MENDHAM CONSULTANTS
Safety, Risk and Reliability Engineers

Woolworths Distribution Centre – Moorebank Logistics Park

State Environmental Planning Policy No.33 - SEPP33 – Screening Test and Preliminary Hazard Analysis Report

Woolworths Ltd.
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Woolworths Ltd.

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Quality Management

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Issue 1 / Rev 0	1/4/20	Initial SEPP33 Screening Test	Frank Mendham PhD RPEQ	
Issue 1 / Rev 1	22/5/20	SEPP33 PHA	Frank Mendham PhD RPEQ	
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Issue 1 / Rev 3	21/06/20	SEPP33 PHA	Frank Mendham PhD RPEQ	
Issue 1 / Rev 4	26/06/20	SEPP33 PHA	Frank Mendham PhD RPEQ	

Table of Contents

Abbreviation	Description
ADG	Australian Dangerous Goods Code
AS	Australian Standard
DA	Development Application
DGs	Dangerous Goods
DGS	Dangerous Goods Store
DPE	Department of Planning and Environment
ESFR	Early Suppression Fast Response sprinklers
FRNSW	Fire and Rescue New South Wales
HIPAP	Hazardous Industry Planning Advisory Paper
LPG	Liquefied Petroleum Gas
PHA	Preliminary Hazard Analysis
RDC	Retail Distribution Centre
SEP	Surface Emissive Power
SEPP	State Environmental Planning Policy

Executive Summary

Background

This report provides advice in relation to regulatory required assessment of a proposed retail distribution centre for its classification as a hazardous development.

Woolworths Ltd. propose to develop a new Retail Distribution Centre within the Moorebank Logistics Park located 35 kilometres (South West) from the Sydney Central Business District. Project JANUS will comprise two (2) sections of retail distribution, both of which will store and handle retail commodities of a wide and varied range. Some of these commodities include small volume individual packages of hazardous chemicals, however in significant quantities.

Additionally, combustible liquid (diesel fuel) and LPG storage is provided at the JANUS site for refuelling of picking equipment, such as forklifts and as standby generator fuel.

Regulatory Assessment

NSW Government advises that SEPP 33 presents a systematic approach to planning and assessing proposals for potentially hazardous and offensive development for the purpose of industry or storage.

Through the policy, the permissibility of a proposal to which the policy applies is linked to its safety and pollution control performance. While SEPP 33 is an enabling instrument, that is, it allows for the development of industry, it also aims to ensure that the merits of proposals are properly assessed in relation to off-site risk and offence before being determined.

By providing for merit-based assessment, the policy overcomes the limitations of previous definitions in which a use was considered hazardous or offensive on the basis of a particular type of industry, in isolation. The merit based SEPP33 approach ensures that locational and design considerations are an integral part of the assessment process.

SEPP 33 ensures that only those proposals which are suitably located, and able to demonstrate that they can be built and operated with an adequate level of safety and pollution control, can proceed.

SEPP33 requires a Screening Test to be undertaken, typically followed by a Preliminary Hazard Analysis. There are three (3) possible levels of Preliminary Hazard Analysis, with the level dependent on the hazard level identified in the Screening Test. Level 2 PHA assessment methodology has been followed utilising a semi quantitative methodology.

This report addresses both the SEPP33 Screening Test (Part 1 of this report) for the Woolworths JANUS Distribution centre project, which was undertaken by Mendham Consultants Pty Ltd in February and March 2020 with a subsequent Preliminary Hazard Analysis (PHA) undertaken (Part 2 of this report), required as an outcome of Part 1.

Part 1: Screening Test

Transportation of Dangerous Goods SEPP33 Screening Test Result:

The findings of the Screening Test indicated that a significantly large number of small volume transportations of dangerous goods occur per week as is expected of a large retail distribution centre servicing up to 266 retail stores per day. It is recommended that this is not a significant risk as the results of the SEPP33 Transportation Threshold screening test indicate (Refer Screening Test Results).

Storage of Dangerous Goods SEPP33 Screening Test Result:

SEPP33 Screening Tests were applied to the proposed dangerous goods storage quantities at the Woolworths JANUS Distribution Centre Development located at the Moorebank Logistics Park.

The screening Tests indicated that only Class 2.1 Liquified Gas (Aerosols) exceeded the screening test thresholds (Refer Screening Test Results) requiring a Preliminary Hazard Analysis to justify its storage in the proposed (worst case – closest to neighbouring boundary) location.

Part 2: Preliminary Hazard Analysis

The initial SEPP33 screening test indicated potential hazardous development due to an aerosol storage fire and possible radiant heat effects at the nearest boundary, triggering the requirement for a Preliminary Hazard Analysis.

In terms of the consequence of a hazardous incident occurring at the proposed Woolworths JANUS Distribution Centre subsequently affecting undeveloped neighbouring industrial zoned space, two (2) potential incident sources were taken forward from an initial hazard identification analysis for further review.

These incidents included: -

1. A fully developed fire associated with the Dangerous Goods Package Store (Special Goods Store) involving failure of the AS1940 compliant non-fire rated roof with subsequent fire and smoke plume emanating from the roof opening; and

2. A fully developed fire associated with the Aerosol Store involving failure of the non-fire rated roof with a subsequent fire and smoke plume emanating from the roof opening.

The identified hazard for both scenarios was radiant heat, as the potential for explosion was considered very low due to the small size of individual retail packages in each store and the robustness of store construction. Toxic release was considered atypical due to the non-storage of toxic hazardous chemicals in each location.

Point source radiant heat analysis indicated for both scenarios that the level estimated at nearest boundaries was well below 4.7kw/m^2, so neither injury risk nor property damage risk exceeded industry accepted thresholds

The likelihood of the hazardous incidents occurring was also estimated as very low, a probability of occurrence in the order of $2.54x10^{-6}$.

Mitigations that support the low probability of a fully developed fire occurring include:-

1. Robust fire rated package store design based on applicable Australian Standards (AS/NZS 3833, AS1940);
2. Early Suppression Fast Response Sprinklers (ESFR) designed for fire extinguishment rather than control of fire spread to FM Global Standards;
3. In-Rack Sprinkler protection to FM Global Standards;
4. Separation and segregation of dangerous goods in accordance with AS/NZS 3833;
5. Hazardous Area Classification in accordance with AS/NZS 60079.10.1.

As noted previously, SEPP 33 is an enabling instrument, allowing for the development of industry, it also aims to ensure that the merits of proposals are properly assessed in relation to off-site risk and offence before being determined. Additionally, the SEPP 33 process allows a merit-based approach beyond initial screening tests, ensuring that locational and design considerations are an integral part of the assessment process by using a PHA process to facilitate the analysis undertaken. Consent Condition B176, perhaps unintentionally, restricts the proper application of SEPP33 in the subject JANUS development case. For this reason, it is recommended, that Consent Condition B176 be amended to suit the following, with respect to the intent of the enabling the complete application of SEPP33:

> "Should the total quantities of dangerous goods present at any time within the development and transport movements to and from the development exceed the screening threshold quantities and movements listed in the Department's Hazardous and Offensive Development guidelines *Applying SEPP 33 (January 2011),* a Preliminary Hazard Analysis must be provided to demonstrate compliance can be achieved with the requirements of SEPP 33."

Based on the PHA results, it is recommended that the proposed JANUS Distribution Centre development is <u>not</u> considered potentially hazardous.

1.0 Background

1.1 Woolworths JANUS

Woolworths Ltd. propose to develop a new Retail Distribution Centre (RDC) within the Moorebank Logistics Park located 35 kilometres (South West) from the Sydney Central Business District.

The precinct has the capacity to transport up to 1.05 million TEU (twenty-foot equivalent units) a year of Import- Export freight and another 0.5 million TEU of interstate freight per year.

Moorebank Logistics Park will have 850,000 sqm of high specification warehousing, as well as auxiliary services including retail and service offerings.

A rail connection to the Southern Sydney Freight Line (SSFL) is being constructed which has direct access to the site, while the M5 and M7 arterial roads are nearby.

Woolworths' Project JANUS will comprise two (2) sections of retail distribution, both of which will store and handle retail commodities of a wide and varied range. Some of these commodities include small volume individual packages of hazardous chemicals, however in significant quantities.

Additionally, combustible liquid (diesel fuel) and LPG storage is provided at the JANUS site for refuelling of picking equipment, such as forklifts and as standby generator fuel.

The approximate location of the Moorebank Logistics Park is shown below in Figure 1.

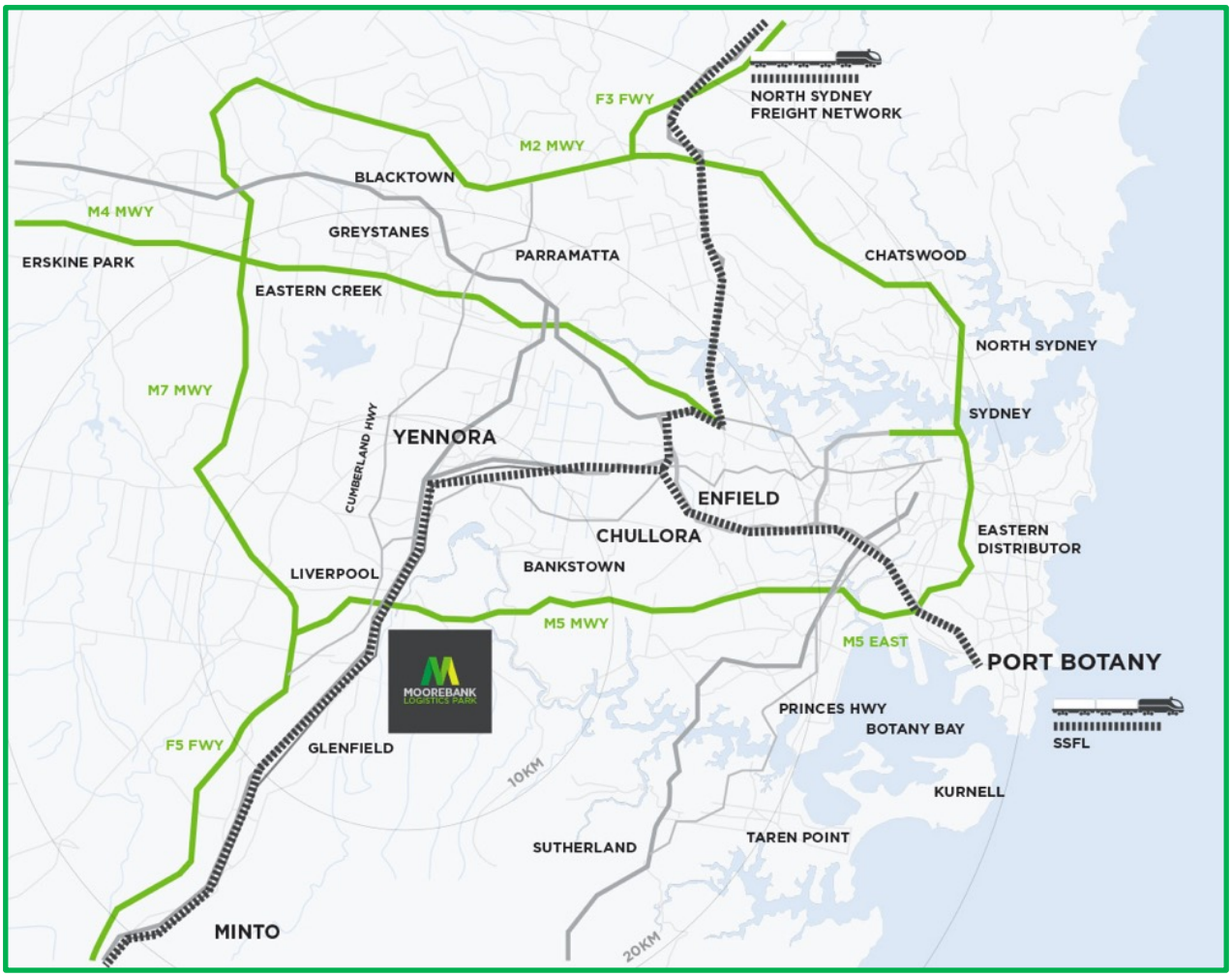


Figure 1.1: Moorebank Logistics Park Location

2.0 Regulatory Framework

2.1 SEPP33 Requirements

State Environmental Planning Policy No.33 (SEPP33) 'Hazardous and Offensive Development' [1] sets out to: -

1. Amend the definitions of hazardous and offensive industries where used in environmental planning instruments; and
2. Render ineffective a provision of any environmental planning instrument that prohibits development for the purpose of a storage facility on the ground that the facility is hazardous or offensive if it is not a hazardous or offensive storage establishment as defined in the policy; and
3. Ensure that in determining whether a development is a hazardous or offensive industry, any measures proposed to be employed to reduce the impact of the development are taken into account; and
4. Ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact.

2.2 Objectives

The objectives of the subject assessment are as follows: -

1. Implement a Screening Test and the potentially required Preliminary Hazard Analysis (PHA) in accordance with:
    a. Hazardous Industry Planning Advisory Paper (HIPAP) No.6 – Hazard Analysis [2]; and
    b. Assessment Guideline – Multi Level Risk Assessment [3] .
2. Assess the PHA results using the criteria in HIPAP No. 4 – Risk Criteria for Land Use Planning [4];
3. The demonstration of regulatory compliance with:
    a. Work Health and Safety Regulation (NSW) 2017 [5]; and
    b. Environmental Planning and Assessment Act 1979 [6] .

2.3 Consent Authority Consideration

The Consent Authority must decide whether a SEPP33 [1] applies to a development proposal, however for the purposes of SEPP 33 [1], a hazardous storage establishment is included in the definition of potentially hazardous industry. Similarly, an offensive storage establishment is included in the definition of potentially offensive industry.

This means that a storage development is considered 'industry' for the purposes of applying the SEPP 33 tests, even if the development is non-industrial. An example may be a storage facility associated with the distribution of flammable, corrosive or toxic substances for retail or wholesale purposes.

SEPP 33 [1] will apply if a proposal for an industrial development requires consent, and it is either potentially hazardous industry or potentially offensive industry (or both). Figure 2 indicates the procedure for determining if SEPP 33 [1] applies.

2.4 Work Scope

Mendham Consultants (MC) have been engaged by Woolworths Ltd (the Client) to undertake a SEPP33 assessment for the JANUS project and a number of subsequent studies relating to dangerous goods storage design and fire risk.

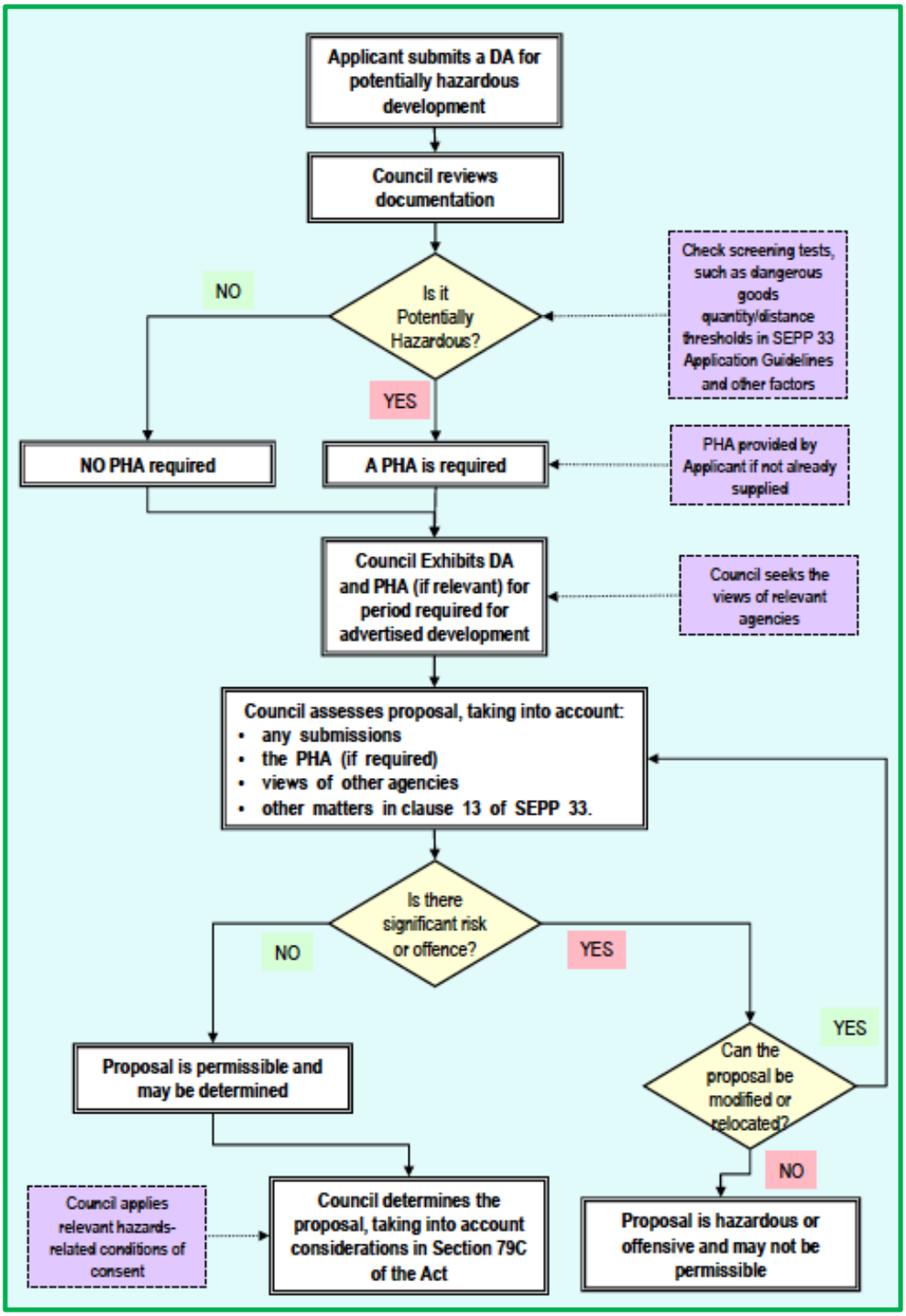


Figure 2: Procedure for Determining if SEPP33 Applies

3.0 PART 1 – SEPP33 SCREENING TEST

3.1 Background

The Screening Test step has been undertaken in accordance with the requirements of SEPP33 [1] in order to determine whether the proposed development is or is not, potentially hazardous and affected by SEPP33 [1].

The Screening Test required the following information: -

- a list of all the hazardous materials used in the proposed development and the quantity of each present;
- dangerous goods classification for each material, including subsidiary class(es);
- the mode of storage used (that is, bulk or packages/containers) and the maximum quantity stored or held on site;
- the distance of the stored material from the site boundary for any of the materials in dangerous goods classes 1.1, 2.1 and 3; and for materials stored in underground tanks, the distance is measured from the above ground filling/dispensing point.
- the average number of annual and weekly road movements of hazardous material to and from the facility, and the typical quantity in each load.

The following information has also been taken into account:

LPG, as defined in AS1596 — LP Gas Storage and Handling, though classified as a flammable gas (2.1), is treated separately for screening purposes and should not be grouped with the other class 2.1 flammable gases; and If combustible liquids of class C1 are present on site and are stored in a separate bund or within a storage area where there are no flammable materials stored they are not considered to be potentially hazardous. If, however, they are stored with other flammable liquids, that is, class 3PGI, II or III, then they are to be treated as class 3PGIII, because under these circumstances they may contribute fuel to a fire.

3.2 DG Transportation Assessment

Dangerous Goods (Hazardous Chemicals) are not transported in Bulk, however, are transported as retail packages.

The following extract from the 'Hazardous and Offensive Development Application Guidelines - Applying SEPP33' [1] details Transportation Screening Thresholds (Refer Table 2): -

Table 1: Transportation Screening Thresholds

	Vehicle Movements		**Minimum quantity***	
	Cumulative	Peak	**per load (tonne)**	
Class	Annual *or*	Weekly	Bulk	Packages
1	see note	see note	see note	
2.1	>500	>30	2	5
2.3	>100	>6	1	2
3PGI	>500	>30	1	1
3PGII	>750	>45	3	10
3PGIII	>1000	>60	10	no limit
4.1	>200	>12	1	2
4.2	>100	>3	2	5
4.3	>200	>12	5	10
5	>500	>30	2	5
6.1	all	all	1	3
6.2	see note	see note	see note	
7	see note	see note	see note	
8	>500	>30	2	5
9	>1000	>60	no limit	

3.2.1 Transported Dangerous Goods Screening Test

Table 2 Summarises actual Transported Dangerous Goods compared with the minimum quantity thresholds for the proposed Moorebank Logistics Park Distribution Centre.

Table 2: Transported Dangerous Goods Screening Test

Class	SEPP33 Minimum Quantity per Load (Tonne) Packages	Cumulative Annual	Peak Weekly	Approx. Vehicle Movements Per **Week**	Vehicle Movements Exceeding Minimum Quantity	Assessment Comments
	(See Note 1)	(See Note 2)	(See Note 3)	(See Note 4)	(See Note 5)	(See Note 6)
2.1	5	1,308	25	1,862	Nil	Volumes transported per vehicle do not exceed Minimum Quantity per Load SEPP33 Transportation Threshold
3PGII	10	2,111	41	1,862	Nil	Volumes transported per vehicle do not exceed Minimum Quantity per Load SEPP33 Transportation Threshold
3PGIII	No Min. Limit	8,654	166	1,862	Nil	Does not exceed SEPP33 Transportation Threshold
4.1	2	16,469	317	1,862	Nil	Volumes transported per vehicle do not exceed Minimum Quantity per Load SEPP33 Transportation Threshold
5	5	64	1	1,862	Nil	Volumes transported per vehicle do not exceed Minimum Quantity per Load SEPP33 Transportation Threshold
8	5	2,225	43	1,862	Nil	Volumes transported per vehicle do not exceed Minimum Quantity per Load SEPP33 Transportation Threshold

Note 1 If quantities are below the level shown in this column, the potential risk is unlikely to be significant unless the number of traffic movements is high.
Note 2 This Column lists the cumulative annual movements of trucks carrying dangerous goods
Note 3 This Column lists the cumulative weekly movements of trucks carrying dangerous goods
Note 4 This column lists the approximate number of all vehicle movements per week (DG and Non DG)
Note 5 This column lists the number of all vehicle movements per week where the minimum dangerous goods quantity (per load) is exceeded.
Note 6 Typical Quantities per load, as follows (As advised by Woolworths Ltd):

2.1 – 0.07 L (i.e. 0.00007 T)
3PGII – 11.38 L (i.e. 0.0118 T)
3PG3 – 13.44 L (i.e. 0.0134 T)
4.1 – 88.5 kg (i.e. 0.0885 T)
5 – 0.07 L (i.e. 0.00007 T)
8 – 2.12L plus 1.46 kg (i.e. 0.00212 T)

3.2.2 Transported Dangerous Goods Screening Test Analysis

Table 1 outlines the transportation screening thresholds of SEPP33.

As quantities below the minimum quantity per load might be considered significant if the number of traffic movements is high a comparison of the JANUS transportation of dangerous goods is compared with the Table 1 criteria, as summarised in Table 2.

Table 2: Comparison of JANUS DG Annual load movements compared with SEPP33 thresholds.

Class	SEPP33 Minimum Quantity per Load (Tonne) Packages	SEPP33 Threshold Cumulative Annual Vehicle Movements	SEPP33 Cumulative Volume Transported at Minimum Quantity per Load (Tonne)	JANUS Quantity per Load (Tonne)	JANUS Cumulative Loads Annual	JANUS Comparative Cumulative Volume Transported per year (Tonne)	Assessment Comments
2.1	5	500	**2,500**	0.00007	1,308	**0.091**	The total volume moved over a year is **<1%** of the SEPP33 Minimum Threshold Quantity per load for the cumulative threshold vehicle movements.
3PGII	10	750	**7,500**	0.0118	2,111	**25**	The total volume moved over a year is **3.3%** of the SEPP33 Minimum Threshold Quantity per load for the cumulative threshold vehicle movements.
3PGIII	No Min. Limit	1000	**No Limit**	0.0134	8,654	**116**	There is not set minimum for this Class and PG.
4.1	2	200	**400**	0.0885	16,469	**1,457**	The total volume moved over a year is **significantly greater** than the SEPP33 Minimum Threshold Quantity per load for the cumulative threshold vehicle movements. The Class 4.1 items are retail packages, which are triple packaged and then shrink wrapped. Items including Shoe Polish etc are considered a much lower risk level than commercial Class 4.1 packages, typically held in large single packaged units.
5	5	500	**2,500**	0.00007	64	**0.005**	The total volume moved over a year is **<1%** of the SEPP33 Minimum Threshold Quantity per load for the cumulative threshold vehicle movements.

Class	SEPP33 Minimum Quantity per Load (Tonne) Packages	SEPP33 Threshold Cumulative Annual Vehicle Movements	SEPP33 Cumulative Volume Transported at Minimum Quantity per Load (Tonne)	JANUS Quantity per Load (Tonne)	JANUS Cumulative Loads Annual	JANUS Comparative Cumulative Volume Transported per year (Tonne)	Assessment Comments
8	5	500	**2500**	0.00212	2,225	**4.7**	The total volume moved over a year is **<2%** of the SEPP33 Minimum Threshold Quantity per load for the cumulative threshold vehicle movements.

3.3 DG Storage Assessment

The SEPP33 [1] Storage Screening Test involved an assessment of hazardous chemicals proposed to be stored and their collation in relation to their dangerous goods classification for each material, including subsidiary risks.

The majority of dangerous goods screening test involves the assessment against a stipulated threshold quantity stored, however flammable and potentially explosive dangerous goods (Classes 1.1, 2.1 and 3) area assessed against a 'Quantity Stored versus Distance to Boundary' function.

Two modes of storage exist at the proposed Moorebank Logistics Park Distribution Centre, as follows:-

- Bulk Storage in the form of diesel fuel and LPG storage in tanks for site operational purposes; and
- Retail primary packages (i.e. in secondary and tertiary packaging on pallets) for distribution to retail facilities by road transport.

Separate assessment of LPG storage though classified as a flammable gas (2.1), was required to be treated separately for screening purposes and was not grouped with the other Class 2.1 flammable gases; and

The combustible liquids of class C1 are stored in a separate bund in tanks however are not within a storage area where there are no flammable materials stored, so were not considered to be potentially hazardous.

(**Note**: Where C1 (e.g. diesel) is stored with other flammable liquids, that is, Class 3PGI, II or III, then it must be treated as Class 3PGIII, because under these circumstances C1 may contribute fuel to a fire.) Diesel fuel is stored separately.

3.3.1 SEPP33 Screening Assessment Methods

The following extract from the SEPP33 Guideline [1] details Screening Threshold Assessment Methods for Stored Dangerous Goods (Refer Table 3): -

Table 3: SEPP 33 Stored Dangerous Goods Assessment Methods (Referenced to SEPP33 Figures and Graphs)

Table 1: Screening Method to be Used

Class	Method to Use/Minimum Quantity
1.1	Use graph at Figure 5 if greater than 100 kg
1.2-1.3	Table 3
2.1 — pressurised (excluding LPG)	Figure 6 graph if greater than 100 kg
2.1 — liquefied (pressure) (excluding LPG)	Figure 7 graph if greater than 500 kg
LPG (above ground)	table 3
LPG (underground)	table 3
2.3	table 3
3PGI	Figure 8 graph if greater than 2 tonne
3PGII	Figure 9 graph if greater than 5 tonne
3PGIII	Figure 9 graph if greater than 5 tonne
4	table 3
5	table 3
6	table 3
7	table 3
8	table 3

Note: *Classes 1.4, 1.5, 1.6, 2.2, 7 and 9 are excluded from the risk screening. Classes used are those referred to in the Dangerous Goods Code and are explained in appendix 6.*

If Table 1 indicates that a graph is to be used: If the quantity is below the minimum quantity in Table 1, then it is not potentially hazardous and there is no need to use the graph.

Using the appropriate graph, plot the group total quantity against the distance from the nearest boundary. If the point lies below the screening threshold line, the proposed development is potentially hazardous.

For class 3 materials only, if storage is underground, the capacity of the tank should be divided by five prior to assessing it against the screening threshold.

If Table 1 indicates that Table 3 is to be used: If the quantity is in excess of the quantity listed in Table 3, the development is potentially hazardous.

Repeat this procedure until all hazardous materials have been assessed.

Consider Transportation Issues

The proposed development may be potentially hazardous if the number of generated traffic movements (for significant quantities of hazardous materials entering or leaving the site) is above the annual or weekly cumulative vehicle movements shown in Table 2.

If the proposal is found to be potentially hazardous with respect to transportation, a route evaluation study should be completed in accordance with the Department of Planning's *HIPAP 11: Route Selection*.

3.3.2 SEPP33 Screening Assessment Threshold Quantities

Table 4 lists the General Screening Threshold Quantities for non-flammable / non-explosive dangerous goods. Note that where flammable and /or explosive dangerous goods are stored, an assessment that compares the quantity stored with distance to the nearest boundary (i.e. JANUS Boundary) is required.

Table 4: General Screening Threshold Quantities

Table 3: General Screening Threshold Quantities

Class	Screening Threshold	Description
1.2	5 tonne	or are located within 100 m of a residential area
1.3	10 tonne	or are located within 100 m of a residential area
2.1	(LPG only — not including automotive retail outlets[1])	
	10 tonne or16 m^3	if stored above ground
	40 tonne or 64 m^3	if stored underground or mounded
2.3	5 tonne	anhydrous ammonia, kept in the same manner as for liquefied flammable gases and not kept for sale
	1 tonne	chlorine and sulfur dioxide stored as liquefied gas in containers <100 kg
	2.5 tonne	chlorine and sulphur dioxide stored as liquefied gas in containers >100 kg
	100 kg	liquefied gas kept in or on premises
	100 kg	other poisonous gases
4.1	5 tonne	
4.2	1 tonne	
4.3	1 tonne	
5.1	25 tonne	ammonium nitrate — high density fertiliser grade, kept on land zoned rural where rural industry is carried out, if the depot is at least 50 metres from the site boundary
	5 tonne	ammonium nitrate — elsewhere
	2.5 tonne	dry pool chlorine — if at a dedicated pool supply shop, in containers <30 kg
	1 tonne	dry pool chlorine — if at a dedicated pool supply shop, in containers >30 kg
	5 tonne	any other class 5.1
5.2	10 tonne	
6.1	0.5 tonne	packing group I
	2.5 tonne	packing groups II and III
6.2	0.5 tonne	includes clinical waste
7	all	should demonstrate compliance with Australian codes
8	5 tonne	packing group I
	25 tonne	packing group II
	50 tonne	packing group III

Note: *The classes used are those referred to in the Australian Dangerous Goods Code and are explained in Appendix 7.*

3.3.3 Stored Dangerous Goods Screening Test (Non Flammables)

Table 5 Summarises the proposed stored dangerous goods compared with the threshold quantities for the proposed JANUS Distribution Centre. (NOTE: Where Class 2.1 (non LPG e.g. Aerosols) and Class 3 exceed a minimum quantity threshold they must be separately assessed using Distance vs Quantity Stored - Graphs).

Table 5 SEPP33 - Proposed Stored Dangerous Goods - Threshold Assessment

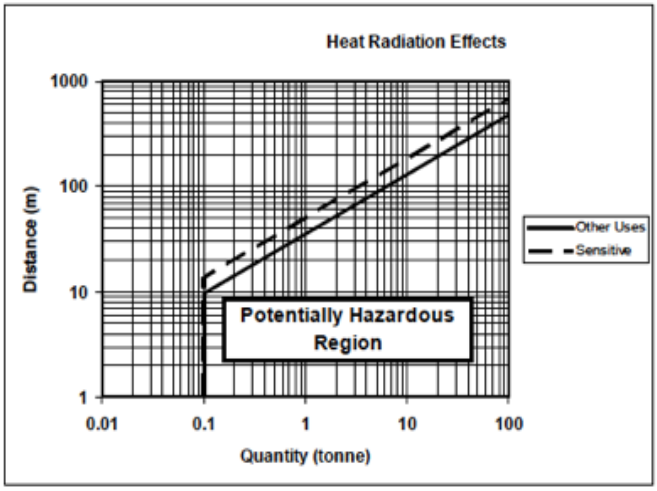
Class	Screening Threshold (Tonnes)	Description	Quantity Stored (Tonnes)	Comments
2.1	10 (16m^3)	LPG Stored Above Ground	6.16	Below Screening Threshold (No Graph involved)
2.1	0.5	Liquefied (e.g. Aerosols) Refer to SEPP33 Graph 7 if exceeds Threshold	115.5 Gross 40 Nett (LPG)	Exceeds quantity therefore requiring assessment against Graph 7. Result: Above screening Threshold on graph 7 therefore SEPP33 applies.
3 PGII	5	Refer to SEPP33 Graph 9 if exceeds Threshold	32.7	Exceeds quantity therefore requiring assessment against Graph 9. Result: Below Screening Threshold on Graph 9
3 PGIII	5	Refer to SEPP33 Graph 9 if exceeds Threshold	44.1	Exceeds quantity therefore requiring assessment against Graph 9. Result: Below Screening Threshold on Graph 9
4.1	5	-	4.2	Below Screening Threshold (No Graph involved)
5.1	5	Any other 5.1 (e.g. Retail Hair products)	1.3	Below Screening Threshold (No Graph involved)
8	25	PGII	12.0	Below Screening Threshold (No Graph involved)
8	50	PGIII	33.0	Below Screening Threshold (No Graph involved)

3.3.4 Stored Dangerous Goods Screening Test (Flammables)

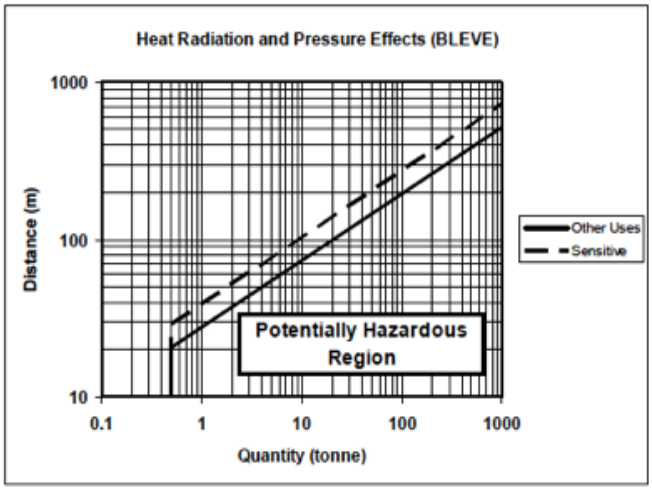
Where hazardous chemicals of Class 2.1 (Pressurised excluding LPG), 2.1 (Liquefied Other – e.g. aerosols), or Class 3 Flammable liquids, the quantity must be plotted against distance from the nearest site boundary (i.e. JANUS Boundary) using the relevant Figure.

Figure 3 of this report includes the relevant graphs from SEPP33 [1]. Refer Figure 3.

Class 2.1 Flammable Gases Pressurised (Excluding LPG)



Class 2.1 Flammable Gases Liquefied Under Pressure (Excluding LPG)



Class 3PGII and 3PGIII Flammable Liquids

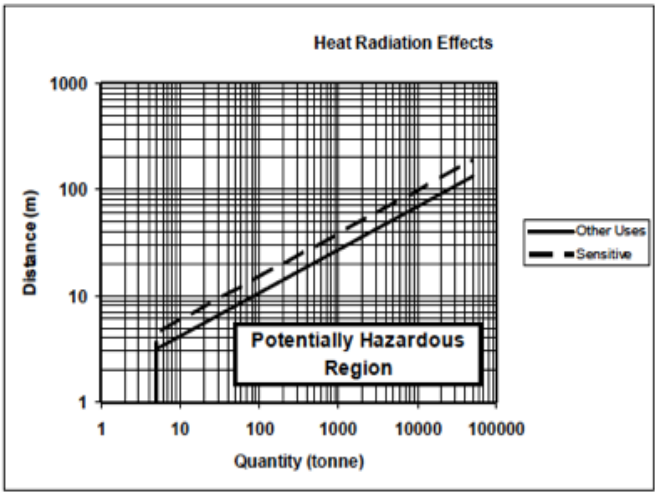


Figure 3: Applicable SEPP33 Graphs

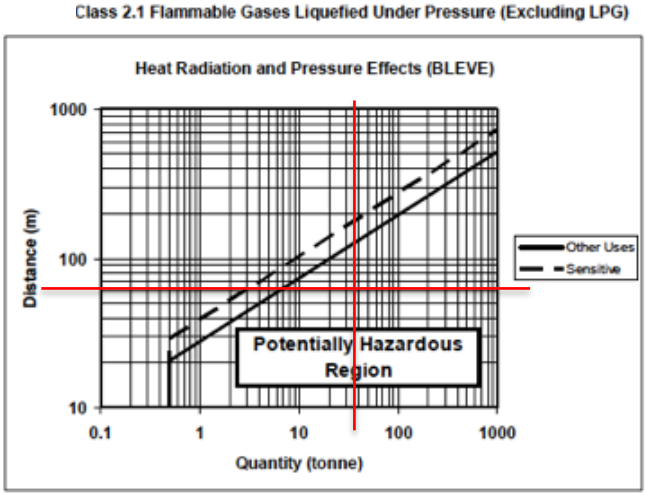
3.3.5 Assessment of Class 2.1 Liquified Gas (e.g. Aerosols)

The nearest boundary distance to the storage of Class 2.1 Liquified Gas is 62.6m (Worst Case Option). [Refer Drawings]

The neighbouring use is industrial so the 'Sensitive' curve in the Class 2.1 Flammable Gases Pressurised (Excluding LPG) is disregarded, however the 'solid line' curve is applied.

The quantity of flammable substance stored is 115 Tonnes Gross, so approximately 40 Tonnes of LPG propellant Nett.

The 'Quantity versus Distance' curves intersects at approximately 150m for 40 Tonnes, indicating that heat radiation effects from the proposed stored quantity at 62.6m are likely to be significantly greater than the screening threshold level, so SEPP33 [1] applies.



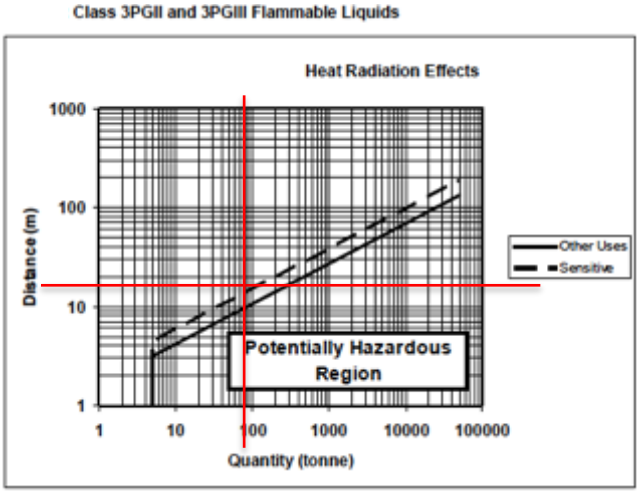
3.3.6 Assessment of Class 3 PGII and Class 3 PGIII Flammable Liquids (Stored together)

The nearest boundary distance to the storage of Class 3 PGII and PG III is 15.2m (Worst Case Option). [Refer Drawings]

The neighbouring use is industrial so the 'Sensitive' curve in the Class 3 PGII and Class 3 PGIII Flammable Liquids is disregarded, however the 'solid line' curve is applied.

The quantity of flammable substance stored is 32.7 Tonnes of Class 3 PGII and 44.1 totalling 76.8 Tonnes of Class 3 PGII at this worst case location.

The Quantity versus Distance curves intersects at approximately 9m for 76.8 Tonnes, indicating that heat radiation effects from the proposed stored quantity at 15.2m are likely to be less than the screening threshold level, so SEPP33 does not apply.



3.4 SEPP 33 Screening Test Conclusions

3.4.1 DG Transportation Screening Test Conclusion

A significantly large number of small volume transportations of dangerous goods occur per week, as is expected of a large retail distribution centre servicing up to 266 retail stores per day.

Whilst a significant number of transport events occur exceeding the SEPP33 cumulative annual and peak weekly movements, the quantity of dangerous goods carried on these movements is insignificant compared with the potential volume, being the product of threshold vehicle movements and minimum dangerous goods volumes per load.

In most cases (Class 2.1 (aerosols), 3PGII, 5 and 8), the total cumulative volumes transported is less than 3% of the SEPP33 amount below allowable threshold levels.

The exception to this is Class 4.1, where small retail items such as shoe polish and deodorant sticks, which are packaged in a primary container, then packaged in an outer carton, then a further secondary carton, then shrink wrapped in sturdy plastic packaging. These products are considered to be insignificant risks during transport.

It is recommended that this is not a significant risk, as the results of the SEPP33 [1] Transportation Threshold screening test indicates.

3.4.2 DG Storage Screening Test Conclusion

SEPP33 [1] Screening Tests were applied to the proposed dangerous goods storage quantities at the Moorebank Logistics Park Distribution Centre.

The following dangerous goods Classes were assessed: -

- 2.1 LPG,
- 2.1 Liquified Gas,
- 3 PGII,
- 3 PGIII,
- 4.1,
- 5.1,
- 8 PGII, and
- 8 PGIII

Screening Tests indicated that only Class 2.1 Liquified Gas (Aerosols) exceeded the Screening Test thresholds requiring a Preliminary Hazard Analysis to justify its storage in the proposed (worst case) location and the facility not being classified as potentially hazardous.

4.0 PART 2: Preliminary Hazard Analysis

4.1 Background Information

This assessment addresses 'Off-Site' risks associated with hazardous chemicals storage and handling and does not address on site risks. A Fire Safety Engineering Report is to be developed by the Fire Engineering Consultant, which will address fire risks associated with the building and its associated structures, its occupants and responding fire brigade intervention (i.e. On Site Risks).

Nine (9) categories of hazardous chemicals across five (5) Dangerous Goods Classes were assessed in the screening test, as well as a transportation screening assessment.

The SEPP 33 [1] Screening Test indicates that the 'Quantity versus Distance' curves intersect at approximately 210m for 115 Tonnes of Aerosols, indicating that heat radiation effects from the proposed stored quantity at 62.6m are likely to be greater than the screening threshold level, so SEPP33 [1] applies.

4.1.1 Aim

A Preliminary Hazardous Analysis (PHA) is provided in this report to address: -

1) Identifying all potential hazards associated with the proposal;
2) Analysing both their consequences (effects) on people and the environment, and their probability (likelihood or frequency) of occurrence;
3) Estimating the resultant risk to the surrounding land uses and environment; and
4) Ensuring that the proposed safeguards are adequate, and thus demonstrate that the operation will not impose a level of risk which is intolerable with respect to its surroundings.

4.2 Site Description

The JANUS site comprises: JR- JANUS Regional (33,721 m^2) and JN-JANUS National having (42,221 m^2) – refer Figure 4.1.

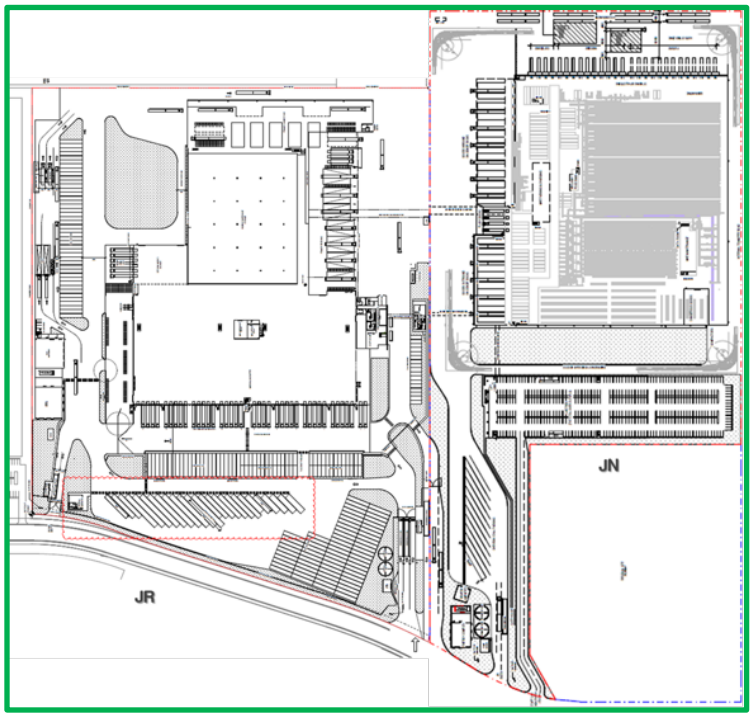


Figure 4.1: JANUS Facility comprising JN - JANUS National and JR – JANUS Regional.

The JANUS project involves the construction and operation of two (2) Warehouse and Distribution Facilities (High Bay Warehouses) across the Subject Site, including:

• Ancillary hardstand,

• Amenities,

• Ancillary offices,

• Associated car parking, and

• Landscaping.

4.3 Occupancy

The anticipated occupancy of the JANUS facility is as follows:-

Shift	JR	JN	Total Combined
Day Shift (06:00 – 14:00)	319	260	579
Evening Shift (14:00 – 20:00)	256	240	496
Night Shift (20:00 – 06:00)	30	Nil	30
Total	605	500	1,105

4.4 Adjacent Land Uses

The proposed JANUS construction site is surrounded by land uses (Refer Table 4.4-1), as follows:-

Table 4.4-1: Adjacent Zoning

Direction	JANUS
North	Industrial Zoned (Undeveloped)
South	Industrial Zoned (Undeveloped)
East	Industrial Zoned (Undeveloped)
West	Conservation Area

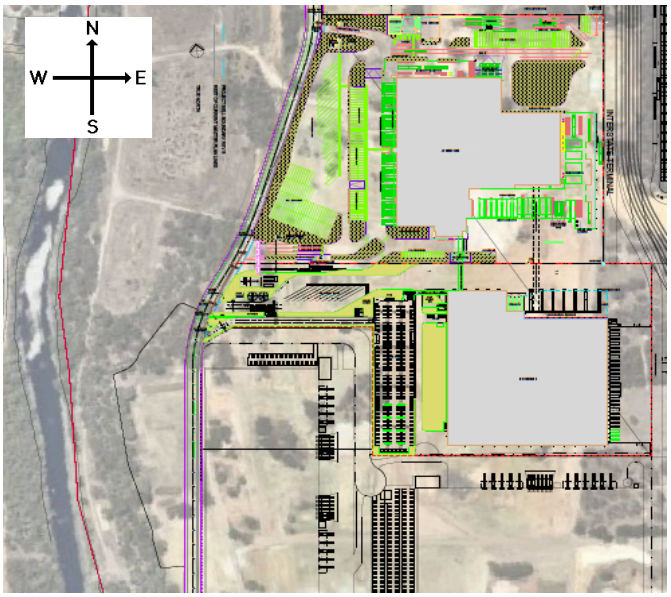


Figure 4.4-1: JANUS Surrounding Land Use

4.5 Surrounding Environment

4.5.1 Sensitive Receptors

The site is located approximately 30 kilometres south-west of the Sydney CBD and is situated within the Liverpool Local Government Area (LGA). The site has been highly disturbed with multiple buildings being demolished and removed since early 2017 as part of early works for the project.

Within a 500 metre buffer zone of the JANUS site, the Capsula Powerhouse Arts Centre is located approximately 450 metres to the northwest and on the other side of Georges River. The only other sensitive receptors located within the 500 metre buffer zone are tenants and operational staff of the Moorebank Logistics Park . Within a one thousand metre buffer zone, there are low, medium and high density residential, public transport and green space all located to the west of the site.

4.5.2 Environmental Values

The site is generally cleared of vegetation and abuts a sparsely wooded open area to the west. The site and this adjacent open area are not mapped as Environmentally Significant Land (ESL) under the Liverpool Local Environmental Plan (2008). As part of the development plan for the overall Moorebank development, this adjacent open area will be developed as a biodiversity conservation zone and managed using appropriate fire regimes to promote biodiversity conservation.

The closest sensitive environmental receptor, after the biodiversity conservation zone, is the Georges River located approximately 200 metres to the west of the site. Vegetation within a 50 metre buffer of Georges River is defined as a biodiversity offset area and mapped as ESL. The Georges River and associated vegetation are unlikely to be impacted by activities conducted at the site as are any fauna associated with this area.

4.6 Description of Dangerous Goods Stored and Handled

4.6.1 Dangerous Goods Inventory

Hazardous chemicals that are dangerous goods are stored as either bulk storage or retail packages, as follows:-

Table 4.6.1-1 Summary of Dangerous Goods Inventory

DG Class	Purpose	Volume (Tonnes)
1.4	Retail Packages	0.2
2.1	Bulk - LPG Stored Above Ground used for Forklifts	6.16
2.1	Retail Packages - Liquefied (e.g. Aerosols)	40.0
3 PG II	Retail Packages	32.7
3 PG III	Retail Packages	44.1
3 PG IV	Bulk – Diesel Fuel (Combustible Liquid C1)	60
4.1	Retail Packages	4.2
5.1	Retail Packages	1.3
8 PG II	Retail Packages	12.0
8 PG III	Retail Packages	33.0

4.6.2 Dangerous Goods - Retail Inventory

Class 2.1 Aerosols:

115 T Gross of aerosols comprising approximately 40T Nett LPG is proposed to be stored in a dedicated aerosol store located outside the JR warehouse. Refer to Figure 4.6.2-1.

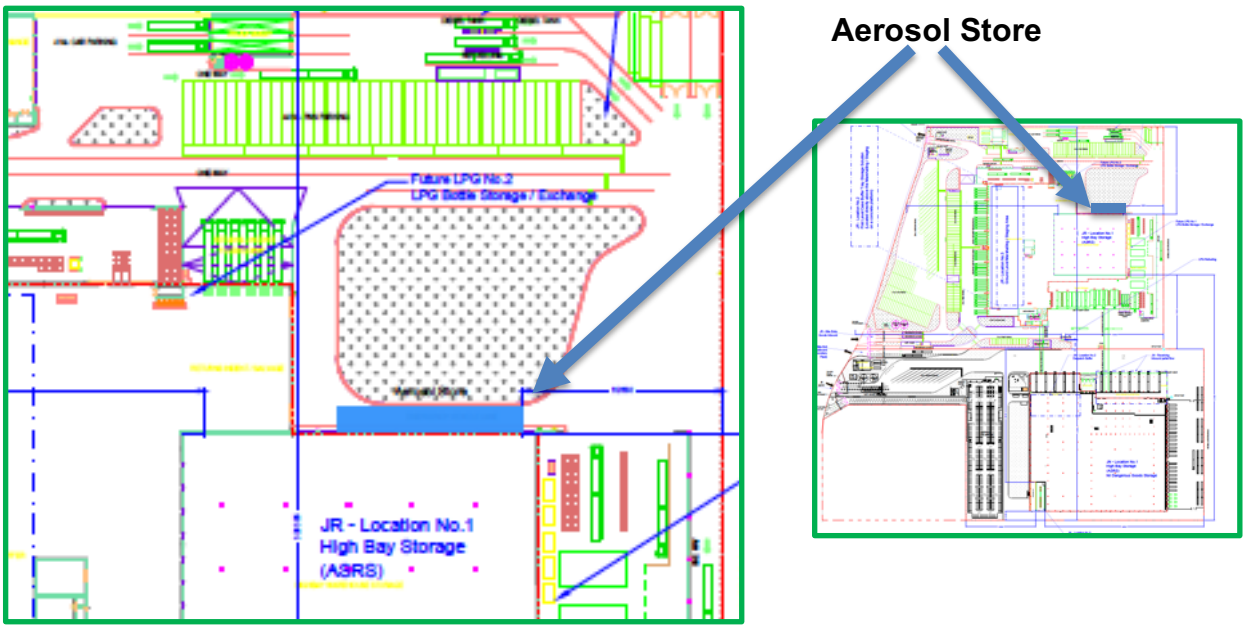


Figure 4.6.2-1: Aerosol Store location at JR

Class 1.4, Class 3 PGII and 3 PG III, Class 4.1:

Retail packages of dangerous goods in Classes 1.4, 3 PGII, 3 PG III and 4.1 are stored in a compliant dangerous goods package store referred to as the 'Special Goods Store' (SGS) located in JANUS JN Facility. Volumes stored are 0.2T, 32.7T, 44.1T and 4.2T respectively. (Refer to Table 4.6.1-1).

Refer to Figure 4.6.2-2.

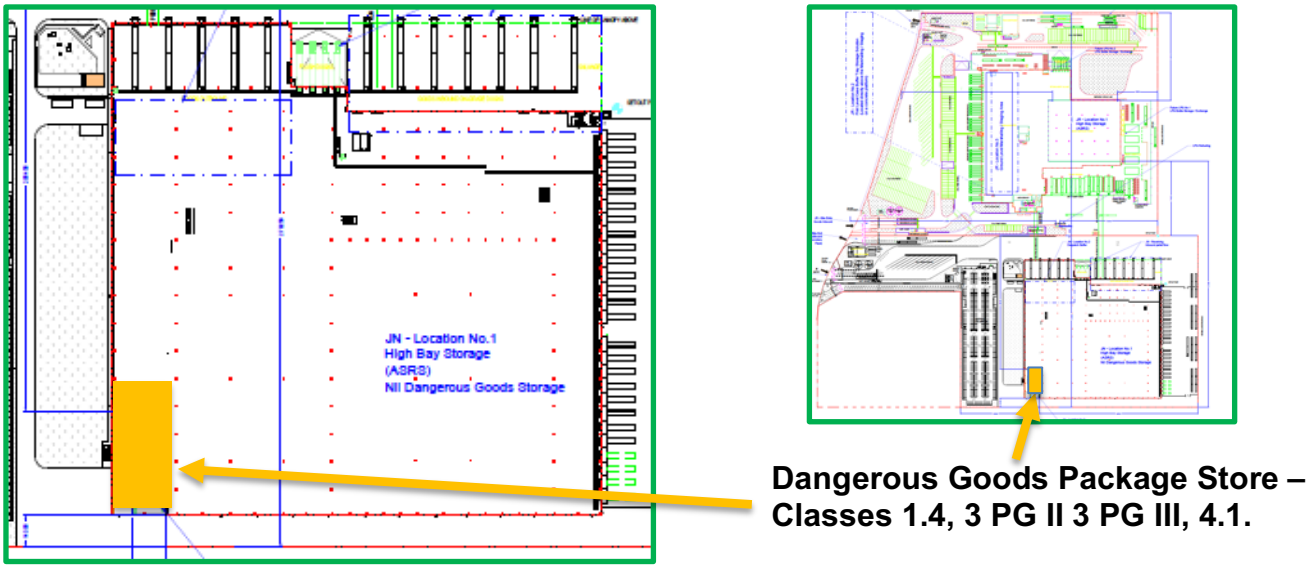


Figure 4.6.2-2: Special Goods Store (DG Package Store)

Class 5.1:

Retail packages of Class 5.1 will be stored in storage racking located in JANUS JR.

1.3 Tonnes is proposed to be stored and will be located in accordance with mixed class dangerous goods storage requirements.

Refer to Figure 4.6.2-3.

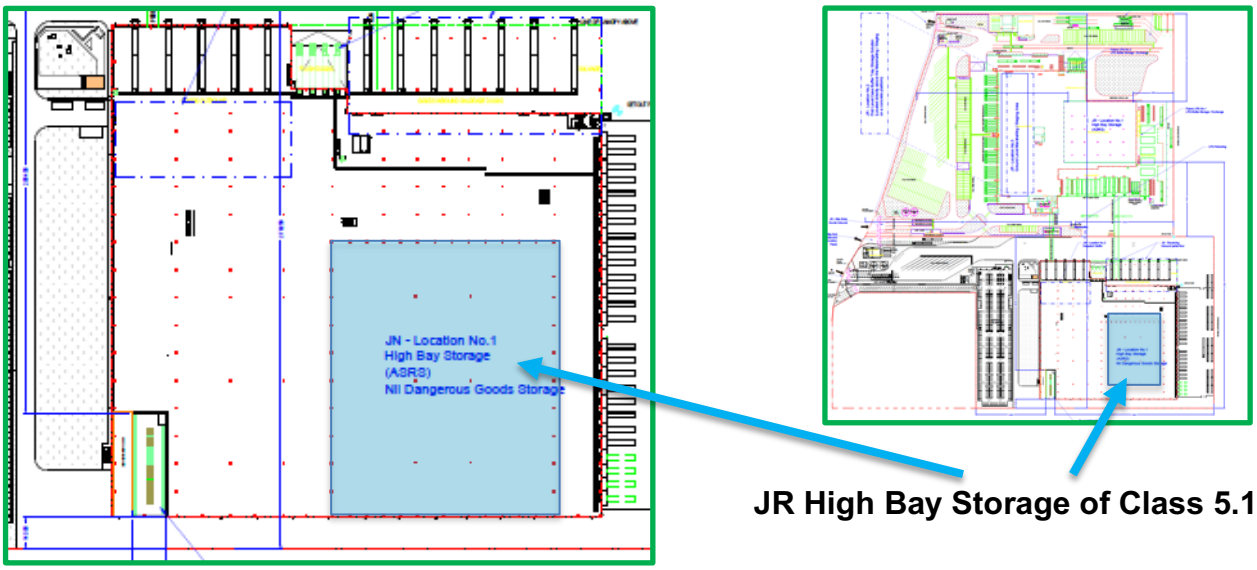


Figure 4.6.2-3: JR High Bay Storage of Class 5.1 Retail Packages

Class 8 PGII and Class 8 PG III:

Retail packages of Class 8 PG II and Class 8 PG III will be stored in JANUS JR in a bunded storage area separated from potentially incompatible dangerous goods. The volumes stored are 12T and 33T respectively.

Refer to Figure 4.6.2-4.

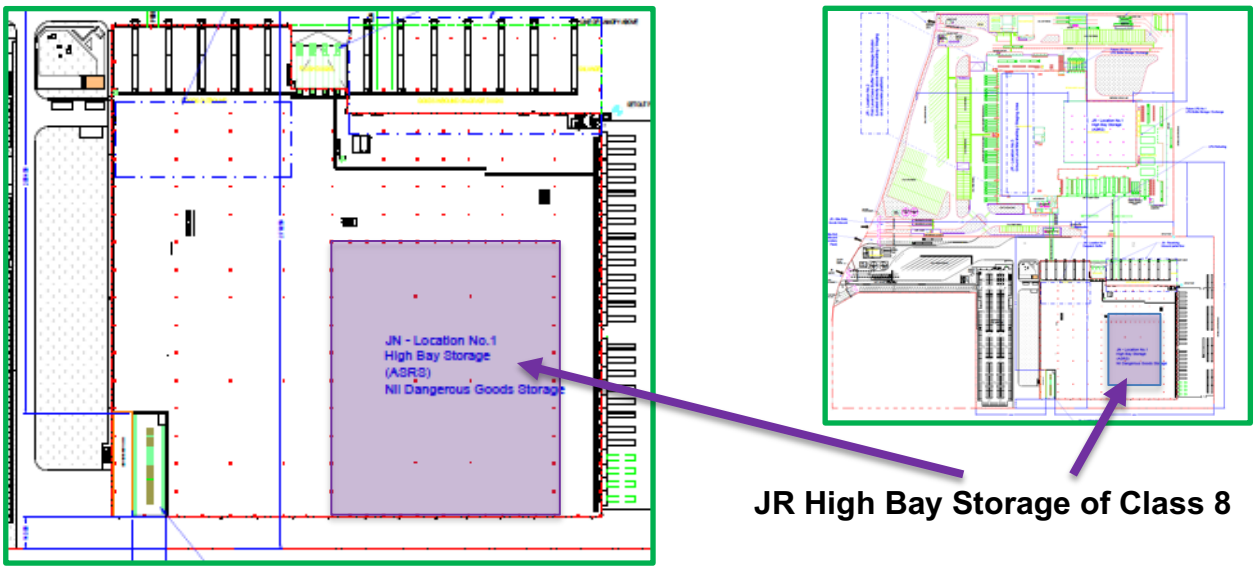


Figure 4.6.2-4: Class 8 PGII and Class 8 PG III Located in JR High Bay Storage

4.6.3 Dangerous Goods - Bulk Inventory

LPG Storage - Bulk Above Ground Tank and Exchange Cylinder Depots:

Class 2.1 is stored in an Above Ground Bulk LPG Tank for the purposes of refuelling Forklift cylinders. The proposed bulk tank volume is 5.9T. Additionally, two exchange LPG Cylinder Storage Depots are proposed. The volume of LPG in storage at each location is estimated to be 0.2T at each of the two (2) locations.

Refer to Figure 4.6.3-1.

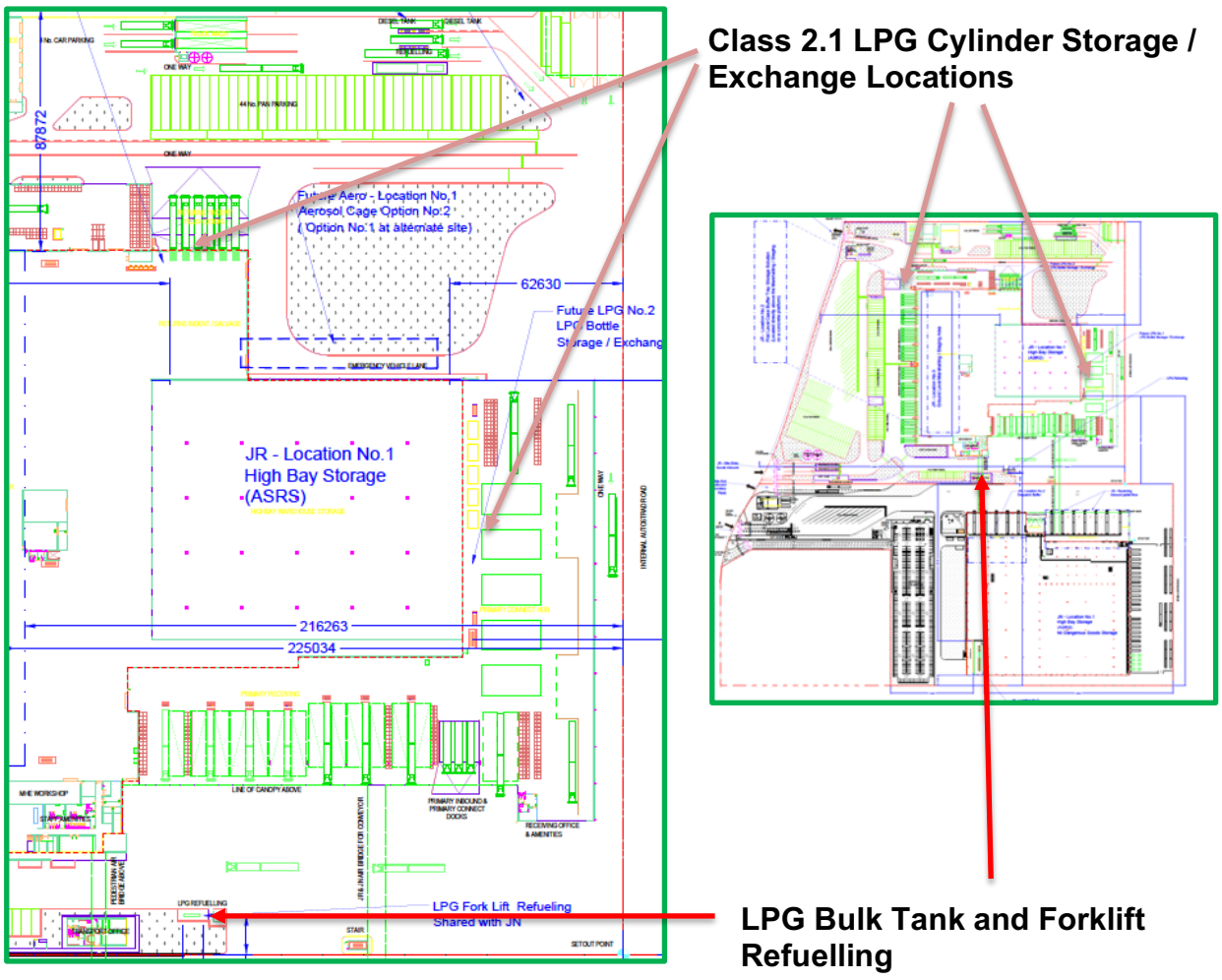


Figure 4.6.3-1: LPG Storage Above Ground Tank and Exchange Cylinder Depots

Diesel Storage in Above Ground Tank:

A 60 T (60 kL) above ground diesel storage tank proposed with its final location to be determined. Diesel fuel will be stored separately from any other dangerous goods. Refer to Figure 4.6.3-2.

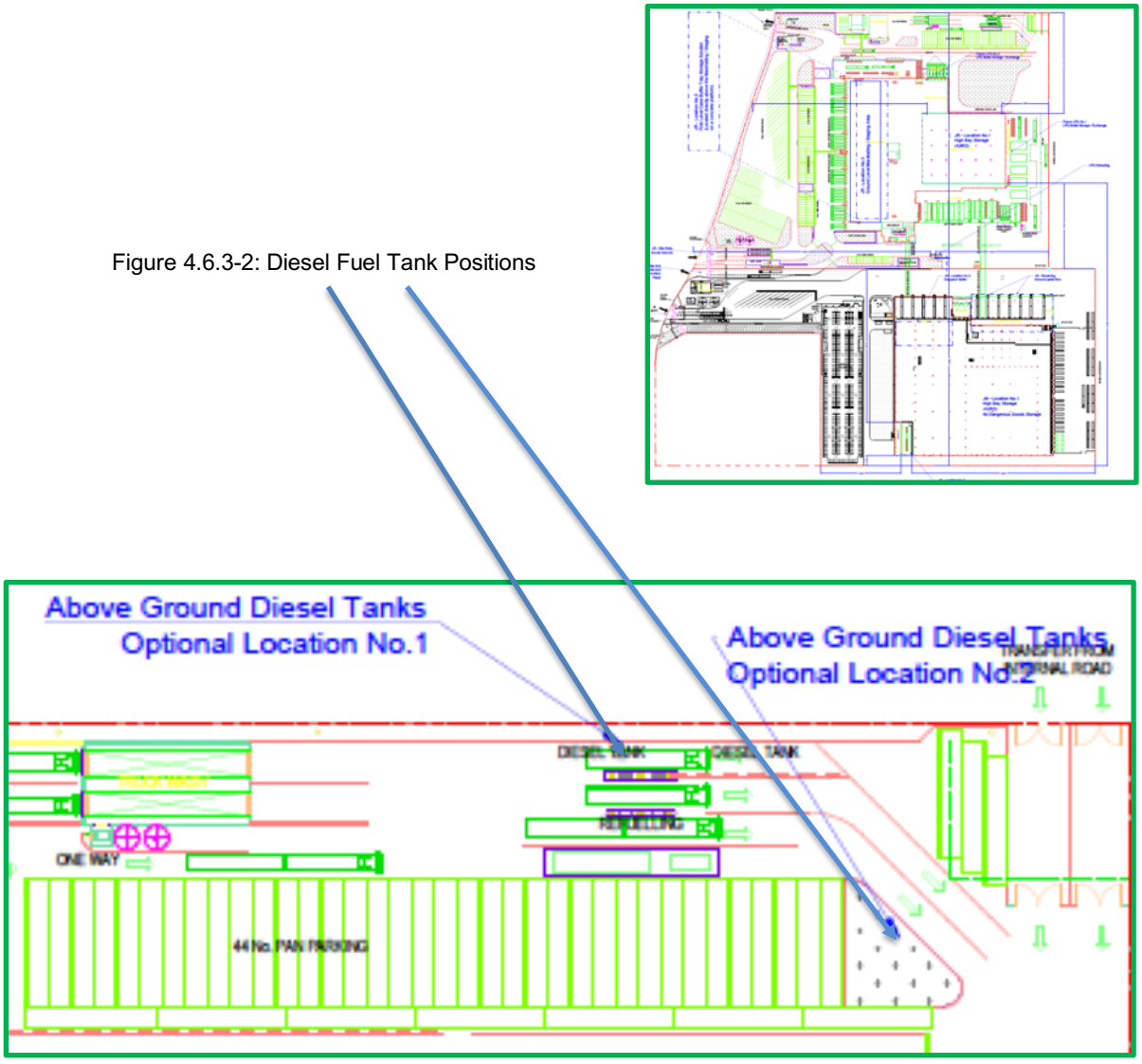


Figure 4.6.3-2: Diesel Fuel Tank Positions

4.7 Aggregate Quantity Ratio

The Aggregate Quantity Ratio (AQR) is an assessment relating to the site's potential to be classified as a Major Hazard Facility (MHF). Threshold quantities are taken from Schedule 15 of WHS Regulation NSW 2017 [5]. Reference to the Dangerous Goods potentially present at the JANUS project have been extracted from Schedule 15 [5], as listed below in Table 4.7-1.

Table 4.7-1: Aggregate Quantity Ratio Volumes from Schedule 15 (WHS Reg)

DG Class	Volume Stored (Tonnes)	Schedule 15 Threshold (Tonnes)
1.4	0.2	Not subject to MHF Legislation
2.1	6.16	200.0
2.1	40.0	
3 PG II	32.7	50,000.0
3 PG III	44.1	
3 PG IV	60	Not subject to MHF Legislation
4.1 PG II or III	4.2	Not subject to MHF Legislation
5.1	1.3	Not subject to MHF Legislation
8 PG II	12.0	Not subject to MHF Legislation
8 PG III	33.0	Not subject to MHF Legislation

4.8 Classification as a Major Hazard Facility

If there is more than 1 hazardous chemical, a threshold quantity of chemicals exists indication an MHF classification where, if a number of chemicals are present, the result of the following aggregation formula exceeds 1:

$$\frac{q_x}{Q_x} + \frac{q_y}{Q_y} + [\ldots] + \frac{q_n}{Q_n}$$

Where:

(a) x, y, [....] and n are the hazardous chemicals present or likely to be present,

(b) q_x, q_y, [....] and q_n is the total quantity of hazardous chemicals x, y, [....] and n present or likely to be present, other than:

(i) a hazardous chemical that is present or likely to be present in an isolated quantity less than 2% of its threshold quantity,

(ii) hazardous chemicals that are solely the subject of intermediate temporary storage, while in transit by road or rail (unless it is reasonably foreseeable that, despite the transitory nature of the storage, hazardous chemicals are or are likely to be present frequently or in significant quantities),

(c) Q_x, Q_y, [....] and Q_n is the individual threshold quantity for each hazardous chemical x, y, [....] and n,

(d) a hazardous chemical is present or likely to be present in an isolated quantity, for the purposes of paragraph (b)(i), if its location at the facility is such that it cannot, on its own, act as an initiator of a major incident.

Calculation: ([DG 2.1] 49.96 + [DG 3 II&III] 76.8) / ([MHF DG 2.1] 200 + [MHF DG 3 PG II and PG III] 50,000)

= 0.0025 therefore the AQR <1.

The facility is not classified as a MHF.

4.9 Risk Analysis and Assessment Process

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 is required and provided in accordance with the NSW Department of Planning 'Multi-level Risk Assessment' guideline [3].

Figure 4.9-1 outlines the formalised process.

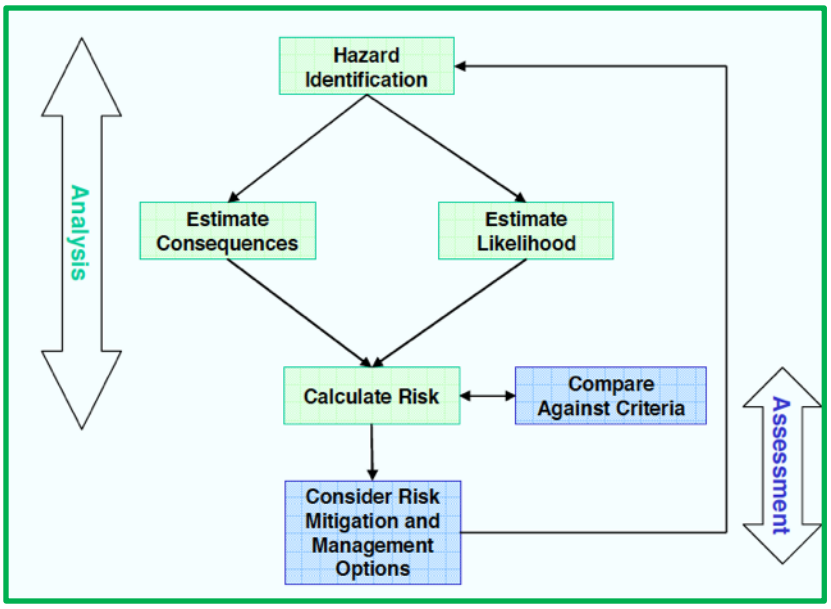


Figure 4.9-1: Risk Analysis and Assessment Process

The approach taken in this report is to assess the risks of offsite injury or property damage for the subject JANUS facility development to an appropriate level consistent with the actual hazards present. A partial quantification (Level 2) approach is undertaken.

The development is a storage facility with only minor activities involving hazardous chemicals (i.e. Forklift Refuelling) where opportunities exist for Loss of Containment. The stored inventory is triple packaged retail commodities stocked only for the replenishment of regional Woolworths stores. Primary package sizes are predominantly less than 1 L each in volume and in many cases less than 100mL. The inventory is received, stored and re-shipped in tough shrink wrap final packaging over secondary and primary packaging on pallets.

Woolworths has developed many Distribution centres, which have been designed to a consistent proven standard and have been assessed and approved previously by State Regulators. The author of this report has had significant involvement with previous Distribution Centre dangerous goods storage and handling design for Woolworths Ltd and others since 2008.

4.10 Hazard Identification

4.10.1 JANUS Dangerous Goods Properties

The following table outlines the properties of dangerous goods associated with the JANUS development.

Table 4.10.1-1: Dangerous Goods Properties of Stored Inventory

DG Class	Location	Dangerous Goods Properties	Context Specific Potential Hazard
1.4S	Retail Packages located in Dangerous Goods Package Store (SGS) Located in JANUS-JN	Classified as Hazardous (GHS) According To Safe Work Australia Criteria. Division 1.4 Substances and articles which present no significant hazard.	The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire will not cause 'virtually instantaneous' explosion of almost the entire contents of the package;

DG Class	Location	Dangerous Goods Properties	Context Specific Potential Hazard
2.1	LPG Stored in Above Ground Bulk Tank	Highly flammable.	Temperatures in a fire may cause cylinders or pressure vessels to rupture (BLEVE) and pressure relief devices to be activated (venting of LPG vapour to atmosphere, forming flammable clouds of air-gas mixture).
2.1	LPG Stored in Forklift Exchange Cylinders in Cylinder Depots.	Highly flammable.	Temperatures in a fire may cause cylinders or pressure vessels to rupture (BLEVE) and pressure relief devices to be activated (venting of LPG vapour to atmosphere, forming flammable clouds of air-gas mixture).
2.1	Retail Packages located in Aerosol Caged Store Located in JANUS-JR	Hydrocarbon Aerosol Propellant contained in retail aerosol packages.	Extremely flammable gas. Vapours are heavier than air. Vapours may travel across the ground and reach remote ignition sources causing a flashback fire danger.
3	Retail Packages located in Dangerous Goods Package Store (SGS) Located in JANUS-JN	Product is flammable.	Vapours may travel considerable distances to a source of ignition where they can ignite, flashback, or explode. Closed containers may explode when exposed to extreme heat. Containers close to fire should be removed if safe to do so.
4.1	Retail Packages located in Dangerous Goods Package Store (SGS) Located in JANUS-JN	The release of the following substances is possible in a fire: Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke). Nitrous oxides.	May form explosive mixtures with air.
5.1	Retail Packages located in High Bay Storage in JANUS-JR	Class 5.1 are oxidising substances and in this situation include hair dye etc contained in retail packages.	Substances which, while in themselves not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material. Such substances may be contained in an article.
8	Retail Packages located in High Bay Storage in JANUS-JR	Class 8 dangerous goods are corrosive substances in this situation and include products such as drain cleaner contained in retail packages.	Class 8 substances (corrosive substances) are substances which, by chemical action, will cause severe damage when in contact with living tissue, or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport.

4.10.2 JANUS Hazardous Chemical Impacts

The following hazard identification is based on guidance provided in Hazardous Industry Planning Advisory Paper No. 6, Hazard Analysis Guidelines [2] and the Hazard Identification Table (Refer Table 4.10.1-1).

It provides a summary of the potential site specific hazards, associated consequences and mitigating controls. The purpose of the table is to identify specific hazards that will be carried over for further assessment.

4.10.3 Injury Impacts

Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 [4] provides industry guidelines and information in relation to the unwanted impacts associated with hazardous chemical incidents. With respect to the JANUS project, the applicable fire and explosion **injury impacts** are as follows in Table 4.10.3-1.**Note:** Toxicity impacts are not shown as nil toxic substances are stored.

Table 4.10.3-1 Hazardous Chemicals Incidents Impacts – Injury Related

	Fire	Overpressure
Dangerous Goods and Storage Arrangements	Injury Threshold at Boundary Maximum permissible radiant heat flux at site boundary is 4.7kWm^{-2} (Refer HIPAP 4) beyond which injury may occur. Is there likely potential to exceed this INJURY threshold?	Injury Threshold at Boundary Maximum permissible overpressure at the site boundary is 7kPa (Refer HIPAP 4) beyond which injury may occur. Is there likely potential to exceed this INJURY threshold?
Class 1.4S stored in Dangerous Goods Store at JANUS JN	No, as the DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection.	No, as the DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection.
Class 2.1 LPG Stored in Above Ground Bulk Tank	No, whilst a large fireball may form from an LPG Tank Loss of Containment, the distance to the boundary is significant and separated by buildings.	No, whilst a BLEVE may form from an LPG Tank Loss of Containment, the distance to the JANUS Distribution Centre boundary is significant and separated by buildings.
Class 2.1 LPG Stored in Forklift Exchange Cylinders in Cylinder Depots.	No, the separation distance to the boundary is significant and cylinders are constrained within a cage.	No, the separation distance to the JANUS Distribution Centre boundary is significant the individual volumes of stored gas are small and not likely to form a major BLEVE.
Class 2.1 Retail Packages located in Aerosol Caged Store Located behind JANUS-JR	**Yes, as the SEPP33 Screening Test indicates, a potential hazard from the impact of radiant heat at the boundary will be carried over for further assessment.**	No, as a BLEVE is unlikely to form from multiple individual aerosol package releases.
Class 3 Retail Packages located in Dangerous Goods Package Store (SGS) in JANUS-JN	**Yes, (even though not identified in the Screening Test) The DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection, however located within 15m of the boundary.** **SEPP33 Screening Test results indicate low risk.**	No, as the DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection. SEPP33 Screening Test results indicate low risk.
Class 4.1 Retail Packages located in Dangerous Goods Package Store (SGS) in JANUS-JN	**Yes, (even though not identified in the Screening Test) The DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection, however located within 15m of the boundary.** **SEPP33 Screening Test results indicate low risk.**	No, as the DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection. SEPP33 Screening Test results indicate low risk.

4.10.4 Property Impacts

Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 [4] provides industry guidelines and information in relation to the unwanted impacts associated with hazardous chemical incidents. With respect to the JANUS project, the applicable fire and explosion property impacts are as follows in Table 4.7.3-1.

Note: Generally, if injury impacts do not exist at the boundary, property impacts will not exist, as the energy required to cause an injury is less than the energy required to cause a property impact. Both assessments are provided however for completeness.

Note: Toxicity impacts are not shown as nil toxic substances are stored.

Table 4.10.4-1 Hazardous Chemicals Incidents Impacts – Property Related

	Fire	Overpressure
Dangerous Goods and Storage Arrangements	Property Threshold at JANUS Distribution Centre Boundary Maximum permissible radiant here flux at site boundary is 23kWm^{-2} (Refer HIPAP 4) beyond which injury may occur. Is there likely potential to exceed this PROPERTY threshold?	Injury Threshold at JANUS Distribution Centre Boundary Maximum permissible overpressure at the site boundary is 14kPa (Refer HIPAP 4) beyond which injury may occur. Is there likely potential to exceed this PROPERTY threshold?
Class 1.4S stored in Dangerous Goods Store at JANUS JN	No, as the DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection.	No, as the DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection.
Class 2.1 LPG Stored in Above Ground Bulk Tank	No, whilst a large fireball may form from an LPG Tank Loss of Containment, the distance to the boundary is significant and separated by buildings.	No, whilst a BLEVE may form from an LPG Tank Loss of Containment, the distance to the JANUS Distribution Centre boundary is significant and separated by buildings.
Class 2.1 LPG Stored in Forklift Exchange Cylinders in Cylinder Depots.	No, the separation distance to the boundary is significant and cylinders are constrained within a cage.	No, the separation distance to the JANUS Distribution Centre boundary is significant the individual volumes of stored gas are small and not likely to form a major BLEVE.
Class 2.1 Retail Packages located in Aerosol Caged Store Located behind JANUS-JR	**Yes, as the SEPP33 Screening Test indicates, a potential hazard from the impact of radiant heat at the boundary will be carried over for further assessment.**	No, as a BLEVE is unlikely to form from multiple individual aerosol package releases.
Class 3 Retail Packages located in Dangerous Goods Package Store (SGS) in JANUS-JN	**Yes, (even though not identified in the Screening Test) the DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection, however located within 15m of the boundary.** **SEPP33 Screening Test results indicate low risk.**	No, as the DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection. SEPP33 Screening Test results indicate low risk.
Class 4.1 Retail Packages located in Dangerous Goods Package Store (SGS) in JANUS-JN	**Yes, (even though not identified in the Screening Test) the DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection, however located within 15m of the boundary.** **SEPP33 Screening Test results indicate low risk.**	No, as the DG Store is a 4 hour fire rated, main building separated, bunded, with ESFR and In-Rack sprinkler protection. SEPP33 Screening Test results indicate low risk.

4.10.5 Environmental Impacts

Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 [4] provides industry guidelines and information in relation to the unwanted environmental impacts associated with hazardous chemical incidents.

For reference purposes, Table 4.10.5-1 lists the HIPAP 4 Table of Environmental Consequences.

Table 4.10.5-2 lists potential environmental impacts of environmental hazardous chemicals that might undergo potential Loss of Containment at the JANUS project.

Table 4.10.5-1: Table of Environmental Impacts

Impact	Description
Catastrophic	Irreversible alteration to one or more eco-systems or several component levels. Effects can be transmitted, can accumulate. Loss of sustainability of most resources. Life cycle of species impaired. No recovery. Area affected 100 km^2.
Very serious	Alteration to one or more eco-systems or component levels, but not irreversible. Effects can be transmitted, can accumulate. Loss of sustainability of selected resources. Recovery in 50 years. Area affected 50 km^2.
Serious	Alteration/disturbance of a component of an ecosystem. Effects not transmitted, not accumulating or impairment. Loss of resources but sustainability unaffected. Recovery in 10 years.
Moderate	Temporary alteration or disturbance beyond natural viability. Effects confined<5000 m^2, not accumulating or impairment. Loss of resources but sustainability unaffected. Recovery temporarily affected. Recovery < 5 years
Not detectable	Alteration or disturbance within natural viability. Effects not transmitted, not accumulating. Resources not impaired.

Table 4.10.5-2: Hazardous Chemicals Incidents Impacts – Environment Related

Dangerous Goods and Storage Arrangements	Likely Environmental Impact	Likely Environmental Impact Level (See Table 4.7.5-1)
Class 5.1 Retail Packages located in High Bay Storage in JANUS-JR	Only retail sized packages are stored with effects unlikely to be transmitted. Client advice is as follows: “Spill Hazard: In terms of the hazard of spill and need for bunding, pallets are stretch wrapped, and experience is that we do not drop whole pallets but may lose cartons during putaway and letdown. During picking there is a risk of a dropped carton, but this would also be outside any pallet sized bunding we might use. Size of Spills: These scenarios of low volume spill that can be cleaned up quite easily without the need for bunding. This is a similar level of spill that would occur in a retail store as covered under AS3833 with clean up under section 3.4.9.2. Keep in mind for risk that these are retail packages that we do not open, mix, decant or process. “	Not Detectable
Class 8 Retail Packages located in High Bay Storage in JANUS-JR	Only retail sized packages are stored with effects unlikely to be transmitted. Client advice is as follows: “Spill Hazard: In terms of the hazard of spill and need for bunding, pallets are stretch wrapped, and experience is that we do not drop whole pallets but may lose cartons during putaway and letdown. During	Not Detectable

Dangerous Goods and Storage Arrangements	Likely Environmental Impact	Likely Environmental Impact Level (See Table 4.7.5-1)
	picking there is a risk of a dropped carton, but this would also be outside any pallet sized bunding we might use. Size of Spills: These scenarios of low volume spill that can be cleaned up quite easily without the need for bunding. This is a similar level of spill that would occur in a retail store as covered under AS3833 with clean up under section 3.4.9.2. Keep in mind for risk that these are retail packages that we do not open, mix, decant or process. “	

4.11 JANUS Hazard Identification Table

Table 4.11-1 is the Hazard Identification table for the JANUS project and outlines the for relevant locations, the cause, consequence and proposed mitigating controls as established at the current design phase.

Table 4.11-1: Hazard Identification Table

Scenario #	JANUS Location	Cause	Consequence	Mitigating Controls
1	Dangerous Goods Store (SGS) Fire located at JANUS JN	Pallet dropped whilst handling. Flammable liquid release of several individual retail packages, development of flammable vapour in proximity to an adequately strong ignition source (e.g. Non Ex Rated Forklift)	Controlled spread of fire within DG package store limited to store volume. Production of radiant heat through roof of DG Store from fire/smoke plume. Explosion is not considered credible due to robust construction of DG Package Store. **This hazard has potential to cause injuries and/or property damage across the site boundary and should be analysed further.**	Hazardous Area Classification, Ignition Source Management of Forklifts and Picking Equipment, ESFR Sprinkler System designed for fire extinguishment rather than just fire control, In-Rack Sprinkler protection, storage segregation of dangerous goods in accordance with AS/NZS 3833. Employee Training and manual intervention controls, including fire extinguishers, fire hoses etc.
2	LPG Storage Tank Fire	Impact by forklift or other vehicle on gas piping. Flammable gas release in proximity to an adequately strong ignition source. Jet fire from damaged pipe. Potential for BLEVE.	Production of radiant heat and explosion overpressure. The associated radiant heat and explosion hazards are limited by the presence of on-site structures between the LPG Tank and the surrounding boundaries. This hazard has minimal potential to cause impacts beyond the JANUS boundary.	LPG Tank will be protected by impact protection bollards and reinforced steel guard rail. Significant separation distance to boundary. Due to the location of the LPG Storage Tank in the centre of the JANUS site the tank and potential fire/explosion is effectively separated from the four (4) boundaries by JANUS structures and distance to the boundaries.
3	LPG Forklift Exchange Cylinder Depot Fire	Flammable gas release in proximity to an adequately strong ignition source. Jet fire from safety relief or damaged cylinder valve.	Production of radiant heat. Due to the minor capacity, use of storage containment cages and considerable distance to boundaries, this hazard has minimal potential to cause offsite impacts.	Small storage volume of cylinders and individual cylinders small in size (18kg). Significant separation distance to boundary.

Scenario #	JANUS Location	Cause	Consequence	Mitigating Controls
4	Aerosol (LPG) Store Fire	Flammable gas release from several dropped and damaged aerosol containers in proximity to an adequately strong ignition source. Initially a minor fire source with potential for spread.	Production of radiant heat. Significant explosion (BLEVE) is not considered credible for aerosols. **This hazard has potential to cause injuries and/or property damage across the site boundary and should be analysed further.**	Hazardous Area Classification, Ignition Source Management of Forklifts and Picking Equipment, ESFR Sprinkler System designed for fire extinguishment rather than basic fire spread control, In-Rack Sprinkler protection. Employee Training and manual intervention controls, including fire extinguishers, fire hoses with foam etc.

4.12 JANUS Identified Hazards Location Diagram

Table 4.11-1 identifies the JANUS facility hazardous chemicals hazards, which are transposed onto Figure 4.12-1, below.

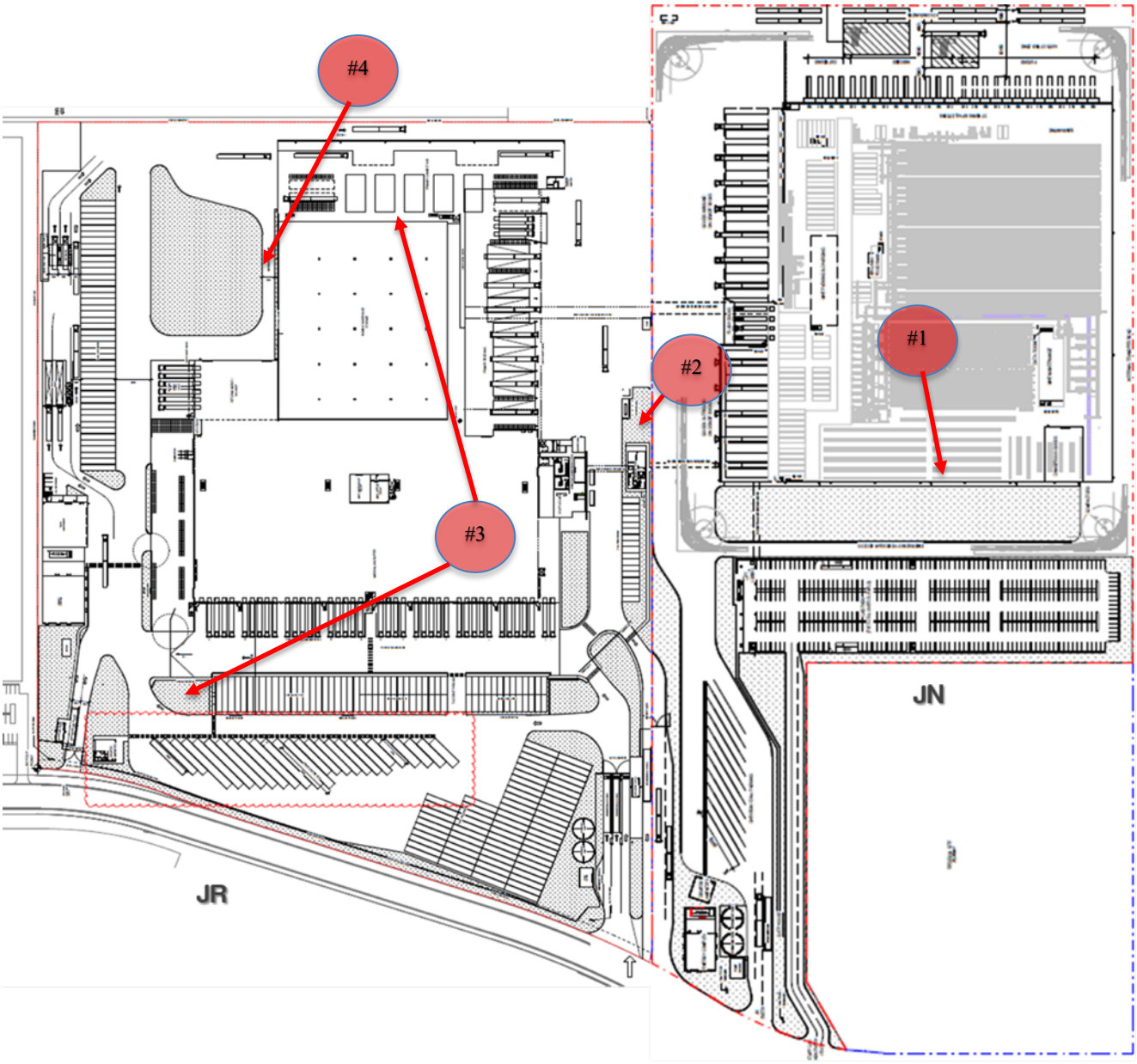


Figure 4.12-1: JANUS Identified Hazard Locations

4.13 External Events

The potential for external events has been contemplated as part of the JANUS risk identification process. No external events were considered as being credible given the location, climate and placement of the Distribution Centre.

The results of this assessment and the issues reviewed are reproduced in Table 4.13-1.

Table 4.13-1: External Events Hazards

External Event	Description
Cyclone	Risk of cyclones unlikely due to site Latitude
External Flooding	Site levels advised to be above flood levels
Airplane Crash	Site not in a flight path
Earthquake	Area considered low risk
Bushfire	This is not a bushfire prone area
Lightning	Design complies with relevant standard to minimise risk
Vehicle Crash On Site	Strictly controlled speed limits and one way traffic route on site

4.14 Estimation of Consequences

4.14.1 Incidents Carried Over For Further Analysis

Two (2) incidents having potential to impact across JANUS boundaries and have been carried forward from the hazard identification process for further analysis, as follows: -

1. Potentially Hazardous Incident # 1 - Dangerous Goods Package Store (Special Goods Store) Fire; and
2. Potentially Hazardous Incident # 4 - Aerosol Store Fire.

Both incidents are associated with a common hazard, which is fire.

Explosion is not considered credible and toxic dangerous goods are not involved.

It is considered that the cause of both fire scenarios are similar in that they are initiated by a minor Loss of Containment event leading to the development of entrained gas or vapour, which is considered to be subsequently ignited by an adequately strong ignition source.

Spread of fire is estimated and the impact of radiant heat is analysed and assessed for its off-site impact against industry thresholds relative to injury impact and property damage, should the energies involved be capable of causing such impacts.

4.14.2 Consequence Factors

In risk analysis, the graphical construct Fault Tree Analysis (FTA) is considered useful for modelling the system conditions using binary variables (0's and 1's) that may result in the occurrence of an unwanted event.

The significance of the output event (otherwise known as the 'Top Level Event') is nominally recognised as the 'consequence factor' being a function of risk and therefore, values of probability (random variables) are not normally applied. There are two (2) possible Top Level Events in the subject scenarios – one relating to Off-Site Injury and the other relating to Off-Site Property Damaged, both related to the same fire events.

The combination of events in the 'AND' gate configuration or even a single event, as in the case of an 'OR' configuration, is required to trigger the output of the Fault Tree (to achieve a value '1'), so input event probability (or risk likelihood factor) is not associated with Fault Trees. It is intended to be a binary construct.

An overall reduction of Individual Risk $_{FATALITY}$ may be achieved by preventing Fault Tree outputs from 'triggering'. This is realised through implementing risk mitigation controls that either address the probability of Fault Tree input occurrence (i.e. Reducing the likelihood or probability of achieving a '1' input condition into a logic gate).

The Fault Tree 'Top Level Event' consequence can be graded either qualitatively, or quantitatively, however for the purpose of a semi-quantitative assessment in this report, a final random variable value between a range of consequence levels (0< Consequence <1) will be applied.

4.14.3 Credible Event Scenario

For the two (2) hazards carried over for further analysis It is considered that the mechanism of failure is almost identical for each scenario (i.e. DG Package Store Fire and Aerosol Store Fire).

Scenario Description

A droppage of flammable dangerous goods product (e.g. Class 3 Flammable Liquids, Class 2.1 Aerosols) leads to the damage of packaging associated with only several retail packages (Aerosols or Fluid Packages) causing flammable product being released.

Under certain conditions of the vapour being within flammable limits, perhaps in the presence of a static energy spark caused by friction against plastic packaging being removed by workers subsequent to droppage, a fire may result.

Should the fire grow, it may cause spread to nearby initially undamaged dangerous goods packages, leading to full fire development.

The following 'Word' picture outlines the progression of the credible event scenario is shown in Figure 1.14.3-1.

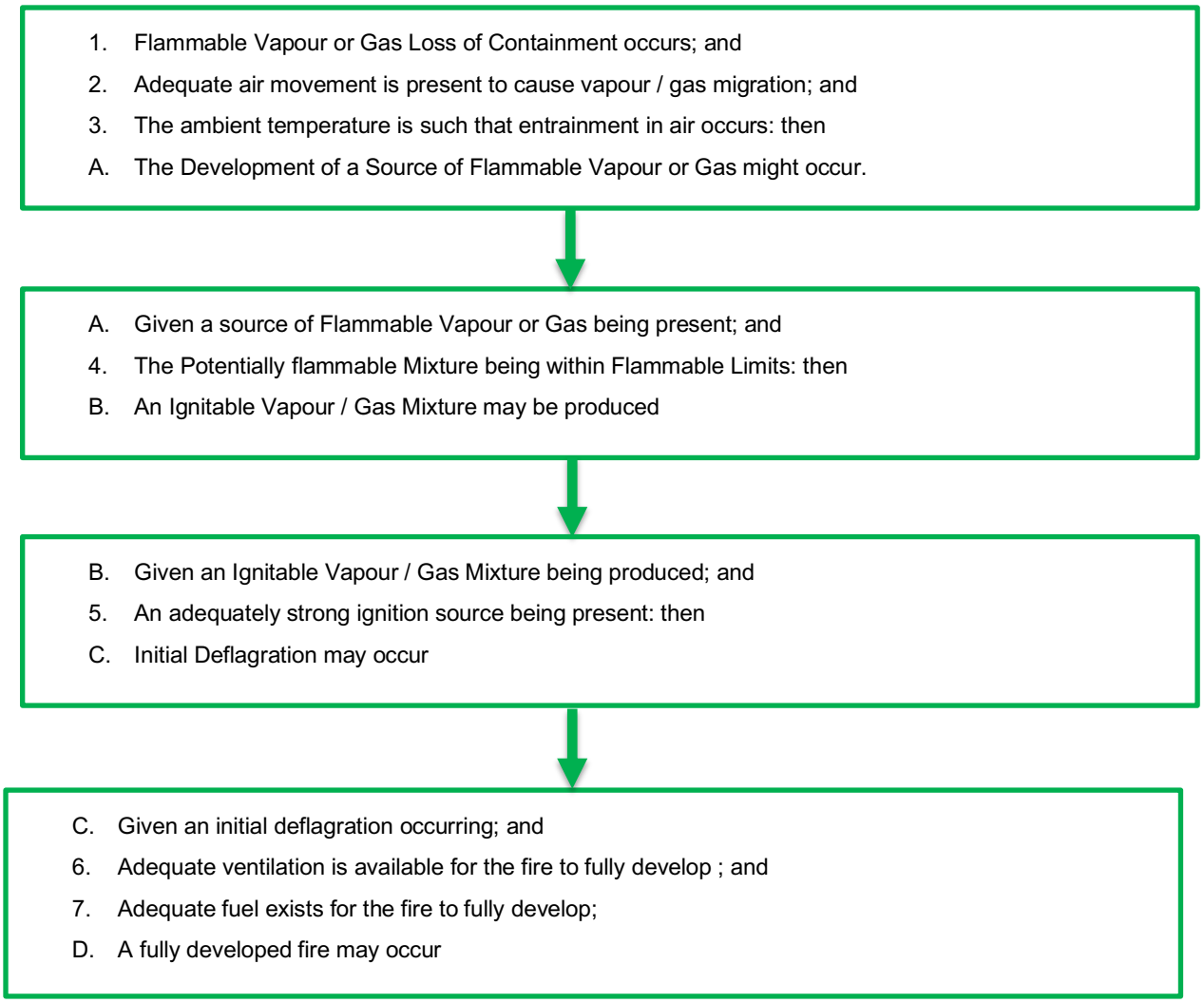


Figure 1.14.3-1: Word Diagram of the progression of the credible event scenarios

4.15 FTA Probability Analysis

The output of Fault Trees is normally used as the 'Given Event' input to a subsequent Event Tree Analysis (ETA), as shown in Figure 4.16-1.

Fault Tree Analysis (FTA) is also referred to as 'probability tree analysis' and is considered an appropriate graphical analysis construct for the representation of the dependence of events. Sequences of discrete random variables or events are typically associated with random variables, or probabilities and may be used to estimate the probability of events across the sequence to a final outcome – The 'Top Level Event'.

Deductive logic that starts with an initiating event used to analyse possible realisations of the variable. The probability of each event is displayed conditional on the occurrence of events that precede it in the Fault Tree; these are called 'nodes'.

The product probability of each event is shown conditional on the occurrence of events representing the possible subsequent sequences at each node (A, B, C, D etc).

Table 4.15-1 lists the progressive events outlined in the FTA shown in Figure 4.16-1: 'Fault Tree Analysis for JANUS Hazards Carried over for Further Assessment'.

Table 4.15-1: Progressive FTA Events

Node Reference	Events
A	Source of Flammable Vapour / Gas
B	Ignitable Vapour / Gas Volume
C	Initial Deflagration
D (Top Level Event)	Fully Developed Fire

4.15.1 Event Probability Analysis - A – Source of Flammable Vapour / Gas

The probability of vapour / gas release, on the basis of the credible threat scenarios derived from previous Woolworths Ltd SGS User Group Workshops is assumed to be equivalent to the probability of a human handling failure in conjunction with the probability of the co-existence of several environmental factors relating to the formation of a fuel spill / gas release and the evaporation / dispersion of fuel.

The probability of a human handling error by a trained technical worker carrying out non-critical routine activities is in the order of 0.003 based on a 'Rates of Error in Human Handling' study carried out by the US Atomic Energy Commission Reactor Safety Study [7] has been applied. Refer Table 4.15.1-1

Given a reasonable level (=> 12 Air Changes Per Hour) of ventilation within the SGS Room and Aerosol Store, it is likely that the most significant accidental release (Flammable liquid or Aerosol gas) will proceed to evaporation or dispersion, so the estimated probability of evaporation or dispersion of an existing spill approximates 1. The overall probability for this event is therefore the product of these probabilities and is effectively the probability of a human error, as described. **Probability of 'A' Vapour Release $P_{(VR)}$ = 0.003**

Table 4.15.1-1: Rates of Error in Human Handling

Type of Activity	Probability of Error Per Task
Critical Routine Task	0.001
Non - Critical Routine Task	0.003
Non-Routine Operations	0.01
Check List Inspection	0.1

4.15.2 Event Probability Analysis - B – Ignitable Gas / Vapour Volume

The potential vapour-air mixture has a readily available supply of fresh air due to mechanical ventilation in the Special Goods Store (designed to AS/NZS 3833 [8] requirements and validated using Computational Fluid Dynamics modelling on previous projects).

Whilst the quantity of flammable liquid released may be considered a small amount, the likelihood of the fuel vapour-air mixture being within the flammable range of the substance is significant.

An assumed probability of 0.9 is considered appropriate for the mixture (i.e. The Hypothetical Volume V_z) being potentially explosive, that is, greater than the Lower Explosive Limit (LEL) and less than the Upper Explosive Limit (UEL). **Probability of 'B' Ignitable Vapour / Gas Volume $P_{(IG)}$ = 0.9**

4.15.3 Event Probability Analysis - C – Initial Deflagration

Ignition sources may be present in the SGS as either 'Fixed' or 'Portable' sources. Astbury (2005) reports in the "Review of unidentified ignition sources of unplanned flammable releases – Comparison of Offshore and Onshore data" [9] of common categories of general ignition sources from the UK 'Major Hazard Incident 'DAta' Service" MHIDAS.

The MHIDAS information breaks the data down into primary ignition sources and secondary ignition sources. For example, 'Auto Ignition' is a primary source with 'Chemical Reaction' as the secondary source. 'Electric' and 'Flame' ignition sources are shown in Table 4.15.3-1 as significant factors of fire during an unplanned flammable liquid release or flammable gas release in land based 'non-process' situations.

Table 4.15.3-1 Non-Process Ignition Sources resulting in fires of unplanned flammable releases. (9)

Primary Ignition Source	Non-Process Flammable Release Fire Starts
Arson	5.5%
Auto Ignition	5.6%
Collision	7.0%
Electric	10.8%
Flame	9.4%
Friction Spark	1.9%
Hot Surface	4.0%
Non Ignition	3.2%
Unknown	53.7%
TOTAL	100%

The credible scenarios developed by previous SGS User Group meetings have indicated the most likely sources of ignition of flammable vapour / gas related to hot surface. The probability of ignition of a flammable vapour as a result of **'flame'** sources is 0.094. It is likely that the ignition of potentially flammable vapour would represent a minor to moderate deflagration. **Probability of 'C' Initial Deflagration $P_{(DEF)}$ = 0.094**

4.15.4 Event Probability Analysis - D – Fully Developed Fire

The proposed design basis for the Dangerous Goods Package Store (SGS) and the Aerosol Store is to meet compliance with AS/NZS 3833 [8] and AS 1940 [10] in terms ventilation rates and combustible storage capacity. Additionally, each store is provided with FM Global compliant ESFR ceiling mounted sprinklers and In-Rack sprinklers, which if activated, would reduce or eliminate the available combustible fuel volume at the fire interface.

ESFR sprinkler systems are designed for fire suppression, whereas standard commercial sprinklers are designed for control of fire growth. The design expectation is that subject fires will be extinguished soon after sprinkler activation by wetting fuel that is intimate with the fire front. In such case, the probability of a fully developed fire $P_{(FDEV)}$ is subject to the probability of the sprinkler system not being available when it is called for i.e. NOT $P_{(S)}$.

Commonly considered failure rates for sprinkler systems in Australia [11] are between 5% (for non-flashover fires) and 1% (or flashover fires). Failure of the sprinkler system is assumed to lead to a fully developed fire. Assuming that the fire is required to undergo flashover to cause the roof of the Package Store or Aerosol Store to fail, then the probability of sprinkler failure applied is 1% or 0.01, so it follows that the probability of the fire reaching flashover and becoming fully developed is equivalent to sprinkler failure, so 0.01. **Probability of 'D' - Fully Developed Fire $P_{(FDEV)}$ = 0.01**

4.16 Fault Tree Analysis

A Fault Tree Analysis (FTA) (Refer Figure 4.16-1) graphically describes the progression of the hazard scenario up to the Top Level Event (Event D). The probability of branch events in the FTA and the Top Level Event probability are described in Table 4.16-1: FTA Probabilities.

Table 4.16-1: FTA Probabilities

Node	Description	Probability
A	Source of Flammable Vapour / Gas	Probability of 'A' Vapour Release $P_{(VR)}$ = 0.003
B	Ignitable Vapour / Gas Volume	Probability of 'B' Ignitable Vapour / Gas Volume $P_{(IG)}$ = 0.9
C	Initial Deflagration	Probability of 'C' Initial Deflagration $P_{(DEF)}$ = 0.094
D	Fully Developed Fire Top Level Event	Probability of 'D' - Fully Developed Fire $P_{(FDEV)}$ = 0.01
Overall Probability of Top Level Event, given occurrence of an initiating event.		$(P_{(VR)} = 0.003).(P_{(IG)} = 0.9).(P_{(DEF)} = 0.094).(P_{(FDEV)} = 0.01)$ $= 2.538 \times 10^{-6}$

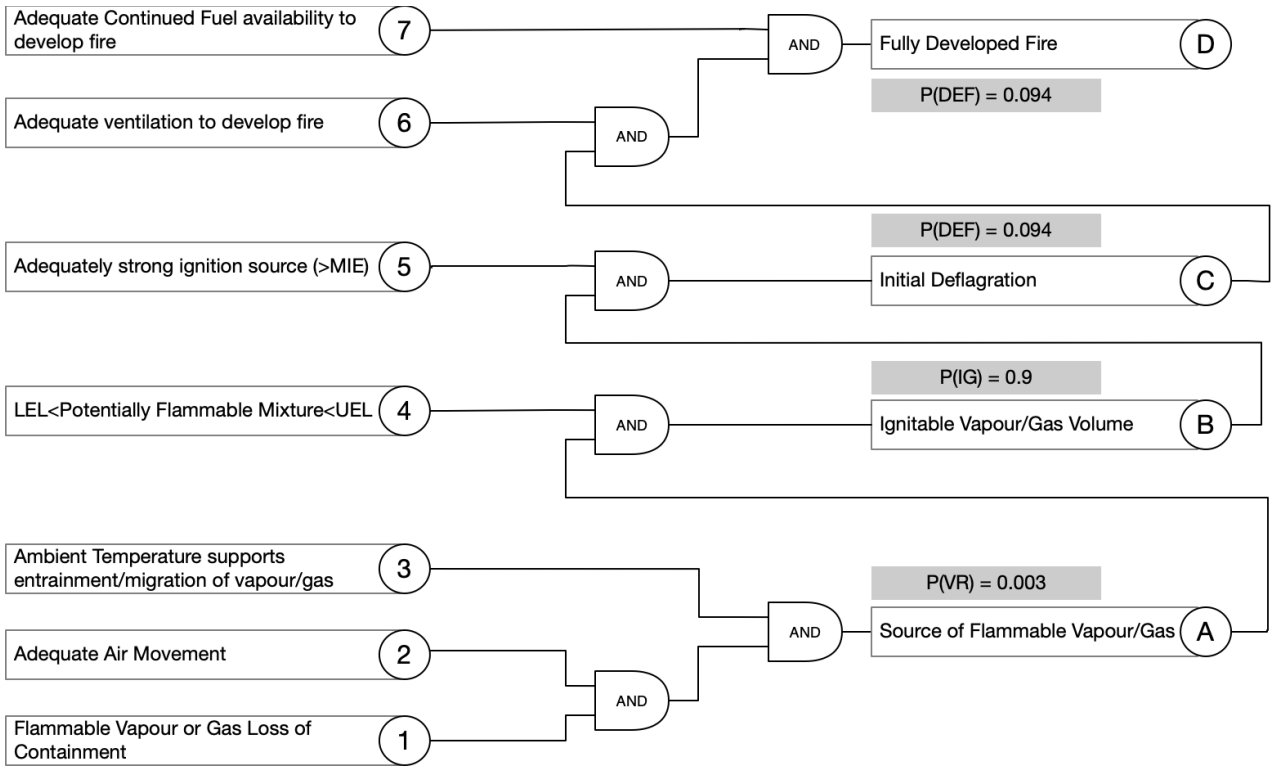


Figure 4.16-1: Fault Tree Analysis for JANUS Hazards Carried over For Further Assessment

4.17 Estimation of Likelihood

4.17.1 Likelihood Analysis - Potential for Off Site Injury

The assessment of the probability of potential Off Site injury, as a result of radiant heat, is based on the assertion that a fully developed fire exists. The fire is assumed to have breached the non-fire-rated roof of the dangerous goods store or aerosol store and not spread to other parts of the facility, consistent with AS1940 [10] design. In contrast, radiant heat external to the store would unlikely be relevant to neighbouring property if the roof has not failed, as the fire would be contained within a predominantly laterally fire rated structure.

It is considered that if the analytically assessed radiant heat flux from the fully developed fire from either the 1) Dangerous Goods Package Store (with failed roof), or from the 2) Aerosol Store with failed roof, is equal to or exceeds

4.7kw/m^2, then the probability arbitrarily allocated is 0.99, an allocation consistent with the theme of HIPAP 4 guidance [4].

There is considered reasonable uncertainty (i.e. estimated to be approximately +/- 10%) in the analytical approach in that the estimated radiant heat flux is greater or less than 4.7kW/m^2 due to currently unknown fuel configurations and unfrozen store dimensions.

To allow for such uncertainty, only values less that 90% (i.e. <0.9x4.7kw/m^2) of the estimated radiant heat flux will be allocated a probability lower than 0.99, that is, values less than <4.23kw/m^2 will be allocated a probability of 0.01.

Values over 4.23kw/m2 will be allocated a probability of 0.99 so as to allow for uncertainty.

Where the radiant heat flux exceeds 4.23kw/m2, $P_{(INJ\ OFF\ SITE)}$ = 0.99

Where the radiant heat flux is less than 4.23kw/m2, $P_{(INJ\ OFF\ SITE)}$ = 0.01

4.17.2 Likelihood Analysis - Potential for Off Site Property Damage

The assessment of the probability of potential Off Site property damage as a result of radiant heat is based on the assertion that a fully developed fire exists. The fire is assumed to have breached the non-fire-rated roof of the dangerous goods store or aerosol store and not spread to other parts of the facility. Radiant heat external to the store would unlikely be relevant to neighbouring property if the roof is not failed, as the fire would be contained within predominantly fire rated structure.

It is considered that if the analytically assessed radiant heat flux from the fully developed fire from either the 1) Dangerous Goods Package Store (i.e. with failed roof) or from the 2) Aerosol Store with failed roof, is equal to or exceeds 23kw/m^2, then the probability arbitrarily allocated is 0.99, however based on HIPAP 4 guidance [4].

There is considered reasonable uncertainty (estimated to be approximately +/- 10%) in the analytical approach in that the estimated radiant heat flux is greater or less than 23kW/m^2 due to currently unknown fuel configurations and store dimensions.

Only values less that 90% of the estimated radiant heat flux will be allocated a probability lower than 0.99, that is, values less than <20.7kw/m^2 will be allocated a probability of 0.01, however values over 20.7kw/m2 will be allocated a probability of 0.99 so as to achieve a conservative approach.

Where the radiant heat flux exceeds 20.7kw/m2, $P_{(INJ\ OFF\ SITE)}$ = 0.99

Where the radiant heat flux is less than 20.7kw/m2, $P_{(INJ\ OFF\ SITE)}$ = 0.01

4.18 Event Tree Analysis

The summed probability of the branches of any sequence in an Event Tree is '1.00' x the probability of the Initiating Event, as the combination of both the possible sequences in the Event Tree must equal the total of all possible sequences in the Event Tree. Refer to Figure 4.18-1 Event Tree Analysis.

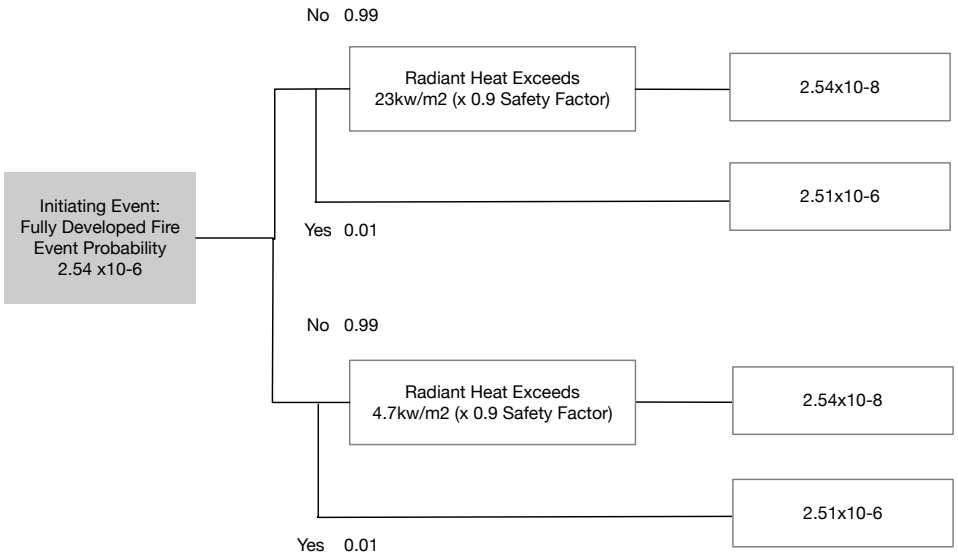


Figure 4.18-1: Event Tree Analysis

4.1 Calculation of Risk

The likelihood of the hazardous incidents occurring was estimated as very low, a probability of occurrence in the order of $2.54x10^{-6}$. The consequence of the hazardous incident occurrence is estimated as not exceeding neighbouring Injury or Property Loss thresholds, which are outlined as follows:-

4.1.1 Deterministic Estimation of Radiant Heat at Nearest

For each scenario: DG Package Store and Aerosol Store, the estimated radiant heat at the boundary, based on estimated room sizes and fire plume characteristics, is as follows:

4.1.2 DG Package Store (SGS) Radiant Heat Assessment

A point source estimate has been undertaken as shown in Figure 4.1.2-3 based on a number of assumptions relating to the size and emissive characteristics of the fire plume emanating from the fully breached roof of the DG Package Store.

An estimate of the 4.7kw/m^2 contour is shown for comparison in Figure 4.1.2-4

A number of assumptions are made, as the final design is incomplete.

- The emitting surface of the fire/smoke plume directly adjacent the nearest property boundary is 15m in width and 10m in height;
- The base of the plume starts at 10m above ground level;
- The colour of the fire plume is black due to the existence of significant entrained hydrocarbons, so has an emissivity of 1;
- As flashover has been reached and the roof steel has failed, it is assumed that the plume temperature is no less than 1000 Deg C at its base; and
- The distance to the nearest boundary is 14.5m.

The estimated Radiant Heat at the nearest property boundary is **3.04 kW/m^2** as shown in Figure 4.1.2-1.

4.7kw/m^2 Radiant Heat is estimated to be 7m from the perimeter of the DG Store fire plume, as shown in Figure 4.1.2-2.

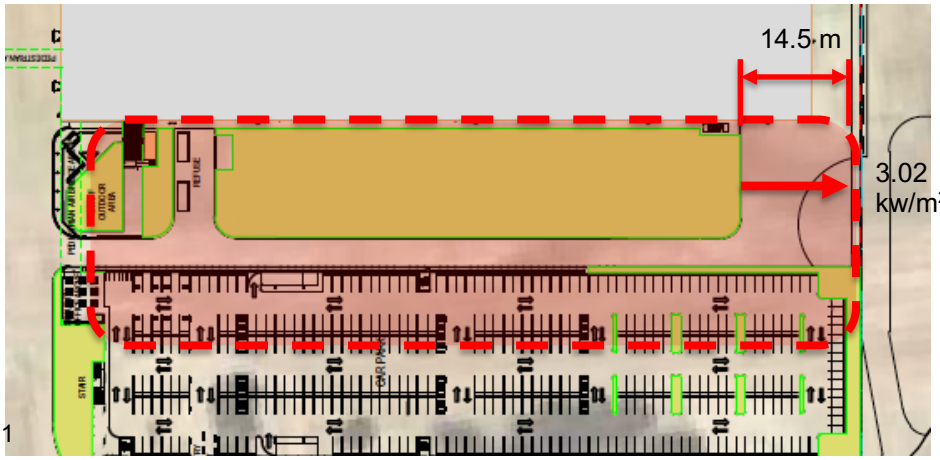


Figure 4.1.2.-1

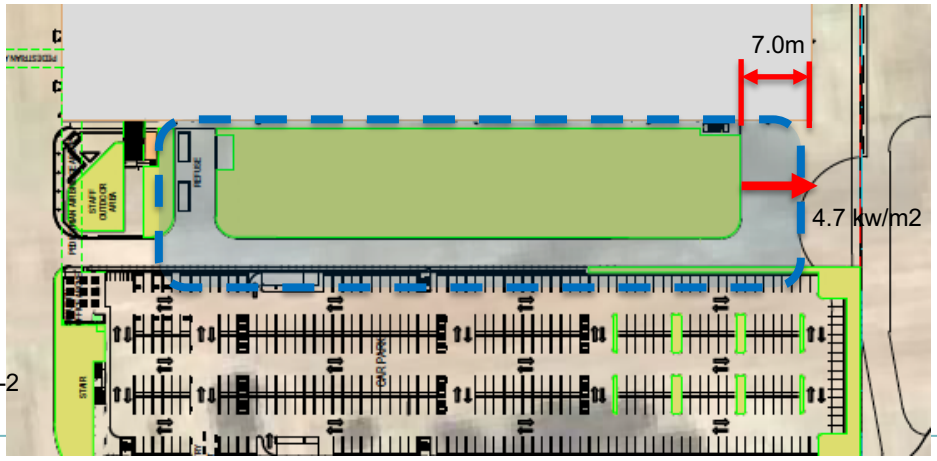


Figure 4.1.2-2

Radiation to Perpendicular Receiver

Fire Engineering Design Guide, Third Edition

Inputs

T	Temperature of radiator	1000	°C
ε	Emissivity	1	
a_1	Width of Area 1 (A_1)	15	m
b_1	Height of Area 1 (A_1)	10	m
a_2	Width of gap to boundary	10	m
c	Distance to receiver	14.50	m
k_1	Radiation reduction factor	1	

where: 1 Radiation through opening (glass breaks)
0.5 Radiation through fire resistant glazing (e.g. -/60/-)

Parameters

σ	Stefan-Boltzmann constant	5.67E-11	kW/m^2K^4

Calculations

$$\dot{q}''_R = k_1 \Phi \varepsilon \sigma \left[(273 + T_e)^4 - (273 + T_r)^4 \right] \quad [7.4]$$

where k_1 is the radiation reduction factor

Φ is the configuration factor (value between 0 and 1.0)

ε is the emissivity of emitter and absorptivity of receiving surface (value between 0 and 1.0). It is conservative to take $\varepsilon = 1.0$.

σ is the Stefan-Boltzmann constant = 56.7 x 10^{-12} ($kW/m^2 K^4$)

T_e is the temperature of emitting surface (maximum firecell temperature) (°C)

T_r is the temperature of receiving surface (°C)

Area 1	
A =	0.24
X =	3.00
Y =	2.90
Configuration Factor for Area 1 =	0.0268
2 x Configuration Factor for Area 1 =	0.0537
Area 2	
A =	0.28
X =	2.00
Y =	2.90
Configuration Factor for Area 2 =	0.0166
2 x Configuration Factor for Area 2 =	0.0332

Output Results

Configuration factor to receiver	0.0204	
Radiation emitted	148.90	kW/m^2
Maximum radiation along boundary	4.69	kW/m^2
Distance from emitter at max.	7.10	m (to nearest 0.1 m)
Radiation received at distance 'c'	**3.04**	**kW/m^2**

Figure 4.1.2-3 Calculated Radiation from DG Store Roof Fire to Nearest Boundary

Radiation to Perpendicular Receiver

Fire Engineering Design Guide, Third Edition

Inputs

	Temperature of radiator	1000	°C
	Emissivity	1	
a_1	Width of Area 1 (A_1)	15	m
b_1	Height of Area 1 (A_1)	10	m
a_2	Width of gap to boundary	10	m
c	Distance to receiver	7.00	m
k_1	Radiation reduction factor	1	

T where: 1 Radiation through opening (glass breaks)

ε 0.5 Radiation through fire resistant glazing (e.g. -/60/-)

Parameters

σ	Stefan-Boltzmann constant	5.67E-11	kW/m^2K^4

Calculations

Area 1		
A =	0.30	
X =	3.00	
Y =	1.40	
Configuration Factor for Area 1 =	0.0790	
2 x Configuration Factor for Area 1 =	0.1579	
Area 2		
A =	0.41	
X =	2.00	
Y =	1.40	
Configuration Factor for Area 2 =	0.0632	
2 x Configuration Factor for Area 2 =	0.1265	

Output Results

Configuration factor to receiver	0.0315		
Radiation emitted	148.90	kW/m^2	
Maximum radiation along boundary	4.69	kW/m^2	
Distance from emitter at max.	7.10	m	(to nearest 0.1 m)
Radiation received at distance 'c'	**4.69**	**kW/m^2**	

Figure 4.1.2-4: Dangerous Goods Store 4.7kw/m^2 contour

4.1.3 Aerosol Store Radiant Heat Assessment

A point source estimate has been undertaken as shown in Figure 4.1.3-3 based on a number of assumptions relating to the size and emissive characteristics of the fire plume emanating from the fully breached roof of the Aerosol Store.

An estimate of the 4.7kw/m^2 contour is shown for comparison in Figure 4.1.3-4

A number of assumptions are made, as the final design is incomplete.

- The emitting surface of the fire/smoke plume directly adjacent the nearest property boundary is 10m in width and 20m in height;
- The base of the plume starts at 10m above ground level;
- The colour of the fire plume is black due to the existence of significant entrained hydrocarbons, so has an emissivity of 1;
- As flashover has been reached and the roof steel has failed, it is assumed that the plume temperature is no less than 1000 Deg C at its base; and
- The distance to the nearest boundary is 62.6m.

The estimated Radiant Heat at the nearest property boundary is **0.26 kW/m^2** as shown in Figure 4.1.3-1.

4.7kw/m^2 Radiant Heat is estimated to be 16m from the perimeter of the DG Store fire plume, as shown in Figure 4.1.3-2.

Figure 4.1.3-1

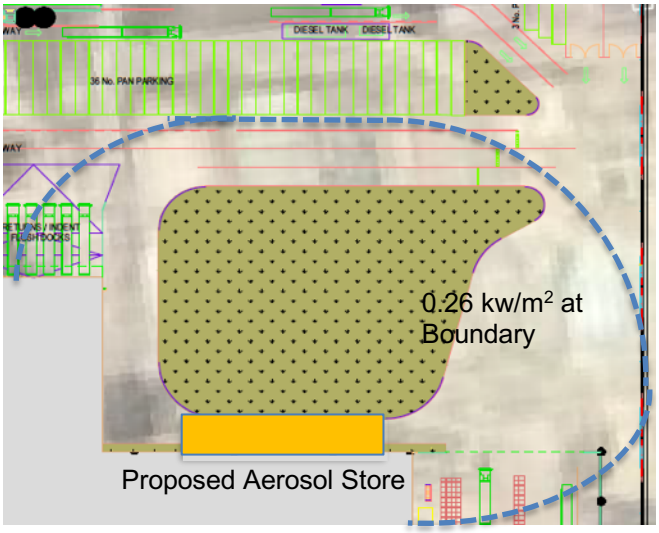


Figure 4.1.3-1

Figure 4.1.3-2

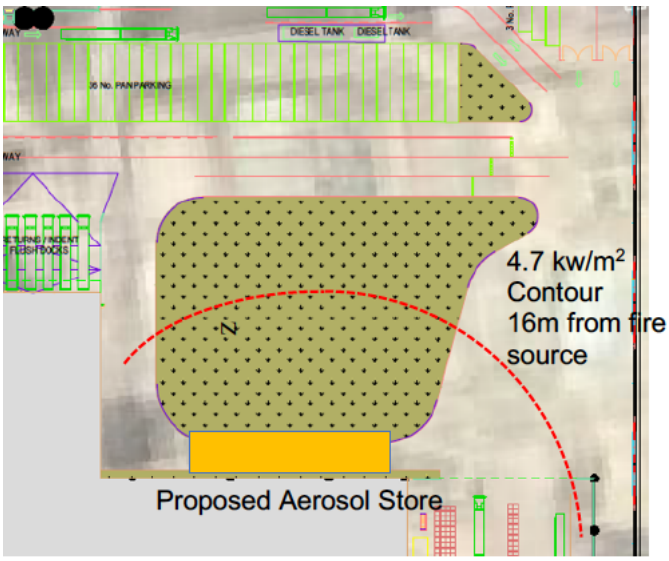


Figure 4.1.3-2

Radiation to Perpendicular Receiver

Fire Engineering Design Guide, Third Edition

Inputs

	Temperature of radiator	1000	°C
	Emissivity	1	
a_1	Width of Area 1 (A_1)	20	m
b_1	Height of Area 1 (A_1)	10	m
a_2	Width of gap to boundary	10	m
c	Distance to receiver	62.60	m
k_1	Radiation reduction factor	1	

where: 1 Radiation through opening (glass breaks)
0.5 Radiation through fire resistant glazing (e.g. -/60/-)

T

ε

Parameters

σ	Stefan-Boltzmann constant	5.67E-11	kW/m^2K^4

Calculations

$$\dot{q}''_R = k_1 \Phi \varepsilon \sigma \left[(273 + T_e)^4 - (273 + T_r)^4 \right] \quad [7.4]$$

where k_1 is the radiation reduction factor

Φ is the configuration factor (value between 0 and 1.0)

ε is the emissivity of emitter and absorptivity of receiving surface (value between 0 and 1.0). It is conservative to take $\varepsilon = 1.0$.

σ is the Stefan-Boltzmann constant = 56.7×10^{-12} ($kW/m^2 K^4$)

T_e is the temperature of emitting surface (maximum firecell temperature) (°C)

T_r is the temperature of receiving surface (°C)

Area 1		
A =	0.08	
X =	4.00	
Y =	12.52	
Configuration Factor for Area 1 =	0.0012	
2 x Configuration Factor for Area 1 =	0.0023	
Area 2		
A =	0.08	
X =	2.00	
Y =	12.52	
Configuration Factor for Area 2 =	0.0003	
2 x Configuration Factor for Area 2 =	0.0006	

Output Results

Configuration factor to receiver	0.0017		
Radiation emitted	148.90	kW/m^2	
Maximum radiation along boundary	7.01	kW/m^2	
Distance from emitter at max.	7.90	m	(to nearest 0.1 m)
Radiation received at distance 'c'	**0.26**	**kW/m^2**	

Figure 4.1.3-3 Calculated Radiation from Aerosol Store Roof Fire to Nearest Boundary

Radiation to Perpendicular Receiver

Fire Engineering Design Guide, Third Edition

Inputs

	Temperature of radiator	1000	°C
	Emissivity	1	
a_1	Width of Area 1 (A_1)	20	m
b_1	Height of Area 1 (A_1)	10	m
a_2	Width of gap to boundary	10	m
c	Distance to receiver	16.00	m
k_1	Radiation reduction factor	1	

T where: 1 Radiation through opening (glass breaks)
0.5 Radiation through fire resistant glazing (e.g. -/60/-)

Parameters

ε

σ	Stefan-Boltzmann constant	5.67E-11	kW/m^2K^4

Calculations

Area 1		
A =	0.20	
X =	4.00	
Y =	3.20	
Configuration Factor for Area 1 =	0.0290	
2 x Configuration Factor for Area 1 =	0.0581	
Area 2		
A =	0.26	
X =	2.00	
Y =	3.20	
Configuration Factor for Area 2 =	0.0132	
2 x Configuration Factor for Area 2 =	0.0265	

Output Results

Configuration factor to receiver	0.0316		
Radiation emitted	148.90	kW/m^2	
Maximum radiation along boundary	7.01	kW/m^2	
Distance from emitter at max.	7.90	m	(to nearest 0.1 m)
Radiation received at distance 'c'	**4.70**	**kW/m^2**	

Figure 4.1.3-4: Aerosol Store 4.7kw/m^2 contour

5.0 Conclusions

The initial SEPP33 screening test indicated potential hazardous development due to an aerosol storage fire and possible radiant heat effects at the nearest boundary, triggering the requirement for a Preliminary Hazard Analysis.

In terms of the consequence of a hazardous incident occurring at the proposed Woolworths JANUS Distribution Centre subsequently affecting neighbouring industrial zoned space, two (2) potential incident sources were taken forward from an initial hazard identification analysis for further review.

These incidents included: -

3. A fully developed fire associated with the Dangerous Goods Package Store (Special Goods Store) involving failure of the AS1940 compliant non-fire rated roof with subsequent fire and smoke plume emanating from the roof opening; and
4. A fully developed fire associated with the Aerosol Store involving failure of the non-fire rated roof with subsequent fire and smoke plume emanating from the roof opening.

The identified hazard for both scenarios was radiant heat, as the potential for explosion was considered very low due to the small size of individual retail packages in each store and the robustness of store construction. Toxic release was considered atypical due to the non-storage of toxic hazardous chemicals in each location.

Point source radiant heat analysis indicated for both scenarios that the level estimated at nearest boundaries was well below 4.7kw/m^2, so neither injury risk nor property damage risk exceeded industry accepted thresholds. Further, once the biodiversity conservation zone is revegetated, it is unlikely that vegetation will be impacted under either scenario.

The likelihood of the hazardous incidents occurring was also estimated as very low, a probability of occurrence in the order of $2.54x10^{-6}$.

Mitigations that support the low probability of a fully developed fire occurring include:-

1. Robust fire rated package store design based on applicable Australian Standards (AS/NZS 3833 [8], AS1940 10]);
2. Early Suppression Fast Response sprinklers (ESFR) designed for fire extinguishment rather than control of fire spread;
3. In-Rack Sprinkler protection;
4. Separation of dangerous goods in accordance with AS/NZS 3833 [8];
5. Hazardous Area Classification in accordance with AS/NZS 60079.10.1 [12].

As noted previously, SEPP 33 is an enabling instrument, allowing for the development of industry, it also aims to ensure that the merits of proposals are properly assessed in relation to off-site risk and offence before being determined. Additionally, the SEPP 33 process allows a merit-based approach beyond initial screening tests, ensuring that locational and design considerations are an integral part of the assessment process by using a PHA process to facilitate the analysis undertaken. Consent Condition B176, perhaps unintentionally, restricts the proper application of SEPP33 in the subject JANUS development case. For this reason, it is recommended, that Consent Condition B176 be amended to suit the following, with respect to the intent of the enabling the complete application of SEPP33:

“Should the total quantities of dangerous goods present at any time within the development and transport movements to and from the development exceed the screening threshold quantities and movements listed in the Department’s Hazardous and Offensive Development guidelines *Applying SEPP 33 (January 2011),* a Preliminary Hazard Analysis must be provided to demonstrate compliance can be achieved with the requirements of SEPP 33.”

Based on the PHA results, it is recommended that the proposed JANUS Distribution Centre development is <u>not</u> considered potentially hazardous.

6.0 References

[1] Hazardous and Offensive Development Application Guidelines - Applying SEPP33, 2011, NSW Dept Planning, Sydney, NSW.

[2] Hazardous Industry Planning Advisory Paper (HIPAP) No.6 – Hazard Analysis, NSW Dept Planning, Sydney, NSW.

[3] Assessment Guideline – Multi Level Risk Assessment, NSW Dept Planning, Sydney, NSW.

[4] HIPAP No. 4 – Risk Criteria for Land Use Planning, 2011, NSW Dept Planning, Sydney, NSW.

[5] Work Health and Safety Regulation (NSW) 2017, SafeWork NSW, Sydney, NSW

[6] Environmental Planning and Assessment Act 1979, NSW Government, Sydney NSW

[7] 'Rates of Error in Human Handling' study carried out by the US Atomic Energy Commission Reactor Safety Study.

[8] AS/NZS 3833, 2007, The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers, SAI Global, Homebush NSW

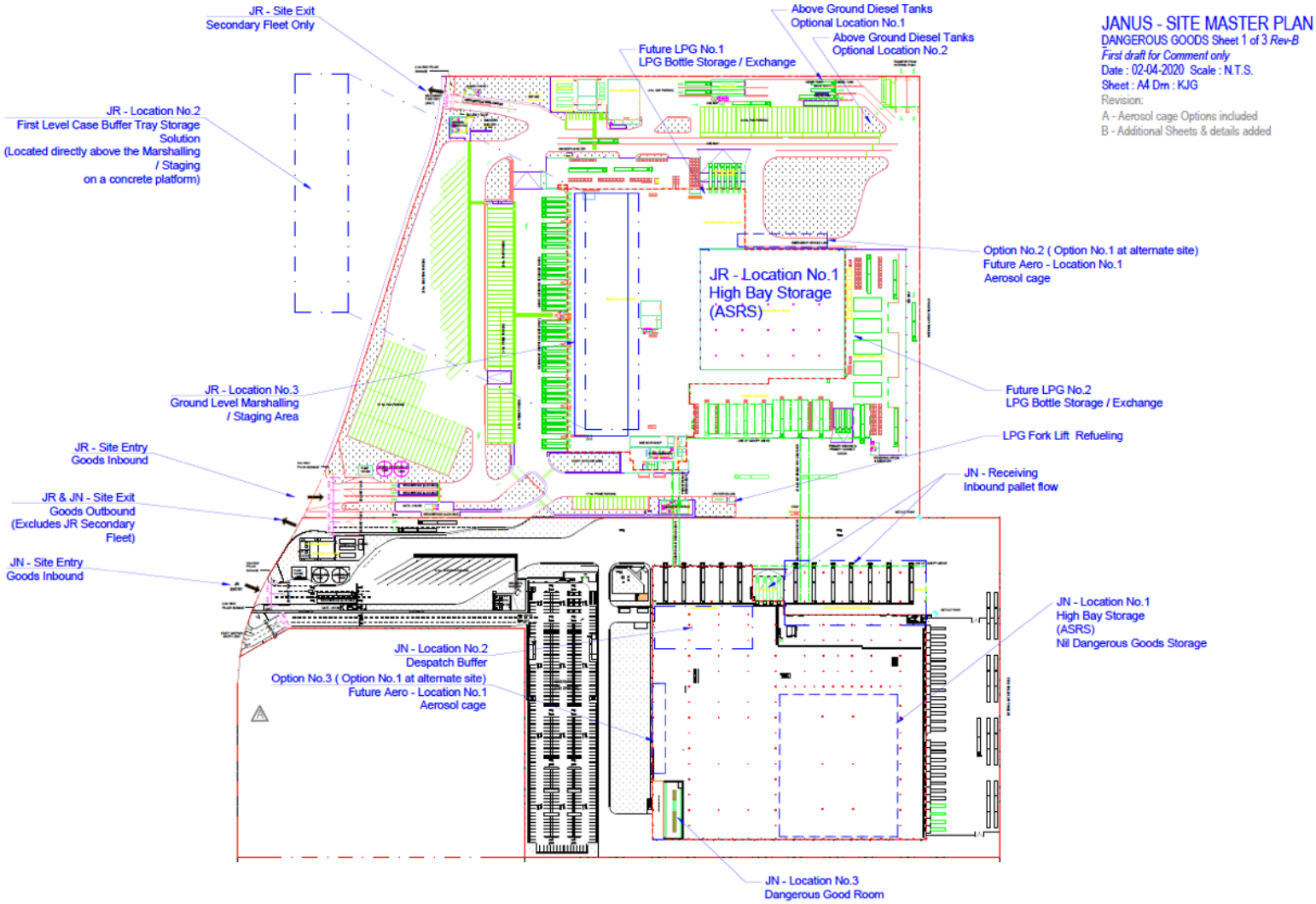
[9] "Review of unidentified ignition sources of unplanned flammable releases – Comparison of Offshore and Onshore data"

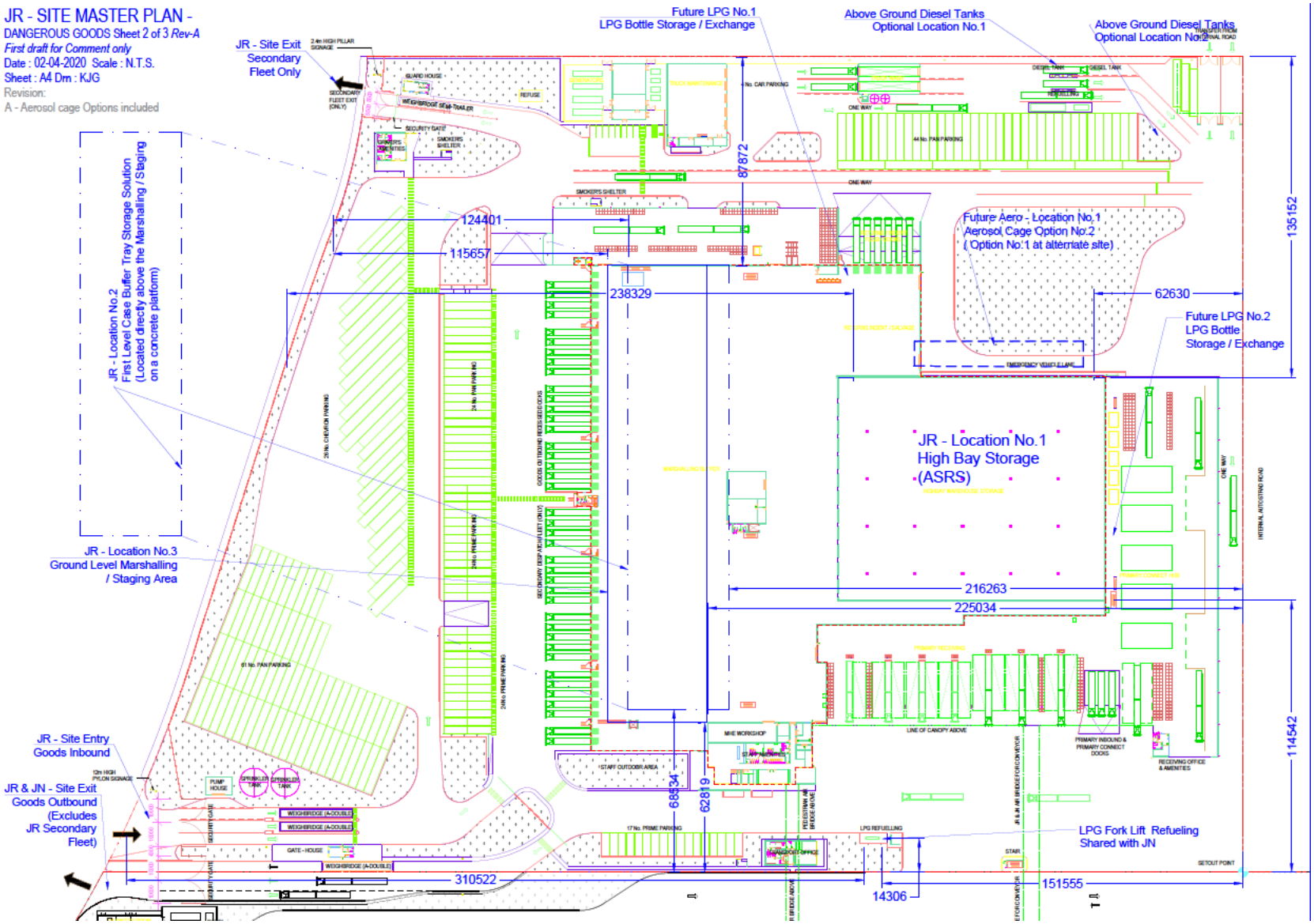
[10] AS1940, 2017, The storage and handling of flammable and combustible liquids, SAI Global, Homebush NSW

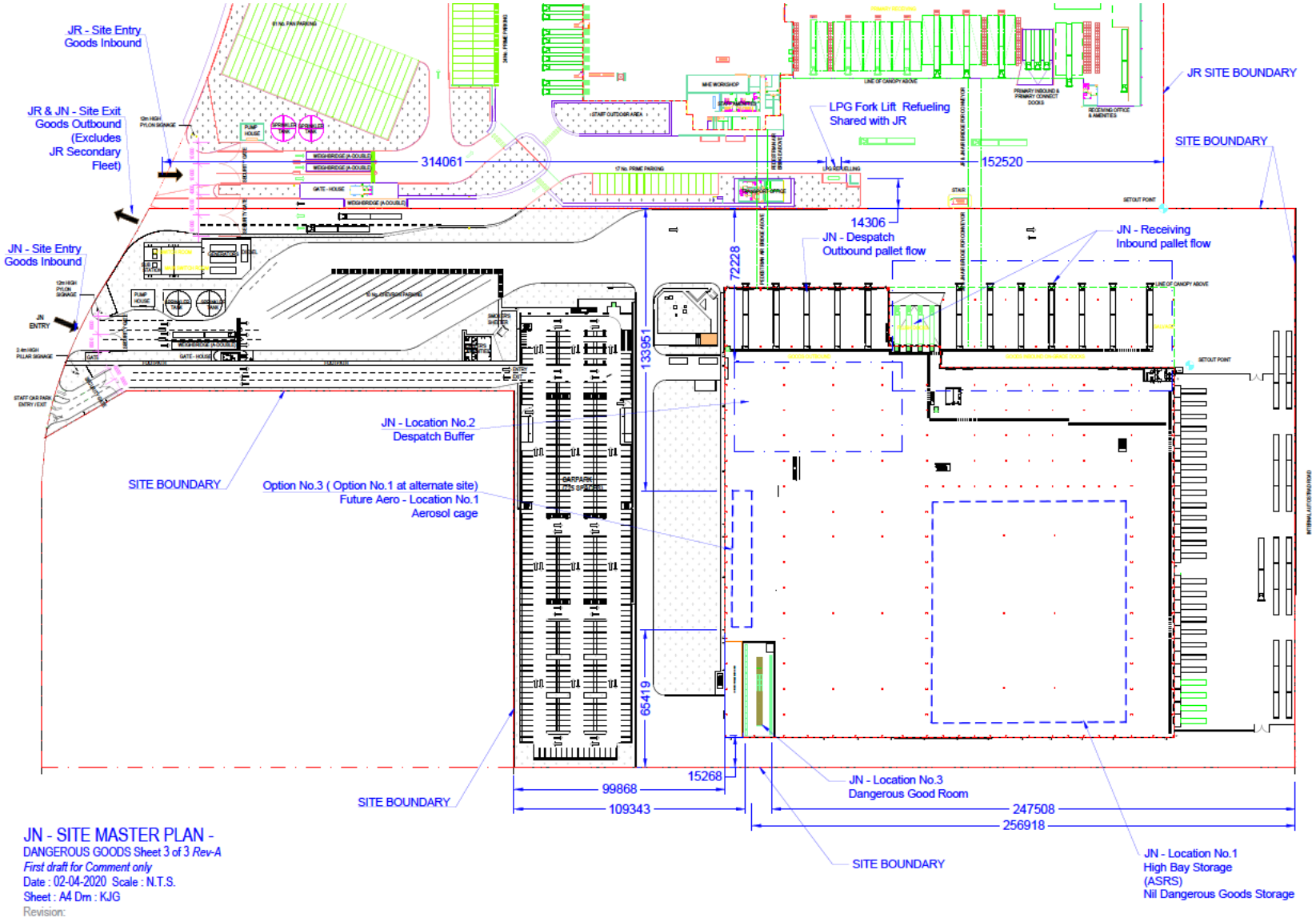
[11] Zhuiykov, S. and Dowling, V. "Maintenance Testing of Sprinkler Heads: Qualitative Analysis Causes of Failures" Fire Safety Science -- Proceedings of the Eighth Int. Symp., International Association for Fire Safety Science, 2005, pp. 811-822. doi:10.3801/IAFSS.FSS.8-811

[12] AS/NZS 60079.10.1, 2009, Explosive atmospheres Classification of areas - Explosive gas atmospheres (IEC 60079-10-1, Ed.1.0(2008) MOD), SAI Global, Homebush NSW

7.0 Drawings


JANUS - SITE MASTER PLAN
DANGEROUS GOODS Sheet 1 of 3 Rev-B
First draft for Comment only
Date : 02-04-2020 Scale : N.T.S.
Sheet : A4 Drn : KJG
Revision:
A - Aerosol cage Options included
B - Additional Sheets & details added
JR - Site Exit
Secondary Fleet Only
JR - Location No.2
First Level Case Buffer Tray Storage
Solution
(Located directly above the Marshalling
/ Staging
on a concrete platform)
JR - Location No.3
Ground Level Marshalling
/ Staging Area
JR - Site Entry
Goods Inbound
JR & JN - Site Exit
Goods Outbound
(Excludes JR Secondary
Fleet)
JN - Site Entry
Goods Inbound
Future LPG No.1
LPG Bottle Storage / Exchange
Above Ground Diesel Tanks
Optional Location No.1
Above Ground Diesel Tanks
Optional Location No.2
JR - Location No.1
High Bay Storage
(ASRS)
Option No.2 (Option No.1 at alternate site)
Future Aero - Location No.1
Aerosol cage
Future LPG No.2
LPG Bottle Storage / Exchange
LPG Fork Lift Refueling
JN - Receiving
Inbound pallet flow
JN - Location No.1
High Bay Storage
(ASRS)
Nil Dangerous Goods Storage
JN - Location No.2
Despatch Buffer
Option No.3 (Option No.1 at alternate site)
Future Aero - Location No.1
Aerosol cage
JN - Location No.3
Dangerous Good Room


JR - SITE MASTER PLAN -
DANGEROUS GOODS Sheet 2 of 3 Rev-A
First draft for Comment only
Date : 02-04-2020 Scale : N.T.S.
Sheet : A4 Drn : KJG
Revision:
A - Aerosol cage Options included
JR - Site Exit Secondary Fleet Only
Future LPG No.1 LPG Bottle Storage / Exchange
Above Ground Diesel Tanks Optional Location No.1
Above Ground Diesel Tanks Optional Location No.2
JR - Location No.2 First Level Case Buffer Tray Storage Solution (Located directly above the Marshalling / Staging on a concrete platform)
Future Aero - Location No.1 Aerosol Cage Option No.2 (Option No.1 at alternate site)
Future LPG No.2 LPG Bottle Storage / Exchange
JR - Location No.1 High Bay Storage (ASRS)
JR - Location No.3 Ground Level Marshalling / Staging Area
JR - Site Entry Goods Inbound
JR & JN - Site Exit Goods Outbound (Excludes JR Secondary Fleet)
LPG Fork Lift Refueling Shared with JN
124401
115657
238329
62630
87872
135152
216263
225034
114542
68834
62819
310522
14306
151555



JN - SITE MASTER PLAN -
DANGEROUS GOODS Sheet 3 of 3 *Rev-A*
First draft for Comment only
Date : 02-04-2020 Scale : N.T.S.
Sheet : A4 Drn : KJG
Revision: