. As these concentrations are taken at the point of release, they will disperse downwind resulting in substantially lower concentrations at the residential areas.

With reference to injury, all value except for sulphur dioxide are below the AEGL-2 concentration. Similar to the above discussion, the concentrations are likely to disperse substantially prior to impacting the residential populations; hence, an injury is unlikely to occur.

Based on the analysis conducted, it is considered that the concentrations at the residential area are likely to be lower than the fatality and injury concentration levels based on the comparison to the fatality and injury targets at the point of release (i.e. worst-case concentration). Notwithstanding this, as there is the potential for a toxic DG to be involved in the fire, the toxicity impacts may exceed those estimated for the toxic products of combustion analysis. Therefore, this incident has been carried forward for further analysis.

Frequency Analysis:

Toxic bi-products of combustion will only be emitted in substantial quantities in a full warehouse fire which occurs with a frequency of $3.53x10^{-6}$ p.a. Assuming a 100% fatality rate to persons downwind of the full warehouse fire.

Further details are included in Section 6.5 of the PHA (**Appendix 3**).

5.5.5.7 Dangerous Goods Liquid Spill, Release and Environmental Incident

Hazard Identification:

There is potential that a spill of the liquid DGs (Class 3, 8 and 9s) could occur at the site which if not contained could be released into the public water course resulting in a potential environmental incident.

To prevent spills escaping from the site has been designed per the requirements of AS/NZS 3833:2007 to contain spills within the site boundaries. This is achieved via a stormwater isolation point and containment within the hardstand and recessed docks.

Therefore, the potential for a release is considered unlikely as this is expected to be contained within the footprint of the warehouse, bunds, site boundary and stormwater system. Nonetheless, in the event of a catastrophic scenario and spills are released from the footprint of the warehouse, it will be necessary to prevent this from being released into the public water course.

The site has been designed to contain spills from operations within primary and tertiary containment areas within the site boundaries via the stormwater system. Therefore, in the event of an incident, it is considered spills will be contained and prevented from entering the public water course. As an offsite incident is unlikely to occur, this incident has not been carried forward for further analysis.

Consequence Analysis:

This hazard has not been carried forward for further analysis.

Frequency Analysis:

This hazard has not been carried forward for further analysis.

5.5.5.8 Warehouse Fire, Sprinkler Activation and Potentially Contaminated Water Release

Hazard Identification:

In the event of a fire, the sprinklers will activate discharging water onto the fire to control and suppress the fire. Contact of the fire water with DGs may result in contamination which, if released to the local watercourse, could result in environmental damage. The facility has been designed to be able to contain all DG spills and liquid effluent resulting from the management of an incident (i.e. fire) within the premises. The site was previously approved to store a range of DGs accounting for the sprinkler discharge. The discharge scenarios are not expected to be different from those identified in previous approvals; hence, it is considered the existing containment strategy would be acceptable for the proposed DG quantities.

Based on the existing construction and containment for the premises, there is adequate fire water retention to meet the "*Best Practice Guidelines for Contaminated Water Retention and Treatment Systems*", hence, this incident has not been carried forward for further analysis.

Consequence Analysis:

This hazard has not been carried forward for further analysis.

Frequency Analysis:

This hazard has not been carried forward for further analysis.

5.5.6 Comparison Against Risk Criteria

The NSW DPIE has issued a guideline on the acceptable risk criteria. The acceptable risk criteria published in the guideline relates to injury, fatality and property damage. The values in the guideline present the maximum levels of risk that are permissible at the land use under assessment.

The adjacent land use would be classified as an industrial site as it is restricted access and only industrial operations are permitted to occur in this area. For industrial facilities, the maximum permissible fatality risk is 50 pmpy. The assessed highest fatality risk at the site boundary is 7.64 pmpy at the closest site boundary; hence, the highest risk is within the permissible criteria and therefore all other risk points beyond the boundary would be within the acceptable criteria.

A review of the potential for incident propagation indicated no incidents resulted in radiant heat exceeding 23 kW/m^2 which impacted across the site boundary; hence, the potential for incident propagation is 0 pmpy.

Based on the estimated injury risk, conducted in the analysis above, the risks associated with injury and nuisances at the closest residential area are not considered to be exceeded.

A review of the cumulative risk profiles in the area indicate two MHF have been relocated from the area; hence, the cumulative risk profile is likely to be less than the existing profile for the area and would thus be considered acceptable.

5.5.7 Conclusions and Recommendations

A hazard identification table was developed for warehouse facilities to identify potential hazards that may be present at the site as a result of operations or storage of materials. Based on the identified hazards, scenarios were postulated that may result in an incident with a potential for offsite impacts. Postulated scenarios were discussed qualitatively and any scenarios that would not impact offsite were eliminated from further assessment. Scenarios not eliminated were then carried forward for consequence analysis.

Incidents carried forward for consequence analysis were assessed in detail to estimate the impact distances. Impact distances were developed into scenario contours and overlaid onto the site layout diagram to determine if an offsite impact would occur. The consequence analysis showed that two of the scenarios (partial escalation and full warehouse fire) would impact over the site boundary and into the adjacent land uses; hence, these incidents were carried forward for frequency analysis and risk assessment.

The frequency analysis and risk assessment showed the cumulative fatality risk of these incidents would be 7.64 pmpy at the site boundary, with lesser risk at further distances from the boundary. HIPAP No. 4 publishes acceptable risk criteria at the site boundary of 50 pmpy (for industrial sites). Therefore, the risk of a fatality at the site boundary as a result of the facility operations would be within the acceptable risk criteria.

It was identified that no incidents would result in radiant heat contours of 23 kW/m^2 extending over the site boundary; hence, the potential for incident propagation to occur is calculated as 0 pmpy.

A review of the cumulative risk profiles in the area indicate two major hazard facilities have been relocated from the area; hence, the cumulative risk profile is likely to be less than the existing profile for the area and would thus be considered acceptable.

Based on the analysis conducted, it is concluded that the risks at the site boundary are not considered to exceed the acceptable risk criteria; hence, the facility would only be classified as potentially hazardous and would be permitted within the current land zoning for the site.

A hazard audit was conducted for the site in 2016 which resulted in several actions to be undertaken. These actions have been extracted from the report and are recommended to be complied with by the new operator. It is noted that not all recommendations apply to the new operator, or the recommendation is restrictive and not in-line with the overarching regulation. Where a recommendation is inconsistent or not applicable to the new operator this has been noted.

Table 7. Hazard Actions

ID	Action	Assessment
1	Ensure that high housekeeping standard are maintained and that specific issues identified are promptly addressed.	Subjective recommendation but the operator should comply with good housekeeping as required by the applicable standards.
2	Ensure all forklifts that are labelled suitable for use in a AS/NZS 60079.10 Zone 2 classified area are being maintained with emphasis on the controls that make the forklift suitable for use in a Zone 2.	Required by WHS Regulations 2017 and AS/NZS 60079 series.
3	Compile a hazardous area dossier.	Required by WHS Regulations 2017 and AS/NZS 60079 series.
4	Remove sources of ignition from within the hazardous area or ensure that electrical equipment is appropriate rated for the area (in accordance with the hazardous area report).	Required by WHS Regulations 2017 and AS/NZS 60079 series.
5	Provide lens covers for lighting within the aerosols cage and any lights that are situated above the hazardous zone resulting from the aerosols cage.	This recommendation should be included.
6	Undertake a review to ensure that the storage of corrosive liquids, acidic (UN 3264) is compliant.	Not applicable as these materials are not proposed to be stored by the new operator.

5.6 STORMWATER OR OTHER CIVIL ENGINEERING MATTERS

The proposal would not impact on stormwater management or other civil engineering matters.

5.7 OTHER MATTERS FOR CONSIDERATION

All other matters for consideration have been previously assessed as part of **SSD-4953** and **SSD-4953 MOD 1** and remain unaffected by the proposed modifications.

5.8 SUITABILITY OF SITE FOR DEVELOPMENT

The subject site will remain suitable for the purpose of warehousing and distribution that will respond to the characteristics of the site and surrounding locality.

5.9 SUBMISSIONS

No submissions have been received at the time of writing this statement. Any submissions received post lodgement shall be reviewed and considered.

5.10 THE PUBLIC INTEREST

The development as modified would have no adverse impact on the public interest. The proposed modifications would improve the functionality of operations, with no adverse visual or amenity impacts for neighbouring properties or the public domain.

PART F CONCLUSION

The purpose of this statement has been to present the proposed modifications to the DGs Facility approved under **SSD-4953** and **SSD-4953 MOD 1**, at 23 – 107 Erskine Park Road Erskine Park, and to assess its potential impacts having regard to Section 4.15(1) of the EP&A Act.

The proposal has been prepared after taking into consideration the following key issues:

- The development history of the subject site;
- Previously approved SSD;
- The context of the site and locality;
- The relevant heads of consideration under Section 4.55(2) of the EP&A Act; and
- The aims, objectives and provisions of the relevant statutory and non-statutory planning instruments.

As detailed throughout this statement and the supporting documentation, the proposed modification is consistent with the objectives and controls of the relevant instruments and policies in place. No significant adverse environmental, economic or social impacts have been identified as likely to arise from the proposed modifications intended. Rather, the proposed MA would provide for positive impacts, including the efficient and continued utilisation of industrial lands in an existing DGs Facility and the generation of employment opportunities in the warehousing and distribution sector, namely for the purposes of facilitating an ongoing operation for warehousing and distribution.

The proposed MA is permissible within the IN1 General Industrial zone and is compatible with the zone objectives. As demonstrated throughout this statement, the amendments proposed would not promote any adverse environmental impacts. Additionally, the matters for consideration under Section 4.15(1) of the EP&A Act (as prescribed for **SSD-4953**) have been satisfactorily addressed, providing that the current (unchanged) built-form and intended use are compatible with the surrounding environment.

In light of the above, the modifications proposed for **SSD-4953** are considered worthy of support by the NSW DPIE.

WILLOW TREE PLANNING

APPENDIX 1

SSD-4953 – Development Consent

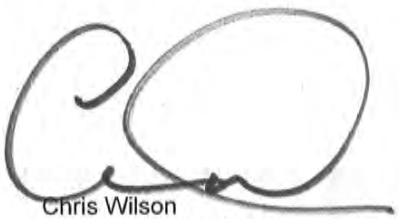
Development Consent

Section 89E of the *Environmental Planning and Assessment Act 1979*

As delegate of the Minister for Planning and Infrastructure under delegation executed on 14 September 2011, I approve the development application referred to in Schedule 1, subject to the Conditions in Schedules 2 to 4.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.



Chris Wilson
Executive Director
Major Projects Assessment

Sydney 21 MAY 2012

SCHEDULE 1

Application Number:	SSD-4953
Applicant:	Prime Constructions Pty Ltd
Approval Authority:	Minister for Planning and Infrastructure
Land:	Building B1, 23-107 Erskine Park Road, Erskine Park (Lot 1 DP 1128233)
Development:	Dangerous Goods Warehouse and Distribution Development

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DEFINITIONS

Applicant	Prime Constructions Pty Ltd
BCA	Building Code of Australia
Council	Penrith City Council
Day	The period from 7am to 6pm on Monday to Saturday, and 8am to 6pm on Sundays and Public Holidays
Development	The development as described in the EIS and RTS
Department	Department of Planning and Infrastructure
Director-General	Director-General of the Department of Planning and Infrastructure, or delegate
EIS	The Environmental Impact Statement titled 'Environmental Impact Statement, Dangerous Goods Storage Facility, 23-107 Erskine Park Road, Erskine Park NSW 2759 (Lot 1 DP 1128233) and accompanying appendices, prepared by McKenzie Group Consulting (NSW) Pty Ltd and dated November 2011
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPA	Environment Protection Authority
EPL	Environmental Protection Licence
Evening	The period from 6pm to 10pm
Facility	The development as described in the EIS
FRNSW	Fire and Rescue NSW
Minister	Minister for Planning and Infrastructure, or delegate
Night	The period from 10pm to 7am on Monday to Saturday, and 10pm to 8am on Sundays and Public Holidays
OC	Occupational Certificate
POEO Act	*Protection of the Environment Operations Act 1997*
Project	Has the same meaning as development (see above)
Reasonable and Feasible	Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements. Feasible relates to engineering considerations and what is practical to build.
RMS	Roads and Maritime Services
RTS	The Response to Submissions Report titled *'Response to Submissions Dangerous Goods Storage Facility 23-107 Erskine Park Road, Erskine Park NSW 2759 (Lot 1 DP 1128233)'* and accompanying appendices, prepared by McKenzie Group Consulting (NSW) Pty Ltd and dated November 2011
Safety Case	A 'Safety Case' as defined under the *Work Health & Safety Regulation 2011* and required by WorkCover NSW
Site	The land referred to in Schedule 1
Statement of Commitments	The Applicant's commitments in the EIS
WorkCover	WorkCover NSW

SCHEDULE 2
ADMINISTRATIVE CONDITIONS

Obligation to Minimise Harm to the Environment

1. The Applicant shall implement all reasonable and feasible measures to prevent and/or minimise any harm to the environment that may result from the construction and/or operation of the development.

Terms of Approval

2. The Applicant shall carry out the development generally in accordance with the:
   (a) EIS;
   (b) Development plans (Appendix 1);
   (c) RTS;
   (d) Statement of Commitments; and
   (e) conditions of this consent.

3. If there is any inconsistency between the above documents, the most recent document shall prevail to the extent of the inconsistency. However, the conditions of this consent shall prevail to the extent of any inconsistency.

4. The Applicant shall comply with any reasonable requirement/s of the Director-General arising from the Department's assessment of:
   (a) any audits, reports, plans, programs, strategies, studies or correspondence that are submitted in accordance with this consent; and
   (b) the implementation of any actions or measures contained in these audits, reports, plans, programs, strategies, studies or correspondence submitted by the Applicant.

Management Plans/Monitoring Programs

5. With the approval of the Director-General, the Applicant may:
   (a) submit any management plan or monitoring program required by this consent on a progressive basis; and
   (b) combine any management plan or program required by this consent with any similar management plan or program that have been approved under previous consents or approvals.

Surrender of Existing Development Consents

6. Within 12 months of this Consent, the Applicant shall surrender development consent DA 11/0302 issued by Council, in accordance with Clause 97 of the EP&A Regulation.

Structural Adequacy

7. The Applicant shall ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures, on the site are constructed in accordance with the relevant requirements of the BCA.

   Notes:
   - *Under Part 4A of the EP&A Act, the Applicant is required to obtain construction and occupation certificates for the proposed building works.*
   - *Part 8 of the EP&A Regulation sets out the requirements for the certification of the development.*

Protection of Public Infrastructure

8. The Applicant shall:
   (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the development; and
   (b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the development.

Operation of Plant and Equipment

9. The Applicant shall ensure that all plant and equipment used for the development is:
   (a) maintained in a proper and efficient condition; and
   (b) operated in a proper and efficient manner.

SCHEDULE 3
SPECIFIC ENVIRONMENTAL CONDITIONS

GENERAL

1. The Applicant shall comply with the requirements of the EPA set out in any EPL issued for the site/development.

HAZARDS AND RISK

Pre-construction

2. The Applicant shall consult with WorkCover NSW prior to the commencement of the detailed design of the development and obtain requirements for updating of the site risk assessments and preparation of the Safety Case required under the *Work Health and Safety Regulation 2011*. The Applicant shall comply with all reasonable WorkCover requirements.

3. The Applicant shall prepare the studies set out under subsections 3(a) to 3(c) (the pre-construction studies) of this condition. Construction, other than of preliminary works that are outside the scope of the hazard studies, shall not commence until study recommendations have been considered and, where appropriate, acted upon. The Applicant shall submit the studies to the Director-General no later than one month prior to the commencement of construction of the development (other than preliminary works), or within such further period as the Director-General may agree.
   (a) FIRE SAFETY STUDY
   A Fire Safety Study for the development. This study shall cover the relevant aspects of the Department of Planning's *Hazardous Industry Planning Advisory Paper No. 2, 'Fire Safety Study Guidelines'* and the New South Wales Government's *'Best Practice Guidelines for Contaminated Water Retention and Treatment Systems'*. The study shall meet the requirements of Fire and Rescue NSW.
   (b) FINAL HAZARD ANALYSIS
   A Final Hazard Analysis of the development, consistent with the Department of Planning's *Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis'*.
   (c) CONSTRUCTION SAFETY STUDY
   A Construction Safety Study, consistent with the Department of Planning's *Hazardous Industry Planning Advisory Paper No. 7, 'Construction Safety'*.

Pre-commissioning

4. The Safety Case shall be submitted to WorkCover not later than six months prior to commissioning or within such further period as WorkCover may agree.

5. Prior to commissioning, the Applicant shall develop and implement the plans and systems set out under subsections 5(a) to 5(b) of this condition. The Applicant shall submit to the Director-General documentation describing the plans and systems no later than two months prior to the commencement of commissioning of the development, or within such further period as the Director-General may agree.
   (a) EMERGENCY PLAN
   A comprehensive Emergency Plan and detailed emergency procedures for the development. This plan shall include detailed procedures for the safety of all people outside of the development who may be at risk from the development. The plan shall be consistent with the Department of Planning's *Hazardous Industry Planning Advisory Paper No. 1, 'Emergency Planning'*.
   (b) SAFETY MANAGEMENT SYSTEM
   A document setting out a comprehensive Safety Management System, covering all on-site operations and associated transport activities involving hazardous materials. The document shall clearly specify all safety related procedures, responsibilities and policies, along with details of mechanisms for ensuring adherence to the procedures. The Safety Management System shall be consistent with the Department of Planning's *Hazardous Industry Planning Advisory Paper No. 9, 'Safety Management'*. Records shall be kept on-site and shall be available for inspection by the Director-General upon request.

   The Emergency Plan and Safety Management System will be deemed to satisfy this condition if they meet WorkCover's requirements for Emergency Plans and Safety Management Systems for Major Hazard Facility's under the *Work Health and Safety Regulation 2011*.

