Preliminary Hazard Analysis

Future Lot 14, 657-767 Mamre Road, Kemps Creek, NSW

Probiotec Limited
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Future Lot 14, 657-767 Mamre Road, Kemps Creek, NSW

Probiotec Limited

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A	12th December 2022	Draft issue for comment	Lucy Jimenez	Renton Parker
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Executive Summary

Background

Altis Property Partners and Frasers Property Industrial (Altis-Frasers) propose to develop a warehouse facility at Kemps Creek, NSW, for Probiotec Limited (Probiotec). Probiotec manufacture and package a range of health and consumer products. Part of their operations involves the storage of materials classified as Dangerous Goods (DGs).

Where DGs are stored, the site is subject to the State Environmental Planning Policy (Resilience and Hazards) (SEPP-RH, Ref. [1]) which aims to assess the risk posed by the site upon the adjacent land uses. The proposed quantities to be stored exceed the SEPP-RH thresholds. Hence, it is necessary to assess the risks posed in the form of a Preliminary Hazard Analysis (PHA) in accordance with the Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 and No. 6 (Ref. [2] & [3]) for submission with the Development Application (DA).

Altis-Frasers has commissioned Riskcon Engineering Pty Ltd (Riskcon) on behalf of Probiotec to prepare the PHA for the proposed facility. This document represents the PHA study for Probiotec facility, to be located in Future Lot 14, at 657-767 Mamre Road, Kemps Creek NSW.

Conclusions

A hazard identification table was developed for the proposed Probiotec warehouse facility 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 none of the scenarios would impact over the site boundary and into the adjacent land use; hence, no incidents were carried forward for frequency analysis and risk assessment.

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

Notwithstanding the conclusions following the analysis of the facility, the following recommendations have been made:

- A spill kits shall be provided adjacent to the flammable liquids cabinet to facilitate clean up response.
- The use of spill kits shall be incorporated into the site Emergency Response Plan (ERP).

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Abbreviations

Abbreviation	Description
ADG	Australian Dangerous Goods Code
AS	Australian Standard
CBD	Central Business District
DA	Development Application
DGs	Dangerous Goods
DPE	Department of Planning and Environment
FRNSW	Fire and Rescue New South Wales
HIPAP	Hazardous Industry Planning Advisory Paper
LPG	Liquefied Petroleum Gas
NZS	New Zealand Standard
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
VCE	Vapour Cloud Explosion

1.0 Introduction

1.1 Background

Altis Property Partners and Frasers Property Industrial (Altis-Frasers) propose to develop a warehouse facility at Kemps Creek, NSW, for Probiotec Limited (Probiotec). Probiotec manufacture and package a range of health and consumer products. Part of their operations involves the storage of materials classified as Dangerous Goods (DGs).

Where DGs are stored, the site is subject to the State Environmental Planning Policy (Resilience and Hazards) (SEPP-RH, Ref. [1]) which aims to assess the risk posed by the site upon the adjacent land uses. The proposed quantities to be stored exceed the SEPP-RH thresholds. Hence, it is necessary to assess the risks posed in the form of a Preliminary Hazard Analysis (PHA) in accordance with the Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 and No. 6 (Ref. [2] & [3]) for submission with the Development Application (DA).

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1.2 Objectives

The objectives of the PHA project include:

- Complete the PHA according to the Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 – Hazard Analysis (Ref. [3]),
- 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, 2011 Ref. [4]).

1.3 Scope of Services

The scope of work is to complete a PHA study for the proposed facility located in Lot 14, 657-767 Mamre Road, Kemps Creek, as required by the Planning Regulations. The scope does not include any other assessments at the site nor any other Probiotec 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**.

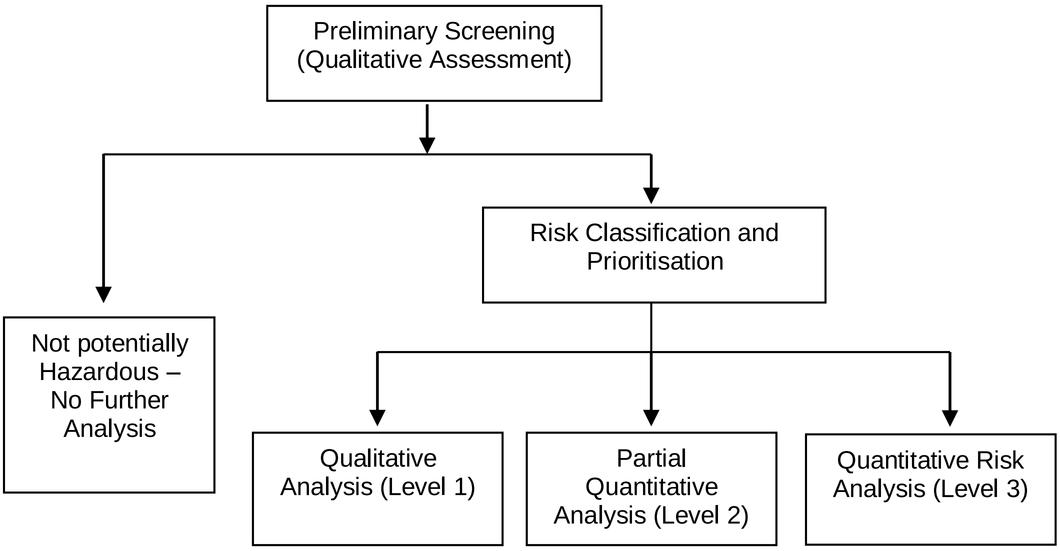

Figure 2-1: The Multi-Level Risk Assessment Approach

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. [3]).

