PRELIMINARY HAZARD ANALYSIS
CHARTER HALL
FLAGSTONE LOT 104
CROWSON LN, NORTH MACLEAN
LOGAN, QLD

Prepared for: Charter Hall

Prepared by: R T Benbow, Principal Consultant

Report No: 248094_PHA_Rev5
December 2024
(Released: 16 December 2024)

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DOCUMENT REVISION RECORD

Revision	Date	Description	Checked	Approved
1	24-09-2024	Draft / Rev1	R T Benbow	R T Benbow
2	25-09-2024	Draft / Rev2	R T Benbow	R T Benbow
3	25-10-2024	Rev3	R T Benbow	R T Benbow
4	04-12-2024	Rev4	R T Benbow	R T Benbow
5	16-12-2024	Rev5	R T Benbow	R T Benbow

DOCUMENT DISTRIBUTION

Revision	Issue Date	Issued To	Issued By
1	24-09-2024	CH Hydrangea Pty Ltd	R T Benbow & Associates
2	25-09-2024	CH Hydrangea Pty Ltd	R T Benbow & Associates
3	25-10-2024	CH Hydrangea Pty Ltd	R T Benbow & Associates
4	04-12-2024	CH Hydrangea Pty Ltd	R T Benbow & Associates
5	16-12-2024	CH Hydrangea Pty Ltd	R T Benbow & Associates

EXECUTIVE SUMMARY

This Preliminary Hazard Analysis (PHA) report has been prepared by R T Benbow & Associates on behalf of CH Hydrangea Pty Ltd (Applicant) in support of a development application over land at 4499-4651 Mount Lindesay Highway, North Maclean QLD 4280 and described as Lot 39 on SP258739 (site). This PDA Development Application seeks approval for the following aspects of development:

- Development Permit for Reconfiguring a Lot - 1 into 5 Lots, plus balance lot and access easements; and
- Development Permit for a Material Change of Use for Warehouse (Distribution Centre)

The material change of use aspect of the proposed development seeks approval for a warehouse (distribution centre) to enable the construction of one of the first buildings within the Flagstone Logistics Estate. The tenant at this stage is confidential, and therefore development approval is sought for a confidential tenant. The proposed warehouse will be located on Proposed Lot 104 and is intended to service as a distribution centre for the tenant, for the receival, warehousing, storing and distribution of products.

This Preliminary Hazard Analysis (PHA) has been prepared in accordance with QLD *Planning guideline State Code 21: Hazardous chemical facilities* and the NSW *Multi-Level Risk Assessment and Hazardous Industry Planning Advisory Papers (HIPAPs)* guidelines. The purpose of the PHA is to assess whether the proposed volume of dangerous goods stored and the operations that occur at the site are offensive or hazardous, thereby posing an unacceptable risk to the surrounding community. Safeguard measures have also been considered and included in the design and operation of the facility to ensure that the safety and amenity of the neighbouring premises would not be affected by the proposed development.

The proposed quantity of dangerous goods does not exceed threshold quantities and the facility is **NOT** a Hazardous Chemical Facility under Schedule 24 of the Planning Regulation 2017 and **NOT** a Major Hazard Facility under Schedule 15 of Work Health and Safety Regulation 2011.

Section 4 of the report identified and examined a number of potential events/consequence scenarios that could occur at the Site. The prevention and protection measures designed into the operations of each of the activities associated with each event were listed and discussed in a series of Hazard Identification Charts.

From the Hazard Identification Charts a list of potentially hazardous events was prepared which was then examined in greater detail to determine which events would be credible and may have significant impacts outside the Site boundary.

The Preliminary Hazard Analysis has found that the operation of the proposed development meets the criteria laid down in HIPAP 4 *Risk Criteria for Land Use Safety Planning* and would not cause any risk, significant or minor, to the community, with the recommended safeguards in place. Furthermore, the site's proposed operations have not been found to be an offensive or hazardous industry based on applying the DSIE guidelines.

Throughout the preparation of this PHA, it has been determined that the proposed development meets all the safety requirements and hence would not be considered to be an offensive or hazardous development.

Contents Page

Tables | Page

Figures | Page

1. INTRODUCTION

This Preliminary Hazard Analysis (PHA) report has been prepared by R T Benbow & Associates on behalf of CH Hydrangea Pty Ltd (Applicant) in support of a development application over land at 4499-4651 Mount Lindesay Highway, North Maclean QLD 4280 and described as Lot 39 on SP258739 (site). This PDA Development Application seeks approval for the following aspects of development:

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This document presents the Preliminary Hazard Analysis (PHA) prepared in accordance with QLD *Planning guideline State Code 21: Hazardous chemical facilities* and the NSW *Multi-Level Risk Assessment and Hazardous Industry Planning Advisory Papers (HIPAPs)* guidelines. The purpose of the PHA is to access whether the proposed development is offensive or hazardous, thereby posing an unacceptable risk to the surrounding community.

2. OVERVIEW OF THE DEVELOPMENT

2.1 PROPOSED DEVELOPMENT

The proposed development detailed in the site plan includes a warehouse (distribution centre) located at Flagstone Logistics Estate proposed Lot 104 Crowson Lane, North Maclean, Logan, QLD. The key features of the development include:

- **Warehouse**: A significant portion of the site is dedicated to a 41,440 m² warehouse.
- **MHE & Workshop**: A 1,010 m² area for mechanical handling equipment and workshop.
- **DG Store**: A 325 m² dangerous goods store.
- **Office Spaces**: The development includes office spaces across two levels, with the ground floor office covering 601 m² and the first floor office covering 400 m².
- **Dock Offices**: Two dock offices, each 90 m² in size.
- **Canopies**: The site has 6,590 m² of canopies for weather protection at loading/unloading areas.
- **Parking and Hardstand Areas**: There are 165 parking spaces, a large hardstand area of 26,749 m², and 4,314 m² of light-duty paving for vehicle access.

The total building footprint for the development is 43,557 m², with the overall site coverage being 54%. The design also includes landscaped areas, fire truck access tracks, a sprinkler system, and waste management zones.

2.2 SITE DETAILS

2.2.1 Site Locality

The proposed development at Flagstone Logistics Estate is located on Crowson Lane, North Maclean, within the Greater Flagstone Priority Development Area (PDA). This site benefits from excellent connectivity, as it is positioned adjacent to the Mount Lindesay Highway and offers easy access to key infrastructure hubs, such as the Logan Motorway and Gateway Motorway. The estate is designed for industrial and logistics purposes, with flexible lot sizes and features like B-Double access and 24/7 operational capability, making it ideal for large-scale operations.

Figure 2-1 shows the location of the site in its local context.

Figure 2-1: Site in a Local Context

2.2.2 Nearest Residences

The closest residences are in a semi rural area opposite the subject site on Crowson Lane, approximately 350 m from the site boundary. Semi rural surround the site.

2.2.3 Nearest Natural Waterway

The nearest natural waterway is located to the East of the Flagstone Estate. Logan River runs in a north-south direction, located approximately 1,790 metres east of the subject site.