Pre-startup

6. PRE-STARTUP COMPLIANCE REPORT
   One month prior to the commencement of operation of the project, the Applicant shall submit to the Director-General, a report detailing compliance with Conditions 2 to 5, including:

(c) dates of study/plan/system completion, commencement of construction and commissioning; and
(d) actions taken or proposed, to implement recommendations made in the studies/plans/systems; and
(e) responses to each requirement imposed by the Director-General under Condition 9.

Post-startup

7. POST-STARTUP COMPLIANCE REPORT
Three months after the commencement of operation of the project, the Applicant shall submit to the Director-General, a report verifying that:
(a) the Emergency Plan required under Condition 5(a) is effectively in place and that at least one emergency exercise has been conducted; and
(b) the Safety Management System required under Condition 5(b) has been fully implemented and that records required by the system are being kept.

Ongoing

8. HAZARD AUDIT
Twelve months after the commencement of operations of the proposed project and every three years thereafter, or at such intervals as the Director-General may agree, the Applicant shall carry out a comprehensive Hazard Audit of the proposed project and within one month of each audit submit a report to the Director-General.

The audits shall be carried out at the Applicant's expense by a qualified person or team, independent of the project, prior to commencement of each audit and shall be consistent with the Department of Planning's *Hazardous Industry Planning Advisory Paper No. 5, 'Hazard Audit Guidelines'*.

9. FURTHER REQUIREMENTS
The Applicant shall comply with all reasonable requirements of the Director-General in respect of the implementation of any measures arising from the reports submitted in respect of Conditions 2 to 8 inclusive, within such time as the Director-General may agree.

WATER

10. The Applicant shall ensure that all surface water discharges from the site comply with:
(a) the discharge limits (both volume and quality) set for the development in any EPL; and
(b) Section 120 of the POEO Act.

11. The Applicant shall store all chemicals, fuels and oils used on-site in appropriately bunded areas in accordance with the requirements of all relevant Australian Standards, and/or EPA's *Environmental Protection Manual: Technical Bulletin Bunding and Spill Management*.

NOISE

Operational Noise Criteria

12. The Applicant shall ensure that the noise generated by the operations on-site does not exceed the limits in Table 1 at any private residential receiver.

Table 1: Noise impact assessment criteria dB(A)

Location	6.00am – 10.00pm	6.00am – 7.00am
	$L_{Aeq\ (15\ minute)}$	$L_{A1\ (1\ minute)}$
Receiver 1 (517 - 537 Mamre Road, Orchard Hills)	33	38
Receiver 2 (100 Pine Creek Circuit, St Clair)	30	30
Receiver 3 (45 Corio Drive, St Clair)	30	34
Receiver 4 (80 Cowarra Drive, St Clair)	30	32

- *Noise generated by the development is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.*

Operating Hours

13. The Applicant shall comply with the operating hours in Table 2 for the site, unless otherwise agreed in writing by the EPA.

Table 2: Operating Hours

Activity	Day	Hours
Construction (Fit-out)	Monday - Friday	7.00am – 6.00pm
	Saturdays	7.00am – 1.00pm
	Sundays and Public Holidays	Nil
Operations	All days	6.00 am to 10.00 pm

14. The Applicant shall implement suitable mitigation measures to minimise noise in the event that a non-compliance is identified with the noise impact assessment criteria in Table 1 of this consent in consultation with the EPA, to the satisfaction of the Director-General.

AIR

Odour

15. The Applicant shall not cause or permit the emission of offensive odours from the site, as defined under Section 129 of the *Protection of the Environment Operations Act 1997*.

Operation

16. The Applicant shall implement best practice air quality management during fit-out and operation including all reasonable and feasible measures to minimise odour, fume and dust emissions generated by the development.

WASTE MANAGEMENT

17. The Applicant shall implement reasonable and feasible measures to minimise the waste generated by the development.

18. The Applicant shall ensure that all waste generated on-site during fit-out and operation of the development is classified in accordance with the EPA's *Waste Classification Guidelines: Part 1 Classifying Waste*, and appropriately disposed of to a facility that may lawfully accept the waste.

TRAFFIC

Vehicle Queuing and Parking

19. The Applicant shall ensure that:
    (a) internal roads, driveways and parking (including grades, turn paths, sight distance requirements, aisle widths, aisle lengths and parking bay dimensions) associated with the development are constructed and maintained in accordance with the latest versions of *AS 2890.1* and *AS 2890.2*;
    (b) the swept path of the longest vehicle entering and exiting the subject site, as well as manoeuvrability through the site, is in accordance with AUSTROADS;
    (c) the development does not result in any vehicles queuing on the public road network;
    (d) heavy vehicles and bins associated with the development do not park or stand on local roads or footpaths in the vicinity of the site;
    (e) all vehicles are wholly contained on-site before being required to stop;
    (f) all loading and unloading of vehicles is carried out on-site;
    (g) all heavy vehicles with loads enter and leave the site with loads covered at all times, except during loading and unloading; and
    (h) the proposed turning areas in the car park are kept clear of any obstacles, including parked cars, at all times.

VISUAL IMPACT

Lighting

20. The Applicant shall ensure that the lighting associated with the development:
    (a) complies with the latest version of *AS 4282(INT) - Control of Obtrusive Effects of Outdoor Lighting*; and
    (b) is mounted, screened and directed in such a manner that it does not create a nuisance to surrounding properties or the public road network.

Signage and Fencing

21. The Applicant shall not install any signage or fencing, without the written approval of the Director-General. In seeking this approval the Proponent shall:
    (a) submit detailed plans of the proposed signage or fencing, which have been prepared in consultation with Council; and
    (b) demonstrate that the proposed signage or fencing is consistent with the relevant requirements in the DCP.

ENERGY AND WATER EFFICIENCY

22. The Applicant shall implement all energy and water efficiency measures outlined in the EIS and regularly review opportunities to implement further efficiency measures.

SECURITY

23. The Applicant shall:
    (a) install and maintain a perimeter fence and security gates on the site; and
    (b) ensure that the security gates on-site are locked whenever the site is unattended.

FIRE MANAGEMENT

24. The Applicant shall:
    (a) implement suitable measures to minimise the risk of fire on-site;
    (b) extinguish any fires on-site promptly; and
    (c) maintain adequate fire-fighting capacity on-site.

SCHEDULE 4
ENVIRONMENTAL MANAGEMENT REPORTING & AUDITING

ENVIRONMENTAL MANAGEMENT STRATEGY

1. The Applicant shall prepare and implement an Environmental Management Strategy for the development to the satisfaction of the Director-General. This strategy must be submitted to the Director-General prior to carrying out any development on-site, and:
   (a) provide the strategic context for environmental management of the development;
   (b) identify the statutory requirements that apply to the development;
   (c) describe in general how the environmental performance of the development would be monitored and managed;
   (d) describe the procedures that would be implemented to:
      - keep the local community and relevant agencies informed about the operation and environmental performance of the development;
      - receive, handle, respond to, and record complaints;
      - resolve any disputes that may arise during the course of the development;
      - respond to any non-compliance;
      - manage cumulative impacts; and
      - respond to emergencies; and
   (e) describe the role, responsibility, authority, and accountability of all the key personnel involved in environmental management of the development.

ENVIRONMENTAL REPORTING & AUDITING

Incident

2. Upon detecting an exceedance of the limits/performance criteria in this consent or the occurrence of an incident that causes (or may cause) material harm to the environment, the Applicant shall immediately (or as soon as practical thereafter) notify the Department and other relevant agencies of the exceedance/incident. Within 7 days of the date of the incident, the Applicant shall provide the Director-General and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.

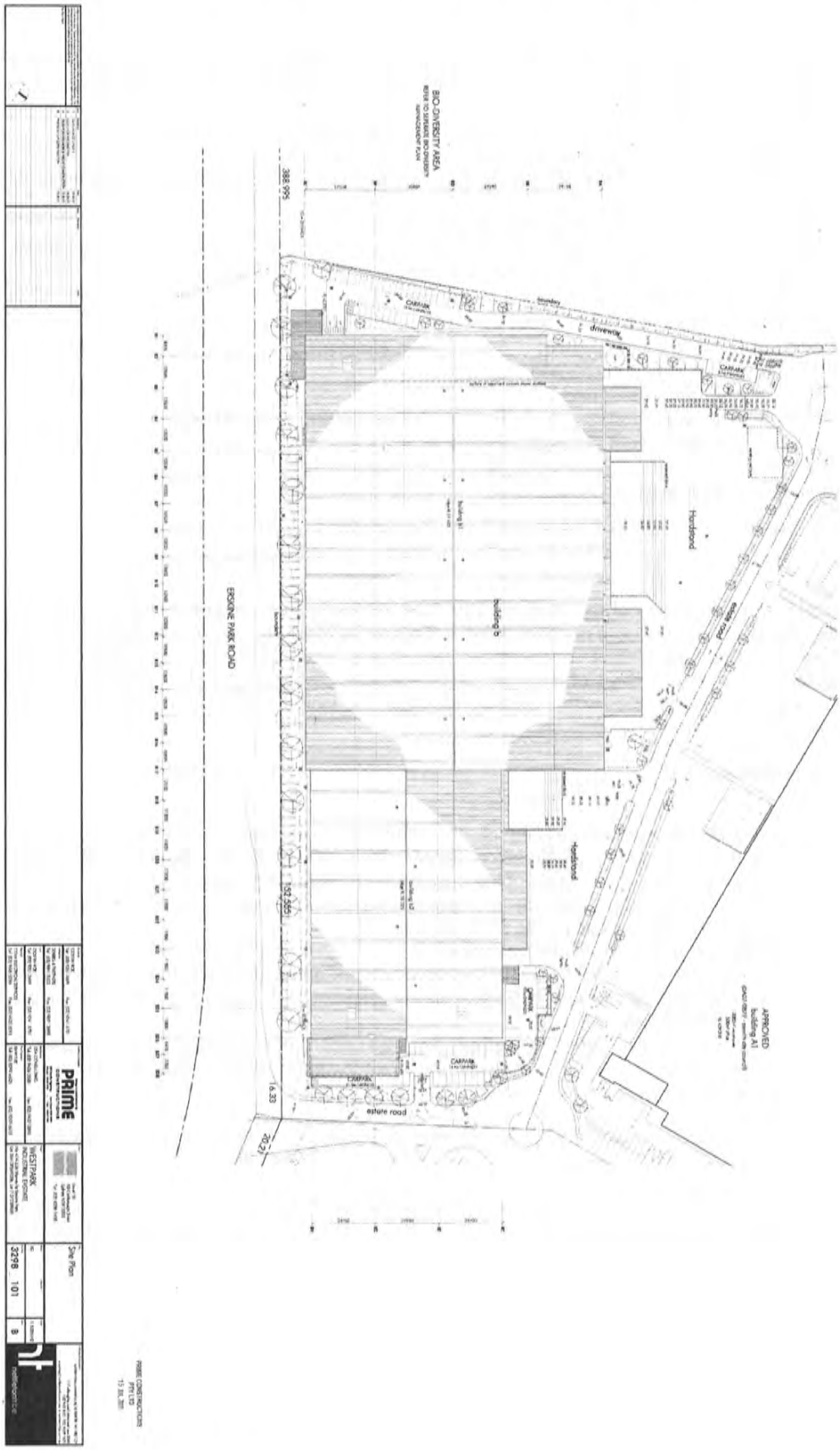
Independent Environmental Audit

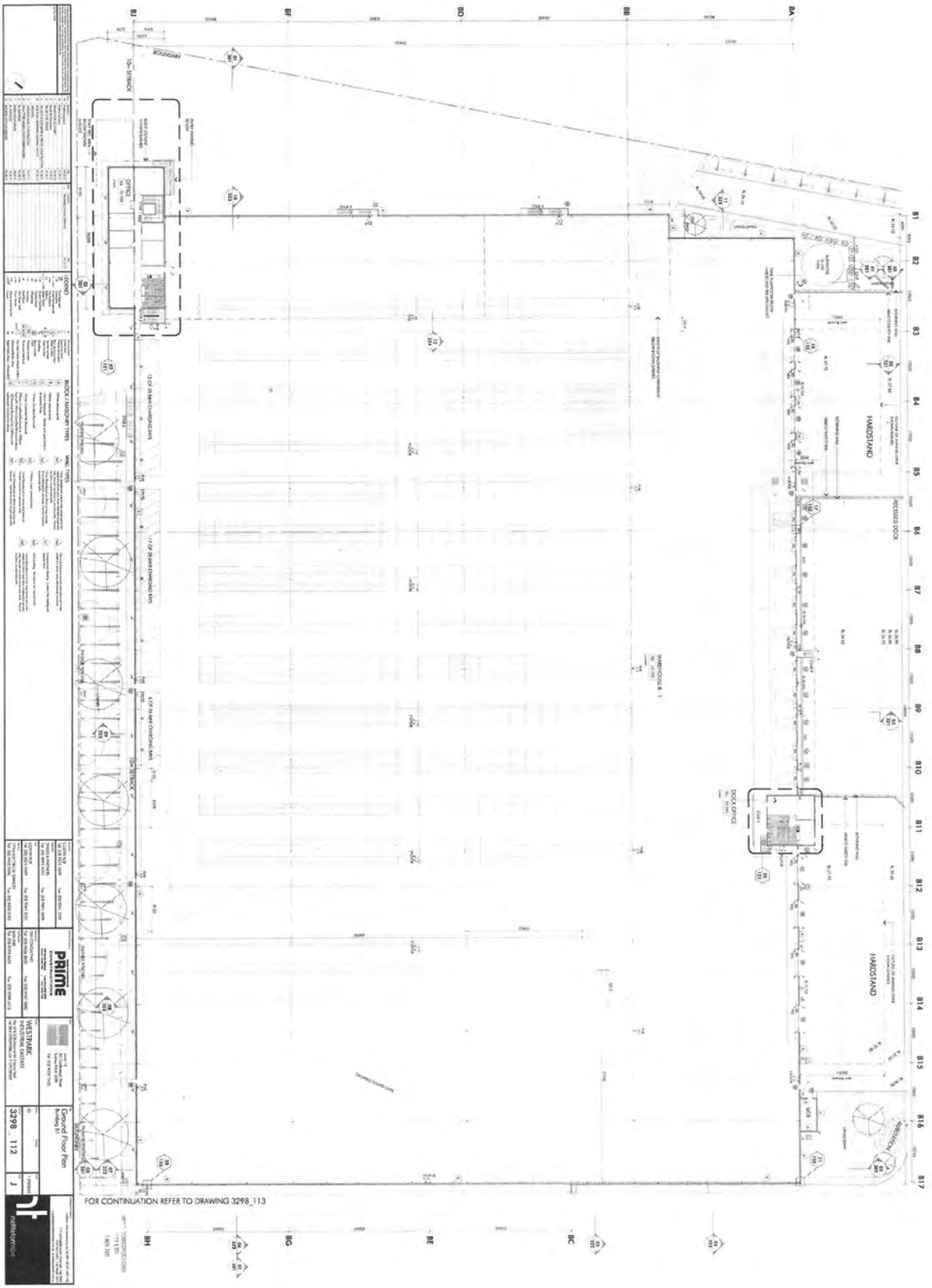
3. Within one (1) year of the commencement of operations of the project, and every three (3) years thereafter, or as otherwise agreed by the Director-General, the Applicant shall commission and pay the full cost of an Independent Environmental Audit of the development. This audit must:
   (a) be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Director-General;
   (b) include consultation with the relevant agencies;
   (c) assess the environmental performance of the development and assess whether it is complying with the relevant requirements in this consent and any relevant EPL (including any plan or program required under these consents);
   (d) review the adequacy of any plans or programs required under these consents; and, if appropriate;
   (e) recommend measures or actions to improve the environmental performance of the development, and/or any plan or program required under these consents.

   Note: This audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Director-General.

4. Within 6 weeks of completing any Independent Environmental Audit, or as otherwise agreed by the Director-General, the Applicant shall submit a copy of the audit report to the Director-General, together with its response to any recommendations contained in the audit report.