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. [2]). 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. [2]). 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 Altis-Frasers. A final report was then developed, incorporating the comments received by Altis-Frasers for submission to the regulatory authority.

3.0 Site Description

3.1 Site Location

The Probiotec warehouse is proposed to be located on Future Lot 14 of the Altis- Frasers development on 657-767 Mamre Road at Kemps Creek, NSW. The site is approximately 39 km west of the Sydney Central Business District (CBD). **Figure 3-1** shows the regional location of the site.

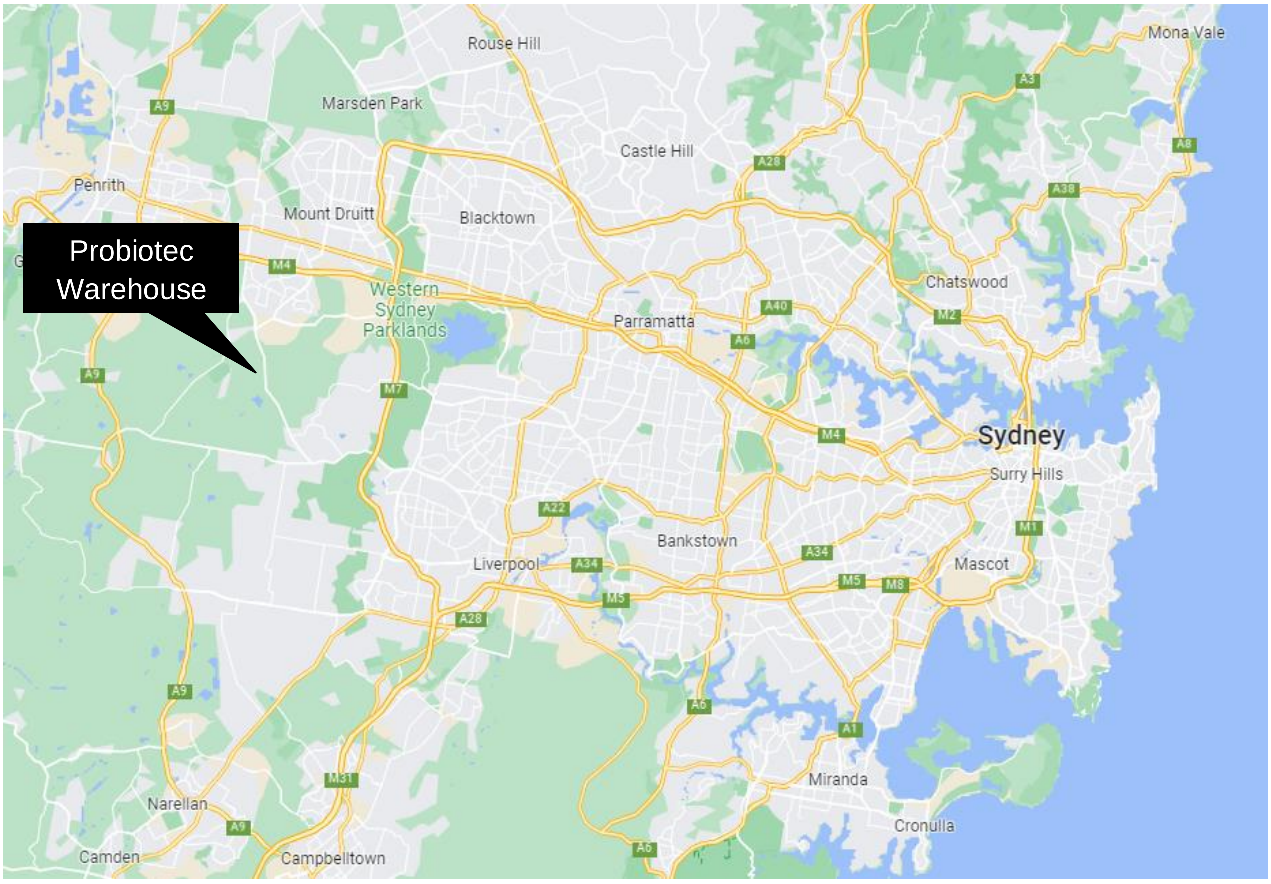

Figure 3-1: Location of the Proposed Probiotec Development, Lot 14, Kemps Creek, NSW

3.2 Adjacent Land Uses

The area is predominantly rural, with a warehouse development located across Mamre Road to the north-east and the Twin Creeks Golf & Country Club located across the South Creek buffer zone to the west. The land to the north and south is currently vacant (rural). The Water NSW Pipeline from Warragamba to Prospect is located on the northern side of the development.

The site is bounded by the following:

- North - Open space edge road, open land and Bakers Lane;
- East - Public access road, warehouse developments across the public access road;
- South - warehouse developments on Lot 12 and Lot 13 of the Kemps Creek Development; and
- West - open land and South Creek (warehouse development will not occur in this area.

Figure 3-2 shows the detailed location shows the site location within the development area.

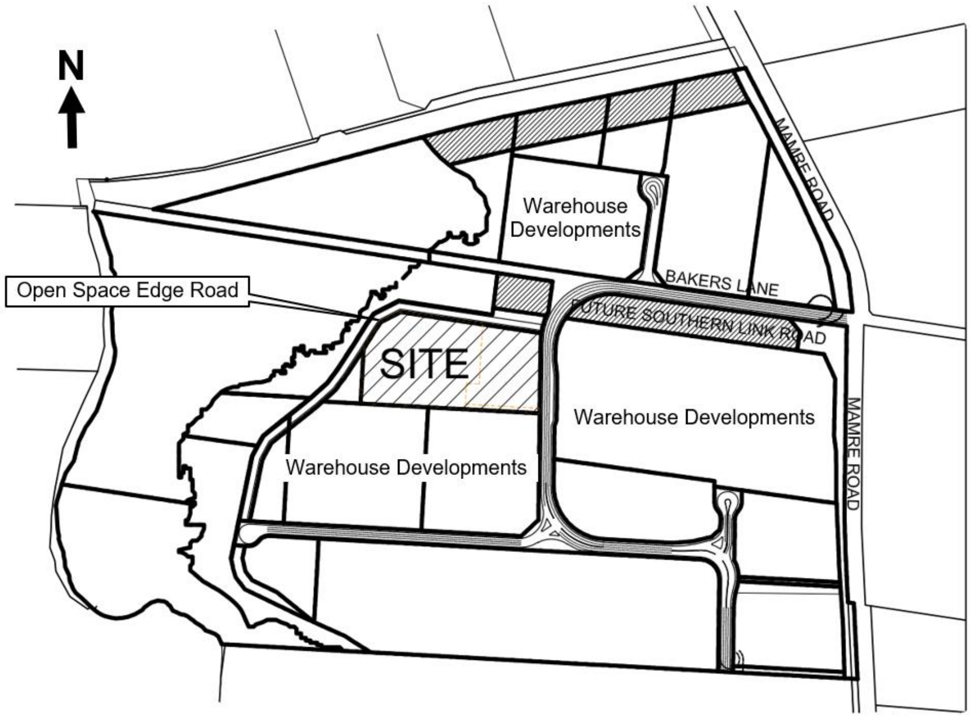

Figure 3-2: Location of the Probiotec Warehouse within the Development Area

3.3 Site Description

The proposed Probiotec warehouse and distribution facility is split into a number of areas where various products are made and stored, along with raw materials using in the distribution process. The distribution areas are located on the western end of the warehouse with the storage racking located on the eastern end. The loading docks are located on the southern side of the warehouse building with an open forecourt area for truck and vehicle manoeuvring.

Cars and vehicles accessing the offices will enter the site via the gate located adjacent to the cul-de-sac on the south west corner of the site. Vehicles will park in the car park areas and access the building via the office entry. Trucks and vehicles accessing the site for deliveries and pick-ups will enter the site in the south east corner of the property via a dedicated truck entry/exit gate. Trucks will then move to the forecourt area where they are directed to a loading gate for load/unload operations.

The warehouse storage comprises eight (8) rows of pallet racking with two rows (back to back), access from the aisles between the rows. Pallet racking is 6 bays high and is accessed by high reach forklift trucks. The building will be erected using “Dado” construction with a concrete wall 2.5m high from the ground to the steel frame and sheet metal cladding. Forecourts and internal floors will be concrete with steel frame and sheet metal roofing.

The warehouse will store a range of DGs. Aerosols will be stored in the racking within Warehouse B, flammable liquids will be stored in a dedicated flammable liquids cabinet, and LPG cylinders for use in forklifts will be stored outdoors. All DGs in the warehouse will be protected by base building specified Storage Mode Sprinkler System (SMSS) sprinklers designed according to AS 2118.1:2017 (Ref. [5]). All DG areas will be protected by hose reel coverage in addition to hydrant coverage. The warehouse will be naturally ventilated for occupation purposes which will provide adequate ventilation flow for preventing accumulation of any vapours released from packages in storage as required by AS/NZS 3833:2007 (Ref. [6]). The proposed site layout and the location of DGs in the warehouse are shown in **Figure 3-3**.

The site will be subject to a hazardous area classification per AS/NZS 60079.10.1:2022 (Ref. [7]) and any electrical equipment within the hazardous zone will be compliant per AS/NZS 60079.14:2017 (Ref. [8]) to minimise the potential for ignition of flammable vapours which may be released during storage.]

3.4 Quantities of Dangerous Goods Stored and Handled

Probiotec are not a dedicated DGs storage facility however, a number of DG are stored and used in support of the medical component distribution business. The Dangerous Goods stored and handled at the Probiotec facility are listed in **Table 3-1**.

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

Class	Packing Group (PG)	Proper Chemical Name	Quantity (kg)	Notes
2.1	n/a	Aerosols	147,820 / 39,955*	LPG in aerosols
2.1	n/a	Petroleum Gases, Liquefied	135	Forklift fuel in cylinders
3	II&III	Flammable Liquid NOS	106	Stored in a flammable liquids cabinet

*Note: This refers to the quantity of propellant within the aerosols and not the total package weight. The propellant content within the cannisters is typically around 25% of product weight.

3.5 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:**

$$AQR = \frac{q_x}{Q_x} + \frac{q_y}{Q_y} + [\ldots] + \frac{q_n}{Q_n}$$ **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 quantity for each class is taken from Schedule 15 of the Work Health and Safety (WHS) Regulation 2017 (Ref. [9]). These are summarised in **Table 3-2** .

Table 3-2: Major Hazard Facility Thresholds

Class	Description	PG	Storage (tonnes)	Threshold (tonnes)
2.1	LPG	n/a	37.1	200
3	Flammable Liquids	II&III	0.1	50,000

A review of the thresholds and the commodities and packing groups listed in **Table 3-1** 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:

$$AQR = \frac{37.1}{200} + \frac{0.1}{50{,}000} = 0.185$$

The AQR is less than 1; hence, the facility would not be classified as an MHF. However, the site would exceed 10% of the MHF threshold and therefore notification to SafeWork NSW of a potential MHF would be required.

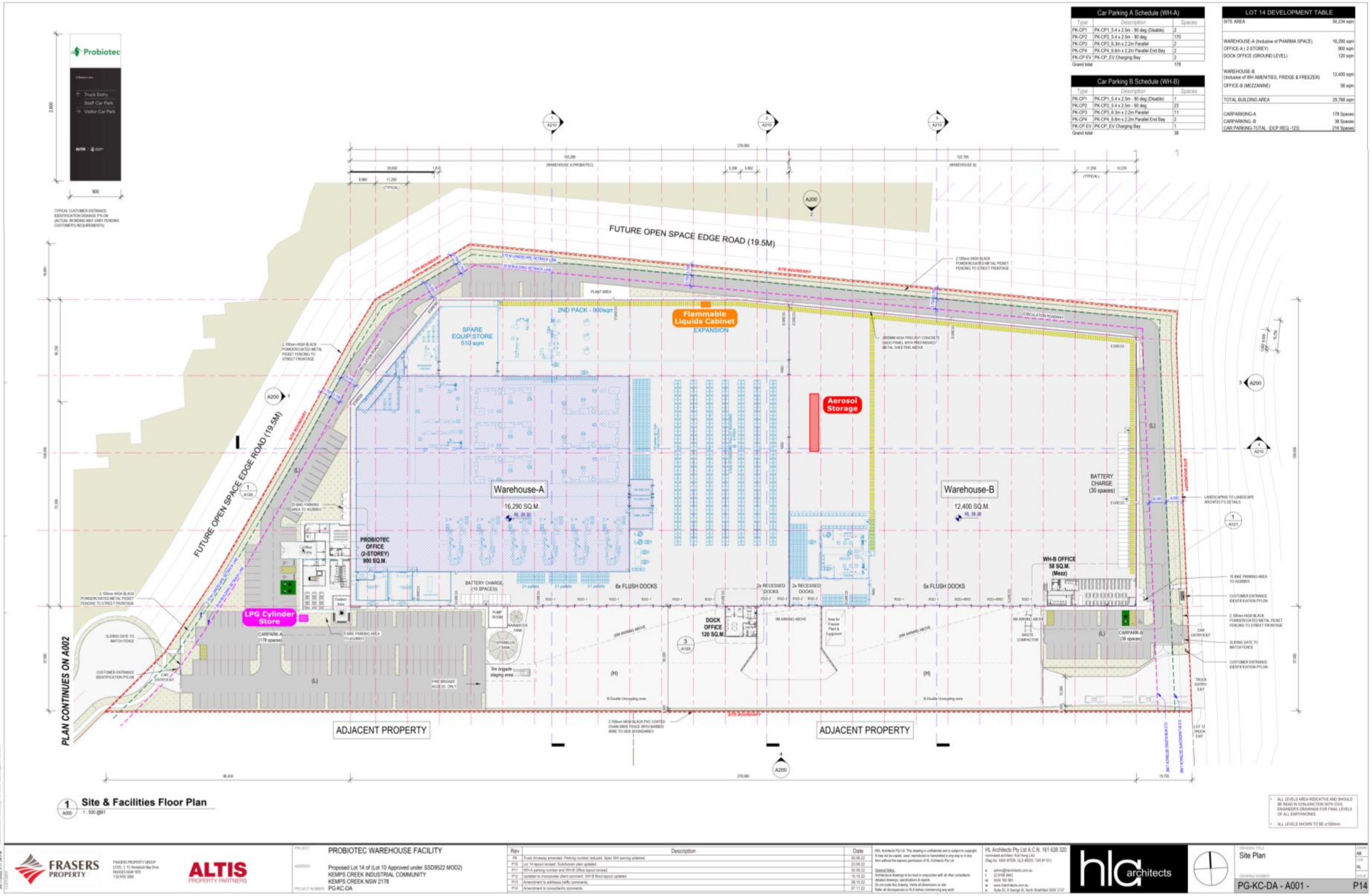

Figure 3-3: Site Layout

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. [3]). 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. [2]) 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. [2]) 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 more than several hundred meters 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. [2]) 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 more than several hundred meters from the site.

- *Property Damage and Accident Propagation* - It is noted in HIPAP No. 4 (Ref. [2]) 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. [2]) 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 more than several hundred meters 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 Gas	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. Where gas released under pressure from a hole in a pressurised component is ignited, a jet fire may occur.
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 60ºC closed-cup test or not more than 65.6ºC 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.

* The Australian Code for the Transport of Dangerous Goods by Road and Rail (Ref. [10]).

4.3 Hazard Identification

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

- LPG release (from a cylinder), ignition and flash fire or explosion.
- LPG release (from aerosol), ignition and racking fire.
- Flammable liquids release, delayed ignition and flash fire or explosion
- Flammable liquid release, ignition, and pool fire.
- Flammable liquids spill, release and environmental incident.
- Full warehouse fire and radiant heat impacts.
- Full warehouse fire and toxic smoke emission.

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

4.4 LPG Release (From Cylinder), Ignition and Flash Fire or Explosion

Liquefied Petroleum Gas (LPG) cylinders will be stored on site for use in forklifts. As LPG is a flammable gas; hence, there is the potential that if a release were to occur it could ignite as a fire or an explosion.

In order for a gas cloud to explode it must be confined, it must accumulate within the explosive limits, and an ignition source must be present. The risk of explosion has been mitigated by ensuring the cylinder store is adequately ventilated as it will be located outside of the warehouse in an open area, thereby minimising the potential for the accumulation of gas above the lower explosive limits. In addition, ignition sources will be eliminated via compliance with AS/NZS 60079 series of standards. The stores shall be zoned as hazardous areas in accordance with AS/NSZ 60079.10.1:2022 (Ref. [7]), and all electrical equipment within the store shall be compliant with AS/NZS 600079.14:2022 (Ref. [8]). As a vapour cloud will not be able to accumulate and ignition sources will be minimised, an explosion is unlikely to occur. The potential for a flash fire is similarly mitigated, by use of ventilation and eliminating ignition sources.

As the potential for an offsite incident to occur from the flammable gas cylinder storage is unlikely to result in consequences impacting over the site boundary, this incident has not been carried forward for further analysis.

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

Aerosols containing Liquefied Petroleum Gas (LPG) as the propellant will be held at the site for storage and distribution. There is potential that an LPG release could occur in the warehouse area due to an accident (packages dropped from forklift, punctured by forklift tines). 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 the deterioration of a package. 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. In in the event of a release, a flammable gas cloud would immediately form as the LPG would instantly flash to gas following release from the canister. Due to the hazardous area rated equipment within the area and protocols, it is considered unlikely for an ignition to occur; however, in the event that an ignition of an LPG release did occur, and the cloud is confined (i.e. pallet racking and stored products), the vapour cloud may explode if ignited, or, if it is unconfined, it may result in a flash fire.

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 SMSS is expected to 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.

A sprinkler-controlled fire within the aerosol racking would be unlikely to impact over the site boundary; notwithstanding this, this incident has been carried forward for consequence analysis.

4.6 Flammable Liquid Release, Delayed Ignition and Flash Fire or Explosion

Minor quantities of flammable liquids will be stored in a dedicated flammable liquids cabinet for use site. There is potential that a flammable liquid spill could occur in the cabinet due to an accident (packages dropped) or deterioration of packaging. If a flammable liquid spill occurred and was not cleaned up immediately, the liquid may begin to evaporate, resulting in the accumulation of a flammable vapour cloud. The vapour cloud may ignite, resulting in a flash fire or explosion.

In order for a vapour cloud to explode it must be confined, it must accumulate within the explosive limits, and an ignition source must be present. The risk of explosion has been mitigated by implementing adequate warehouse ventilation, which limits the potential for the accumulation of the vapour to occur. In addition, if a spill occurred during operational hours, it would be identified by personnel working in the warehouse where it could be immediately cleaned up. To ensure appropriate cleaning equipment is available, the following recommendation has been made:

- A spill kit shall be provided to ensure spills can be cleaned up immediately following identification.

It should be noted that in the event the spill occurs within the flammable liquids cabinet, there is the potential for the accumulation of vapour to occur. However, a vapour cloud within the cabinet it will not be able to explode as ignition sources shall be eliminated via compliance with AS/NZS 60079 series of standards. The storage of flammable liquids is subject to hazardous area classification per AS/NZS 60079.10.1:2022 (Ref. [7]) with electrical equipment selected to minimise the potential for ignition per AS/NZS 60079.14:2022 (Ref. [8]).Ignition sources shall also be controlled by placarding in accordance with AS/NZS 3833:2007 (Ref. [6]).

Furthermore, only 106 kg of flammable liquids will be stored in the cabinet in small packages. The associated vapour cloud formed by the release of flammable liquid would be insufficient to result in offsite impacts from ignition.

Based on the minor storage of flammable liquids in a DG cabinet, control of ignition sources, and operation practices, the risk of a vapour cloud explosion or a flash fire that is large enough to ignite and impact over the site boundary is considered to be low (if not negligible). Hence, this incident has not been carried forward for further analysis.

4.7 Flammable Liquid Release, Ignition and Pool Fire

As noted in **Section 4.6**, there is the potential for flammable liquids to be released if packages are damaged or deteriorated. In the event the spill is ignited immediately, a pool fire may occur. As previously discussed, the potential for the ignition of a flammable material shall be minimised by the elimination of ignition sources via compliance with the AS/NZS 60079 series of standards.

If a flammable liquid spill it was ignited, the initial fire would be small, as only 106 kg of flammable liquids will be stored on site within the cabinet in small packages. The heat generated from a fire of minimal size would be insufficient to result in offsite impacts from ignition. In addition, the flammable liquids cabinet is located away from other dangerous good stored on site, therefore the potential for the fire propagating to other areas in the warehouse is considered to be low.

Based on the minor storage of flammable liquids in a DG cabinet, control of ignition source, and limited fire size, the risks of a flammable liquids fire impacting over the site boundary is considered to be low (if not negligible). Hence, this incident has not been carried forward for further analysis.

4.8 Flammable Liquid Spill, Release and Environmental Incident

There is potential that a spill of flammable liquids (Class 3) could occur at the site due to an accident (packages dropped) or from a damaged/deteriorated package. In the event that a spill occurs, and it is not contained, DGs could be released into the public water course resulting in a potential environmental incident.

All flammable liquids will be stored in a dedicated flammable liquids cabinet which will be bunded in accordance with the requirements of AS/NZS 3833:2007 (Ref. [6]). Therefore, a release of flammable liquids from a damaged package will be contained within the storage cabinet. Furthermore, approximately 106 kg of flammable liquids will be stored in small packages. In the event a spill occurs outside the cabinet due to a dropped package, the release would be contained within the warehouse area, and trained personnel would be capable of responding to the release. To ensure appropriate cleaning equipment is available, the following recommendations have been made:

- A spill kits shall be provided adjacent to the flammable liquids cabinet to facilitate clean up response.
- The use of spill kits shall be incorporated into the site Emergency Response Plan (ERP).

Therefore, a spill of flammable liquids resulting in an offsite release and environmental incident is not considered to be a credible scenario. Hence, this incident has not been carried forward for further analysis.

4.9 Full Warehouse Fire and Radiant Heat

There is potential that if a fire occurred within the warehouse and the fire protection systems failed to activate, a small fire may escalate, resulting in propagation throughout the warehouse and a full warehouse fire.

However, the allocated storage area of DGs within the warehouse is approximately 100 m^2 of the total warehouse, which has a floor area of approximately 28,690 m^2. Therefore, less than 1% of the warehouse is allocated to DG storage; hence, a full warehouse fire will mostly resemble a standard warehouse fire not involving DGs. Furthermore, it is considered unlikely for a fire to occur simultaneously with the sprinkler system failing to operate.

As the potential for propagation into the general warehouse area is considered to be low, and a full warehouse fire would not be dissimilar to a standard warehouse, this incident has not been carried forward for further analysis.

4.10 Full Warehouse Fire and Toxic 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. Smoke generated from the fire may result in toxic products of combustion impacting downwind; however, as there are no toxic substances within this warehouse, the potential for toxic smoke to be generated is considered to be negligible compared to a standard warehouse fire. As there are no unique smoke hazards from this scenario, this incident has not been carried forward for further analysis.

5.0 Consequence Analysis

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

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.

The incident has been assessed in the following section.

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

A damaged aerosol canister could result in the release of LPG which if ignited may result in a fire. As the fire grows, the radiant heat may impact adjacent aerosol storage heating the LPG within aerosol cans which may rupture rocketing the canisters around the aerosol store. The heat generated from the fire will activate the SMSS which will suppress and control the fire while cooling adjacent packages minimising the potential for lateral fire 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** with the contours illustrated in **Figure 5-1.**

Table 5-1: Heat Radiation from an Aerosol Racking Fire

Heat Radiation (kW/m^2)	Distance (m)	
	Base Case	Sensitivity
35	6.0	13.0
23	7.0	16.0
12.6	9.0	22.0
4.7	14.0	34.0

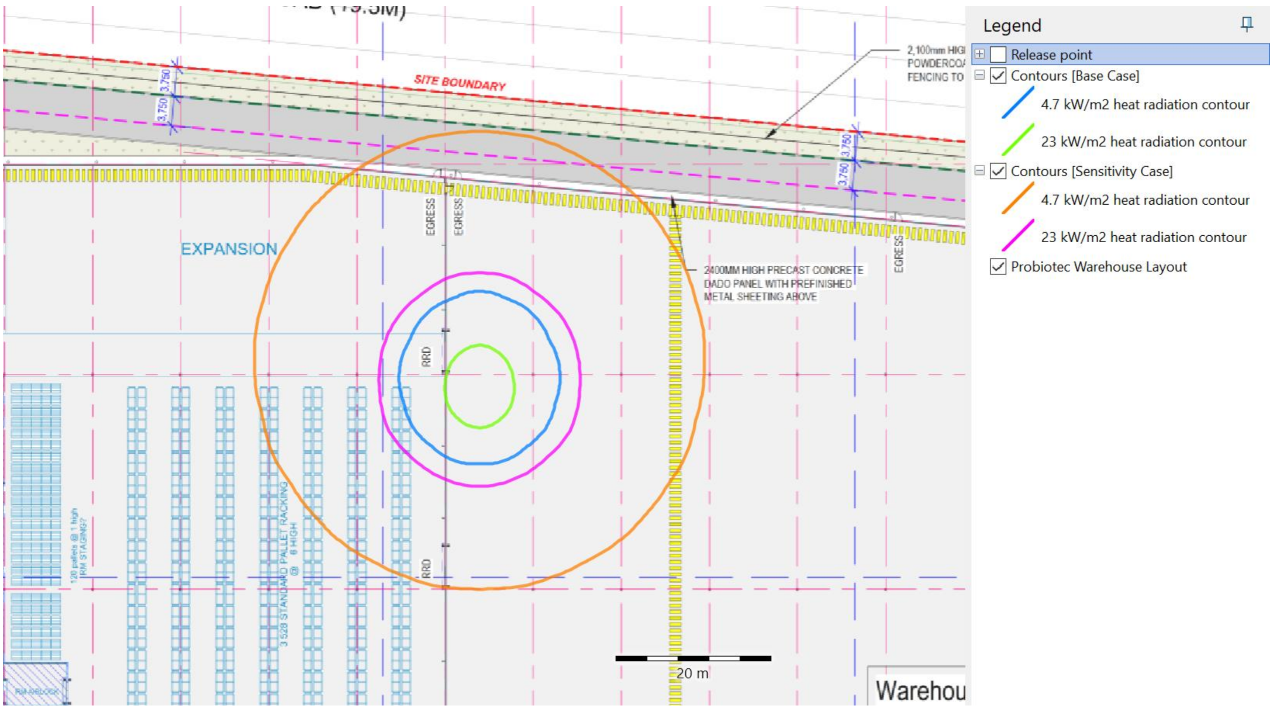

Figure 5-1: Sprinkler Controlled Aerosol Fire Radiant Heat Contours

A review of the contours illustrated in **Figure 5-1** indicates that for the 4.7 and the 23 kW/m^2 contours for the sensitivity analysis and the 4.7 kW/m^2 contour for the base case, neither case impacts over the site boundary. Therefore, would be no offsite impact; hence this incident has not been carried forward for further analysis.

6.0 Conclusion and Recommendations

6.1 Conclusions

A hazard identification table was developed for the proposed Probiotec warehouse facility 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 none of the scenarios would impact over the site boundary and into the adjacent land use; hence, no incidents were carried forward for frequency analysis and risk assessment.

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.

6.2 Recommendations

Notwithstanding the conclusions following the analysis of the facility, the following recommendations have been made:

- A spill kits shall be provided adjacent to the flammable liquids cabinet to facilitate clean up response.
- The use of spill kits shall be incorporated into the site Emergency Response Plan (ERP).

7.0 References

[1] NSW Department of Planning and Environment, "Applying SEPP33 – Hazardous and Offensive Developments," NSW Department of Planning and Environment, Sydney, 2011.

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

[3] Department of Planning, "Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis," Department of Planning, Sydney, 2011.

[4] Department of Planning, Multi-Level Risk Assessment, Sydney: Department of Planning, 2011.

[5] Standards Australia, "AS 2118.1:2017 - Automatic Fire Sprinkler Systems General Systems," Standards Australia, Sydney, 2017.

[6] Standards Australia, "AS/NZS 3833:2007 - Storage and Handling of Mixed Classes of Dangerous Goods, in Packages and Intermediate Bulk Containers," Standards Australia, Sydney, 2007.

[7] Standards Australia, AS/NZS 60079.10.1:2022 - Explosive Atmospheres Part 10.1: Classification of Areas, Explosive Gas Atmospheres, Sydney: Standards Association of Australia, 2022.

[8] Standards Australia, AS/NZS 60079.14:2022 - Explosive Atmospheres Part 14: Electrical Installations, Design, Selection and Erection, Sydney: Standards Australia, 2022.

[9] SafeWork NSW, "Work Health and Safety Regulation," SafeWork NSW, Lisarow, 2017.

[10] Road Safety Council, The Australian Code for the Transport of Dangerous Goods by Road and Rail Edition 7.7, Canberra: Road Safety Council, 2020.

[11] Standards Australia, AS/NZS 1596:2014 - The Storage and Handling of LP Gas, Sydney: Standards Australia, 2014.

Appendix A

Hazard Identification Table

Appendix A

A1. Hazard Identification Table

Appendix Table A-1: Hazard Identification Table

ID	Area/ Operation	Hazard Cause	Hazard Consequence	Safeguards
1	Flammable Gas Cylinders (LPG)	• Loss of containment of LPG	• Fire and / or explosion resulting in potential injuries onsite and potentially offsite	• Small cylinders (i.e. <50 L) • Valve guards on cylinders • Pressure tested cylinders • Minor storage complying with AS/NZS 1596:2014 (Ref. [11])
2	Warehouse	• Heating of aerosol containers (containing Class 2.1 gas) from a general warehouse fire	• Rupture, ignition and explosion / rocketing of cylinder within warehouse • Spreading fire	• All aerosols are stored in a cage, limiting spread of fire. • In-rack sprinklers and suppression mode sprinklers according to FM Global Data Sheet 8-9. • Automatic fire protection system • Trained forklift operators • Aerosol storage area compliant with AS/NZS 3833:2007 (Ref. [6])
3	Warehouse	• Heating of aerosol containers (containing Class 2.1 gas) from a general warehouse fire	• Delayed ignition and flash fire / explosion • Spreading fire	• All aerosols are stored in a cage, limiting spread of fire. • In-rack sprinklers and suppression mode sprinklers according to AS 2118.1:2017 (Ref. [5]) • Automatic fire protection system • Trained forklift operators • Aerosol storage area compliant with AS/NZS 3833:2007 (Ref. [6]) • Warehouse ventilation • Hazardous Area Classification (HAC) in accordance with AS/NZS 60079.10.1:2022 (Ref. [7]) & control of ignition sources according to AS/NZS 60079.14:2022 (Ref. [8])

ID	Area/ Operation	Hazard Cause	Hazard Consequence	Safeguards
4	Warehouse	• Dropped pallet • Damaged packaging (receipt or during storage) • Deterioration of packaging	• Spill of flammable liquids (Class 3) • Accumulation of flammable vapour cloud • Delayed ignition and vapour cloud explosion/flash fire	• Minor storage (maximum 106 kg) • Storage of flammable liquids in a bunded flammable liquids cabinet • Hazardous Area Classification (HAC) in accordance with AS/NZS 60079.10.1:2022 (Ref. [7]) & control of ignition sources according to AS/NZS 60079.14:2022 (Ref. [8]) • First attack fire-fighting equipment (e.g. hose reels & extinguishers) • Fire detection systems • Warehouse ventilation
5	Warehouse	• Dropped pallet • Damaged packaging (receipt or during storage) • Deterioration of packaging	• Spill of flammable liquids (Class 3) • Immediate ignition and pool fire	• Minor storage (maximum 106 kg) • Storage of flammable liquids in a bunded flammable liquids cabinet • Hazardous Area Classification (HAC) in accordance with AS/NZS 60079.10.1:2022 (Ref. [7]) & control of ignition sources according to AS/NZS 60079.14:2022 (Ref. [8]) • First attack fire-fighting equipment (e.g. hose reels & extinguishers) • Fire detection systems • Warehouse ventilation
6	Warehouse	• Dropped pallet • Damaged packaging (receipt or during storage) • Deterioration of packaging	• Release of Class 3 to the environment • Minor environmental release	• Small sized packages • Minor storage (maximum 106 kg) • Storage of flammable liquids in a bunded flammable liquids cabinet • Inspection of packages upon delivery to the site. • Trained operators (including spill response training).

ID	Area/ Operation	Hazard Cause	Hazard Consequence	Safeguards
7	Warehouse	• Dropped or damaged package, resulting in a release of DGs and localised fire. • Failure of sprinkler protection system	• Localised fire propagating to a full warehouse fire	• In-rack sprinklers according to AS 2118.1:2017 (Ref. [5]) • Automatic fire protection system • Aerosols stored within a caged area. • Storage of DGs in accordance with AS/NZS 3833:2007 (Ref. [6])
8	Warehouse	• Dropped or damaged package, resulting in a release of DGs and localised fire. • Failure of sprinkler protection system	• Localised fire propagating to a full warehouse fire • Toxic smoke emissions	• In-rack sprinklers according to AS 2118.1:2017 (Ref. [5]) • Automatic fire protection system • Aerosols stored within a caged area. • Storage of DGs in accordance with AS/NZS 3833:2007 (Ref. [6]) • No toxic substances stored in the warehouse

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.

Each incident has been assessed in the sections below.

B2. Gexcon - Effects

The modelling was prepared using Effects which is proprietary software owned by Gexcon which has been developed based upon the TNO Coloured books and updated based upon CFD modelling tests and physical verification experiments. The software can model a range of incidents including pool fires, flash fires, explosions, jet fires, toxic dispersions, warehouse smoke plumes, etc.

B3. Radiant Heat Physical Impacts

Appendix Table B-1 provides noteworthy heat radiation values and the corresponding physical effects of an observer exposed to these values (Ref. [2]).

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)

B4. 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 and in-rack sprinklers to suppress the fire and cool adjacent packages to minimise the potential for rocketing. As heat and smoke is generated from the fire, the in-rack sprinklers and the SMSS will activate.

Two sprinkler activation scenarios have been assessed:

- A base case 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 (equivalent area 7 m^2) with the second row having an approximate diameter of 9 m (equivalent area 63.6 m^2).

LPG was selected as the modelling material, which 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.

Parameters		
Inputs	**Sensitivity Case**	**Base Case**
Process Conditions		
Chemical name	LPG Sample (Sample mixtures)	LPG Sample (Sample mixtures)
Calculation Method		
Type of pool fire calculation	Two zone model Rew & Hulbert	Two zone model Rew & Hulbert
Type of pool fire source	Instantaneous	Instantaneous
Fraction combustion heat radiated (-)	0.35	0.35
Soot definition	Calculate/Default	Calculate/Default
Source Definition		
Total mass released (kg)	1000	1000
Temperature of the pool (°C)	25	25
Process Dimensions		
Type of pool shape (pool fire)	Circular	Circular
Max. pool fire surface area (m2)	63.6	**7**
Height of the confined pool above ground level (m)	0	0
Include shielding at bottomside flame	No	No
Meteo Definition		
Wind speed at 10 m height (m/s)	2	2
Predefined wind direction	S	S
Environment		
Ambient temperature (°C)	25	25
Ambient pressure (bar)	1.0151	1.0151
Ambient relative humidity (%)	60	60
Amount of CO2 in atmosphere (-)	0.0004	0.0004

The above information was input into Effects with the results for each scenario shown in **Appendix Table B-2** and **Appendix Table B-3.**

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

Output	Base Case	Sensitivity
Flame Height (m)	10.9	23.5
SEP (kW/m^2)	40.3	49.2

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

Heat Radiation (kW/m^2)	Distance (m)	
	Base Case	Sensitivity
35	6.0	13
23	7.0	16
12.6	9.0	22
4.7	14.0	34