2.2.4 Nearest Industrial/Commercial Premises

The site is in a semi-rural area with the nearest commercial agriculture property approximately 600 metres to the west of the site.

3. DANGEROUS GOODS STORAGE & HANDLING

3.1 QUANTITIES OF DANGEROUS GOODS

The following table presents the proposed dangerous goods stored on site.

Table 3-1: Dangerous Goods Stored on Site

DG Class	DG Description	Packing Group	Anticipated Maximum Quantity (kg)	Maximum Container Size	Anticipated Maximum Pallet Locations	Goods Description
1.4	Explosives		490	55g	5	Fireworks, party poppers, sparklers, caps
2.1	Flammable Gases	n/a	12,453	700g	97	Insect Sprays, deodorants, air fresheners, WD40, oil spray, tyre spray, lighters
2.2	Non - Flammable Gases	n/a	27	150mL	1	Crazy string
3	Flammable Liquids	II, III	2,981	1,000mL	13	Methylated spirits, mineral turpentine, liquid paper, adhesives
4.1	Flammable Solids	II	1,242	360g	5	Moth balls, firelighters
9	Miscellaneous Goods	II, III			252	Lithium batteries

The proposed dangerous goods storage at the facility includes several classes of hazardous materials, each with specific characteristics that require tailored storage solutions:

<u>Class 1.4 Explosives:</u>

Goods: Fireworks, party poppers, sparklers, caps.
Maximum Quantity: 490 kg.
Characteristics: Low-risk explosives, capable of producing minor explosions in the event of fire or impact.
Storage Requirements: Separated and isolated storage with strict fire safety measures and limited access to prevent ignition.

<u>Class 2.1 Flammable Gases:</u>

Goods: Aerosols such as insect sprays, deodorants, WD-40, oil spray, lighters.
Maximum Quantity: 12,453 kg.
Characteristics: High flammability, capable of rapid combustion when exposed to an ignition source.
Storage Requirements: To be stored in cages with proper ventilation and adherence to AS4332-2004 for gas cylinder storage.

Class 2.2 Non-Flammable Gases:

Goods: Crazy string (non-flammable gas products).
Maximum Quantity: 27 kg.
Characteristics: Inert but stored under pressure, which could pose an explosion risk if containers are compromised.
Storage Requirements: Minimal risk but must be stored in accordance with relevant standards for gas safety.

Class 3 Flammable Liquids:

Goods: Methylated spirits, mineral turpentine, adhesives.
Maximum Quantity: 2,981 kg.
Characteristics: Highly flammable, these liquids present a fire hazard and require careful containment to prevent spills and vapour accumulation.
Storage Requirements: Segregated storage in bunded areas to contain spills and prevent fire spread. Ventilation is required to disperse any accumulated vapours.

Class 4.1 Flammable Solids:

Goods: Mothballs, firelighters.
Maximum Quantity: 1,242 kg.
Characteristics: Capable of combustion when exposed to heat or friction, posing a fire hazard.
Storage Requirements: Isolated storage with fire protection measures, ensuring that any ignition sources are kept away.

Class 9 Miscellaneous Dangerous Goods:

Goods: Lithium batteries.
Maximum Quantity: 252 pallets (approximately 80,000kg)
Characteristics: Capable of thermal runaway, leading to fires or explosions if damaged or overheated.
Storage Requirements: Requires fire-resistant storage, temperature monitoring, and protection from physical damage.

3.2 LOGAN PLANNING SCHEME 2015

Performance outcomes PO5 and PO6 (and their associated acceptable outcomes) of the Management of emissions and hazardous activities code of the Logan Planning Scheme 2015 (Planning Scheme) provide assessment benchmarks relevant to hazardous chemicals. These assessment benchmarks are:

Table 3-2: Logan Planning Scheme – Relevant Performance and Acceptable Outcomes

Hazardous Chemicals	
PO5 Buildings containing fire-risk hazardous chemicals are designed to detect the early stages of a fire situation and notify a designated person.	**AO5** Buildings containing fire-risk hazardous chemicals are provided with 24 hour monitored fire detection system for early detection of a fire event.
PO6 Aboveground storage areas containing hazardous chemicals and fuels are designed with spill containment systems.	**AO6** Bunded areas for the storage of hazardous chemicals and fuels are provided: a. in a separate enclosed area with an impervious floor; b. of a capacity at least 100 percent of the capacity of the largest tank or package plus 25 percent of the combined capacity; c. covered by sufficient roofing to prevent the egress of rainwater entering the bunded area if the storage area is outside.

As demonstrated below, the proposed development complies with the assessment benchmarks.

PO5: Buildings containing fire-risk hazardous chemicals are designed to detect the early stages of a fire situation and notify a designated person.

The building design will include an automatic wet pipe fire sprinkler system in accordance with relevant Australian Standards. The main system for fire detection would be staff on the Site as they would be able to quickly detect any chemical leaks which may lead to an increased fire risk via visual or odour recognition. Once such situations are detected, appropriate first response action would be taken.

Adequately trained and experienced personnel would be always located on-site during operating hours. These personnel would be formed into emergency fire fighting teams and would be the first fire fighting response before the fire brigade arrived on-site. In the event of a fire incident, the Queensland Fire Department would be notified and would be called to the site to ensure the fire is extinguished. Smoke detectors would be fitted to all office and administration areas.

PO6: Aboveground storage areas containing hazardous chemicals and fuels are designed with spill containment systems.

The flammable liquids are to be stored in a separate enclosed area with an impervious floor, with bunding around the racks where these dangerous goods products would be stored. Bunding is not needed for aerosols or flammable solid.

Bunding of the building is required based on the following containment volume being required:

- 100% of the largest package i.e. 1,000 L
- 25% of the combined capacity of 3,000 L i.e. 750 L

Minimum height of bunding is 100 mm. The floor area to be bunded is approximately 60 square metres. The total volume of bunding within the Class 3 bunded area is 6m^3. The bunding capacity is sufficient for 100 percent of the capacity of the largest tank plus 25 percent of the combined capacity. This meets the provisions of AO6 in the Logan Planning Scheme 2015.

The site's stormwater system includes a detention tank. This tank will be fitted with a valve which can be closed in the event of an emergency, to prevent fire water runoff from being discharged to the adjoining public stormwater infrastructure.

3.3 WORK HEALTH AND SAFETY REGULATION 2011

The proposed storage quantities have been assessed against Schedule 15 of the Work Health and Safety Regulation 2011, the thresholds for hazardous chemicals at major hazard facilities:

DG Class	DG Description	Packing Group	Goods Description	Schedule 15 Threshold Quantity (kg)	10% of Schedule 15 Threshold Quantity (kg)	Anticipated Maximum Quantity (kg)
1.4	Explosives		Fireworks, party poppers, sparklers, caps	n/a	n/a	490
2.1	Flammable Gases	n/a	Insect Sprays, deodorants, air fresheners, WD40, oil spray, tyre spray, lighters	200,000	20,000	12,453
2.2	Non - Flammable Gases	n/a	Crazy string	n/a	n/a	27

3	Flammable Liquids	II, III	Methylated spirits, mineral turpentine, liquid paper, adhesives	50,000	5,000	2,981
4.1	Flammable Solids	II	Moth balls, firelighters	n/a	n/a	1,242
9	Miscellaneous Goods	II, III	Lithium batteries	n/a	n/a	-

The site does not exceed the threshold quantities of dangerous goods under Schedule 15 of the Work Health and Safety Regulation 2011, and is therefore not a Major Hazard Facility (MHF). The site also does not exceed 10% of the Schedule 15 chemicals listed in the Work Health and Safety Regulation 2011 and therefore is not a Hazardous Chemical Facility.

4. HAZARD IDENTIFICATION

Due the absence of equivalent guidelines in Queensland and Logan City Council regulations, the hazardous industry planning advisory papers (HIPAP) published by the NSW Department of Planning, were used as a suitable published benchmark, as recommended by Workplace Health and Safety Queensland in the *Model Planning Scheme Development Code for Hazardous Industries and Chemicals*.

The HIPAP guidelines outline rely on a systematic and analytical approach to the identification and analysis of hazards and the quantification of off-site risks to assess risk tolerability and land use safety implications. The Department of Planning has advocated a merit-based approach, the level and extent of analysis must be appropriate to the hazards present and therefore, need only progress to the extent necessary for the particular case.

4.1 METHODOLOGY

The procedures adopted by this study for assessing hazardous impacts involve the following steps:

Step 1: Hazard identification;
Step 2: Hazard analysis (consequence and probability estimations); and
Step 3: Risk evaluation and assessment against specific criteria.

The following sections of the report discuss the hazard identification and analysis process as prescribed by the Department of Planning in its document entitled *Hazardous Industry Planning Advisory Paper No 6 – Guidelines for Hazard Analysis* (DUAP 1992).

4.2 HAZARD IDENTIFICATION

This is the first step in the risk assessment. It involves the identification of all theoretically possible hazardous events as the basis for further quantification and analysis. This does not in any way imply that the hazard identified or its theoretically possible impact will occur in practice. Essentially, it identifies the particular characteristics and nature of hazards to be further evaluated in order to quantify potential risks.

To identify hazards, a survey of operations was carried out to isolate the events which are outside normal operating conditions and which have the potential to impact outside the boundaries of the Site. In accordance with HIPAP 6, these events do not include occurrences that are a normal part of the operation cycles of the Site but rather the atypical and abnormal, such as the occurrence of a significant liquid spill during product transfer operations.

4.3 HAZARD ANALYSIS

After a review of the events identified in the hazard identification stage and the prevention/protection measures incorporated into the design of the Site, any events which are considered to have the potential to result in impacts off-site or which have the potential to escalate to larger incidents are carried to the next stage of analysis.

4.3.1 Consequence Estimation

This aspect involves the analysis and modelling of the credible events carried forward from the hazard identification process in order to quantify their impacts outside the boundaries of the Site. In this case these events typically include fire and the potential effects on people and/or damage to property.

4.3.2 Probability Likelihood Estimation

Where necessary, the likelihood of incidents quantified as a result of this hazard assessment are determined by adopting probability and likelihood factors derived from published data.

4.3.3 Risk Evaluation and Assessment

The risk analysis includes the consequences of each hazardous event and the frequencies of each initiating failure. The results of consequence calculations together with the probabilities and likelihood's estimated are then compared against the accepted criteria, as specified by Department of Planning risk criteria applicable for the site. Whether it is considered necessary to conduct the predictions would depend on the probabilities and likelihoods estimated and if the risk criteria are exceeded. The consequence and likelihood matrix utilised in this assessment is provided in Table 4-1. Consequence definitions are provided in Table 4-2.

Table 4-1: Modified Consequence and Likelihood Matrix for Qualitative Analysis

Frequent >1/yr	II	II	I	I	I	I
Probable $>10^{-1}$ to 1/yr	III	II	II	I	I	I
Possible $>10^{-2}$ to 10^{-1}/yr	III	III	II	II	I	I
Unlikely $>10^{-4}$ to 10^{-2}/yr	III	III	III	III	II	I
Very Unlikely $>10^{-6}$ to 10^{-4}/yr	III	III	III	III	III	II
Extremely Unlikely $<=10^{-6}$/yr	III	III	III	III	III	III
Likelihood						

Consequence	Minor	Significant	Severe	Serious	Extremely Serious	Catastrophic

Note: This matrix is a modified version of the qualitative analysis matrix published in the Australian/New Zealand Standard 31000:2009 – “*Risk Management*”.

Region **I** High, synonymous to the Intolerable Region as per HIPAP

Region **II** Medium Risk, or beginning of ALARP or As Low As Reasonably Practicable as per HIPAP

Region **III** Low, synonymous to Negligible as per HIPA

Table 4-2: Matrix Based Assessment Consequence Definitions

	Minor	Significant	Severe	Serious	Extremely Serious	Catastrophic
Safety and Health	One minor injury, First Aid	Recordable or single MTI	Multiple MTI or one LTI	Permanent disability casualty or multiple LTI	Multiple permanent disabilities or one fatality	Multiple fatalities
Environment	Very minor pollution. No offsite escape of material (contained within the operational areas). On site nuisance value only.	Minor local pollution. Nuisance offsite effect, typically of short duration, e.g. noise, odours, dust and/or visible plumes for less than one hour.	Evident pollution, local concern. Minimal duration offsite effects (e.g. waterway slightly discoloured, turbid etc around the point of release with no or very few fish killed).	Significant local pollution. For example, waterways discoloured 10s of metres, fire or smoke affecting people near to the site.	Major local pollution. Observable offsite effect (e.g. waterways discoloured 10s to 100s of metres for a few weeks with a significant number of aquatic life adversely affected).	Extremely severe pollution. Ecosystems at high risk of destruction. Only resolved via long term solutions (potentially taking years).
Public Relations	Minor issue, one complaint	Local issue, 10 complaints	Local media, 100 complaints	Regional or state media	Wide media national coverage	Headlines, corporate damage
Financial Impact	<$25,000	$25,000 to $100,000	>$100,000 to $1 million	>$1 million to $20 million	>$20 million to $100 million	>$100 million

4.4 Assessment Criteria

The risk criteria applied by Department of Planning is published in their document *Hazardous Industry Planning Advisory Paper No 4 - Risk Criteria for Land Use Safety Planning* (DUAP 1992). The following is a general discussion of the criteria that is used to assess the risk of a development on the surrounding community and environment.

4.4.1 Individual Fatality Risk Levels

The following paragraphs are reproduced from HIPAP No. 4 relating to individual fatality risk levels:

> *"People in hospitals, children at school or old-aged people are more vulnerable to hazards and less able to take evasive action, if need be, relative to the average residential population. A lower risk than the one in a million criteria (applicable for residential areas) may be more appropriate for such cases. On the other hand, land uses such as commercial and open space do not involve continuous occupancy by the same people.*
>
> *The individual's occupancy of these areas is on an intermittent basis and the people present are generally mobile. As such, a higher level of risk (relative to the permanent housing occupancy exposure) may be tolerated. A higher level of risk still is generally considered acceptable in industrial areas"* (DUAP 1992).

The risk assessment criteria for individual fatality risk are presented below.

Table 4-3: Individual Fatality Risk Criteria

Land Use	Risk Criteria x 10^{-6}
Hospitals, schools, etc.	0.5
Residential	1
Commercial	5
Sporting and active open space	10
Industrial	50

4.4.2 Injury Risk Levels

Injury risk levels from advisory notes to interpreting *State Code 21: Hazardous chemical facilities*, states the following for heat of radiation.

- Incident heat flux radiation at areas outside the facility boundary shall not be exposed to heat radiation exceeding 4.7 kW/m^2, except industrial land use which should not exceed 12.6 kW/m^2, at frequencies of more than 50 chances in a million per year.
- Incident explosion overpressure at areas outside the facility boundary shall not be exposed to an overpressure greater than 7kPa, except industrial land use which shall not exceed 14 kPa, at frequencies of more than 50 chances in a million per year.

The requirements for toxic exposure are stated as follows:

- Toxic concentrations in residential areas should not exceed a level that would be seriously injurious to sensitive members of the community following a relatively short period of exposure at maximum frequency of 10 in a million per year.

- Toxic concentrations in residential areas should not cause irritation to the eyes or throat, coughing or other acute physiological responses in sensitive members of the community over a maximum frequency of 50 in a million per year.

Please note that a risk hazard assessment only examines events that are considered to have the potential for significant off-site consequences.

Based on correspondence with QLD Fire Department, heat flux should not exceed 3 kW/m^2 in areas required for fire fighter personal access by QLD Fire Department in the event of an incident.

4.4.3 Risk of Property Damage and Accident Propagation

HIPAP No. 4 indicates that siting of a hazardous installation must account for the potential for propagation of an accident causing a “domino” effect on adjoining premises. This risk would be expected within an industrial estate where siting of hazardous materials on one Site may potentially cause hazardous materials on an adjoining premises to further develop the size of the accident.

The criteria for risk to damage to property and of accident propagation are stated as follows:

- Incident heat flux at neighbouring potentially hazardous installations or at land zones to accommodate such installations should not exceed a risk of 50 in a million per year for the 23 kW/m^2 heat flux level.

- Incident explosion overpressure at neighbouring potentially hazardous installations, at land zoned to accommodate such installations or at nearest public buildings should not exceed a risk of 50 in a million per year for the 14 kPa explosion overpressure level.

4.4.3.1 Heat-Flux Radiation Criteria

Table 4-4: Consequences of Heat Radiation

Heat Radiation (kW/m^2)	Effect
1.2	Received from the sun at noon in summer
2.1	Minimum to cause pain after 1 minute
3	Based on correspondence with QLD Fire Department, heat flux should not exceed 3 kW/m^2 in areas required for fire fighter personal access by QLD Fire Department in the event of an incident
4.7	Will cause pain in 15–20 seconds and injury after 30 seconds’ exposure (at least second degree burns will occur)

Table 4-4: Consequences of Heat Radiation

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

4.4.3.2 Explosion Over-Pressure Criteria

Table 4-5: Consequences of Explosion Overpressure

Explosion Overpressure	Effect
3.5 kPa (0.5 psi)	• 90% glass breakage. • No fatality and very low probability of injury.
7 kPa (1 psi)	• Damage to internal partitions and joinery but can be repaired. • Probability of injury is 10%. No fatality.
14 kPa (2 psi)	• House uninhabitable and badly cracked.
21 kPa (3 psi)	• Reinforced structures distort. • Storage tanks fail. • 20% chance of fatality to a person in a building.
35 kPa (3 psi)	• House uninhabitable. • Wagons and plant items overturned. • Threshold of eardrum damage. • 50% chance of fatality for a person in a building and 15% chance of fatality for a person in the open.
70 kPa (10 psi)	• Threshold of lung damage. • 100% chance of fatality for a person in a building or in the open. • Complete demolition of houses.

4.5 HAZARD IDENTIFICATION CHARTS

Hazard Identification Charts have been prepared for the Warehouse based on operating scenarios that are relevant to the proposed development. Each chart consists of four columns:

Column 1
Heading: Functional/Operation Area
The area of the site involved with the potential event is listed

Column 2
Heading: Possible Initiating Event
The individual events that are considered to be likely or realistic are then listed. Where the possible consequences are similar the events are listed together, each one individually numbered.

Column 3
Heading: Possible Consequences
The outcomes of an event if it occurred are listed.

Column 4
Heading: Prevention/Protection Measures
The measures designed into the functional/operation area and the site are listed. These measures may include for example safeguards, design features, management methods and/or operator training.

Table 4-6: Event/Consequence Analysis Table

Functional/Operational Area	Possible Initiating Event	Possible Consequences	Prevention/Protection Measures
1. Flammable Liquid Storage Racks	1. Spill of limited quantity of liquids caused by a leak in a faulty or damaged packages. 2. Spill causes fire. 3. Packaging material ignites, due to arson or other fire. 4. Full scale warehouse fire.	1. Spill is immediately detected and cleaned up without incident. 2. Spillage escapes to stormwater. 3. Spilt flammable liquid is ignited. 4. Spilt flammable liquid forms explosive gas mixture, which finds source of ignition and results in fire or explosion. 5. Fully developed warehouse fire, with other containers spilling to fuel the fire. Heat radiation reaches other areas causing fire.	1. All storage areas of flammable liquids are in accordance with AS1940-2017 2. Strict control of ignition sources including a hot work permit system will operate. No smoking will be permitted in the Warehouse area. The whole of the Warehouse is designed as a Hazardous Area Zone 2 in accordance with AS2430-2004. Only forklift and electrical equipment rated for hazardous areas are used in the warehouse. 3. Flammable fume will be rapidly dispersed due to the large building space. 4. Building has fire sprinklers and foam hose reels. 5. Stored containers to be inspected and damaged containers removed from the stores. 6. Employees are in regular attendance of Warehouse and spill control action can be immediately implemented. 7. Warehouse is roofed and bunded to contain spillages to AS 1940-2017. 8. Procedures, facilities and absorbent materials for spillage control are maintained on site. 9. All employees working in the Warehouse are trained and experienced in the relevant procedures (eg. spill control procedures). 10. Product Packaging comply with specifications under the ADG code. 11. All employees provided with relevant personal protection equipment. 12. Buildings are locked when unattended. 13. Shelving systems and bunds are regularly inspected to ensure integrity 14. Emergency evacuation plan and emergency response plan involve adjoining warehouse occupants are implemented.

Table 4-6 (Cont.): Event/Consequence Analysis Table

Functional/Operational Area	Possible Initiating Event	Possible Consequences	Prevention/Protection Measures
2. Aerosol racks	1. Fire/heat radiation in Aerosol storage area. 2. Forklift accident causes damage to aerosol container. 3. Damaged or faulty aerosol container leaks causing release of flammable gas	1. Flammable gas finds ignition source causing an explosion. 2. Explosion ignites flammable materials in the Warehouse causing a fire. 3. Heat from fire in the Warehouse causes aerosol container to become projectiles. 4. Fire spreads to adjacent areas.	5. All storage areas of corrosive liquids would be in accordance with AS3780-2005 6. Aerosol cans are packed in cartons, secured on pallets and stored within a secure cage, preventing aerosols from becoming projectiles. Product Packaging comply with specifications under the ADG code. 7. Strict control of ignition sources including a hot work permit system will operate. No smoking will be permitted in the Warehouse area. The whole of the Warehouse would be designed as a Hazardous Area Zone 2 in accordance with AS2430-2004. Only forklift and electrical equipment rated for hazardous areas are used in the warehouse. 8. All employees trained in emergency response and evacuation procedures. 9. Fire services located in the vicinity of storage area. Factory building sprinkler system would adequately control the outbreak of a fire. 10. Building is compartmentalised minimising the potential for a fire to spread to adjacent areas. 11. Stored containers to be inspected and damaged containers removed from the stores. 12. Aerosols will be stored on the rack facing 240/240/240 fire wall. 13. Employees are in regular attendance of Warehouse and control action can be immediately implemented. Buildings are locked when unattended. 14. Flammable gas fume will be rapidly dispersed due to the large building space 15. Shelving systems and cages are regularly inspected to ensure integrity. 16. Emergency evacuation plan and emergency response plan involve adjoining warehouse occupants are implemented.

Table 4-6 (Cont.): Event/Consequence Analysis Table

Functional/Operational Area	Possible Initiating Event	Possible Consequences	Prevention/Protection Measures
3. Loading Dock Area	1. Packaging damage during product transfer	1. Spill of material. 2. Material escapes to stormwater. 3. Spilt material forms vapour. 4. Vapour impacts on employee's personal health and safety. 5. Material finds an ignition source resulting in a fire.	1. All product transfer operations are supervised by experienced operators trained in safe operating procedures. 2. No materials are stored in bulk. Maximum volume of packaging would be 10 L. 3. The site's stormwater system is fitted with a fire water retention dam, which will be closed in the emergency event. 4. Spill control equipment is provided near the loading dock area. Employees are in regular attendance to implement spill control procedures. 5. Strict control of ignition sources including a hot work permit system will operate. No smoking will be permitted in the loading dock area. 6. Fire services are located near the loading dock area. 7. Emergency evacuation plan and emergency response plan involve adjoining warehouse occupants are implemented.
4. Explosives (Class 1.4)	1. Fireworks ignited due to mishandling 2. Ignition from accidental drop	1. Small explosion, localized damage 2. Ignition of nearby materials leading to fire	1. Stored per AS2187 2. Strict handling protocols 3. Isolated storage location 4. Firefighting equipment nearby

Table 4-6 (Cont.): Event/Consequence Analysis Table

Functional/Operational Area	Possible Initiating Event	Possible Consequences	Prevention/Protection Measures
5. **Flammable Solids (Class 4.1)**	1. Spill from damaged containers 2. Solids catch fire	1. Fire localized to area 2. Escalation to other flammable goods	1. Solids stored per AS/NZS 5026 2. Fire suppression systems 3. Regular container inspections
6. **Lithium Batteries (Class 9)**	1. Battery short circuit 2. Battery ignites	1. Fire starts in battery storage 2. Fire spreads to adjacent areas	1. Stored per UN3480/81 guidelines 2. Temperature monitoring systems 3. Fire-resistant storage areas

4.6 HAZARDS IDENTIFIED FOR FURTHER ANALYSIS

Following a review of the Hazard Identification Charts in Section 4.5, a series of potentially hazardous events or scenarios were considered to require a comprehensive qualitative analysis. Each event or scenario is discussed in detail and the need for further quantitative analysis considered.

The following hazards are identified for further analysis:

- Major Flammable Liquid Pool Fire;
- Flammable Gas Leak from Aerosol Cans.

Detailed consequence and frequency estimations will be provided for these events if the initial risk screening its consequences show an elevated societal risk.

5. CONSEQUENCE AND FREQUENCY ESTIMATIONS

The consequences of an accident involving a particular hazardous substance depends on the type and quantity of hazardous substance, the type of activity using the substance as well as the exposed population.

5.1 RISK CLASSIFICATION AND PRIORITISATION

The Department of Planning document Multi-Level Risk Assessment (DUAP 1997) outlines a method of risk classification and prioritisation to assist in assessment of risk. The technique is based on the Manual for classification of risks due to major accidents in process and related industries (IAEA, 1993). The IAEA method was developed to produce a broad estimate of the risks due to major accidents from the manufacture, storage, handling and transport of hazardous materials. The technique involves three stages:

- Estimation of the consequences of a major accident;
- Estimation of the probability of a major accident happening; and
- Estimation of societal risk.

5.1.1 Estimation of Consequence of a Major Accident

The consequences of a major accident depend on the type of substance and activity and the quantity involved, as well as the exposed population. After excluding those substances and activities, which neither present a significant off-site risk nor could potentially affect adjacent inventories, the following steps are undertaken:

- Classify the activity;
- Estimate the effect distance and area;
- Estimate the population distribution; and
- Consider Mitigation Correction Factors, which takes into account possible mitigatory actions that people could take, such as evacuation and sheltering.

An estimate of the external consequences of a major accident may be calculated using these factors.

5.1.2 Estimation of Probability of a Major Accident Happening

The method used for estimating probability is based on probability numbers related to the type of installation and hazardous substance used, together with the following probability correction factors:

- Frequency of loading/unloading operations;
- Provision of safety systems associated with the storage and handling of flammable substances;
- A quantitative assessment of the management and safety levels of the organisation; and
- A quantitative assessment of the wind direction towards a populated area.

An estimate of the probability of a major accident may be calculated using these factors.

5.1.3 Estimation of Societal Risk

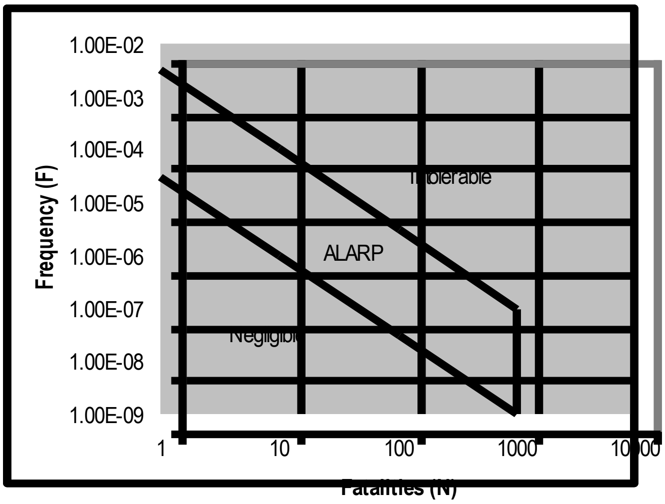
At this stage, pairs of numbers have been calculated for each activity, comprising the number of fatalities per accident and expected frequency of the accident. The results may be transferred to a plot of frequency verses consequence (F-N curve) and a direct estimate of societal risk can be determined. The F-N curve is divided into three regions:

- Negligible - accidents are not considered to have significant off-site consequences;
- ALARP - while risk of an accident may be tolerable, steps should be taken to reduce the risk level to as low as reasonably possible (ALARP); and
- Intolerable - risk of an accident with the potential for significant off-site consequences is unacceptable.

The Department of Planning is currently refining this approach as it is seen as a complex one, which does not lend itself to easy implementation and may not be possible in practice. Therefore, the Department suggests that judgements on societal risk be made on the basis of qualitative approach on the merit of each case rather than on specifically set numerical values.

The F-N curve used to classify societal risk is shown in Figure 5-1.

Figure 5-1: IAEA F-N Curve



a) The quantity of aerosols stored is approx. 12 tonne. (432 T) is classified as CII (reference 13) from IAEA Table IV(A).

b) IAEA Table V for a Classification of Substance by Effect Category CII shows a maximum distance of 50-100 m with an effect area category of 1.5 hectare.

c) As noted previously, the Site is located in an industrial area. From IAEA Table VI, the population density is conservatively estimated to be d = 40 persons/hectare.

d) The circular area of 1.5 hectare from the warehouse would not include residential area, hence the populated fraction of circular area would be close to zero. However, to be conservative and to account for on site employees, 20% population fraction was chosen and from IAEA Table VII the Population Correction Factor is $f_A = 0.2$.

e) IAEA Table VIII for Flammables (13) gives a correction factor for mitigation, which takes into account possible mitigatory actions that people may take, such as evacuating and sheltering. For flammable substances the Mitigation Factor is $f_m = 0.1$.

f) The external consequences are, as per clause A2.4.5 is the following.

$$C_{a,s} = A * d * f_A * f_m = 1.5 * 40 * 0.2 * 0.1 = 1.2 \text{ fatalities/accident}$$

Following is a summary of the probability calculation.

(i) IAEA Table IX shows that for Flammable Gases (reference No 13) the Average Probability Number ($N^*_{I,S}$) for storage activity is 4.

(ii) A conservative assumption of 200 – 500 loading/unloading per year was chosen and from IAEA Table X(A) $N_L = -1.5$.

(iii) IAEA Table XI shows that three probability correction factors apply, fire wall protection, sprinkler system and the quantity of >500 cylinders stored. Given these conditions, $N_F = 1 + 0.5 – 1 = 0.5$.

(iv) IAEA Table XII shows that for an Average Industry Practice an organisation's safety correction factor of $N_O = 0$ will be used.

(v) IAEA Table XIII shows a wind direction factor of $N_P = 0$ will be used as a conservative approach.

(vi) The Probability Number as per clause A2.5 is calculated as follows:

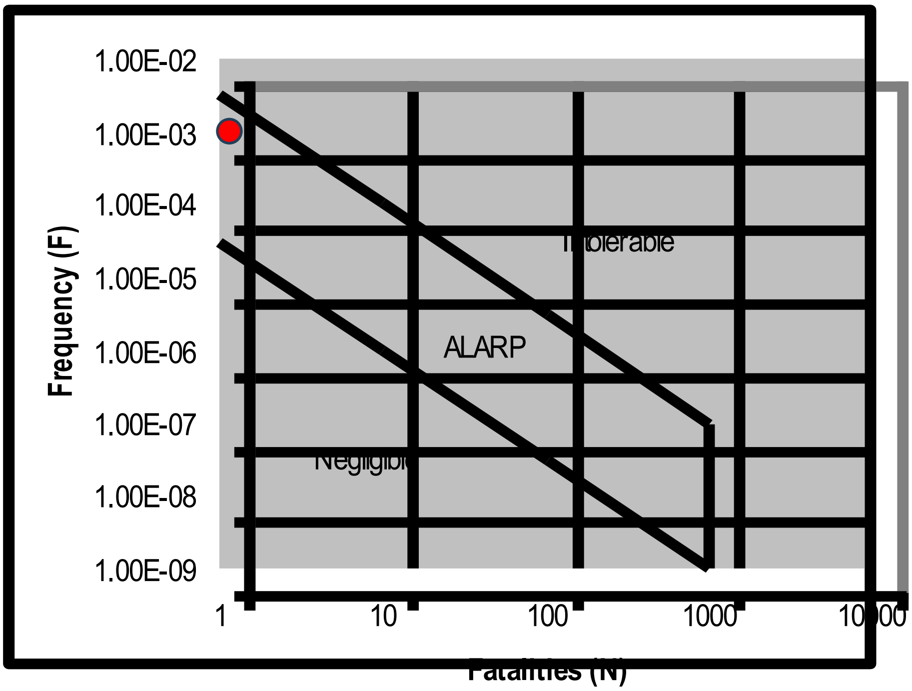
$$N_{I,S} = N^*_{I,S} + N_L + N_F + N_O + N_P = 4 – 1.50 + 0.5 + 0 + 0 = 3$$

(vii) IAEA Table XIV converts this to a frequency of $P = 1x10^{-3}$ accidents/year.

5.1.3.1 Cumulative Frequency – Fatalities Curve

The cumulative fatalities and cumulative probability of a major accident occurring is plotted in the F-N curve. The probability of a major accident occurring, which could result in 1.2 or less fatalities per accident is 1 event in 1,000 years. This falls under the ALARP zone which means that while risk of an accident may be tolerable, steps should be taken to reduce the risk level to as low as reasonably possible. Given the quantity of dangerous goods stored on site, detailed consequence estimations were conducted for major hazards identified previously.

Figure 5-2: Cumulative F - N Curve



5.2 Fire in DG Store

A fire event involving the entire DG store was modelled using TNO Effects 7.6.0 safety software as a confined pool fire.

The following table presents the potential fire scenarios and assumptions used.

Table 5-1: Heat of Radiation Pool Fire Scenarios

Scenario	Location	Description	Pool Size	Quantity	Representative Chemical Used
Scenario 1	DG Store	Flammable Liquid Storage Fire	325 sqm	2,981 kg	Gasoline

Figure 5-3: Heat of Radiation vs Distance

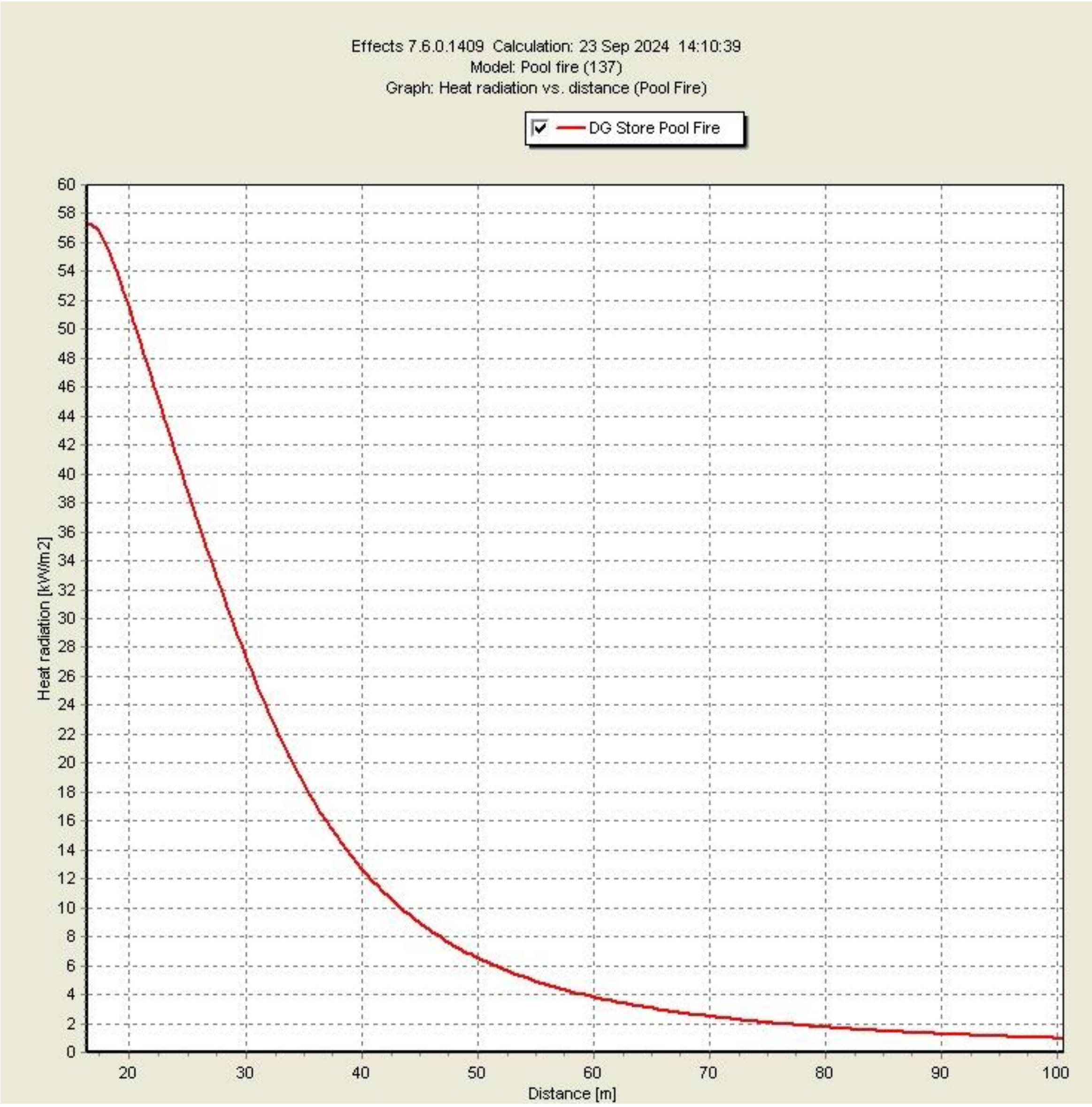
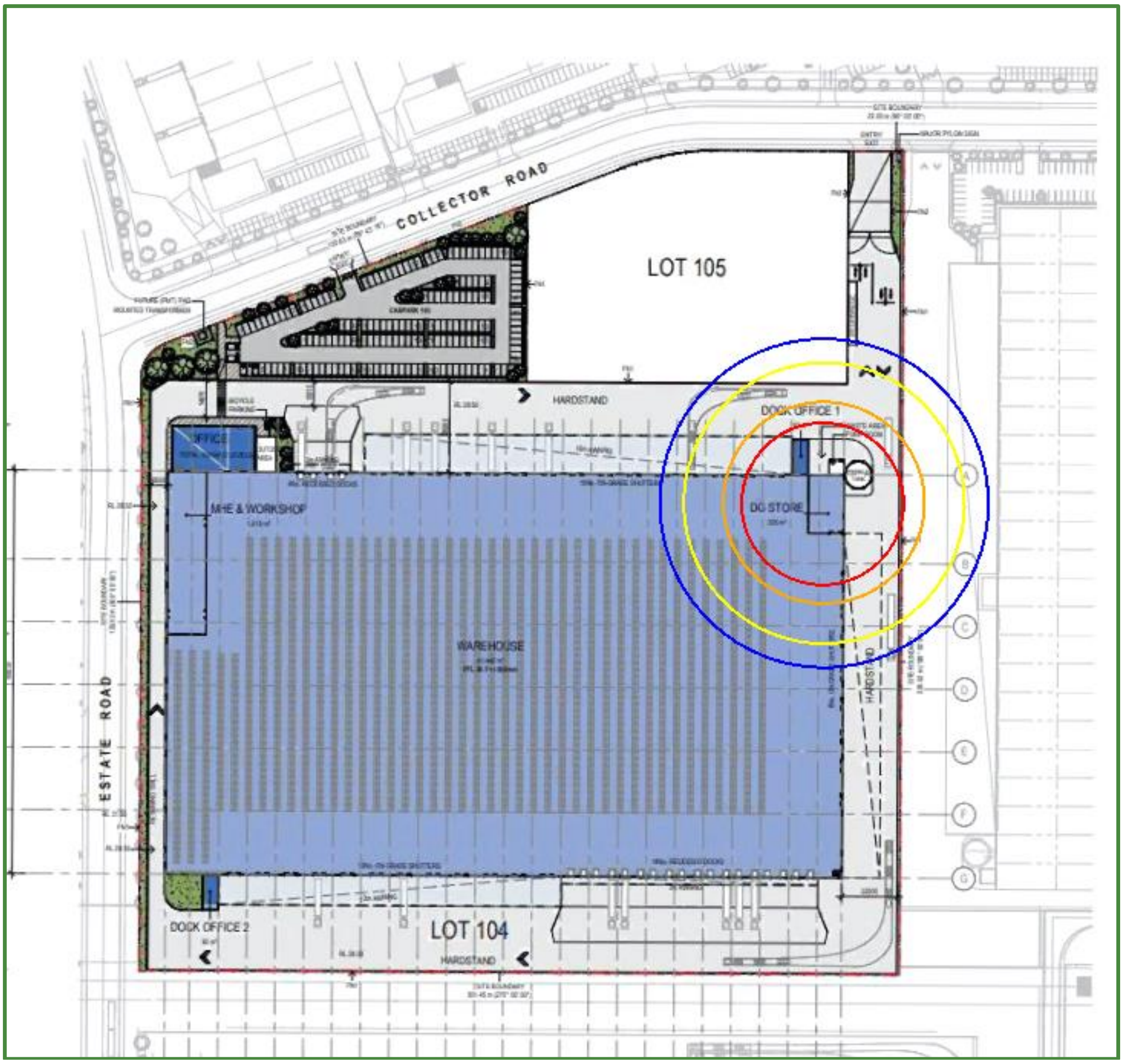


Table 5-2: Heat of Radiation vs Distance

Heat of Radiation	Scenario 1 – Distance (m)
3 kW/m^2	65.4
4.7 kW/m^2	55.9
12.6 kW/m^2	40.1
23.0 kW/m^2	32.3

The figures below shows the heat radiation contours for all the intensities listed in the table above. These contours are not adjusted for the presence of building walls and doorways.

Figure 5-4: Heat Radiation Contours - Scenario 1 - Flammable Liquid Fire



Note: Blue: 3 kW/m^2; Yellow: 4.7 kW/m^2; Orange: 12.6 kW/m^2; Red: 23.0 kW/m^2

The data on Scenario 1 shows that the heat flux levels with 3 kw/m^2 radiant heat flux extends to 65.4 meters, towards the external awning of the adjoining property. Any potential structural damage and heat radiation exposure to the adjoining property will be mitigated with the implementation of fire rated walls in the proposed warehouse.

5.3 FLAMMABLE GAS LEAK FROM AEROSOL CANS

Hydrocarbon mixture of flammable propane and butane gases is commonly used as propellant, which contributes up to 30% of aerosol product weight. The product weight of a can ranges from 150 g to 300 g.

A flash fire could occur when a cloud of flammable gas mixed with air is ignited. Combustion of a flammable gas and air mixture occurs if the composition of the mixture lies in the flammable range and if the conditions exist for ignition. A flammable gas burns in air only over a limited range of composition. Below the Lower Explosive Limit (LEL) the mixture is too lean to cause fire. Butane is selected as the propellant as it has the highest combustion energy from the typical components found aerosol products. The volume ratio of Butane to air at LEL is 1.8.

In calculating the consequences of a vapour cloud forming from a leak from aerosol can it was conservatively assumed that all Butane vapour from a 300 g aerosol can would be continuously released until it is empty. Butane vapour will then uniformly mixed with air, filling the entire warehouse before it found a source of ignition.

For a pallet of leaking aerosol cans, the amount of Butane vapour released in the air would be approximately

$$M = 960 \text{ cans/pallet} \times 300 \text{ g/can} \times 0.30 = 86{,}400 \text{ g}$$

Applying ideal gas equation for Butane gas at Standard Temperature Pressure, the volume of gas released can be calculated:

$$PV = nRT$$

$$V = \frac{(86{,}400g)(8.314)(298K)}{(58.1g/mol)(101325Pa)} = 36m^3$$

where: P = pressure (Pa), V = volume (m^3), n = number of moles (mol), R = universal gas constant and T = temperature (K)

The volume of air filling up the entire warehouse would be in excess of 120,000 m^3. Therefore, the volume ratio of Butane to air is 3×10^{-4}. To reach a LEL of 1.8, at least 5,600 pallets of cans should leak at the same time. There would only be 1,500 pallets of aerosol cans stored in the warehouse and they would be leak tested by the product manufacturer prior to dispatch, limiting the probability of leak during storage. The warehouse will also be ventilated which would further dilute the concentration of flammable gas in the air. Therefore, the event of a major flammable gas leak from aerosol cans leading to a fire would not be considered as a credible event.

6. ENVIRONMENTAL SAFEGUARD PROCEDURES

The proposed design and operation of the facility would include environmental safeguards to provide sufficient protection to the site such that if a pollution incident occurred, there would be minimal impact to the natural environment or nuisance caused to the amenity of adjacent occupiers of neighbouring premises.

These safeguards would enable the majority of the untoward events associated with storage, handling and process operations to be contained avoiding pollution incidents or off-site hazards. This section of the report provides a summary of these environmental safeguards.

All of the procedures and environmental safeguards outlined would be implemented as part of the site's operational activities.

As evaluated in Section 5, the consequences of fire due to major spill can be limited by implementing appropriate spill control procedure and hazardous zoning. From the calculation, spill of flammable liquids larger than 2,000 kg should be considered as an emergency situation where power disconnection and site evacuation procedure need to be undertaken during clean up. If required, fire brigade should be brought on site to ensure appropriate spill clean up and to provide immediate action in the event of fire initiation. This condition would be incorporated in the appropriate procedures.

Procedures would be prepared for the following:

- Identification of flammable and combustible liquids;
- Storage and handling of flammable and combustible liquids;
- Use of fire fighting equipment;
- Safe forklift operating procedure;
- Use of static earth straps;
- Safety inspections;
- Spill Procedure;
- General emergency procedures;
- Fire and explosion emergency procedures;
- Evacuation procedure; and
- Medical emergency procedure.

As part of these procedures it is essential that hardware is provided on-site in close proximity to the dangerous good storage areas. This would include:

- Means of isolating a spill would be held in designated areas and clearly signposted;
- Flammable and combustible liquid storage areas within the dangerous goods store (containment area 325sqm).
- A manual isolation valve is located on the stormwater system that will enable a spill on the site to be isolated from the stormwater system as a result of an emergency;
- Fire protection would rely heavily on the use of a foam induction system available for the hose reels;
- Site will be bunded to contain at least 90 minutes of fire fighting water;

- Location of dangerous goods to assist in reducing the hazard to fire fighters and to maximise the ability to control fires;
- Site declared non-smoking areas and clearly signposted;
- Signposting of each depot includes the Hazchem sign, depot number, and necessary warning signs and location of the spill control kits; and
- It is recommended that the fire manifest be updated and located at the entrance to the general office. The manifest is now usual practice and aids the fire brigades by providing the following information:
  - Manifest plan;
  - Contents of each depot;
  - Material Safety Data Sheets; and
  - Products stored in each depot.

6.1 ENVIRONMENTAL MANAGEMENT PROCEDURES

The following environmental management safeguards would be in use on Site. Some of the procedures also achieve safety objectives:

- Spill Control Procedure;
- Use of Chemical Spill Kits;
- Site Isolation from Stormwater;
- Use of Stormwater Isolation Valve;
- Ventilation of Work Areas;
- Reporting Environmental Incident;
- Preventative Maintenance on Environmental Management Equipment;
- Fire Management;
- Emergency Response Procedure; and
- Emergency Evacuation Procedure.

As part of these procedure essential hardware would be provided on-site in close proximity to the appropriate areas.

7. CONCLUSIONS

The Preliminary Hazard Analysis has found that the operation of the proposed development meets with Australian Standards and the requirements of the Logan Planning Scheme 2015 and Work Health and Safety Regulation 2011. The proposed development also satisfies the criteria laid down in HIPAP 4 *Risk Criteria for Land Use Safety Planning* and would not cause any risk, significant or minor, to the community.

It is the conclusion of this assessment that the proposed site and its operations would meet all the safety requirements. The proposed additions would not be an offensive or hazardous development.

This concludes the PHA.

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8. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use of CH Hydrangea Pty Ltd, as per our agreement for providing environmental services. Only CH Hydrangea Pty Ltd is entitled to rely upon the findings in the report within the scope of work described in this report. Otherwise, no responsibility is accepted for the use of any part of the report by another in any other context or for any other purpose.

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