APPENDIX 1 – SITE PLANS

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DOCK OFFICE
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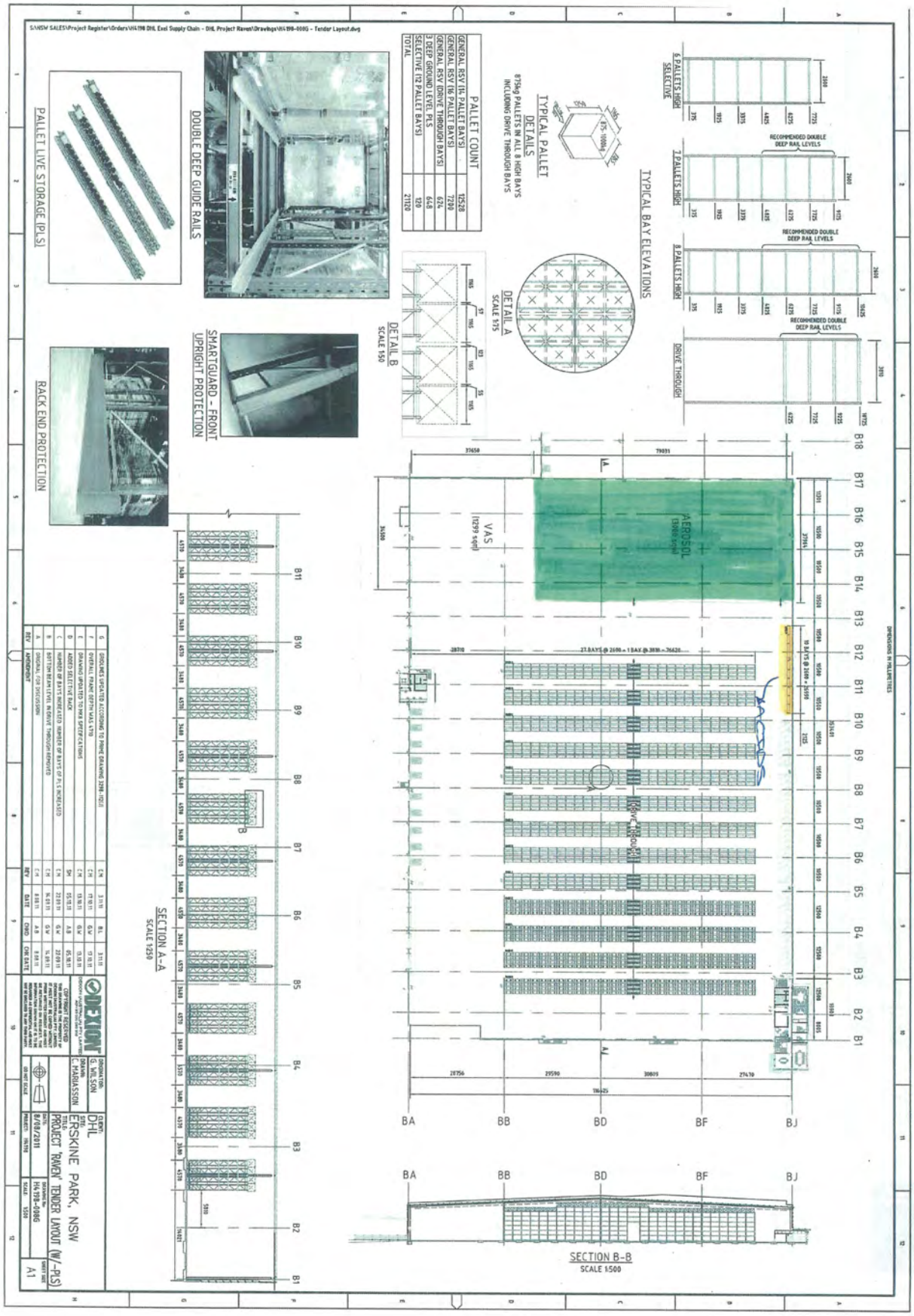
WESTPARK
INDUSTRIAL ESTATE
Ground Floor Plan
3298
112
J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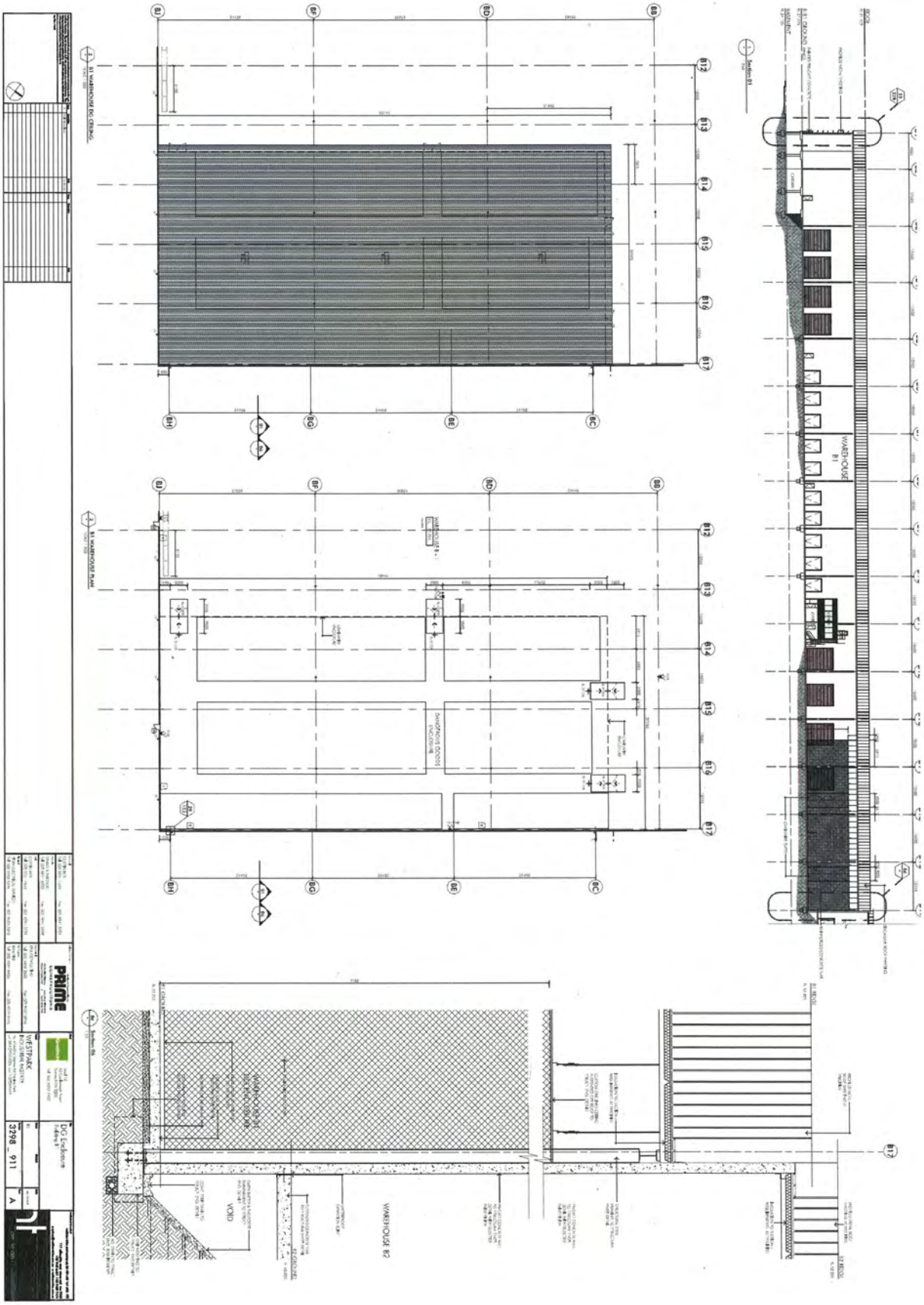
DOUBLE DEEP GUIDE RAILS
SMARTGUARD - FRONT UPRIGHT PROTECTION
RACK END PROTECTION
PALLET COUNT
GENERAL RSV (1% PALLET BAYS) 12528
GENERAL RSV (16 PALLET BAYS) 7290
GENERAL RSV (DRIVE THROUGH BAYS) 624
3 DEEP GROUND LEVEL PLS 648
SELECTIVE (12 PALLET BAYS) 120
TOTAL 21120
TYPICAL PALLET DETAILS
875kg PALLETS IN ALL 8 HIGH BAYS INCLUDING DRIVE THROUGH BAYS
DETAIL A SCALE 1:25
DETAIL B SCALE 1:50
TYPICAL BAY ELEVATIONS
6 PALLETS HIGH SELECTIVE
7 PALLETS HIGH
8 PALLETS HIGH
DRIVE THROUGH
RECOMMENDED DOUBLE DEEP RAIL LEVELS
AEROSOL
VAS
SECTION A-A SCALE 1:250
SECTION B-B SCALE 1:500
DIMENSIONS IN MILLIMETRES
DHL
ERSKINE PARK, NSW
PROJECT 'RAVEN' TENDER LAYOUT (W/- PLS)
8/08/2011
HN-178-0986
A1


WAREHOUSE B1
WAREHOUSE B2
VOID
3298_911

WILLOW TREE PLANNING

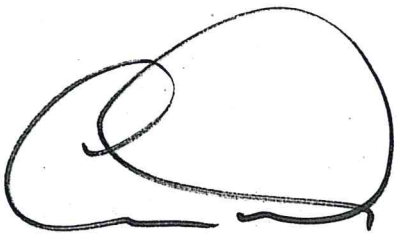
APPENDIX 2

SSD-4953 MOD 1 – Instrument

Notice of Modification

Section 96(1A) of the *Environmental Planning and Assessment Act 1979*

As delegate for the Minister for Planning and Infrastructure under delegation dated 27 February 2013, I hereby modify the development consent SSD-4953 referred to in Schedule 1, subject to the Conditions in Schedule 2.



Chris Wilson
Executive Director
Development Assessment Systems and Approvals

Sydney 18 MARCH 2013

SCHEDULE 1

State Significant Development Consent (SSD-4953), granted by the Minister for Planning and Infrastructure on 21 May 2012 for a dangerous goods warehouse and distribution development at 23-107 Erskine Park Road, Erskine Park (Lot 1 DP 1128233) in the Penrith City local government area.

SCHEDULE 2

1. Replacing the definition of 'Applicant' in the definitions list as follows:

Applicant	Prime Constructions Pty Ltd, or its successors in title

2. Replacing the definition of 'Development' in the definitions list as follows:

Development	The development as described in the EIS and RTS, as modified by SSD-4953 MOD 1

3. Inserting a new definition 'SSD-4953 MOD 1' in the definitions list in alphabetical order as follows:

SSD-4953 MOD 1	Modification application SSD-4963, accompanying Environmental Assessment dated November 2012 and Response to Submissions Report dated February 2013, prepared by McKenzie Group Consulting (NSW) Pty Ltd

4. Replacing Condition 2 after Condition 1 in Schedule 2 with the following:

Terms of Approval

2. The Applicant shall carry out the development generally in accordance with the:
   (a) EIS;
   (b) Development plans (Appendix 1);
   (c) RTS;
   (d) SSD-4953 MOD 1;
   (e) Statement of Commitments; and
   (f) conditions of this consent.

5. Replacing Condition 12 and Condition 13 after Condition 11 in Schedule 3 with the following:

Operational Noise Criteria

12. The Applicant shall ensure that the noise generated by the operations on-site does not exceed the limits in Table 1 at any private residential receiver.

Table 1: Noise impact assessment criteria dB(A)

Location	Day	Evening	Night	
	L_{Aeq} (15 minute)	L_{Aeq} (15 minute)	L_{Aeq} (15 minute)	L_{A1} (1 minute)
Receiver 1 (517 - 537 Mamre Road, Orchard Hills)	36	36	36	45
Receiver 2 (100 Pine Creek Circuit, St Clair)	35	35	35	45
Receiver 3 (45 Corio Drive, St Clair)	35	35	35	45
Receiver 4 (80 Cowarra Drive, St Clair)	35	35	35	45

Note:
- *Noise generated by the development is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.*

Operating Hours

13. The Applicant shall comply with the operating hours in Table 2 for the site.

Table 2: Operating Hours

Activity	Day	Hours
Construction (Fit-out)	Monday - Friday	7.00am – 6.00pm
	Saturdays	7.00am – 1.00pm
	Sundays and Public Holidays	Nil
Operations	All days	24 hours

6. Inserting new Conditions 14A and 14B after Condition 14 in Schedule 3 with the following:

14A. Within 2 months of the approval of SSD-4953 MOD 1, during a period of 24 hour a day operation as described in the Environmental Assessment for SSD-4953 MOD 1, the Applicant shall undertake a Noise Compliance Validation Assessment. This assessment shall:

(a) be prepared by a suitably qualified and experienced expert in consultation with the EPA;

(b) be submitted to the EPA and the Department within 2 weeks of its completion;

(c) include noise monitoring undertaken at day, evening and night (as defined in the *EPA's Industrial Noise Policy*) over 3 consecutive operating days for a minimum of:
- 1.5 hours during the day;
- 30 minutes during the evening; and
- 1 hour at night.

(d) identify whether the project is complying with the development noise limits specified in Condition 12 (Table 1) of this Schedule; and
(e) outline the mitigation measures to be implemented if exceedences of the development noise limits are identified, to the satisfaction of the Director-General.

Meteorological Monitoring

14B. By 25 April 2013, unless otherwise approved by the Director-General, the Applicant shall install a meteorological weather monitoring station on the site that complies with the requirements in the latest version of the EPA's *Approved Methods for Sampling of Air Pollutants in New South Wales* guideline. The meteorological station must be maintained so as to be capable of continuously monitoring the following parameters: air temperature, wind direction, wind speed, rainfall and relative humidity.

WILLOW TREE PLANNING

APPENDIX 3

Preliminary Hazard Analysis

Riskcon engineering

Preliminary Hazard Analysis

23-107 Erskine Park Road, Erskine Park

DHL Supply Chain (Australia) Pty Limited
Document No. RCE-20110_DH_PHA_Final_25Nov20_Rev(0)
Date 25/11/2020

Preliminary Hazard Analysis

23-107 Erskine Park Road, Erskine Park

DHL Supply Chain (Australia) Pty Limited

Prepared by

Riskcon Engineering Pty Ltd
Unit 19/5 Pyrmont Bridge Road
Camperdown, NSW 2050
www.riskcon-eng.com
ABN 74 626 753 820

Quality Management

Rev	Date	Remarks	Prepared By	Reviewed By
A	26 October 2020	Draft issue for comment	Jason Costa	Renton Parker
0	26 Otcober 2020	Issued Final		

Executive Summary

Background

DHL Supply Chain (Australia) Pty Limited (DHL) operates Warehouse B1 at 23-107 Erskine Park Road which was approved to store a range of DG products including Classes 2.1, 3, 4.1, 5.1, 8 and 9. It has been proposed to store a new customer within the warehouse which would result in exceedance of the approved DG quantities; subsequently, it is necessary to review and update the DG quantities within a Preliminary Hazard Analysis (PHA) to reflect the anticipated quantities as part of a new Development Application (DA).

DHL has commissioned Riskcon Engineering Pty Ltd (Riskcon) to prepare a PHA for the facility. This document represents the PHA study for the warehouse at Erskine Park.

Conclusions

A hazard identification table was developed for warehouse facilities to identify potential hazards that may be present at the site as a result of operations or storage of materials. Based on the identified hazards, scenarios were postulated that may result in an incident with a potential for offsite impacts. Postulated scenarios were discussed qualitatively and any scenarios that would not impact offsite were eliminated from further assessment. Scenarios not eliminated were then carried forward for consequence analysis.

Incidents carried forward for consequence analysis were assessed in detail to estimate the impact distances. Impact distances were developed into scenario contours and overlaid onto the site layout diagram to determine if an offsite impact would occur. The consequence analysis showed that two of the scenarios (partial escalation and full warehouse fire) would impact over the site boundary and into the adjacent land uses; hence, these incidents were carried forward for frequency analysis and risk assessment.

The frequency analysis and risk assessment showed the cumulative fatality risk of these incidents would be 7.64 chances per million per year (pmpy) at the site boundary, with lesser risk at further distances from the boundary. HIPAP No. 4 (Ref. [1]) publishes acceptable risk criteria at the site boundary of 50 pmpy (for industrial sites). Therefore, the risk of a fatality at the site boundary as a result of the facility operations would be within the acceptable risk criteria.

It was identified that no incidents would result in radiant heat contours of 23 kW/m^2 extending over the site boundary; hence, the potential for incident propagation to occur is calculated as 0 pmpy.

A review of the cumulative risk profiles in the area indicate two major hazard facilities have been relocated from the area; hence, the cumulative risk profile is likely to be less than the existing profile for the area and would thus be considered acceptable.

Based on the analysis conducted, it is concluded that the risks at the site boundary are not considered to exceed the acceptable risk criteria; hence, the facility would only be classified as potentially hazardous and would be permitted within the current land zoning for the site.

Recommendations

A hazard audit was conducted for the site in 2016 which resulted in several actions to be undertaken. These actions have been extracted from the report and are recommended to be complied with by the new operator. It is noted that not all recommendations apply to the new operator, or the recommendation is restrictive and not in-line with the overarching regulation. Where a recommendation is inconsistent or not-applicable to the new operator this has been noted.

• ID	Action	Assessment
1	Ensure that high housekeeping standard are maintained and that specific issues identified are promptly addressed	Subjective recommendation but the operator should comply with good housekeeping as required by the applicable standards.
2	Ensure all forklifts that are labelled suitable for use in a AS/NZS 60079.10 Zone 2 classified area are being maintained with emphasis on the controls that make the forklift suitable for use in a Zone 2.	Required by WHS Regulations 2017 and AS/NZS 60079 series
3	Compile a hazardous area dossier	Required by WHS Regulations 2017 and AS/NZS 60079 series
4	Remove sources of ignition from within the hazardous area or ensure that electrical equipment is appropriate rated for the area (in accordance with the hazardous area report)	Required by WHS Regulations 2017 and AS/NZS 60079 series
5	Provide lens covers for lighting within the aerosols cage and any lights that are situated above the hazardous zone resulting from the aerosols cage	This recommendation should be included
6	Undertake a review to ensure that the storage of corrosive liquids, acidic (UN 3264) is compliant	Not applicable as these materials are not proposed to be stored by the new operator

Additional Comments from DPIE

The Department of Planning, Industry, and Environment has provided additional comments on the submission of the revised PHA. These have been included in the following table with a response.

ID	DPIE Comment	Response
1	Provide a clear comparison of the dangerous goods currently stored on site with what is now proposed (including classes, quantities and representative types of products);	The DGs quantities have been adjusted to suit new customers proposed for the site. It is noted the site was previously approved as a Major Hazard Facility (MHF). The quantities stored are less than MHF. A comparison of the previously approved quantities against this PHA have been provided separately.
2.	Clarify how the proposed modifications will change current operations on site, including whether the increased quantities of DGs to be stored will result in additional vehicle movements and whether there will be an increased intensity of activities undertaken beyond what was considered in previous acoustic assessments under SSD 4953 and MOD 1	Unclear of the impact upon noise. As noted, the warehouse operates at lower DG volumes than when the warehouse was approved as an MHF. The transport movements are not expected to be significantly different to the current operations and are expected to be less than the movements approved when the facility was an MHF.
3	Provide updated site plans to reflect the proposed changes, where necessary, from those plans included in the SSD 4953 consent	Submitted separately to this report

ID	DPIE Comment	Response
4	A detailed layout of the storage proposed for Class 2, Class 3 and Class 4.1 demonstrating the separation and segregation requirements of AS 3833 and AS 2118.1 are met;	Figure 3-4 has been included to show the layout of the DGs within the DG cage. The separation distances are considered to comply with the Work Health and Safety Regulation (i.e. the risks are to be assessed So Far As Is Reasonably Practicable). This is based upon the separation distances themselves along with the fire protection requirements incorporated into the building design which far exceeds the minimum requirements of AS/NZS 3833 upon which the separation distances are based (i.e. the separation distances do not include protection requirements when determining the separation distances).
5	An assessment of the DGs (and combustible liquid C1) and the compatibility with the installed (or proposed) sprinkler arrangement in the warehouse, with reference to AS 2118.1.	A fire protection designer has been engaged to ensure the commodities will be protected in accordance with AS 2118.1 which exceeds the fire protection requirements of AS/NZS 3833. The analysis of the PHA is to determine whether the incidents at the site would impact adjacent land uses above the acceptable criteria. It is not a design assessment document. Therefore, any sprinkler requirements to protect the proposed commodities would be provided in separate documentation and not within the PHA.

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Abbreviations

Abbreviation	Description
ADG	Australian Dangerous Goods Code
AS	Australian Standard
CBD	Central Business District
CCPS	Centre for Chemical Process Safety
DA	Development Application
DGs	Dangerous Goods
DGS	Dangerous Goods Store
DPE	Department of Planning and Environment
FRNSW	Fire and Rescue New South Wales
HIPAP	Hazardous Industry Planning Advisory Paper
HSE	Health and Safety Executive
LPG	Liquefied Petroleum Gas
PFD	Probability of Failure on Demand
PHA	Preliminary Hazard Analysis
Pmpy	Per million per year
RDC	Retail Distribution Centre
SEP	Surface Emissive Power
SEPP	State Environmental Planning Policy
SMSS	Storage Mode Sprinkler System
SSC	Spread Sheet Calculator
VF	View Factor

1.0 Introduction

1.1 Background

DHL Supply Chain (Australia) Pty Limited (DHL) operates Warehouse B1 at 23-107 Erskine Park Road which was approved to store a range of DG products including Classes 2.1, 3, 4.1, 5.1, 8 and 9. It has been proposed to store a new customer within the warehouse which would result in exceedance of the approved DG quantities; subsequently, it is necessary to review and update the DG quantities within a Preliminary Hazard Analysis (PHA) to reflect the anticipated quantities as part of a new Development Application (DA).

DHL has commissioned Riskcon Engineering Pty Ltd (Riskcon) to prepare a PHA for the facility. This document represents the PHA study for the warehouse at Erskine Park.

1.2 Objectives

The objectives of the PHA project, for warehouse B1 at 23-107 Erskine Park Road, Erskine Park, include:

- Complete the PHA according to the Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 – Hazard Analysis (Ref. [2]);
- Assess the PHA results using the criteria in HIPAP No. 4 – Risk Criteria for Land Use Planning (Ref. [1]); and
- Demonstrate compliance of the site with the relevant codes, standards and regulations (i.e. NSW Planning and Assessment Regulation 1979, WHS Regulation, 2017 Ref. [3]).

1.3 Scope of Services

The scope of work is to complete a PHA study for warehouse B1 located at 23-107 Erskine Park Road, Erskine Park, required by the Planning Regulations for the proposed development. The scope does not include any other assessments at the site or any other DHL facilities.

2.0 Methodology

2.1 Multi-Level Risk Assessment

The Multi-Level Risk Assessment approach (Ref. [4]) published by the NSW Department of Planning and Environment, has been used as the basis for the study to determine the level of risk assessment required. The approach considered the development in context of its location, the quantity and type (i.e. hazardous nature) Dangerous Goods stored and used, and the facility's technical and safety management control. The Multi-Level Risk Assessment Guidelines are intended to assist industry, consultants and the consent authorities to carry out and evaluate risk assessments at an appropriate level for the facility being studied.

There are three levels of risk assessment set out in Multi-Level Risk Assessment which may be appropriate for a PHA, as detailed in **Table 2-1**.

Table 2-1: Level of Assessment PHA

Level	Type of Analysis	Appropriate If:
1	Qualitative	No major off-site consequences and societal risk is negligible
2	Partially Quantitative	Off-site consequences but with low frequency of occurrence
3	Quantitative	Where 1 and 2 are exceeded

The Multi-Level Risk Assessment approach is schematically presented in **Figure 2-1**.

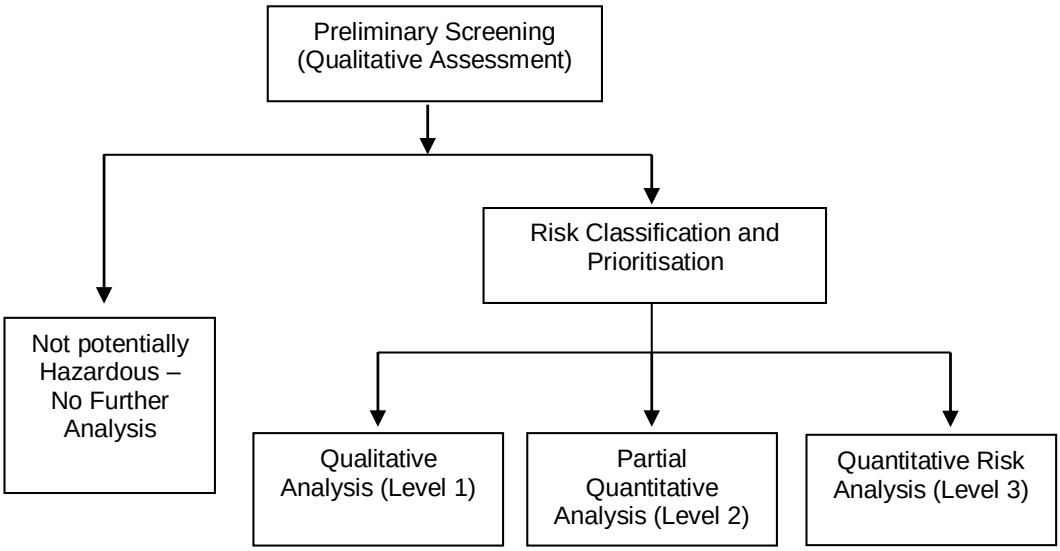

Figure 2-1: The Multi-Level Risk Assessment Approach

Based on the type of DGs to be used and handled at the proposed facility, a **Level 2 Assessment** was selected for the Site. This approach provides a qualitative assessment of those DGs of lesser quantities and hazard, and a quantitative approach for the more hazardous materials to be used on-site. This approach is commensurate with the methodologies recommended in "Applying SEPP 33's" Multi Level Risk Assessment approach (DPE, 2011).

2.2 Risk Assessment Study Approach

The methodology used for the PHA is as follows;

Hazard Analysis – A detailed hazard identification was conducted for the site facilities and operations. Where an incident was identified to have a potential off-site impact, it was included in the recorded hazard identification word diagram (**Appendix A**). The hazard identification word diagram lists incident type, causes, consequences and safeguards. This was performed using the word diagram format recommended in HIPAP No. 6 (Ref. [2]).

Each postulated hazardous incident was assessed qualitatively in light of proposed safeguards (technical and management controls). Where a potential offsite impact was identified, the incident was carried into the main report for further analysis. Where the qualitative review in the main report determined that the safeguards were adequate to control the hazard, or that the consequence would obviously have no offsite impact, no further analysis was performed. **Section 3.1** of this report provides details of values used to assist in selecting incidents required to be carried forward for further analysis.

Consequence Analysis – For those incidents qualitatively identified in the hazard analysis to have a potential offsite impact, a detailed consequence analysis was conducted. The analysis modelled the various postulated hazardous incidents and determined impact distances from the incident source. The results were compared to the consequence criteria listed in HIPAP No. 4 (Ref. [1]). The criteria selected for screening incidents is discussed in **Section 3.1**.

Where an incident was identified to result in an offsite impact, it was carried forward for frequency analysis. Where an incident was identified to not have an offsite impact, and a simple solution was evident (i.e. move the proposed equipment further away from the boundary), the solution was recommended, and no further analysis was performed.

Frequency Analysis – In the event a simple solution for managing consequence impacts was not evident, each incident identified to have potential offsite impact was subjected to a frequency analysis. The analysis considered the initiating event and probability of failure of the safeguards (both hardware and software). The results of the frequency analysis were then carried forward to the risk assessment and reduction stage for combination with the consequence analysis results.

Risk Assessment and Reduction – Where incidents were identified to impact offsite and where a consequence and frequency analysis was conducted, the consequence and frequency analysis for each incident were combined to determine the risk and then compared to the risk criteria published in HIPAP No. 4 (Ref. [1]). Where the criteria were exceeded, a review of the major risk contributors was performed, and the risks reassessed incorporating the recommended risk reduction measures. Recommendations were then made regarding risk reduction measures.

Reporting – on completion of the study, a draft report was developed for review and comment by DHL. A final report was then developed, incorporating the comments received by DHL, for submission to the regulatory authority.

3.0 Site Description

3.1 Site Location

The site is located at 23-107 Erskine Park Road which is approximately 49 km west of the Sydney Central Business District (CBD). **Figure 3-1** shows the regional location of the site in relation to the Sydney CBD. Provided in **Figure 3-2** is the layout of the site.

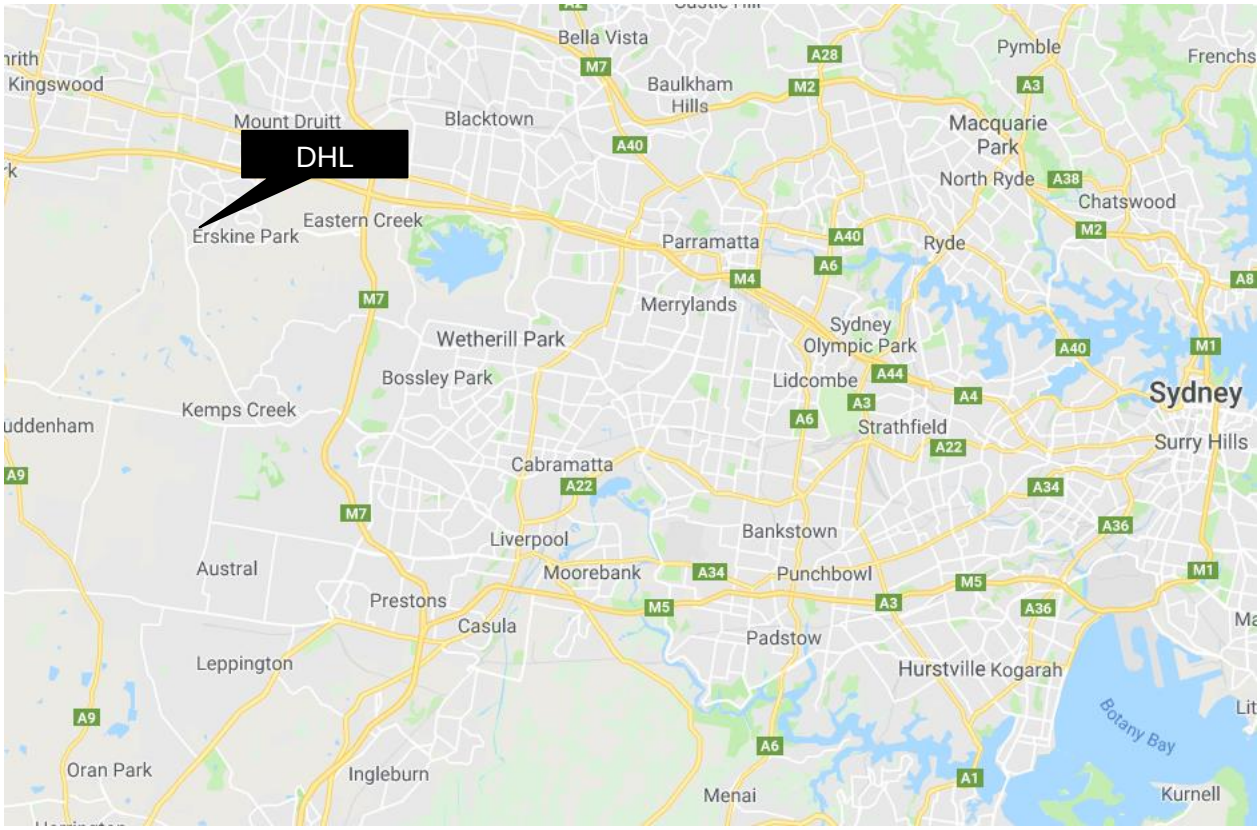

Figure 3-1: Regional Site Location

Figure 3-2: Site Location

3.2 Adjacent Land Uses

The land is located in an industrial area surrounded by the following land uses, which are adjacent to the site:

- North – Warehousing
- South – Public road / warehousing
- East – Warehousing
- West – Undeveloped land

3.3 General Description

The site consists of hardstand areas, unloading/loading docks, car parking and the warehouse structure which composes warehouse space, battery charging, office areas, amenities and ancillary services. DG classes and volumes are discussed in **Section 3.5**. **Figure 3-3** can be used to assist in understanding the description provided below.

3.4 Warehouse Detailed Description

The warehouse will have a total floor area of approximately 21,000 m^2. The warehouse will store a range of DGs including; Class 2.1, 2.2, 3, 4.1, 8 and 9s.

The DGs will be stored in accordance with the Retail Distribution Centre (RDC) requirements of AS/NZS 3833:2007 (Ref. [5]) for the retail packaged goods.

The warehouse area will be protected by a ceiling mounted Storage Mode Sprinkler System (SMSS). DGs classed as flammable (gases, liquids and solids) will be block stacked 2 high; hence, will be adequately protected by ceiling mounted protection. The sprinklers will activate upon fire detection and will suppress and control any fire which may occur. The warehouse is mechanically ventilated above the requirements of AS/NZS 3833:2007 (Ref. [5]) which will remove any vapours should they be released. In addition, the flammable storage area is bunded to contain spills which is above the requirements of the standard.

The wall separating warehouse B1 from warehouse B2 is a 4-hour fire rated wall (FRL 240/240/240) which exceeds the minimum requirements of the standard.

In the event of a fire, potentially contaminated water will be contained within the site boundary via activation of a stormwater isolation valve. Water will be contained within the site boundaries, stormwater system and recessed docks.

The site will be subject to a hazardous area classification per AS/NZS 60079.10.1:2009 (Ref. [6]) and any electrical equipment within the hazardous zone will be compliant per AS/NZS 60079.14:2017 (Ref. [7]).

The storage configuration of the DG cage has been provided in **Figure 3-4** which shows the separation distances between each class. It is noted that the separation distances are considered to comply with the requirements of the Work Health and Safety Regulation based upon the indicative requirements from AS/NZS 3833:2007 (Ref. [5]) and the presence of fire protection far exceeding that required for the commodities being protected.

3.5 Quantities of Dangerous Goods Stored and Handled

The classes and quantities to be approved in the facility are summarised **Table 3-1**. The location of the DGs within the warehouse are shown in **Figure 3-3.**

Table 3-1: Maximum Classes and Quantities of Dangerous Goods Stored

Class	Packing Group	Quantity (kg)
2.1	-	600,000 (150,000 kg of LPG) *
2.2	-	200,000
3	II & III	200,000
4.1	II & III	50,000^
8	II & III	200,000
9	III	500,000

*Assuming density of 1,000 kg/m^3 and 25% of product weight is propellant

^Not currently stored

3.6 Aggregate Quantity Ratio

Where more than one class of dangerous goods are stored and handled at the site an AQR exists. This ratio is calculated using **Equation 3-1:**

$$AQR = \frac{q_x}{Q_x} + \frac{q_y}{Q_y} + [\dots] + \frac{q_n}{Q_n}$$ **Equation 3-1**

Where:

x,y […] and n are the dangerous goods present

q_x, q_y, […] and q_n is the total quantity of dangerous goods x, y, […] and n present.

Q_x, Q_y, […] and Q_n is the individual threshold quantity for each dangerous good of x, y, […] and n

Where the ratio AQR exceeds a value of 1, the site would be considered a Major Hazard Facility (MHF). The threshold quantities for each class is taken from Schedule 15 of the Work Health and Safety (WHS) Regulation 2017 (Ref. [3]). These are summarised in **Table 3-2**, Classes 2.2, 4.1(II & III), 8 and 9 are not subject to MHF legislation.

Table 3-2: Major Hazard Facility Thresholds

Class	Packing Group	Threshold (tonnes)	Storage (tonnes)
2.1	n/a	200	150
3	II & III	50,000	200

A review of the thresholds and the commodities and packing groups listed in **Table 3-2** indicates only Class 2.1 and 3 are assessable against the MHF thresholds. Therefore, substituting the storage masses into **Equation 3-1** the AQR is calculated as follows:

$$AQR = \frac{150}{200} + \frac{200}{50000} = 0.754$$

The AQR is less than 1; hence, the facility would not be classified as an MHF.

Figure 3-3: Dangerous Goods Storage Locations.

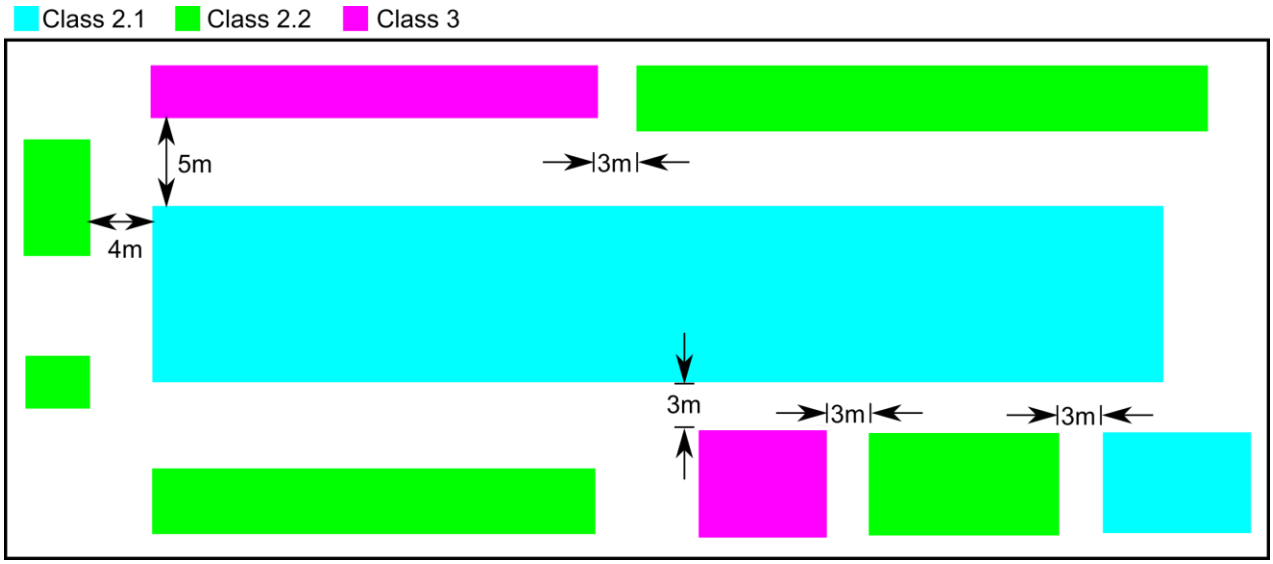

Figure 3-4: DG Cage Storage Configuration

4.0 Hazard Identification

4.1 Introduction

A hazard identification table has been developed and is presented at **Appendix A**. This table has been developed following the recommended approach in Hazardous Industry Planning Advisory Paper No .6, Hazard Analysis Guidelines (Ref. [2]). The Hazard Identification Table provides a summary of the potential hazards, consequences and safeguards at the site. The table has been used to identify the hazards for further assessment in this section of the study. Each hazard is identified in detail and no hazards have been eliminated from assessment by qualitative risk assessment prior to detailed hazard assessment in this section of the study.

