Riskcon engineering

Final Hazard Analysis

Warehouse 7, Logos Moorebank Development, Moorebank Avenue

Mainfreight Logistics Pty Ltd
Document No. RCE-23150_Mainfreight_FHA_Final_31Jul23_Rev(0)
Date 31/07/2023

Final Hazard Analysis

Warehouse 7, Logos Moorebank Development, Moorebank Avenue

Mainfreight Logistics Pty Ltd

Prepared by

Riskcon Engineering Pty Ltd
37 Pogson Drive
Cherrybrook NSW 2126
www.riskcon-eng.com
ABN 74 626 753 820

Quality Management

Rev	Date	Remarks	Prepared By	Reviewed By
A	6th July 2023	Draft issued for comment	Renton Parker	Jason Costa
0	31st July 2023	Final issued		

Executive Summary

Background

Mainfreight Logistics Pty Ltd (Mainfreight) has proposed to lease a new warehouse to house their distribution operations to be located at Warehouse 7 of the Logos Moorebank Development on Moorebank Avenue, Moorebank. The centre will store a range of goods including some materials classified as Dangerous Goods (DGs). Where DGs are stored, the site is subject to Chapter 3 of the State Environmental Planning Policy (Resilience and Hazards) 2021 (Ref.) which aims to assess the risk posed by the site upon the adjacent land uses. The proposed quantities to be stored would exceed the Chapter 3 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. &) for submission with the Development Application (DA). A PHA has been prepared and a Final Hazard Analysis (FHA) is now required to review any changes that may not have been addressed in the PHA.

Tactical Group are involved in the development of the facility and have commissioned Riskcon Engineering Pty Ltd (Riskcon) to prepare the FHA for the facility. This document represents the FHA study for Warehouse 7 of the Logos Moorebank Development on Moorebank Avenue, Moorebank.

Conclusions

A review of the hazards identified in the PHA were reviewed to determine whether the hazards apply and if any changes have occurred at the site which would alter the risk profile of the site. The review identified that there had been no significant changes; hence, the original conclusions of the PHA remain valid. It is noted that two incidents relating to a full warehouse fire were re-reviewed as part of the FHA which determined that the original PHA was conservative and that the risk profile identified in the original PHA likely overestimated the risk profile. Therefore, it is considered that the risk profile of the site is improved as a result of the FHA review.

Based upon the review, the site would be below the acceptable criteria for industrial land uses of 50 chances pmpy and that the development would continue to be appropriate for the land zoning.

Recommendations

No recommendations have been made as part of the FHA.

Table of Contents

List of Figures

List of Tables

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
FHA	Final Hazard Analysis
HIPAP	Hazardous Industry Planning Advisory Paper
LPG	Liquefied Petroleum Gas
PHA	Preliminary Hazard Analysis
Pmpy	Per million per year
RDC	Retail Distribution Centre
SEPP	State Environmental Planning Policy
SMSS	Storage Mode Sprinkler System

1.0 Introduction

1.1 Background

Mainfreight Logistics Pty Ltd (Mainfreight) has proposed to lease a new warehouse to house their distribution operations to be located at Warehouse 7 of the Logos Moorebank Development on Moorebank Avenue, Moorebank. The centre will store a range of goods including some materials classified as Dangerous Goods (DGs). Where DGs are stored, the site is subject to Chapter 3 of the State Environmental Planning Policy (Resilience and Hazards) 2021 (Ref. [1]) which aims to assess the risk posed by the site upon the adjacent land uses. The proposed quantities to be stored would exceed the Chapter 3 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). A PHA has been prepared and a Final Hazard Analysis (FHA) is now required to review any changes that may not have been addressed in the PHA.

Tactical Group are involved in the development of the facility and have commissioned Riskcon Engineering Pty Ltd (Riskcon) to prepare the FHA for the facility. This document represents the FHA study for Warehouse 7 of the Logos Moorebank Development on Moorebank Avenue, Moorebank.

1.2 Objectives

The objectives of the FHA project, for the proposed facility at Warehouse 7 of the Logos Moorebank Development on Moorebank Avenue, Moorebank, include:

- Complete the FHA according to the Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 – Hazard Analysis (Ref. [3]);
- Assess the FHA 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).

1.3 Scope of Services

The scope of work is to complete a FHA study for Warehouse 7 of the Logos Moorebank Development on Moorebank Avenue, Moorebank, required by the Planning Regulations for the proposed development. The scope does not include any other assessments at the site nor any other facilities.

2.0 Methodology

2.1 Multi-Level Risk Assessment

The Multi-Level Risk Assessment approach (Ref. [1]), although 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 FHA, 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**.

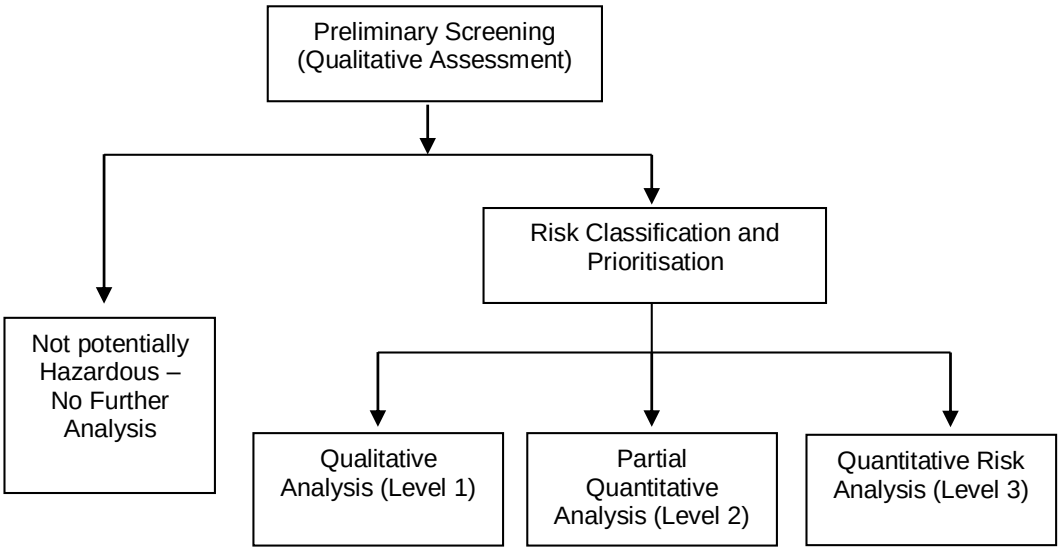

Figure 2-1: The Multi-Level Risk Assessment Approach

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. [3]). 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. [3]). 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. A final report was then developed, incorporating the comments received for submission to the regulatory authority.

3.0 Site Description

3.1 Site Location

The site is located at Logos Moorebank Development on Moorebank Avenue, Moorebank which is approximately 38 km south-west 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: 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 – Industrial
- South – Industrial
- East – Industrial
- West – Industrial

3.3 Warehouse Detailed Description

The warehouse will serve as distribution centre for Mainfreight for the receival, warehousing, sorting and distribution of products. Products delivered to the site will be sorted in the sorting and packaging area, and stored in palletised, plastic wrapped containers.

Combustible liquids are stored in containers up to Intermediate Bulk Containers (IBCs) which hold 1,000 L and will be stored in a dedicated DG Store, which will be designed to comply with AS/NZS

1940:2017 (Ref. [5]). This store shall be constructed of fire walls with an FRL of 240/240/240 extending through the roof as a parapet by 0.5 m. The store will be mechanically ventilated, which will provide adequate ventilation flow for preventing accumulation of any vapours released from packages in storage as required by AS/NZS 1940:2017 (Ref. [5]).

Aerosol packages will be stored on racks in an aerosol cage within the warehouse, away from the main racking. The aerosol racks will be fitted with in-rack sprinklers per AS 2118.1:2017 (Ref. [6]). The storage of aerosols will be compliant with AS/NZS 3833:2007 (Ref. [7]).

Flammable liquids in the form of retail sized products and potable spirits will be stored throughout the warehouse in accordance with AS/NZS 3833:2007 (Ref. [7]).

The warehouse will be protected by an automatic sprinkler system involving both ceiling mounted and in-rack sprinklers depending on commodities stored. The sprinklers which will activate upon fire detection which will suppress and control any fire that may occur. All DG areas (Aerosol store, combustibles store, and flammable liquid store) will be protected by base building specified Storage Mode Sprinkler System (SMSS) sprinklers and by in-rack sprinklers.

The whole site will be capable of containing at least 90 minutes of potentially contaminated fire water as required by AS/NZS 3833:2007 (Ref. [7]) and the NSW "*Best Practice Guidelines for Contaminated Water and Retention Systems*" (Ref. [8]). The water will be contained via isolation of the stormwater system which is performed by the actuation of a penstock valve upon fire detection.

The site will be subject to a hazardous area classification per AS/NZS 60079.10.1:2009 (Ref. [9]) and any electrical equipment within the hazardous zone will be compliant per AS/NZS 60079.14:2017 (Ref. [10]) to minimise the potential for ignition of flammable vapours which may be released during storage.

3.4 Quantities of Dangerous Goods Stored and Handled

The dangerous goods stored at the warehouse are for various customers and may fluctuate with customer requirements. The classes and quantities to be approved in the facility are summarised in **Table 3-1.** The location of the DGs within the warehouse are shown in **Figure 3-2.**

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

Class	Description	PG	Pallets	Quantity (kg)
2.1	Flammable Gas (Aerosols)	n/a	1470	588,000^ / 147,000*
3	Flammable Liquids (perfumery products)	II & III	2,000	800,000^
3	Flammable liquids (alcohol, 40% abv)	III	6,000	2,400,000^
C1/C2	Combustible Liquids	n/a	2,500	1,350,000

^Assumed 400 kg/pallet

*Based upon 25% of the aerosol being an LPG propellant

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 quantities for each class have been taken from Schedule 15 of the Work Health and Safety (WHS) Regulation 2017 (Ref. [11]). These are summarised in **Table 3-2,** noting combustible liquids (C1/C2) 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	147
3	II & III	50,000	3,200
C1/C2	n/a	n/a	600

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:

$$AQR = \frac{147}{200} + \frac{3200}{50{,}000} = 0.799$$

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

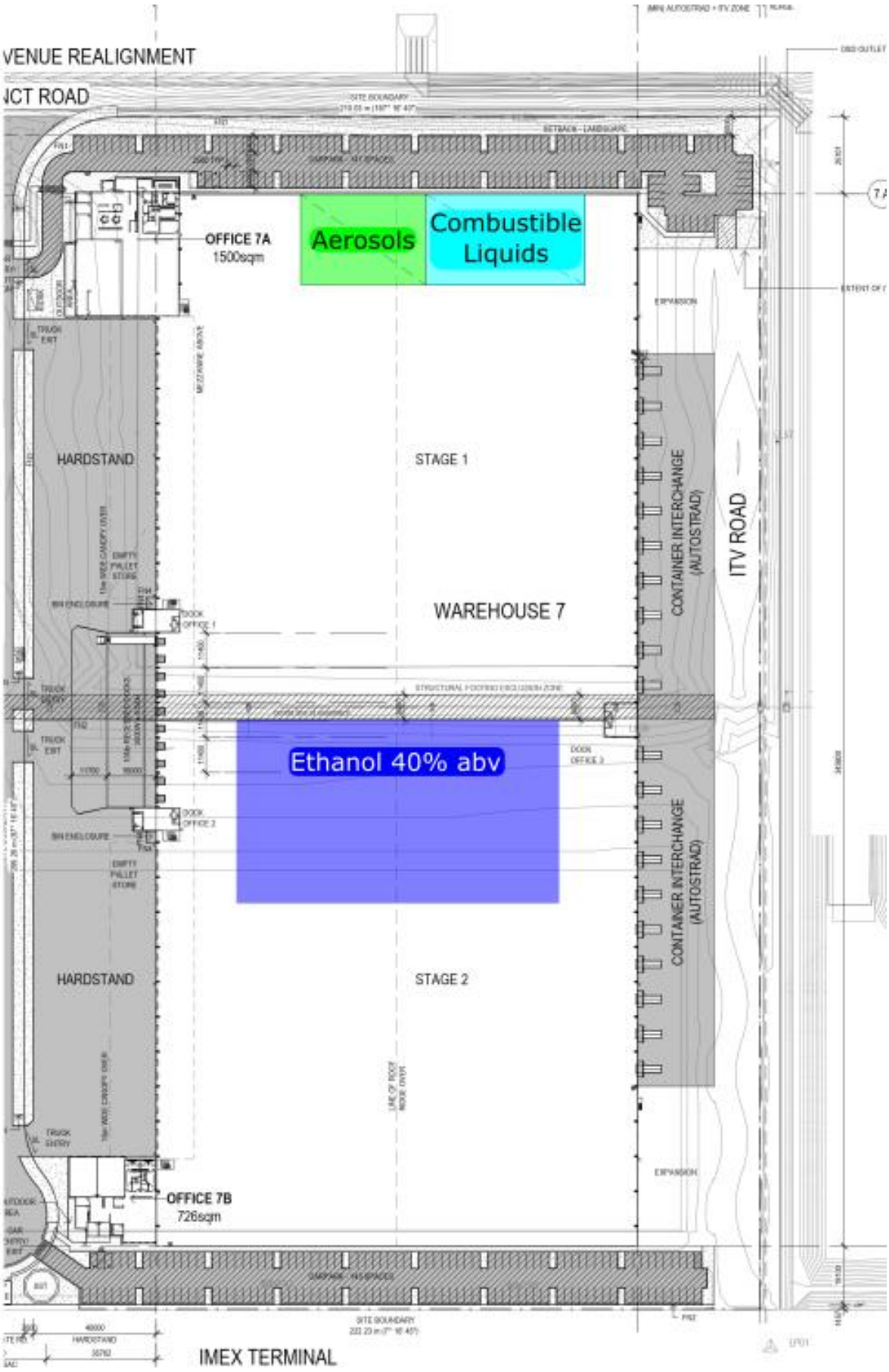

Figure 3-2: Site Layout

4.0 Hazard Identification and Review

4.1 Introduction

A hazard identification was prepared as part of the original PHA which has been included in **Appendix A** of this report. To determine whether additional assessment is required, the original hazards identified in the PHA have been listed below with each hazard reviewed in turn to confirm whether any changes have occurred that would require reassessment.

- Flammable liquid or gas release, delayed ignition and flash fire or explosion.
- Flammable material spill, ignition and racking fire.
- Combustible liquid spill, ignition and pool fire.
- LPG release (from aerosol), ignition and racking fire.
- Ethanol Intermediate Fire and Radiant Heat
- Combustible Liquid Intermediate Fire and Radiant Heat
- Aerosol Intermediate Fire and Radiant Heat
- Full warehouse fire and radiant heat.
- Full warehouse fire and toxic smoke emission.
- Dangerous goods liquid spill, release and environmental incident.
- Warehouse fire, sprinkler activation and potentially contaminated water release.

4.2 Flammable Liquid or Gas Release, Delayed Ignition and Flash Fire or Explosion

The PHA assessed the potential for an explosion or flash fire to occur from the release of Liquefied Petroleum Gas (LPG). The findings of the assessment indicated that explosion or flash fire were unlikely to occur based upon the volume of gas released, the lack of confinement, and the ignition source controls. Subsequently, offsite impacts would be unable to occur, and the scenario was not carried forward for further analysis.

This finding remains valid; hence, this incident has not been carried forward for further analysis.

4.3 Flammable Material Spill, Ignition and Racking Fire

The PHA assessed the potential for a release of flammable material to be released which was ignited which developed into a fire within the racking which was controlled and suppressed by sprinklers. The incident was carried forward for consequence analysis to identify whether offsite impacts would occur from flammable liquids burning. The results of the analysis indicated that the 4.7 kW/m^2 and the 23 kW/m^2 contours would not impact offsite and was therefore not carried forward for further analysis.

A review of the storage location within the warehouse indicates that this has not been moved since the original site approval; hence, the consequence impacts and conclusions determined in the PHA would remain valid. Subsequently, this incident has not been carried forward for further analysis.

4.4 Combustible Liquid Spill, Ignition and Pool Fire

Due to the significant storage of combustible liquids at the site, the PHA assessed the potential for a release of combustible material to be released which was ignited which developed into a fire within the racking which was controlled and suppressed by sprinklers. The incident was carried forward for consequence analysis to identify whether offsite impacts would occur from flammable liquids burning. The results of the analysis indicated that the 4.7 kW/m^2 and the 23 kW/m^2 contours would not impact offsite and was therefore not carried forward for further analysis.

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

Similarly, to **Section 4.3** a sprinkler-controlled fire involving aerosols was analysed in the PHA to assess the potential for offsite impacts. As with the flammable liquid fire, the contours arising from the aerosol storage were modelled and shown to not impact offsite with the incident not carried forward for further analysis.

A review of the storage location within the warehouse indicates that this has not been moved since the original site approval; hence, the consequence impacts and conclusions determined in the PHA would remain valid. Subsequently, this incident has not been carried forward for further analysis.

4.6 Ethanol Intermediate Fire and Radiant Heat

An ethanol intermediate fire and radiant heat incident was assessed due to the potential for offsite impact. Heat radiation contours were found to impact over the site boundary and so frequency analysis was conducted which determined that the frequency associated was 3.53 chances of a fatality in a million per year (pmpy). The total allowable frequency per the NSW Department of Planning and Environment guideline is 50 pmpy and so this incident is not considered probable. The total cumulative risk due to all incidents was found to be 22 pmpy which is less than half of the allowable risk. Therefore, this incident has not been carried forward for further analysis.

4.7 Combustible Liquid Intermediate Fire and Radiant Heat

Similarly, to **Section 4.4** a sprinkler-controlled fire involving combustible liquids was analysed in the PHA to assess the potential for offsite impacts. As with the flammable liquid fire, the contours arising from the combustible liquids storage were modelled and shown to not impact offsite with the incident not carried forward for further analysis.

A review of the storage location within the warehouse indicates that this has not been moved since the original site approval; hence, the consequence impacts and conclusions determined in the PHA would remain valid. Subsequently, this incident has not been carried forward for further analysis.

4.8 Aerosol Intermediate Fire and Radiant Heat

An aerosol intermediate fire and radiant heat incident was assessed due to the potential for offsite impact. Heat radiation contours were found to impact over the site boundary and so frequency analysis was conducted which determined that the frequency associated was 3.53 chances of a fatality in a million per year (pmpy). The total allowable frequency per the NSW Department of Planning and Environment guideline is 50 pmpy and so this incident is not considered probable. The total cumulative risk due to all incidents was found to be 22 pmpy which is less than half of the allowable risk. Therefore, this incident has not been carried forward for further analysis.

4.9 Full Warehouse Fire and Radiant Heat

In the event the sprinkler system failed to control a flammable liquid or aerosol fire it was identified that this could escalate into a full warehouse fire which could have offsite impacts. However, due to the relatively low storage volume of DGs throughout the facility in that the proposed storage composes approximately 11,500 m^2 of floor area with the total warehouse covering 54,000 m^2; hence, the DGs cover around 21% of the total floor area. Therefore, in the event of a full warehouse fire, it would not be dissimilar to a standard warehouse fire and would not present a unique hazard.

As the site design has not changed significantly since approval it is considered that the previously approved risk profile would be improved (i.e. reduced risk) based upon the review within the FHA.

Based on the above, it is considered that a full warehouse fire is not a significant risk and that the true risk profile of the warehouse would be less than assessed in the PHA. Subsequently, this incident has not been carried forward for further analysis.

4.10 Full Warehouse Fire and Toxic Smoke Emission

A toxic smoke emission incident was analysed in the PHA based upon the toxic by-products of combustion that may form in a full warehouse fire. However, as there are not toxic substances stored in the warehouse and that the DGs occupy around 2% of the floor area, it is considered that the risk of a toxic smoke plume from combustion by-products is not dissimilar to a standard warehouse. Subsequently, it is considered that the original PHA overestimates the risk profile of the facility which was found to be acceptable. As the site design has not changed significantly since approval it is considered that the previously approved risk profile would be improved (i.e. reduced risk) based upon the review within the FHA.

4.11 Dangerous Goods Liquid Spill, Release and Environmental Incident

A spill of flammable liquids was assessed in the original PHA for the potential for an environmental incident. Based upon the small packages stored, the presence of spill kits to clean up any spills and the provision of site containment, the potential for an offsite impact from DG spillage was identified to be negligible and this incident was not carried forward for further analysis. This conclusion remains the same for the FHA review; hence, this incident has not been carried forward for further analysis.

4.12 Warehouse Fire, Sprinkler Activation and Potentially Contaminated Water Release

In the event of a fire and sprinkler activation, it was identified that potentially contaminated fire water could be discharged from the site which may damage the environment. To eliminate this incident, it was recommended to include a containment strategy which could hold 702 m^3 of potentially contaminated water. The volume was calculated based on 90 minutes of operation which exceeds the 60-minute design basis for the sprinkler tank; hence, it is considered that potentially contaminated water would likely be held within the site and be unable to impact the environment. Subsequently, the incident was not carried forward for further analysis. This finding is considered to still apply and so this incident has not been carried forward for further analysis.

5.0 Conclusion and Recommendations

5.1 Conclusions

A review of the hazards identified in the PHA were reviewed to determine whether the hazards apply and if any changes have occurred at the site which would alter the risk profile of the site. The review identified that there had been no significant changes; hence, the original conclusions of the PHA remain valid. It is noted that two incidents relating to a full warehouse fire were re-reviewed as part of the FHA which determined that the original PHA was conservative and that the risk profile identified in the original PHA likely overestimated the risk profile. Therefore, it is considered that the risk profile of the site is improved as a result of the FHA review.

Based upon the review, the site would be below the acceptable criteria for industrial land uses of 50 chances pmpy and that the development would continue to be appropriate for the land zoning.

5.2 Recommendations

No recommendations have been made as part of the FHA.

6.0 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 1940:2017 - Storage and Handling of Flammable and Combustible Liquids, Sydney: Standards Australia, 2017.

[6] Standards Australia, “AS 2118.1:2017 - Automatic Fire Sprinkler Systems General Systems,” Standards Australia, Sydney, 2017.

[7] 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.

[8] NSW Department of Planning, “Best Practice Guidelines for Contaminated Water Retention and Treatment Systems,” NSW Department of Planning, Sydney, 1994.

[9] Standards Australia, AS/NZS 60079.10.1:2009 - Explosive Atmospheres Part 10.1: Classification of Areas, Explosive Gas Atmospheres, Sydney: Standards Association of Australia, 2009.

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

[11] SafeWork NSW, “Work Health and Safety Regulation,” SafeWork NSW, Lisarow, 2017.

Appendix A

Hazard Identification Table

A1. Hazard Identification Table

ID	Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
1	Warehouse	• Dropped pallet • Damaged packaging (receipt or during storage) • Deterioration of packaging	• Release of Class 2.1, 3 and C1/C2 to the environment	• Small retail sized packages (< 20 L) other than combustibles • Inspection of packages upon delivery to the site. • Trained forklift operators (including spill response training). • Storage of DGs within AS/NZS 3833:2007 compliant store (Ref. [7])
2		• Dropped pallet • Damaged packaging (receipt or during storage) • Deterioration of packaging	• Spill of flammable liquids, evolution of flammable vapour cloud ignition and vapour cloud explosion/flash fire • Spill of flammable or combustible liquids, ignition and pool fire/racking fire	• Small retail sized packages (< 20 L) • Inspection of packages upon delivery to the site • Control of ignition sources according to AS/NZS 60079.14:2017 (Ref. [10]) • Automatic fire protection system (in-rack and SMSS per AS 2118.1:2017 (Ref. [6])) • First attack fire-fighting equipment (e.g. hose reels & extinguishers) • Fire detection systems • Storage of DGs within AS/NZS 3833:2007 compliant store (Ref. [7])
3		• Heating of Class 2.1 from a general warehouse fire	• Rupture, ignition and explosion/rocketing of cylinder within warehouse spreading fire	• In-rack sprinklers according to AS 2118.1:2017 (Ref. [6]) • Automatic fire protection system • Aerosols stored within a caged area.
4	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 in excess of the maximum required fire water, per AS/NZS 3833:2007 (Ref. [7])

ID	Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
				• Site drainage to comply with the Best Practice Guide for Potentially Contaminated Water Retention and Treatment Systems (Ref. [8])
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)