In order to determine acceptable impact criteria for incidents that would not be considered for further analysis, due to limited impact offsite, the following approach has been applied:

- *Fire Impacts* - It is noted in Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 (Ref. [1]) that a criterion is provided for the maximum permissible heat radiation at the site boundary (4.7 kW/m^2) above which the risk of injury may occur and therefore the risk must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk, for this study, incidents that result in a heat radiation less that at 4.7 kW/m^2, at the site boundary, are screened from further assessment.
- Those incidents exceeding 4.7 kW/m^2 at the site boundary are carried forward for further assessment (i.e. frequency and risk). This is a conservative approach, as HIPAP No. 4 (Ref. [1]) indicates that values of heat radiation of 4.7 kW/m^2 should not exceed 50 chances per million per year at sensitive land uses (e.g. residential). It is noted that the closest residential area is over 220 m from the site, hence, by selecting 4.7 kW/m^2 as the consequence impact criteria (at the adjacent industrial site boundary) the assessment is considered conservative.
- *Explosion* - It is noted in HIPAP No. 4 (Ref. [1]) that a criterion is provided for the maximum permissible explosion over pressure at the site boundary (7 kPa) above which the risk of injury may occur and therefore the risk must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk, for this study, incidents that result in an explosion overpressure less than 7 kPa, at the site boundary, are screened from further assessment. Those incidents exceeding 7 kPa, at the site boundary, are carried forward for further assessment (i.e. frequency and risk). Similarly, to the heat radiation impact discussed above, this is conservative as the 7 kPa value listed in HIPAP No. 4 relates to residential areas, which are over 220 m from the site.
- *Toxicity* – Toxic products are not anticipated to be stored; hence, have not been assessed.
- *Property Damage and Accident Propagation* - It is noted in HIPAP No. 4 (Ref. [1]) that a criterion is provided for the maximum permissible heat radiation/explosion overpressure at the site boundary (23 kW/m^2/14 kPa) above which the risk of property damage and accident propagation to neighbouring sites must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk to incident propagation, for this study, incidents that result in a heat radiation heat radiation less than 23 kW/m^2 and explosion over pressure less than 14 kPa, at the site boundary, are screened from further assessment. Those incidents exceeding 23 kW/m^2 at the site boundary are carried forward for further assessment with respect to incident propagation (i.e. frequency and risk).

- *Societal Risk* – HIPAP No. 4 (Ref. [1]) discusses the application of societal risk to populations surrounding the proposed potentially hazardous facility. It is noted that HIPAP No. 4 indicates that where a development proposal involves a significant intensification of population, in the vicinity of such a facility, the change in societal risk needs to be taken into account. In the case of the facility, there is currently no significant intensification of population around the proposed site; however, the adjacent land has been rezoned residential; hence, there will be housing located approximately 220 m from the site. Therefore, societal risk has been considered in the assessment.

4.2 Properties of Dangerous Goods

The type of DGs and quantities stored and used at the site has been described in **Section 3**. **Table 4-1** provides a description of the DGs stored and handled at the site, including the Class and the hazardous material properties of the DG Class.

Table 4-1: Properties* of the Dangerous Goods and Materials Stored at the Site

Class	Hazardous Properties
2.1 – Flammable Gases	Class 2.1 includes flammable gases which are ignitable when in a mixture of 13 per cent or less by volume with air or have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit. Ignited gas may result in explosion or flash fire.
3 – Flammable Liquids	Class 3 includes flammable liquids which are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc.) which give off a flammable vapour at temperatures of not more than 60^{o}C closed-cup test or not more than 65.6^{o}C open-cup test. Vapours released may mix with air and if ignited, at the right, concentration will burn resulting in pool fires at the liquid surface.
4.1 – Flammable Solids	Flammable solid materials are materials that may burn when exposed to an ignition source, examples of flammable solids include matches and some waxes.
8 – Corrosive Substances	Class 8 substances (corrosive substances) are substances which, by chemical action, could cause damage when in contact with living tissue (i.e. necrosis), or, in case of leakage, may materially damage, or even destroy, other goods which come into contact with the leaked corrosive material. Releases to the environment may cause damage to sensitive receptors within the environment.
9 – Miscellaneous DGs	Class 9 substances and articles (miscellaneous dangerous substances and articles) are substances and articles which, during transport present a danger not covered by other classes. Releases to the environment may cause damage to sensitive receptors within the environment.

* The Australian Code for the Transport of Dangerous Goods by Road and Rail (Ref. [8]

4.3 Hazard Identification

Based on the hazard identification table presented in **Appendix A**, the following hazardous scenarios have been developed:

- LPG release, delayed ignition and flash fire or explosion.
- LPG release (from aerosol), ignition and racking fire.
- Flammable material spill, ignition and racking fire.

- Forklift loading/unloading, damaged packaged, flammable liquid or aerosol release, ignition and pallet fire.
- Full warehouse fire and radiant heat.
- Full warehouse fire and smoke emission.
- Dangerous goods liquid spill, release and environmental incident.
- Warehouse fire, sprinkler activation and potentially contaminated water release.

Each identified scenario is discussed in further detail in the following sections.

4.4 LPG Release, Delayed Ignition and Flash Fire or Explosion

As noted in **Section 3.5**, aerosols will be held at the site for storage and distribution. There is potential that a Liquefied Petroleum Gas (LPG) release to occur from an aerosol in the warehouse area due to an accident (packages dropped from forklift, punctured by forklift tines) or deterioration of packaging. If a gas release occurred a flammable atmosphere may form which if ignited would immediately flash back to the source of release which may form into a fire. Due to the low confinement of the area and the volumes likely to be released from such a scenario, an explosion is not considered a credible scenario.

It is noted that the potential for a release of LPG is low as aerosol canisters are pressure tested during manufacture and filling, hence, release would predominately result from damaged product rather than deterioration.

Aerosols typically hold <500 g of total product with the quantity of the LPG propellant being approximately 25% of the weight of the product hence, for a 500 g product approximately 125 g of LPG would be released.

Packages are inspected for damage upon receipt at the loading dock before they are transported into the warehouse. This minimises the likelihood that a damaged package is incorrectly stored. Once stored inside the warehouse, deterioration or damage are unlikely to occur.

To minimise the likelihood that a flammable vapour cloud may contact an ignition source, the electrical equipment within the aerosol store will be installed according to the requirements of AS/NZS 60079.14:2017 (Ref. [7]).

Based on the warehouse design operation practices and the storage of small packages, the risk of a vapour cloud being generated that is large enough to ignite and have a substantial impact by way of a vapour cloud explosion or a flash fire, is considered to be low (if not negligible); hence, this hazard has not been carried forward for further analysis.

4.5 LPG Release (From Aerosol), Ignition and Racking Fire

As noted in **Section 4.4** the potential for release of LPG from an aerosol is considered low due to the quality assurance testing on aerosol canisters during the filling process. The release of LPG would likely result from damage to aerosols during transport and storage rather than from deterioration. Packages are inspected upon delivery and an accident involving aerosols would trigger an additional inspection to verify that damage had not occurred prior to storage within the warehouse.

Notwithstanding this, there is the potential for a release of LPG to occur within the storage racking. Due to the hazardous area rating of the area, it is considered unlikely for an ignition to occur; however, in the event an ignition of an LPG release did occur a fire could result.

The fire would consume the packaging with the generated heat impacting the adjacent aerosols. As the LPG within the adjacent aerosols expands the canisters may rupture releasing LPG which would ignite and rocket the canister throughout the aerosol cage potentially spreading the fire.

As the fire grows, the ceiling mounted sprinklers will activate to suppress the fire and cool adjacent packages to minimise the potential for aerosol rupture and rocketing. Activation of this system would control the fire within the sprinkler array as specified by testing conduct by FM Global in Data Sheet 7-31 (Ref. [9]).

Though the fire will be controlled, there is the potential for radiant heat to impact over the site boundary. Therefore, this incident has been carried forward for further analysis.

4.6 Flammable Material Spill, Ignition and Racking Fire

There is the potential for flammable material products to be damaged (i.e. punctured by forklift tynes, dropped package, etc.) or deteriorate resulting in a release of flammable liquid. All products are inspected prior to storage within the warehouse; hence, if a leak has occurred it would be identified and would be managed to ensure that it was not stored in the warehouse. Once stored, deterioration of the packaging is unlikely to occur.

If a flammable material spill did occur (e.g. dropped pallet or package during handling) it would be unlikely that it would ignite due to the controlled ignition sources and ventilation systems. Notwithstanding this, there is the potential for the spill to ignite.

Upon ignition, the heat emitted will impact the bulbs which when heated to the activation temperature will break the bulbs discharging water to suppress and control the fire within the sprinkler array.

Although a fire is likely to be controlled within the sprinkler array there may be the potential for an offsite impact to occur; hence, this incident has been carried forward for further analysis.

4.7 Forklift Loading/Unloading, Damaged Packaged, Flammable Liquid or Aerosol Release, Ignition and Pallet Fire

Pallets will be loaded and unloaded via forklift outside of the warehouse. Delivered products may be temporarily stored on pallets in a transit area prior to relocation into the warehouse. Conversely, pallets may be located temporarily during dispatch operations.

During relocation of pallets there is the potential for forklift tines to puncture the product or for the pallets to be dropped resulting in damage. If the packages are damaged they may release flammable liquid or gases which could ignite resulting in a pallet fire.

The potential for a fire to occur within the transit area is considered to be low and based on the quantity of material on a pallet the impact is unlikely to impact off site. As an offsite impact is unlikely to occur, this incident has not been carried forward for further analysis.

4.8 Full Warehouse Fire and Radiant Heat

There is potential that if a fire occurred and the fire protection systems failed to activate, a small fire may escalate as radiant heat impacts adjacent packages resulting in deterioration and release

of additional fuel. While it is considered unlikely for a fire to occur simultaneously with the sprinkler system failing to operate there is the potential for this scenario to occur which may result in offsite impacts. Therefore, this incident has been carried forward for further analysis.

4.9 Full Warehouse Fire and Smoke Emission

As discussed in **Section 4.8** there is the potential for a full warehouse fire to occur in the event of sprinkler failure. As products are burned they will emit toxic products of combustion (i.e. carbon monoxide) which may have substantial downwind impacts. Depending on the concentration of the toxic bi-products, this may result in injury or fatality. Therefore, this incident has been carried forward for further analysis.

4.10 Dangerous Goods Liquid Spill, Release and Environmental Incident

There is potential that a spill of the liquid DGs (Class 3, 8 and 9s) could occur at the site which if not contained could be released into the public water course resulting in a potential environmental incident.

To prevent spills escaping from the site has been designed per the requirements of AS/NZS 3833:2007 (Ref. [5]) to contain spills within the site boundaries. This is achieved via a stormwater isolation point and containment within the hardstand and recessed docks.

Therefore, the potential for a release is considered unlikely as this is expected to be contained within the footprint of the warehouse, bunds, site boundary and stormwater system. Nonetheless, in the event of a catastrophic scenario and spills are released from the footprint of the warehouse, it will be necessary to prevent this from being released into the public water course.

The site has been designed to contain spills from operations within primary and tertiary containment areas within the site boundaries via the stormwater system. Therefore, in the event of an incident, it is considered spills will be contained and prevented from entering the public water course. As an offsite incident is unlikely to occur, this incident has not been carried forward for further analysis.

4.11 Warehouse Fire, Sprinkler Activation and Potentially Contaminated Water Release

In the event of a fire, the sprinklers will activate discharging water onto the fire to control and suppress the fire. Contact of the fire water with DGs may result in contamination which, if released to the local watercourse, could result in environmental damage. The facility has been designed to be able to contain all DG spills and liquid effluent resulting from the management of an incident (i.e. fire) within the premises. The site was previously approved to store a range of DGs accounting for the sprinkler discharge. The discharge scenarios are not expected to be different from those identified in previous approvals; hence, it is considered the existing containment strategy would be acceptable for the proposed DG quantities .

Based on the existing construction and containment for the premises, there is adequate fire water retention to meet the '*Best Practice Guidelines for Contaminated Water Retention and Treatment Systems*" (Ref. [10]), hence, this incident has not been carried forward for further analysis.

5.0 Consequence Analysis

5.1 Incidents Carried Forward for Consequence Analysis

The following incidents were identified to have potential to impact off site:

- LPG release (from aerosol), ignition and racking fire.
- Flammable material spill, ignition and racking fire.
- Full warehouse fire and radiant heat.
- Full warehouse fire and smoke emission.

Each incident has been assessed in the following sections.

5.2 LPG Release (From Aerosol), Ignition and Racking Fire

There is the potential for a fire to develop involving aerosols stored within the warehouse resulting in a racking fire. As the fire grows the SMSS would activate suppressing and controlling the fire while cooling adjacent packages minimising the potential for lateral spread due to radiant heat. A detailed analysis has been conducted in **Appendix B** and the radiant heat impact distances estimated for this scenario are presented in **Table 5-1**.

Table 5-1: Heat Radiation from Class 2.1 Sprinkler Controlled Scenarios

Heat Radiation (kW/m2)	Distance (m)	
	Base Case	Sensitivity
35	3.3	5.1
23	4.5	7.4
12.6	6.6	11.5
4.7	12.0	21.4

The blocked stacked aerosol storage is located 6 m from the wall which is an additional 6.5 m from the closets site boundary. Therefore, 4.7 kW/m^2 radiant heat would not impact over the site boundary in the base case, only impacting over the site boundary in the sensitivity case. A review of the 23 kW/m^2 impact distance indicates an offsite impact would not occur in neither the base case nor sensitivity case. The impact contours for both the base and sensitivity case fires are illustrated in **Figure 5-1**.

As an offsite impact may occur at the 4.7 kW/m^2 radiant heat levels, this incident has been carried forward for further analysis.

Figure 5-1: Sprinkler Controlled Aerosol Fire Radiant Heat Contours

5.3 Flammable Material Spill, Ignition and Racking Fire

There is the potential for a fire to develop involving flammable materials stored within the warehouse resulting in a racking fire. As the fire grows the SMSS would activate suppressing and controlling the fire while cooling adjacent packages minimising the potential for lateral spread due to radiant heat. A detailed analysis has been conducted in **Appendix B** and the radiant heat impact distances estimated for this scenario are presented in **Table 5-2**.

Table 5-2: Heat Radiation from a Flammable Material Sprinkler Controlled Fire

Heat Radiation (kW/m2)	Distance (m)	
	Base Case	Sensitivity
35	2.9	4.6
23	4.0	6.6
12.6	6.0	10.3
4.7	10.7	19.0

The blocked stacked flammable material storage is located 6 m from the wall which is an additional 6.5 m from the closets site boundary. Therefore, 4.7 kW/m^2 radiant heat would not impact over the site boundary in the base case, only impacting over the site boundary in the sensitivity case. A review of the 23 kW/m^2 impact distance indicates an offsite impact would not occur in neither the

base case nor sensitivity case. The impact contours for both the base and sensitivity case fires are illustrated in **Figure 5-2**.

As an offsite impact may occur at the 4.7 kW/m^2 radiant heat levels, this incident has been carried forward for further analysis.

Figure 5-2: Sprinkler Controlled Flammable Material Fire Radiant Heat Contours

5.4 Full Warehouse Fire and Radiant Heat

If a fire occurs within the warehouse and the sprinkler systems fail to activate, the fire will spread throughout the warehouse and is unlikely to be contained and would likely consume the entire warehouse. A detailed analysis has been conducted in **Appendix B** and the radiant heat impact distances estimated for this scenario are presented in **Table 5-3**.

Table 5-3: Heat Radiation Impacts from a Full Warehouse Fire

Heat Radiation (kW/m^2)	Distance (m)
35	Maximum heat flux is 20
23	Maximum heat flux is 20
12.6	34.0
4.7	76.0

*Based on the research by Mudan & Croche reported in Lees (Ref. [11]) & Cameron/Raman (Ref. [12])

As shown in **Figure 5-3**, the radiant heat impacts at 4.7 kW/m^2 extend over the site boundary; hence, there is the potential for a fatality at the site boundary to occur. Therefore, this incident has been carried forward for further analysis.

It is noted that due to the fire size there will be considerable smoke emitted which would obscure the flame surface reducing the average surface emissive power (SEP) and subsequently it would not exceed 23 kW/m^2. In addition, the distance to the closest buildings is 23 m which would allow attenuation of radiant heat from of luminous spots and would not result in sustained radiant heat such that propagation to adjacent facilities would not occur.

Figure 5-3: Full Warehouse Fire Radiant Heat Contours

5.5 Full Warehouse Fire and Toxic Smoke Emission

A detailed analysis has been performed in **Section B6** of **Appendix B** to estimate the impact of toxic products of combustion on the surrounding area.

Provided in **Table 5-4** is a summary of several toxic products of combustion which may be present in the smoke plume and their acceptable concentration of exposure for the Acute Exposure Guideline Levels (AEGL). These levels provide guidance on exposure concentrations for general populations, including susceptible populations over a range of exposure times to assist in the assessment of releases which may result in a toxic exposure.

Provide below is a summary of the AEGL tiers of exposure:

- **AEGL-3** is the airborne concentration, expressed as parts per million (ppm) or milligrams per cubic meter (mg/m^3), of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

- **AEGL-2** is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
- **AEGL-1** is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

Selection for fatality or serious injury is based on an AEGL-3 values with injury values selected as those based on AEGL-2. It is noted the report AEGL values are based on 30-minute exposure.

Table 5-4: Concentrations of Toxic Products of Combustion from a Smoke Plume

Pollutant	Fatality or Serious Injury (ppm)	Injury (ppm)	Concentration (ppm)
Carbon monoxide	600	150	14.0
Nitric Dioxide	25	15	13.0
Hydrogen cyanide	21	10	14.5
Hydrogen chloride	210	43	10.7
Sulphur dioxide	30	0.75	6.1

The analysis indicates all quantities are below the AEGL-3 values. It is noted the analysis conducted is based on the primary toxic bi-product (carbon monoxide) which forms at rates higher than other toxic bi-products. Therefore, application of this result to other components is considered conservative. As these concentrations are taken at the point of release, they will disperse downwind resulting in substantially lower concentrations at the residential areas.

With reference to injury, all value except for sulphur dioxide are below the AEGL-2 concentration. Similar to the above discussion, the concentrations are likely to disperse substantially prior to impacting the residential populations; hence, an injury is unlikely to occur.

Based on the analysis conducted, it is considered that the concentrations at the residential area are likely to be lower than the fatality and injury concentration levels based on the comparison to the fatality and injury targets at the point of release (i.e. worst-case concentration). Notwithstanding this, as there is the potential for a toxic DG to be involved in the fire, the toxicity impacts may exceed those estimated for the toxic products of combustion analysis. Therefore, this incident has been carried forward for further analysis.

6.0 Frequency Analysis

6.1 Incidents Carried Forward for Frequency Analysis

The following incidents have been carried forward for frequency analysis:

- LPG release (from aerosol), ignition and racking fire.
- Combustible liquid spill, ignition and racking fire.
- Full warehouse fire and radiant heat.
- Full warehouse fire and toxic smoke emission.

These incidents have been assessed in the following sections.

6.2 LPG Release (From Aerosol), Ignition and Racking Fire

The frequency of a warehouse fire at the site can be estimated from a number of sources (e.g. general warehouse fire frequencies or the summation of individual fire frequencies for each of the initiating fire events). As this is a preliminary hazard analysis, the fire frequency has been selected from general fire frequency data.

A detailed fire frequency analysis has been conducted in **Appendix C**. The results of this analysis indicates an initiating fire frequency would be in the order of $1x10^{-3}$ p.a. based on a review of large fires. This is the selected initiating frequency.

6.2.1 Sensitivity Case Scenario

It is noted that the site is fitted with ceiling mounted sprinkler systems that will activate upon exposure to a fire, controlling the fire and preventing the fire growth. For the fire to escalate to the sensitivity case scenario the primary array is required to fail.

The Centre for Chemical Process Safety (CCPS) provides failure rate data for water fire protection systems including all components (pump, distribution system, nozzles, seals, piping, controls and base plate) of 9.66 per 10^6 hours (Ref. [13]). The hourly failure rate is converted to failures per annum by:

Failures per Annum = Failures per hour x 8760 hours per year

Failures per Annum = $9.66x10^{-6}$ x 8760 = 0.085

The system will only operate when a fire is detected; hence, the system operates in demand mode. The protection system will be tested monthly totalling 12 tests per annum. The probability of failure on demand (PFD) is estimated using:

$$PFD = \frac{1}{2}\lambda_{du}\left(\frac{1}{t}\right)$$

Where:

λ_{du} = dangerous undetected failures of a component

t = number of test intervals per annum

PFD = 0.5 (0.085) (1/12) = 0.00353

Hence, the frequency of a base case scenario within the warehouse is the frequency of an initiating fire x the probability of fail on demand (PFD) of the sprinkler system x 50% probability that the

primary array fails to control the fire. The probability of a base case scenario fire is $1.77x10^{-6}$ p.a. This is illustrated in the Fault Tree shown at **Figure 6-1.**

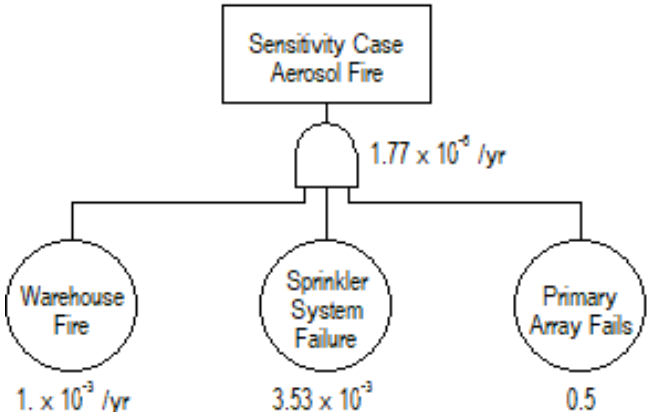

Figure 6-1: Sensitivity Case Scenario Aerosol Fire Fault Tree

To estimate the probability of fatality it is necessary to review the susceptibility to personnel exposed to radiant heat that may occur at the site boundary. Tolerance to an exposure (i.e. radiant heat or toxicity) differs across a population which may be estimated using Probit analysis. For radiant heat exposure, the Probit equation is shown in **Eqn 6-1**.

$$Y = K_1 + K_2 lnV \qquad \textbf{Eqn 6-1}$$

Where:

- K_1 = -36.38
- K_2 = 2.56
- $V = I^{4/3}t$
- I = radiant heat intensity (W/m^2)
- t = time (seconds)

The value obtained from the Probit equation is then read from the graph shown in **Figure 6-2**. Which yields the percentage of fatality for personnel exposed to the input radiant heat.

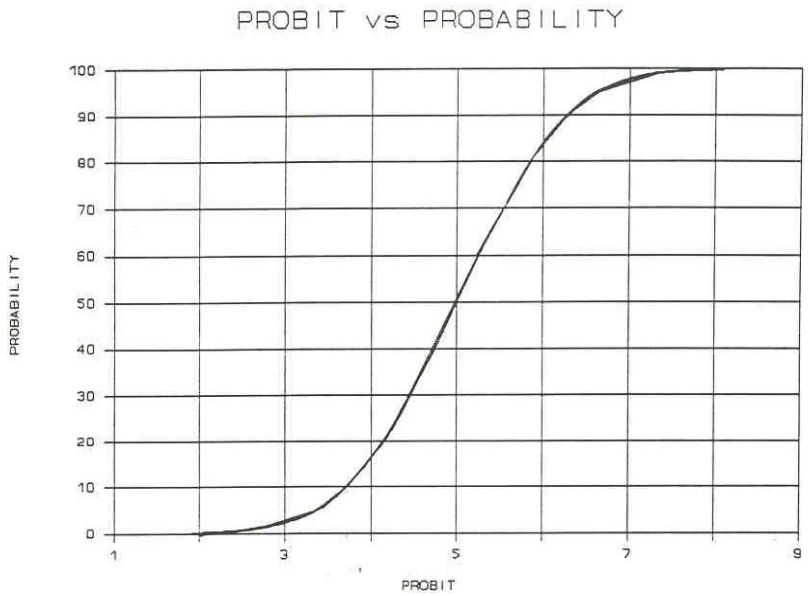

Figure 6-2: Probit vs Probability

The closet boundary is 12.5 m away from the closest storage area within the warehouse which when input into the Spreadsheet Calculation results in a radiant heat exposure of 11.2 kW/m^2 for the sensitivity scenario.

Exposure time is taken to be 30 seconds which is considered conservative as personnel in the area would feel the intensity of the flame and would be able to evacuate the area to an area of lower radiant heat within 30 seconds. Substituting these values into the Probit equation results in a Probit values which can be read from **Figure 6-2.** The inputs, Probit values and fatality percentage for the base case are summarised in **Table 6-1**.

Table 6-1: Sensitivity Case Aerosol Fire Fatality Percentage

Item	Sensitivity Case
Initial Radiant Heat (kW/m^2)	11.2
Exposure Time (s)	30
Probit	4.4
Fatality (%)	25

The risk of a fatality is the event frequency multiplied by the fatality percentage based on exposure to the hazard. The results are summarised in **Table 6-2**.

Table 6-2: Sensitivity Case Aerosol Fire Fatality Risk

Item	Sensitivity Case
Fatality (%)	25
Event Frequency	1.77x10^{-6}
Fatality Risk (pmpy)	0.44

6.3 Flammable Material Spill, Ignition and Racking Fire

Only the flammable material sensitivity scenario impacted over the site boundary; hence, this has been reviewed in the following subsection.

6.3.1 Sensitivity Scenario

As with the aerosol sensitivity scenario, this scenario only occurs when the primary array ceiling mounted sprinklers fail to control the fire. Therefore, the calculated frequency for the aerosol sensitivity scenario has been taken for the flammable material fire scenario. Thus the selected frequency of the combustible liquid sensitivity case fire scenario is $1.77x10^{-6}$ p.a.

Using the methodology discussed in **Section 6.2.1** the probability of a fatality due to the exposure can be calculated. As noted, the closest boundary is 12.5 m away which results in a radiant heat exposure of 9.4 kW/m^2 in the sensitivity case scenario. The probit calculation inputs and results are summarised in **Table 6-3**.

Table 6-3: Sensitivity Case Combustible Liquid Fire Fatality Percentage

Item	Sensitivity Case
Initial Radiant Heat (kW/m^2)	9.4
Exposure Time (s)	30
Probit	3.5
Fatality (%)	7.7

The risk of a fatality is the event frequency multiplied by the fatality percentage based on exposure to the hazard. The results are summarised in **Table 6-4**.

Table 6-4: Sensitivity Case Combustible Liquid Fire Fatality Risk

Item	Sensitivity Case
Fatality (%)	7.7
Event Frequency	$1.77x10^{-6}$
Fatality Risk (pmpy)	0.14

6.4 Full Warehouse Fire and Radiant Heat

A full warehouse fire will only occur if both sprinkler systems fail to contain the fire and would be considered a catastrophic event. The frequency of a full warehouse fire is $3.53x10^{-6}$ p.a. as illustrated in the Fault Tree shown at **Figure 6-3**.

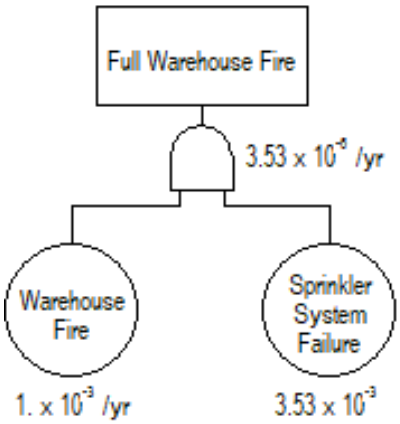

Figure 6-3: Full Warehouse Fire Fault Tree

Assuming a 100% fatality rate would result in a fatality risk from a full warehouse fire of $3.53x10^{-6}$ x 1 = 3.53 pmpy.

6.5 Full Warehouse Fire and Smoke Emission

Toxic bi-products of combustion will only be emitted in substantial quantities in a full warehouse fire which occurs with a frequency of $3.53x10^{-6}$ p.a. Assuming a 100% fatality rate to persons downwind of the full warehouse fire, the fatality risk becomes $3.53x10^{-6}$ x 1 = $3.53x10^{-6}$ p.a.

6.6 Total Fatality Risk

The total fatality risk at the site is the summation of all events. The fatality risk for each incident is summarised in **Table 6-5** which shows the overall site fatality risk is 7.64 pmpy.

Table 6-5: Overall Fatality Risk

Item	Fatality Risk
Aerosol Sensitivity Case Fire	0.44
Flammable Material Sensitivity Case Fire	0.14
Full Warehouse Fire	3.53
Toxic smoke impact	3.53
Total (pmpy)	**7.64**

6.7 Comparison Against Risk Criteria

The NSW Department of Planning and Environment has issued a guideline on the acceptable risk criteria (Ref. [1]). The acceptable risk criteria published in the guideline relates to injury, fatality and property damage. The values in the guideline present the maximum levels of risk that are permissible at the land use under assessment.

The adjacent land use would be classified as an industrial site as it is restricted access and only industrial operations are permitted to occur in this area. For industrial facilities, the maximum permissible fatality risk is 50 pmpy. The assessed highest fatality risk at the site boundary is 7.64 pmpy at the closest site boundary; hence, the highest risk is within the permissible criteria and therefore all other risk points beyond the boundary would be within the acceptable criteria.

A review of the potential for incident propagation indicated no incidents resulted in radiant heat exceeding 23 kW/m^2 which impacted across the site boundary; hence, the potential for incident propagation is 0 pmpy.

Based on the estimated injury risk, conducted in the analysis above, the risks associated with injury and nuisances at the closest residential area are not considered to be exceeded.

A review of the cumulative risk profiles in the area indicate two major hazard facilities have been relocated from the area; hence, the cumulative risk profile is likely to be less than the existing profile for the area and would thus be considered acceptable.

7.0 Conclusion and Recommendations

7.1 Conclusions

A hazard identification table was developed for warehouse facilities to identify potential hazards that may be present at the site as a result of operations or storage of materials. Based on the identified hazards, scenarios were postulated that may result in an incident with a potential for offsite impacts. Postulated scenarios were discussed qualitatively and any scenarios that would not impact offsite were eliminated from further assessment. Scenarios not eliminated were then carried forward for consequence analysis.

Incidents carried forward for consequence analysis were assessed in detail to estimate the impact distances. Impact distances were developed into scenario contours and overlaid onto the site layout diagram to determine if an offsite impact would occur. The consequence analysis showed that two of the scenarios (partial escalation and full warehouse fire) would impact over the site boundary and into the adjacent land uses; hence, these incidents were carried forward for frequency analysis and risk assessment.

The frequency analysis and risk assessment showed the cumulative fatality risk of these incidents would be 7.64 chances per million per year (pmpy) at the site boundary, with lesser risk at further distances from the boundary. HIPAP No. 4 (Ref. [1]) publishes acceptable risk criteria at the site boundary of 50 pmpy (for industrial sites). Therefore, the risk of a fatality at the site boundary as a result of the facility operations would be within the acceptable risk criteria.

It was identified that no incidents would result in radiant heat contours of 23 kW/m^2 extending over the site boundary; hence, the potential for incident propagation to occur is calculated as 0 pmpy.

A review of the cumulative risk profiles in the area indicate two major hazard facilities have been relocated from the area; hence, the cumulative risk profile is likely to be less than the existing profile for the area and would thus be considered acceptable.

Based on the analysis conducted, it is concluded that the risks at the site boundary are not considered to exceed the acceptable risk criteria; hence, the facility would only be classified as potentially hazardous and would be permitted within the current land zoning for the site.

7.2 Recommendations

A hazard audit was conducted for the site in 2016 which resulted in several actions to be undertaken. These actions have been extracted from the report and are recommended to be complied with by the new operator. It is noted that not all recommendations apply to the new operator, or the recommendation is restrictive and not in-line with the overarching regulation. Where a recommendation is inconsistent or not-applicable to the new operator this has been noted.

ID	Action	Assessment
1	Ensure that high housekeeping standard are maintained and that specific issues identified are promptly addressed	Subjective recommendation but the operator should comply with good housekeeping as required by the applicable standards.
2	Ensure all forklifts that are labelled suitable for use in a AS/NZS 60079.10 Zone 2 classified area are being	Required by WHS Regulations 2017 and AS/NZS 60079 series

ID	Action	Assessment
	maintained with emphasis on the controls that make the forklift suitable for use in a Zone 2.	
3	Compile a hazardous area dossier	Required by WHS Regulations 2017 and AS/NZS 60079 series
4	Remove sources of ignition from within the hazardous area or ensure that electrical equipment is appropriate rated for the area (in accordance with the hazardous area report)	Required by WHS Regulations 2017 and AS/NZS 60079 series
5	Provide lens covers for lighting within the aerosols cage and any lights that are situated above the hazardous zone resulting from the aerosols cage	This recommendation should be included
6	Undertake a review to ensure that the storage of corrosive liquids, acidic (UN 3264) is compliant	Not applicable as these materials are not proposed to be stored by the new operator

8.0 References

[1] Department of Planning, “Hazardous Industry Planning Advisory Paper No. 4 - Risk Criteria for Land Use Safety Planning,” Department of Planning, Sydney, 2011.

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[7] Standards Australia, AS/NZS 60079.14:2017 - Explosive Atmospheres Part 14: Electrical Installations, Design, Selection and Erection, Sydney: Standards Australia, 2017.

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[14] FM Global, “FM Global Data Sheet 7-31: Storage of Aerosol Products,” 2016.

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[16] Thermal-Fluids Central, “Heat of Combustion,” Global Digital Central, 8 July 2011. [Online]. Available: https://www.thermalfluidscentral.org/encyclopedia/index.php/Heat_of_Combustion. [Accessed 4 July 2017].

Appendix A

Hazard Identification Table

A1. Hazard Identification Table

Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
Warehouse	• Dropped pallet • Damaged packaging (receipt or during storage) • Deterioration of packaging	• Release of Class 2.1, 3 or 4.1 DGs to the environment	• Small retail sized packages for aerosols (< 250 mL) • Inspection of packages upon delivery to the site • Inspection of packages prior to storage within the warehouse areas. • Trained forklift operators (including spill response training). • Storage of products complying with applicable standards (i.e. AS/NZS 3833) • Bunded warehouse areas
	• Dropped pallet • Damaged packaging (receipt or during storage) • Deterioration of packaging	• Spill of flammable materials, ignition and pool fire • Release of flammable gas (from aerosol), ignition and fire within racking	• Inspection of packages upon delivery to the site • Inspection of packages prior to storage within warehouse areas • Control of ignition sources according to AS/NZS 60079.14:2017 (Ref. [7]) (aerosols) • Automatic fire protection system (SMSS) • First attack fire-fighting equipment (e.g. hose reels & extinguishers) • Storage of products complying with applicable standards (i.e. AS/NZS 3833)
	• Heating of Class 2.1 from a warehouse fire	• Rupture, ignition and explosion/rocketing of canisters within warehouse spreading fire	• Stored in a mesh cage • Sprinklers according to FM Global Data Sheet 7-31 (Ref. [14]) • Automatic fire protection system

Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
Sprinkler activation	• Fire activates SMSS resulting in fire water release and potential contaminated fire water offsite	• Environmental impact to surrounding areas (e.g. stormwater drainage)	• Dangerous Goods Stores are bunded to contain spills and sprinkler discharge according to AS/NZS 3833:2007 (Ref. [5])
Pallet Loading/Unloading	• Dropped containers from the pallet • Impact damage to containers on the pallet (collision with racks or other forklifts)	• Spill of flammable liquids, evolution of flammable vapour cloud ignition pool, fire under the pallet • Full pallet fire as a result of fire growth	• Trained & licensed forklift drivers • First attack fire-fighting equipment (hose reels & extinguishers) • SMSS if incident occurs internally • No potential for fire growth beyond the single pallet (limited stock externally)

Appendix B

Consequence Analysis

B1. Incidents Assessed in Detailed Consequence Analysis

The following incidents are assessed for consequence impacts.

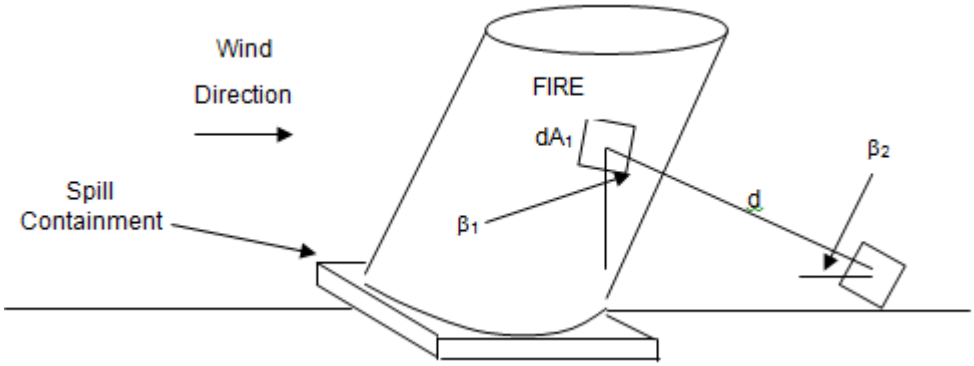
- LPG release (from aerosol), ignition and racking fire.
- Flammable material spill, ignition and racking fire.
- Full warehouse fire and radiant heat.
- Full warehouse fire and smoke emission.

Each incident has been assessed in the sections below.

B2. Spreadsheet Calculator (SSC)

The SSC is designed on the basis of finite elements. The liquid flame area is calculated as if it is a circle to find the radius for input into the SSC model.

The SSC is designed on the basis of finite elements. The liquid flame area is calculated as if it is a circle to find the radius for input into the SSC model. **Appendix Figure B-1** shows a typical pool fire, indicating the target and fire impact details.



Appendix Figure B-1: Heat Radiation on a Target from a Cylindrical Flame

A fire in a bund or at a tank roof will act as a cylinder with the heat from the cylindrical flame radiating to the surrounding area. A number of mathematical models may be used for estimating the heat radiation impacts at various distances from the fire. The point source method is adequate for assessing impacts in the far field; however, a more effective approach is the view factor method, which uses the flame shape to determine the fraction of heat radiated from the flame to a target. The radiated heat is also reduced by the presence of water vapour and the amount of carbon dioxide in air. The formula for estimating the heat radiation impact at a set distance is shown in **Equation B-1** (Ref. [12]).

$$Q = EF\tau$$ **Equation B-1**

Where:

- Q = incident heat flux at the receiver (kW/m^2)
- E = surface emissive power of the flame (kW/m^2)
- F = view factor between the flame and the receiver
- τ = atmospheric transmissivity

The calculation of the view factor (F) in **Equation B-1** depends upon the shape of the flame and the location of the flame to the receiver. F is calculated using an integral over the surface of the flame, S (Ref. [12]). The formula can be shown as:

$$F = \int\int s \frac{\cos\beta_1 \cos\beta_2}{\pi d^2}$$ **Equation B-2**

Equation B-2 may be solved using the double integral **or** using a numerical integration method in spread sheet form. This is explained below.

For the assessment of pool fires, a Spread Sheet Calculator (SCC) has been developed, which is designed on the basis of finite elements. The liquid flame area is calculated as if the fire is a vertical cylinder, for which the flame diameter is estimated based on the fire characteristics (e.g. contained within a bund). Once the flame cylindrical diameter is estimated, it is input into the SSC model. The model then estimates the flame height, based on diameter, and develops a flame geometric shape (cylinder) on which is performed the finite element analysis to estimate the view factor of the flame. **Appendix Figure B-1** shows a typical pool fire, indicating the target and fire impact details.

The SSC integrates the element dA_1 by varying the angle theta θ (the angle from the centre of the circle to the element) from zero to 90º in intervals of 2.5 degrees. Zero degrees represents the straight line joining the centre of the cylinder to the target (x0, x1, x2) while 90º is the point at the extreme left hand side of the fire base. In this way the fire surface is divided up into elements of the same angular displacement. Note the tangent to the circle in plan. This tangent lies at an angle, gamma, with the line joining the target to where the tangent touches the circle (x4). This angle varies from 90º at the closest distance between the liquid flame (circle) and the target (x0) and gets progressively smaller as θ increases. As θ increases, the line x4 subtends an angle phi Φ with x0. By similar triangles we see that the angle gamma γ is equal to 90- θ - Φ . This angle is important because the sine of the angle give us the proportion of the projected area of the plane. When γ is 90º, sin(γ) is 1.0, meaning that the projected area is 100% of the actual area.

Before the value of θ reaches 90º the line x4 becomes tangential to the circle. The fire cannot be seen from the rear and negative values appear in the view factors to reflect this. The SSC filters out all negative contributions.

For the simple case, where the fire is of unit height, the view factor of an element is simply given by the expression in **Equation B-3** (Derived from **Equation B-2**):

$$VF = \Delta A \frac{\sin\gamma}{\pi \times X4 \times X4}$$ **Equation B-3**

Where ΔA is the area of an individual element at ground level.

Note: the denominator (π. x4. x4) is a term that describes the inverse square law for radiation assumed to be distributed evenly over the surface of a sphere.

Applying the above approach, we see the value of x4 increase as θ increase, and the value of sin(γ) decreases as θ increase. This means that the contribution of the radiation from the edge of the circular fire drops off quite suddenly compared to a view normal to the fire. Note that the SSC adds up the separate contributions of **Equation B-3** for values of θ between zero until x4 makes a tangent to the circle.

It is now necessary to do two things: (i) to regard the actual fire as occurring on top of a fire wall (store) and (ii) to calculate and sum all of the view factors over the surface of the fire from its base

to its top. The overall height of the flame is divided into 10 equal segments. The same geometric technique is used. The value of x4 is used as the base of the triangle and the height of the flame, as the height. The hypotenuse is the distance from target to the face of the flame (called X4'). The angle of elevation to the element of the fire (alpha α) is the arctangent of the height over the ground distance. From the cos(α) we get the projected area for radiation. Thus there is a new combined distance and an overall equation becomes in **Equation B-4 ((**Derived from **Equation B-3**):

$$VF = \Delta A \frac{\sin\gamma \times \cos\alpha}{\pi \times X4 \times X4} \qquad \textbf{Equation B-4}$$

The SCC now turns three dimensional. The vertical axis represents the variation in θ from 0 to 90º representing half a projected circle. The horizontal axis represents increasing values of flame height in increments of 10%. The average of the extremes is used (e.g. if the fire were 10 m high then the first point would be the average of 0 and 1 i.e. 0.5 m), the next point would be 1.5 m and so on).

Thus, the surface of the flame is divided into 360 equal area increments per half cylinder making 720 increments for the whole cylinder. Some of these go negative as described above and are not counted because they are not visible. Negative values are removed automatically.

The sum is taken of the View Factors in **Equation B-3**. Actually, the sum is taken without the ΔA term. This sum is then multiplied by ΔA which is constant. The value is then multiplied by 2 to give both sides of the cylinder. This is now the integral of the incremental view factors. It is dimensionless so when we multiply by the emissivity at the "face" of the flame (or surface emissive power, SEP), which occurs at the same diameter as the fire base (pool), we get the radiation flux at the target.

The SEP is calculated using the work by Mudan & Croche (Ref. [11] & Ref. [12]) which uses a weighted value based on the luminous and non-luminous parts of the flame. The weighting is based on the diameter and uses the flame optical thickness ratio where the flame has a propensity to extinguish the radiation within the flame itself. The formula is shown in **Equation B-5**.

$$SEP = E_{max}e^{-sD} + E_s(1 - e^{-sD}) \qquad \textbf{Equation B-5}$$

Where;

E_{max} = 140

S = 0.12

E_s = 20

D = pool diameter

The only input that is required is the diameter of the pool fire and then estimation for the SEP is produced for input into the SSC.

The flame height is estimated using the Thomas Correlation (Ref. [12]) which is shown in **Equation B-6**.

$$H = 42d_p\left[\frac{\dot{m}}{\rho_a\sqrt{gd_p}}\right]^{0.61} \qquad \textbf{Equation B-6}$$

Where;

d_p = pool diameter (m)

ρ_a = density of air (1.2 kg/m^3 at 20^{o}C)

$\dot{m}$ = burning rate (kg/m^2.s)

g = 9.81 m/s^2

The transmissivity is estimated using **Equation B-7** (Ref. [15]).

$$\tau = 1.006 - 0.01171(\log_{10} X(H_2O) - 0.02368(\log_{10} X(H_2O))^2 - 0.03188(\log_{10} X(CO_2) + 0.001164(\log_{10} X(CO_2))^2$$

Equation B-7

Where:

- τ = Transmissivity (%)
- X(H_2O) = $\frac{R_H \times L \times S_{mm} \times 2.88651 \times 10^2}{T}$
- X(CO_2) = $\frac{L \times 273}{T}$

and

- R_H = Relative humidity (% expressed as a decimal)
- L = Distance to target (m)
- S_{mm} = saturated water vapour pressure in mm of mercury at temperature (at 25^{o}C S_{mm} = 23.756)
- T = Atmospheric temperature (K)

Appendix Table B-1 provides noteworthy heat radiation values and the corresponding physical effects of an observer exposed to these values (Ref. [1]).

Appendix Table B-1: Heat Radiation and Associated Physical Impacts

Heat Radiation (kW/m^2)	Impact
35	• Cellulosic material will pilot ignite within one minute's exposure • Significant chance of a fatality for people exposed instantaneously
23	• Likely fatality for extended exposure and chance of a 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
12.6	• Significant chance of a 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
4.7	• Will cause pain in 15-20 seconds and injury after 30 seconds exposure (at least second degree burns will occur)

2.1	• Minimum to cause pain after 1 minute

B3. LPG Release (From Aerosol), Ignition and Racking Fire

The release of LPG from a damaged package could result in a fire if the release ignited. The fire would begin to grow expanding LPG within other aerosols which may rupture, ignite and rocket around the aerosol store. The store is fitted with SMSS to suppress the fire and cool adjacent packages to minimise the potential for rocketing.

As heat and smoke is generated from the fire, the SMSS will activate. Two sprinkler activation scenarios have been assessed:

- A worst credible (WC) scenario whereby the first row of the SMSS activates and controls the spread of a fire.
- A sensitivity scenario whereby the first row of sprinklers fails to activate and the fire is instead controlled by the second row of the SMSS.

The first row of sprinkler has an approximate diameter of 3 m with the second row having an approximate diameter of 9 m. These diameters are used to estimate the flame height and SEP for the fire scenarios. To estimate the flame height and SEP the following information was substituted into the models:

- Equivalent fire diameter: WC – 3 m, Sensitivity - 9 m
- Burning rate – 0.099 kg/m^2.s (the burning rate for LPG, Ref. [11]).

The selection of a LPG burning rate is considered appropriate and conservative as a fire involving aerosols will be composed predominantly of packaging (i.e. plastic wrapping and cardboard) which will be punctuated by rupturing of cans and combustion of the released LPG. The packaging is a solid material that will yield a lower burning rate than selected as it requires an additional phase change prior to combustion reducing the rate at which the product burns.

Furthermore, the analysis is considered incredibly conservative as it assumes a 100% burning area; however, as the subject areas will encompass aisle spaces, there will be no combustible material stored in these locations. Therefore, it is considered the results generated from this analysis would substantially overestimate the radiant heat impacts from the identified scenarios.

The results for flame height and SEP for each scenario are summarised in **Appendix Table B-2**.

Appendix Table B-2: Flame Height and SEP for Class 2.1 Sprinkler Controlled Scenarios

Output	Base Case	Sensitivity
Flame Height (m)	9.8	21.0
SEP (kW/m^2)	103.7	60.8

The inputs summarised in **Appendix Table B-2** were input in to the SSC with the results for each scenario shown in **Appendix Table B-3**.

Appendix Table B-3: Heat Radiation from Class 2.1 Sprinkler Controlled Scenarios

Heat Radiation (kW/m2)	Distance (m)	
	Base Case	Sensitivity
35	3.3	5.1

Heat Radiation (kW/m2)	Distance (m)	
	Base Case	Sensitivity
23	4.5	7.4
12.6	6.6	11.5
4.7	12.0	21.4

B4. Flammable Material Spill, Ignition and Racking Fire

In the event that a flammable material package is damaged and flammable material is released the volatile component will vaporise which may contact an ignition source resulting in a pool fire. As the fire grows it may accelerate the deterioration of other packages resulting in failure and release of additional flammable material and combustion of packaging.

As heat and smoke is generated from the fire, the SMSS will activate. Two sprinkler activation scenarios have been assessed:

- A worst credible (WC) scenario whereby the first row of the SMSS activates and controls the spread of a fire.
- A sensitivity scenario whereby the first row of sprinklers fails to activate and the fire is instead controlled by the second row of the SMSS.

The first row of sprinklers has an approximate diameter of 3 m with the second row having an approximate diameter of 9 m. These diameters are used to estimate the flame height and SEP for the fire scenarios. To estimate the flame height and SEP the following information was substituted into the models:

- Equivalent fire diameter: WC – 3 m, Sensitivity - 9 m
- Burning rate – 0.0667 kg/m^2.s (this value encompasses a large range of flammable liquid burning rates and is considered conservative due to the nature of the flammable liquids stored, Ref. [11])

The selection of a flammable material burning rate is considered appropriate and conservative as a the fire will be composed of burning flammable liquids and packaging. The packaging is a solid material that will yield a lower burning rate than selected as it requires an additional phase change prior to combustion reducing the rate at which the product burns.

Furthermore, the analysis is considered incredibly conservative as it assumes a 100% burning area; however, as the subject areas will encompass aisle spaces, which will have no combustible material stored these locations. Therefore, it is considered the results generated from this analysis would substantially overestimate the radiant heat impacts from the identified scenarios.

The results for flame height and SEP for each scenario are summarised in **Appendix Table B-4**.

Appendix Table B-4: Flame Height and SEP for a Flammable Material Sprinkler Controlled Fire

Output	Base Case	Sensitivity
Flame Height (m)	7.7	16.5
SEP (kW/m^2)	103.7	60.8

The inputs summarised in **Appendix Table B-4** were input in to the SSC with the results for each scenario shown in **Appendix Table B-5**.

Appendix Table B-5: Heat Radiation from a Flammable Material Sprinkler Controlled Fire

Heat Radiation (kW/m2)	Distance (m)	
	Base Case	Sensitivity
35	2.9	4.6
23	4.0	6.6
12.6	6.0	10.3
4.7	10.7	19.0

B5. Full Warehouse Fire and Radiant Heat

If the fire protection system fails (SMSS), there is the potential that a fire could develop into a full warehouse fire. The warehouse has an area of 21,000 m^2 which has been used as an input to estimate the equivalent circular diameter. The dimensions of a warehouse fire have substantial impact on the interpretation of the results; however, application of the area of the warehouse fire, assuming an ideal circle, provides a conservative analysis of the warehouse.

Substituting the area of the warehouse into the model results in an equivalent circular diameter of:

$$D = \sqrt{\frac{4 \times 21000}{\pi}} = 163.5\ m$$

The warehouse is composed of several areas which will have different burning rates. Therefore, to estimate an average burning rate across the facility, the contribution of each of the fire areas has been used to estimate the contribution to average burning rate.

Provided in **Appendix Table B-6** is a summary of the individual areas within the facility, the applicable burning rates based on commodities stored and the contribution of these areas to burning rate.

Appendix Table B-6: Estimation of Average Burning Rate

Class	Quantity (kg)	% of Total Quantity	Burning Rate (kg/m2.s)	Burning Rate Based on %
2.1	150,000	11	0.0990.0	0.011
2.2	200,000	14	0.022	0.003
3	200,000	14	0.0667	0.010
4.1	50,000	4	0.0667	0.002
8	200,000	14	0.022	0.003
9	600,000	43	0.022	0.009
Total	**1,400,000**	**100**		**0.038**

The following information was input into the models;

- Equivalent fire diameter – 163.5 m
- Burning rate – 0.038 kg/m^2.s

The models provided the following information for the warehouse fire;

- SEP – 20 kW/m^2

- Flame Height – 88.0 m (from model without roof restriction)

Provided in **Appendix Table B-7** are the results generated by the SSC.

Appendix Table B-7: Heat Radiation Impacts from a Full Warehouse Fire

Heat Radiation (kW/m^2)	Distance (m)
35	Maximum heat flux is 20
23	Maximum heat flux is 20
12.6	34.0
4.7	76.0

* Research conducted in relation to large fires (Ref. [12]) indicates that where a large fire occurs, it is difficult for complete combustion to occur towards the centre of the fire due to the lack of air being unable to reach the centre of the flames. Hence, combustion tends to occur effectively at the fire surface, but poorly towards the centre of the fire. This generates large quantities of black smoke, which shields the flame surface as the smoke from the centre of the fire escapes towards the outer fire surface. The research presented in Lees (Ref. [11]) indicates that fires will generate a SEP within a range of between 20 kW/m^2 for larger fires and 130 kW/m^2 for smaller fires. Hence, a full warehouse fire would be of significant dimensions, generating large quantities of black smoke, shielding the flames at the fire surface. Hence, for the analysis of a full warehouse fire in this study, an SEP value of 20 kW/m^2 has been used.

B6. Full Warehouse Fire and Smoke Emission

During the fire, un-combusted toxic products may be present in the smoke plume or toxic bi-products may be generated which will be dispersed in the smoke plume. It is necessary to assess the associated impacts of the smoke plume downwind of the facility as it may have far reaching impacts on the wider community. When assessing the downwind impacts of the fire plume, the main contributors to the dispersion are:

- The fire size (diameter) and energy released as convective heat
- The atmospheric conditions such as wind speed, relative humidity, atmospheric stability and ambient temperature.

These parameters interact to determine the buoyancy of the smoke plume (vertical rise) which is controlled by the convective energy within the smoke plume in addition to the atmospheric conditions. The atmospheric conditions will vary from stable conditions (generally night time) to unstable conditions (high insolation from solar radiation) which results in substantial vertical mixing which aids in the dispersion. Contributing to this is the impact of wind speed which will limit the vertical rise of a plume but may exacerbate the downwind impact distance.

The atmospheric conditions are classified as Pasquill Guifford's Stability categories which are summarised in **Appendix Table B-8** (Ref. [15]).

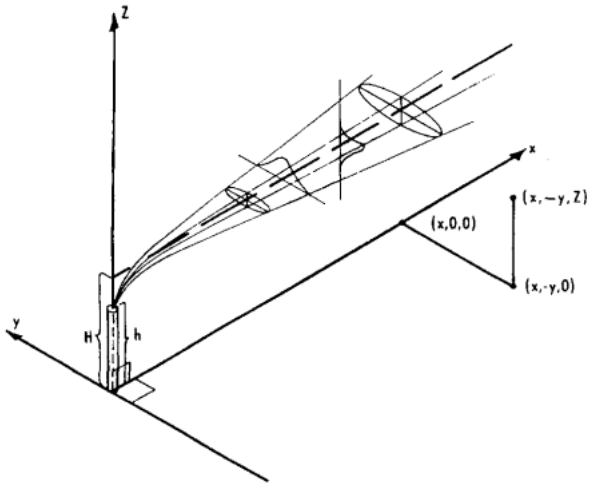
Appendix Table B-8: Pasquill's Stability Categories

Surface wind speed at 10 m height (m/s)	Insolation			Night	
	Strong	Moderate	Slight	Thinly overcast or ≥50% cloud	<50% cloud.
<2	A	A-B	B	-	-
2-3	A-B	B	C	E	F

Surface wind speed at 10 m height (m/s)	Insolation			Night	
	Strong	Moderate	Slight	Thinly overcast or ≥50% cloud	<50% cloud.
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
>6	C	D	D	D	D

Generally, the most onerous conditions are F conditions which result in stable air masses and typically have inversion characteristics. Inversion characteristics occur when a warm air mass sits above a cold air mass. Typically, hot air will rise due to lower density than the bulk air; however, in an inversion, a warm air mass sits above the cooler denser air; hence, as the warm air rises through the cold mass it hits a 'wall' of warmer air preventing vertical mixing above this point. In a fire scenario, the hot smoke plume will cool as it rises; however, if it encounters an inversion, it will begin to run along this boundary layer preventing vertical mixing and allowing the smoke plume to spread laterally for substantial distances.

A smoke plume is buoyant, and will disperse laterally and vertically as it rises essentially following a Gaussian dispersion as shown **Appendix Figure B-2** (Ref. [15]).



Appendix Figure B-2: Co-ordinate System for Gas Dispersion

Ian Cameron, professor of Risk Engineering at the University of Queensland, has developed a risk assessment tool known as Risk Assessor produced by DAESIM Technologies. The tool has numerous risk engineering applications; however, the component of interest for this assessment is the smoke plume modelling from fire scenarios. The model has been developed based on a Gaussian dispersion model accounting for modifications to the plume drag coefficients required to model a plume dispersion from a warehouse fire (Ref. [15]).

The model requires several inputs which have been summarised in **Appendix Table B-9** with the associated value input as part of this modelling exercise. As noted, the more onerous conditions occur during stable air conditions which allow far reaching effects with reduced dispersion due to low air velocities and vertical mixing. The industry standard for modelling this scenario is selection of F1.5 (F stability at 1.5 m/s wind velocity) which has been adopted for this assessment.

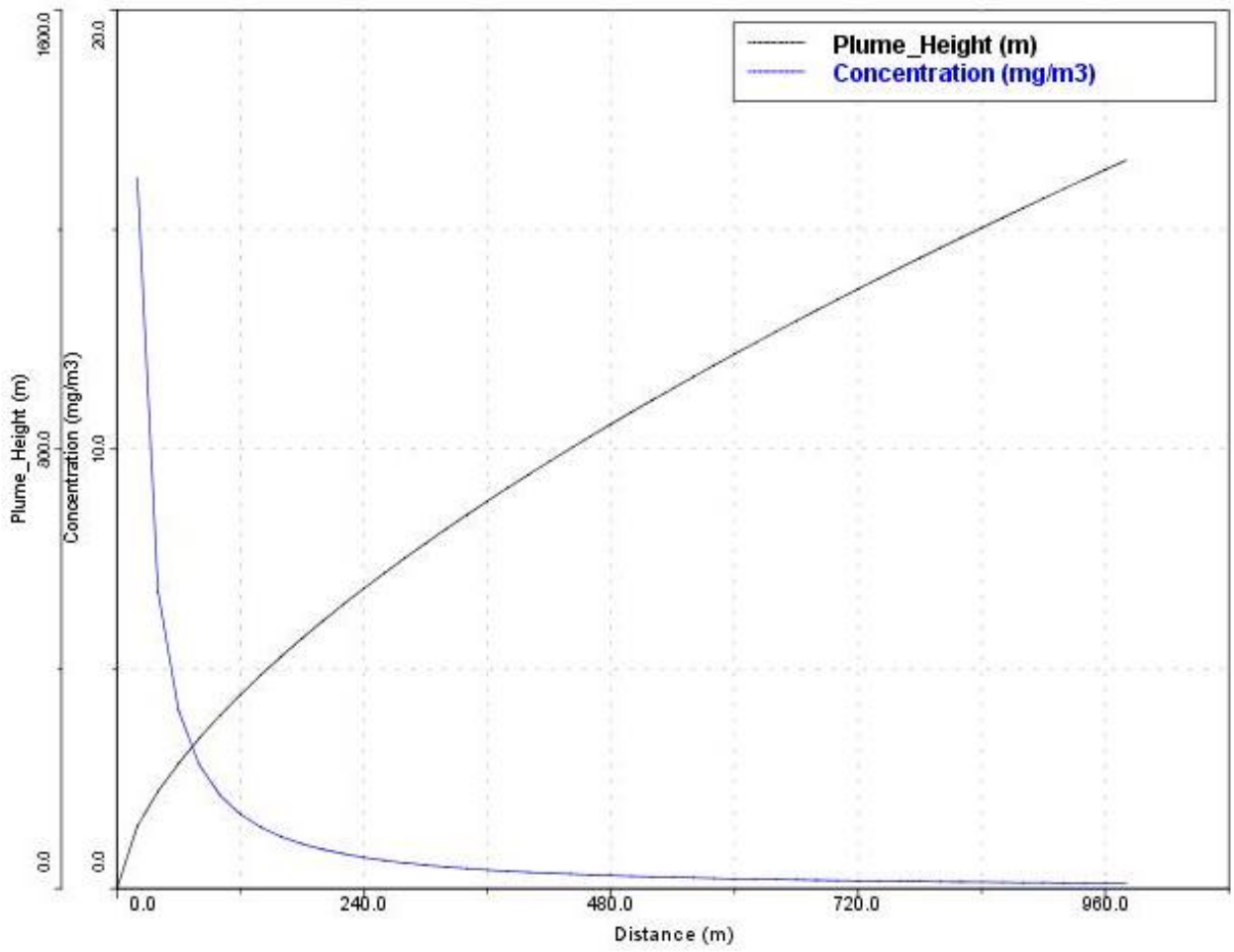
Appendix Table B-9: Input Data for Plume Gaussian Dispersion

Input	Selected Values	Justification
Max burning rate (kg/m^2.s)	0.038	Taken from full warehouse fire above
Fire equivalent Diameter (m)	163.5	Equivalent diameter of the warehouse
Heat of combustion (kJ/kg)	45,000	Heat of combustion for combustible liquid (diesel) Ref. [16]
Fraction energy radiated	0.5	Conservative assumption based on high radiant heat blocking which occurs from dense smoke
Pollutant Rate (kg/s)	28,728	Burning rate multiplied by area multiplied by 6 (number of racks) multiplied by 6 (number of surfaces on a pallet that can burn)
Wind speed (m/s)	1.5	Industry standard
Stability	F	Industry standard

Provided in **Appendix Figure B-3** is an overlayed plot of plume smoke concentrations and plume height with distance. The analysis is based on the F stability; however, the Gaussian dispersion is unable to model temperature inversions. The response of the smoke plume to an inversion will depend on the height that the plume interacts with the inversion. At low altitudes, the smoke plume will have substantial heat and will 'punch through' the inversion and continue a Gaussian dispersion as expected. However, with increasing height, the plume will cool which may equalise at a temperature less than the inverted air mass. Subsequently, the plume will level out at the point of the inversion.

The worst-case concentration occurs in the initial phases of the fire and rapidly decrease with distance from the fire. It has been assumed that an inversion occurs at low level and the plume has insufficient heat to 'punch through' the inversion and remains trapped relatively close to the ground. A maximum value of 16 mg/m^3 has been selected per **Appendix Figure B-3** that may impact the surrounding area with regards to potential toxic bi-products of combustion.

Toxic products are a minor quantity of materials stored within the warehouse. Therefore, the mass of other products burning generating toxic bi-products of combustion far exceeds the quantity of toxic products that could be release in the smoke plume considering the majority of the toxic products will be combusted. Therefore, it is considered conservative to apply the toxic bi-products of combustion concentration to any toxic products stored in the warehouse.



Appendix Figure B-3: Plume Concentration and Plume Height vs Distance

Provided in **Appendix Table B-10** is a summary of several toxic products of combustion which may be present in the smoke plume and their acceptable concentration of exposure for the Acute Exposure Guideline Levels (AEGL). These levels provide guidance on exposure concentrations for general populations, including susceptible populations over a range of exposure times to assist in the assessment of releases which may result in a toxic exposure.

Provide below is a summary of the AEGL tiers of exposure:

- **AEGL-3** is the airborne concentration, expressed as parts per million (ppm) or milligrams per cubic meter (mg/m^3), of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.
- **AEGL-2** is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
- **AEGL-1** is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

Selection for fatality or serious injury is based on an AEGL-3 values with injury values selected as those based on AEGL-2. It is noted the report AEGL values are based on 30-minute exposure.

Appendix Table B-10: Concentration of Toxic Products of Combustion in Smoke Plume

Pollutant	Fatality or Serious Injury (ppm)	Injury (ppm)	Concentration (ppm)
Carbon monoxide	600	150	14.0
Nitric Dioxide	25	15	13.0
Hydrogen cyanide	21	10	14.5
Hydrogen chloride	210	43	10.7
Sulphur dioxide	30	0.75	6.1

Appendix C

Warehouse Fire Frequency Estimation

C1. Estimation of the Frequency of a Full Warehouse Fire

A review of readily available warehouse fire frequency information was conducted and a number of direct sources were identified. These were:

- Health and Safety Executive (HSE) in the United Kingdom [Hymes & Flynn, UKAEA - SRD/HSE R578, 2002] – this document lists the major warehouse fire frequency to be $2.5x10^{-3}$ p.a.;
- Baldwin, Accident Analysis and Prevention (Vol.6) – indicates a serious fire frequency in warehouses to be in the order of $1x10^{-3}$ p.a.;
- Environmental Impact Assessment Report for the Commission of Inquiry into Proposed Manufacturing Plant by WR Grace Australia Ltd., Kurnell, Sydney, October 1987 – indicates a fire frequency of $4.6x10^{-3}$ per warehouse year; and
- VROM 2005, Guidelines for quantitative risk assessment CPR 18E (Purple Book), Publication Series on Dangerous Substances (PGS 3), The Netherlands. – $4x10^{-4}$ p.a.

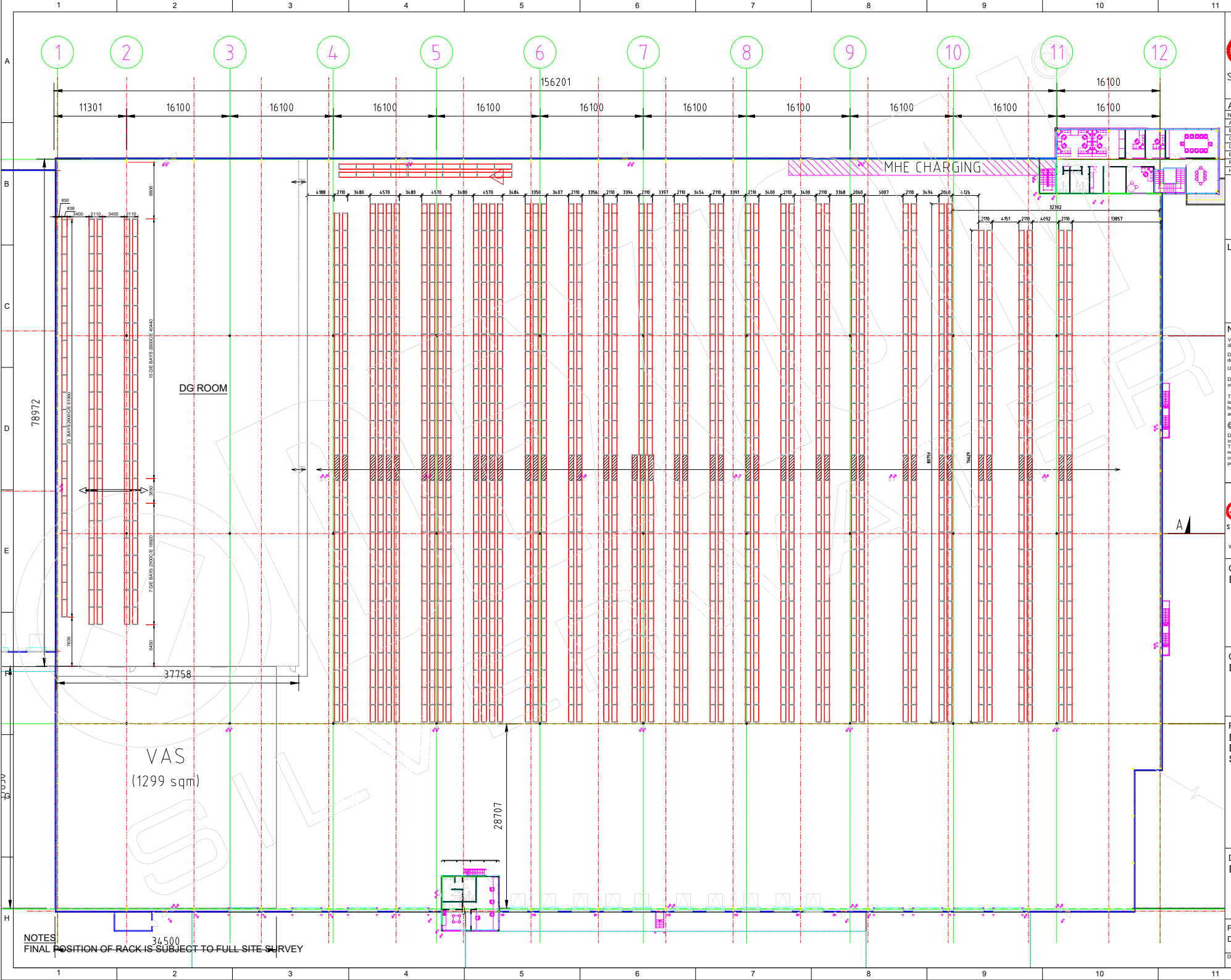
It is noted that the mix of overseas data and local data (albeit some is dated) correlates to indicate a fire frequency in warehouses to be in the order of $1x10^{-3}$ to $4x10^{-4}$. The data presented in the reports reviewed was for general warehouses, where stringent controls for spill and ignition sources (such as flame and explosion proof fittings, bunding, smoking and naked flame controls, isolation of power supplied on warehouse closure, etc.) were not part of the warehouse hazard controls. Hence, for a DG warehouse, containing specific ignition and fire control systems, it would be expected that a major fire would occur with a lesser frequency than that of general warehouses. Notwithstanding this, to ensure a conservative assessment has been provided within the study, the estimated initiating fire frequency for the facility has been estimated as $1x10^{-3}$ p.a. (i.e. the upper end of the range).

Selected Initiating Fire Frequency = $1x10^{-3}$ p.a.

WILLOW TREE PLANNING

APPENDIX 4

Floor Plan



NOTES
FINAL POSITION OF RACK IS SUBJECT TO FULL SITE SURVEY

DEXION SILVERWATER

AMENDMENTS

No.	Item	Drawn	Date
A	ORIGINAL FOR DISCUSSION	SS	24/09/20
B	FIRE BAFFLE	AM	12/10/20
C	HEIGHT LIMITING BEAM	SS	22/10/20
D	ELEVATIONS ADJUSTED	SS	22/10/20
E	NEW LAYOUT AND ELEVATIONS	SS	27/10/20
F	ELEVATIONS ADJUSTED	SS	28/10/20
H	ELEVATIONS ADJUSTED	SS	06/11/20

LEGEND

NOTES

Verify all dimensions and levels on site and report any discrepancies prior to the commencement of work.

Drawings are to be read in conjunction with all referenced documents.

Use figured dimensions only. Do not scale from drawings.

Dexion Silverwater cannot guarantee the accuracy of content and format for copies of drawings issued electronically.

The completion of the issue details checked and authorised section is confirmation of the status of the drawing. The drawing shall not be used for construction unless endorsed 'For Construction' and authorised for issue.

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DANGEROUS GOODS
SHED B1

DRAWING:
DSQ5069-0920S2RH

PROJECT No.	SHEET: 1
DSQ5069	SCALE: NTS

Dexion Silverwater Info: