Unit 3, 5 Clerke Place
Kurnell, NSW

Wynyard Pty Ltd

Fire Safety Upgrade Report

Holmes Fire

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A	14 October 2020	Preliminary Issue for Review	SPD	MXB
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Version	Extent of Revision
B	Finalisation of report.

Written By:

Silvia Parra
Fire Engineer
BSc (Civil), MSc. (Fire)

Reviewed By:

Michael Bower
Senior Fire Engineer
MFireSafetyEng,
Registered Certifier - Fire Safety (BDC0735)

About Holmes Fire

Holmes Fire is a professional engineering consultancy specialising in the field of fire and safety engineering, including performance based fire engineering, Building Code of Australia assessments and human behaviour analysis. These services are provided for all building classifications, both new and existing, and infrastructure projects.

As the largest specialist fire engineering firm in Australasia, with offices in Brisbane, Sydney, Melbourne, and throughout New Zealand, and the USA, Holmes Fire has extensive experience in delivering performance based fire engineering designs.

Holmes Fire is committed to providing superior service and value to our clients. This is done by finding innovative safety solutions that complement the architectural designs of buildings and meet the needs of Clients, Emergency Services, Approval Authorities and the building users. Holmes Fire believes in communicating effectively with all stakeholders and establishing ongoing relationships.

Executive Summary

This report addresses the proposed fire safety upgrade of the existing Class 7b and Class 8 use at Unit 3 located at 5 Clerke Place, Kurnell, NSW for compliance with Section 4.12(8) of the Environmental Planning and Assessment Act 1979 and Clause 94 of the Environmental Planning and Assessment Regulation 2000.

The project is considered a designated development under part 4 of the Environmental Planning and Assessment act 1979. NSW Planning & Environment determined that the Environmental Impact Statement must include an assessment of potential impacts of the proposed development on the existing environment and develop appropriate measures to avoid, minimise, mitigate and/or manage these potential impacts in relation to the following matters:

> *"- Fire management (including the location of fire hydrants and water flow rates at the hydrants) and containment measures;*
>
> *- Details of the size and volume of storage areas and their arrangements to minimise fire spread and facilitate emergency vehicle access"*

The works discussed in this fire safety upgrade report are proposed as a fire safety upgrade strategy for the existing building and is considered an addendum to the Environmental Impact Statement to address in more detail two fire safety requirements of the Environmental Impact Statement being protection of openings and width of paths of travel. The objective of the upgrade strategy is to improve the fire safety features of the building such that the relevant legislative requirements are satisfied.

While satisfaction of the Performance Requirements of the Building Code of Australia is not applicable in this instance, consideration has been given to them in determining the appropriate fire safety upgrade measures.

Ongoing compliance of the building with respect to the facilitation of occupant evacuation in the event of fire provided for within this report can be achieved by compliance with the following conditions:

- The Schedule of Works specified within Section 2 of this report is implemented and maintained; and
- The Assumptions and Limitations specified within Sections 1.4 and 1.4 of this report are considered.

This report is provided in accordance with the fee proposal and 'Agreement for the Provision of Consulting Engineering Services' (140012.00.FP001b), dated 7 February 2020, as executed between Holmes Fire LP and the Client. Holmes Fire LP is a New Zealand limited partnership formed under the New Zealand Limited Partnerships Act 2008. No obligations in contract exist between Holmes Fire LP and any other party.

It is assumed that the schedule of works, assumptions and limitations of this report are read, understood and implemented. Holmes Fire should be contacted if there are any queries in regards to the content. Holmes Fire takes no responsibility for the misinterpretation by others.

Where building alterations or a change of occupancy occurs, subsequent to the measures mentioned above being provided, the validity of this fire safety upgrade analysis may be compromised and further analysis will be required.

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1 INTRODUCTION

1.1 Report Purpose

The purpose of this report is to detail the proposed fire safety upgrade strategy for the existing Class 7b and Class 8 use at Unit 3 located at 5 Clerke Place, Kurnell, NSW, and to demonstrate that the proposed upgrade provides adequately for life safety in the event of fire.

This report formulates a fire safety upgrade for consideration of the Planning Secretary's Environmental Assessment Requirements, dated 6 March 2018, and compliance with the relevant Performance Requirements of the Building Code of Australia, Volume One of the National Construction Code of Australia 2019 (BCA) [1]. The subject building will be converted into a waste management facility where animal fat and used cooking oils will be processed and stored with a Class 5 office upstairs in the mezzanine.

The project is considered a designated development under part 4 of the Environmental Planning and Assessment act 1979. NSW Planning & Environment determined that the Environmental Impact Statement must include an assessment of potential impacts of the proposed development on the existing environment and develop appropriate measures to avoid, minimise, mitigate and/or manage these potential impacts in relation to the following matters:

> *"- Fire management (including the location of fire hydrants and water flow rates at the hydrants) and containment measures;*
>
> *- Details of the size and volume of storage areas and their arrangements to minimise fire spread and facilitate emergency vehicle access"*

This report is based on an inspection of the building carried out by Holmes Fire on the 26 February 2020.

1.2 Relevant Stakeholders

The relevant stakeholders for the subject project are listed in Table 1-1.

Table 1-1: Relevant Stakeholders

Name	Company	Role
Effie Nassis & Zois Nassis	Wynyard Pty Ltd	Client
Lyndall Wynne	Wynne Planning	Client's Representative
Jason Clements	DP Property Consulting Pty Ltd	BCA consultant
John Hatch	Jmh living design	Architect
Peter Campion	Atak Group Services Pty Ltd	Other consultants
Michael Bower	Holmes Fire	Fire Engineer

1.3 Fire Safety Upgrade Concept Report

A Fire Safety Upgrade Concept Report was prepared by Holmes Fire detailing the proposed upgrade strategy, with the final report 140786.00.CFSUCR001a issued on the 14 October 2020. All comments raised by stakeholders during this process have been incorporated into this report.

1.4 Assumptions and Limitations

1.4.1 Generally

It is assumed that the schedule of works, limitations and assumptions of this report are read, understood and implemented. Holmes Fire should be contacted if there are any queries in regards to the content. Holmes Fire takes no responsibility for the misinterpretation by others.

Statements within this report such as 'adequate safety will be provided' or 'the level of safety / risk will not be reduced', and the like, are considered to be definitive statements only to the degree expected in all reasonable likelihood. Such statements are subject to the assumptions and limitations within this report and the possibility of the converse statement is not excluded.

Where building alterations or a change of occupancy occurs, the validity of this fire safety upgrade analysis may be compromised and further analysis will be required. The data, methodologies, calculations and conclusions within this report relate to the subject building and must not be used for any other purpose.

This report specifies a Schedule of Works. The detailed design, then construction, of items and systems identified in that schedule is the responsibility of others. To increase the likelihood that 'as built' components of the Schedule of Works are constructed as specified, it is our recommendation that construction monitoring be provided, by an appropriately qualified Professional Engineer. Unless Holmes Fire is commissioned to provide those services, we are not liable for any shortcomings of construction. If we are engaged for construction monitoring, our liability is as set out in the associated agreement for professional services.

1.4.2 Building Code of Australia Compliance

The primary assumption of this report is that the fire safety design for the building complied with all relevant building codes and standards at the time of construction.

The implementation of the "Schedule of Works" detailed in Section 2 will allow the proposed design to satisfy Clause 94 of the EP&A Regulation and Section 4.12(8) of the EP&A Act 1979 for fire safety.

This Fire Safety Upgrade Report has been prepared based upon information provided to Holmes Fire. Holmes Fire has not verified the accuracy or completeness of this information and assumes that the information provided is accurate and complete. Holmes Fire shall not be responsible for any errors or omissions which may be incorporated into this report as a result.

1.4.3 Regulatory Requirements

A number of issues within the BCA are recognised to be interpretive. Where these issues are encountered, interpretations have been made consistent with Holmes Fire policy which is believed to be in accordance with standard industry practice.

1.4.4 Beyond Regulatory Requirements

The design proposed herein is specifically formulated to address the life safety needs of the building occupants, with consideration given to the objectives of Section 4.12(8) of the EP&A Act 1979 and Clause 94 of the EP&A Regulation, which are limited to issues of life safety, fire spread and fire brigade intervention. Note that tenable conditions may not be maintained close to the fire.

Unless specifically requested by the client or stated in this report, issues above and beyond the Section 4.12(8) of the EP&A Act 1979 and Clause 94 of the EP&A Regulation fire safety requirements have not been considered. This may include, but not be limited to, property protection, business continuance, egress for persons with disabilities and extent or availability of insurance. Other legislative requirements which have not been considered include the Disability Discrimination Act, and Work Health & Safety and Dangerous Goods legislation. It is assumed that these and all other legislative requirements are satisfied as applicable.

Multiple fires, arson attack, explosion, malicious acts and acts of terrorism have not been addressed within this report as they are not considered to be a reasonable scenario in this instance.

2 SCHEDULE OF WORKS

The following works in Table 2-1 are to be implemented to satisfy the requirements of this Fire Safety Upgrade Report.

Table 2-1: Schedule of Works

Item	Description of Works Required	Relevant Party(s)
Construction		
1.1 – Vat 46 valve	The protruding valve on Vat 46, the is to be provided with a black and yellow striped adhesive hazard tape wrapped around soft foam to be installed on the circular ring surrounding the valve.	Owner
1.2 – Blade wall/slab	A blade wall and slab achieving an FRL of not less than -/60/- is to be provided in front of the unprotected opening and above the roller door as shown in Figure 2-1. The blade wall/slab should cover the adjacent opening extending 0.2 m above and below the opening height and it should protrude 0.2 m of the opening width.	Architect / Owner
1.3 – Catwalk flooring	Potential trip hazards at floor level are to be ameliorated by the installation of stainless steel steps and catwalk type raised flooring. Note: The design is to be done by others.	Architect/Owner
Services		
2.1 – Portable fire extinguishers	Portable Fire Extinguishers suitable for fires involving carbonaceous solids (Class A), flammable and combustible liquids (Class B) and cooking oils and fats (Class F) shall be provided in accordance with AS 2444-32001.	Fire Services Contractor / Owner
2.2 – Smoke alarm and detection system	a) A smoke detection system complying with AS 1670.1-2018 shall be installed within the building and connected to a fire indicator panel capable of indicating the location of activated smoke detectors. b) The system should incorporate alarm signalling equipment in accordance with AS 1670.3-2018 to automatically call the fire brigade	Fire Services Contractor / Owner

Item	Description of Works Required	Relevant Party(s)
Maintenance and Commissioning		
4.1 – Maintenance	All fire services in the building are to be maintained in accordance with the latest relevant industry maintenance standards, these currently being AS 1851-2012 and AS/NZS 2293.2-2019.	Maintenance contractor
Management		
Fire Safety Upgrade Notice	A permanent notice is to be provided adjacent to the Annual Fire Safety Statement, advising that the building is subject to a fire safety upgrade. The sign, see Appendix A, is to be printed to at least A4 size, framed, and be securely mounted. Note that this sign is not to be mounted to a fire rated or smoke proof element in a manner which may compromise that element.	Owner
Fire Safety Schedule	This Fire Safety Upgrade is to be specifically listed on the Final Fire Safety Schedule.	Principal Certifying Authority
Annual Fire Safety Statement	This Fire Safety Upgrade Report is to be specifically and continuously listed on the Annual Fire Safety Statement.	Owner

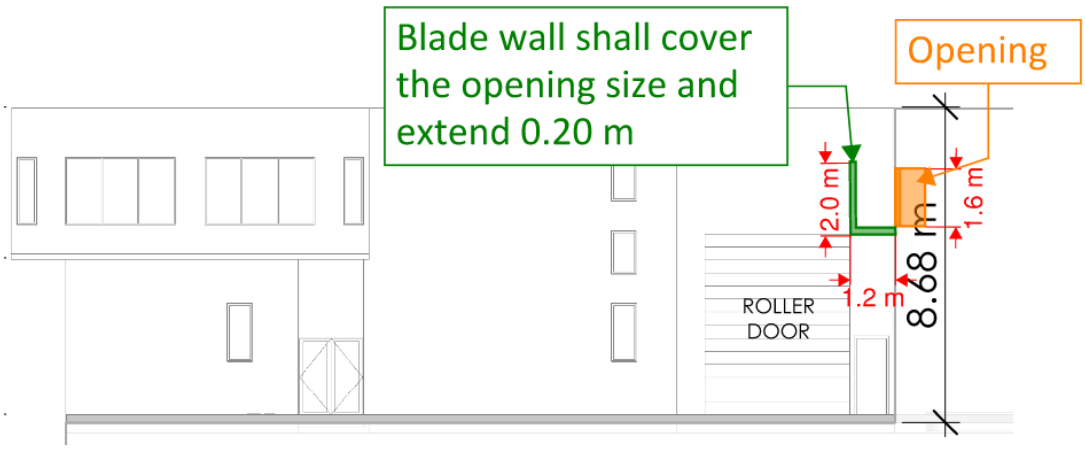

Figure 2-1: Location and Dimensions of Blade Wall and Slab

3 BUILDING CHARACTERISTICS

The project involves the retrofit of the existing Class 7b and Class 8 use at Unit 3 located at 5 Clerke Place, Kurnell, NSW. The subject building will be converted into a waste management facility where animal fat and used cooking oils will be processed and stored with a Class 5 office upstairs in the mezzanine. The subject building is a single fire compartment separated from the remainder of the building by FRL 90/90/90 rated wall.

The general description of, and requirements for, the building under the Deemed-to-Satisfy Provisions of BCA 2019 are as indicated in Table 3-1.

Table 3-1: BCA General Description

BCA Clause		Description
Schedule 3	Effective Height	~ 4.5 m
A6	Classification	Class 7b – Storage Class 8 – Process Class 5 – Office
C1.1	Type of Construction Required	Type C construction
C1.2	Rise in Storeys	2, with 2 storeys contained
C2.2	Floor Area and Volume Limitations	Class 5 / Class 7b & 8 Maximum floor area: 3,000 m² / 5,000 m² Maximum volume: 18,000 m² / 30,000 m² These size limitations for the fire compartments are not exceeded, based on the building being a single fire compartment. Building area ~ 690 m²

3.1 Location of Building

As indicated on the map[1] in Figure 3-1, the subject Unit 3 is located at 5 Clerke Place, Kurnell, NSW. The surrounding area contains commercial premises, warehouses and other buildings for the production and assembling of goods. The Caltex oil refinery and the Sydney Desalination Plant area located in the area.

Cronulla Fire Station is located on 91 The, Kingsway, approximately 8.2 km from the subject building. Kogarah Fire Station is located less than 18 km by road from the subject building.

Figure 3-1: Location of Building

3.2 Fire Safety Provisions

The building is to be provided with the required BCA Deemed-to-Satisfy compliant fire safety measures, with additional or modified fire safety measures as required by this Fire Safety Upgrade Report. It is the Building Surveyor's responsibility to determine the complete list of fire safety measures. The fire safety measures listed in Table 3-2 are generally additional to, or modifications of, the Deemed-to-Satisfy compliant measures. A number of Deemed-to-Satisfy compliant measures may also been included where this have been specifically relied upon within this Fire Safety Upgrade Report. It is assumed that all of these systems will be suitably operable and appropriately maintained. Note that this list is provided for general information only and does not cover all essential fire safety measures within the building.

[1] http://maps.google.com.au/maps, 18 February 2020

Table 3-2: Fire Safety Provisions

Fire Safety Provisions	Standard of Performance
Emergency lighting	BCA 2019 Clause E4.2 & E4.4, AS 2293.1-2005
Exit signage	BCA 2019 Clause E4.5, NSW E4.6 & E4.8, AS 2293.1-2005
Fire hydrant system	BCA 2019 Clause E1.3, AS 2419.1-2005
Fire hose reels	BCA 2019 Clause E1.4, AS 2441-2005
Portable fire extinguishers	BCA 2019 Clause E1.6, AS 2444-2001
Automatic fire detection system	BCA 2019 Clause E2.2a, Spec. E2.2a, AS 1670.1-2018
Fire alarm monitoring system	BCA 2019 Spec. E2.2a, AS 1670.3-2018
Warning and operational signage	BCA 2019 Clause D2.23, Clause 183 of the Environmental Planning and Assessment Regulation 2000
Fire Management Plan	Fire Management Plan 140012.00.FMP01b, Version e, dated 14 October 2020, prepared by Holmes Fire

4 OCCUPANT CHARACTERISTICS

4.1 Number of Occupants

Consideration has been made on the maximum number of occupants that the building can host for the proposed type of use. Based on the occupant density specified within Table D1.13 of the BCA for a factory and an office occupancy, those being 50 m² per person and 10 m² per person respectively, the occupant load permitted in the building is provided within Table 4-1.

It has been taken into account the proposed operation and personnel requirements for the subject waste management facility. It is expected that operations in the facility will be carried out by one worker for respective work shifts. Processes in the building would keep running 24 hours a day, 7 days of the week. Hence, evacuation strategies would be focused on allowing necessary evacuation provisions to the facility's employee and say two delivery personnel and one business manager/owner.

Table 4-1: Number of Occupants

Location	Area	Occupant Density	No. of Occupants
Ground Floor	530 m²	50 m² per person	11
First Floor	160 m²	10 m² per person	16
Total			**27***
* BCA clause D1.13(c) allows "any other suitable means of assessing its capacity". Therefore, the number of occupants is estimated to be four (4) personnel at any one time.			

4.2 Description of Occupants

The characteristics of occupants in a building can have a significant impact on the evacuation behaviour and the total evacuation time for a building. It is expected that one employee will be working on the premises, but consideration has been made of a greater number of occupants in the building and their characteristics as presented below.

Occupants within the facility are expected to primarily consist of staff. Visitors are expected to be limited only to persons transporting materials to the facility while being accompanied by a member of the facility staff. Visitors are expected to have a short stay on the premises, limited to the time required for loading and unloading of materials.

In the event of fire, all occupants are assumed to perceive the fire alarm. There is however usually scepticism as to whether the alarm is genuine or not, and occupant behaviour following the alarm depends on many different factors such as social influence, commitment and training [2] [3]. At the time of the fire occupants within the building are assumed to be awake, alert, and either sitting or standing. Occupants may delay initiating their evacuation whilst they search or wait for secondary cues, stop machinery or equipment or investigate and possibly attempt to fight the fire. Note that occupants close to the fire origin are likely to become aware of the fire at an earlier stage due to visual or olfactory cues.

As the majority of occupants are expected to be under employment within the premises, it is assumed that they are familiar with the egress paths.

Accessibility issues to people with certain disabilities might occur on the premises. The Disability Discrimination Act 1992 [4] makes it against the law to discriminate against people with disabilities in the

work area. The same Act provides an exception if the cost or difficulties of providing access will place an unjustifiable hardship on an organisation. Accessibility issues might occur in the building due to the containment walls, the equipment to be installed in the facility and the nature of the activities required to be performed by the facility employee. Therefore, a person who uses a wheelchair, a person walking on crutches or someone with a mobility impairment is not expected to be present in the facility as it is deemed to be more akin to a plant room having regard to the single employee.

5 FIRE SAFETY OBJECTIVES

5.1 Primary Fire Safety Objective

It is proposed to provide a fire safety upgrade strategy that complements the existing features of the building and achieves a cost effective solution. Notwithstanding the above, the primary objective is to holistically improve the fire safety features of the building and the life safety of occupants.

It must be noted that given the period in which the building was originally constructed, the building would not comply with the requirements of BCA 2019, in which the requirements for fire safety have increased with increased knowledge and awareness of fire safety in buildings.

The fire safety requirements of the BCA Deemed-to-Satisfy Provisions will be considered throughout the upgrade strategy with satisfaction of the Performance Requirements of the BCA being an objective of the fire safety upgrade assessment, to the degree necessary, as appropriate to the circumstances to provide adequate fire protection and structural capacity appropriate to the buildings new use, in compliance with the Category 12fire safety provisions as required by Clause 94 of the EP&A Regulation for a for an existing building, with rebuilding, alteration, enlargement or extension.

6 PROPOSED ASSESSMENT SUMMARY

6.1 Compliance with EP&A Regulation

Table 6-1 outlines the issues of non-compliance with the BCA Deemed-to-Satisfy Provisions that are the subject of this report. This information is provided in order to establish a benchmark level of fire safety for the building. While full compliance with the BCA is NOT required in this instance, consideration will be given to the Performance Requirements relevant to the non-compliance. The intent of this upgrade strategy is to achieve adequate fire protection and structural capacity as provided for by Clause 94. All other non-compliances with the Deemed-to-Satisfy Provisions will be upgraded to achieve compliance. These are detailed in Table 6-2.

Table 6-1: Non-Compliance with Deemed-to-Satisfy Provisions

Relevant BCA Clause	Deemed-to-Satisfy Non-Compliance	BCA Performance Requirement Considered	Upgrade Strategy
C3.2 & C3.4	Clause C3.2 requires openings in external walls that are required to be fire rated to be protected in accordance with Clause C3.4 if they are located within 3 m of an allotment boundary. The building contains openings in the frontal external wall located approximately 1.2 and 3.0 m from a fire source feature in the adjacent building (Unit 2)	CP2 & CP8	A blade wall and slab achieving an FRL of not less than -/60/- is to be provided in front of the unprotected opening and above the roller door. The blade wall/slab should cover the adjacent opening extending 0.2 m above and below the opening height and it should protrude 0.2 m of the opening width. This blade wall/slab will protect the adjacent buildings from incoming and outgoing radiation through the unprotected openings.

Relevant BCA Clause	Deemed-to-Satisfy Non-Compliance	BCA Performance Requirement Considered	Upgrade Strategy
D1.6	The clear width of paths of travel to exits is required to be at least 1,000 mm. However, the clear width is reduced to 800 mm between Vat 45 & Vat 46 and 700 mm between Vat 42 & Vat 48.	DP4	It has been demonstrated by use of anthropometric data that the clear width of not less than 800 mm between Vat 45 & Vat 46 and 700 mm between Vat 42 & Vat 48 provide a level of fire safety that complies with the Performance Requirements in relation to the dimensions of a path of travel to an exit. The protruding valve on Vat 46 is to be highlighted with a black and yellow striped adhesive hazard tape to be installed on the circular ring surrounding the valve. Potential trip hazards at floor level are to be ameliorated by the installation of stainless steel steps and catwalk type raised flooring

Table 6-2: Additional Items to be Included within Upgrade

Relevant BCA Clause	Reason for Non-Compliance	Methodology
Clause E1.6	Portable Fire extinguishers must be appropriate for the type of materials expected in the building.	Portable Fire Extinguishers suitable for fires involving carbonaceous solids (Class A), flammable and combustible liquids (Class B) and cooking oils and fats (Class F) shall be provided in accordance with AS 2444-32001.
Clause E2.2	The does not incorporate a smoke alarm and detection system.	A smoke detection system complying with AS 1670.1-2018 shall be installed within the building and connected to a fire indicator panel capable of indicating the location of activated smoke detectors. The system should incorporate alarm signalling equipment in accordance with AS 1670.3-2018 to automatically call the fire brigade.

7 FIRE HAZARD ASSESSMENT

The use of the building, as understood by Holmes Fire, is not anticipated to result in an increased risk from that ordinarily expected of a building containing Class 8 areas.

Table A-1 provides data obtained from the NSW Fire Brigades Annual Statistics Report [5] for 2003/2004 to 2006/2007 on the area of fire origin. The majority of the 929 fires in factories originate within the service, equipment areas. These statistics also indicate that a significant percentage of fires originate in process, and manufacturing areas.

Table A-1: Area of Fire Origin in Basic Industry, Utility, Defence, Manufacturing Buildings

Area of Fire Origin	Percentage
Service, equipment areas	25.2%
Process, manufacturing areas	18.6%
Other storage areas[2]	9.3%
Other functional areas[3]	8.9%
Service facilities	7.5%
Product storage areas	6.5%
Undetermined or not reported	5.7%
Structural areas[4]	5.2%
Office	2.9%
Kitchen, cooking area	2.9%
Other location	2.6%
Garage, carport, vehicle areas	2.3%
Means of egress[5]	1.2%
Assembly/sales areas[6]	1.2%
Total:	100%

[2] Comprising closet and small storage area, supply storage room or area, records storage room/vault, shipping/receiving/loading area or loading dock, waste or rubbish area/container and other

[3] Comprising sleeping areas, dining area, lunchroom, cafeteria, lavatory, locker room, cloakroom, laundry area, printing room, laboratory and other

[4] Comprising crawl space, verandah, concealed spaces, exterior wall and roof spaces, awning and other

[5] Comprising hallway, corridor, mall, exterior and interior stairway, lobby or entranceway, fire isolated escape route and other

[6] Comprising large assembly areas with fixed seats, large open room without fixed seats, small assembly area with or without fixed seats, lounge area, sales/show-room area, library, swimming pools and other

7.1 Characteristics and Quantities of the Materials Stored or Used

According to the Risk Assessment Report by Sherpa Consulting, the facility is expected to store and process four types of materials as described in Table 7-1. These materials are considered as non-combustible and therefore are not considered as a special hazard.

Table 7-1: Description of the materials stored and processed in the facility

Material	Approximate quantity	Suitable Extinguishing Media	Hazards from Combustion Products	Properties
Margarine, margarine shortening and cake shortening	10 tonnes of solid material will be accepted per month.	Alcohol resistant foam, dry chemical or carbon dioxide.	N/A	Flash point >282°C
Blocks of animal fat (tallow)	40 tonnes of solid material will be accepted per month.	Water fog. Foam. Dry chemical powder.	Hazardous gases.	Flash point >273.9°C
New cooking oils	550 tonnes of liquid oils will be accepted per month.	Carbon dioxide, Dry powder or foam.	Product oxidises to form carbon, carbon monoxide and/or carbon dioxide, and smoke.	Will burn if involved in a fire.
Used cooking oils	300 tonnes of liquid oils will be accepted per month, with up to 60 tonnes being stored on the premises at any given time.	Dry chemical, foam for Class B fires.	Combustion may produce CO and other decomposition products in the case of incomplete combustion.	Will burn if involved in a fire. Flash Point >260°C

These raw materials will be heated with steam coils operating at 55°C to dewater them. As these materials are not classified as combustible there is no hazard introduced by the heating.

The capacity of the proposed tanks in the facility is shown in Table 7-2.

Table 7-2: Capacity of storage tanks

Tank name	Tank Shape	Diameter	Height [m]	Estimated volume	Qty	Total Area	Total volume
VAT 50	Cylinder	1.6 m	3.8 m	7.6 m^3	1	2.0 m^2	7.6 m^3
VAT 46	Cylinder	2.4 m	4.2 m	19.0 m^3	1	4.5 m^2	19.0 m^3
VAT 48, VAT 47	Cylinder	2.5 m	4 m	19.6 m^3	2	9.8 m^2	39.3 m^3
VAT 49	Cylinder	2.8 m	3.2 m	19.7 m^3	1	6.2 m^2	19.7 m^3
VAT 43, VAT 42, VAT 41	Cylinder	3 m	6.45 m	45.6 m^3	3	21.2 m^2	136.8 m^3
VAT 45, VAT 44	Cylinder Cone	3.8 m	3.6 m (Cylinder) 1.95 m (Cone)	48.2 m^3	2	N/A*	96.4 m^3
Total						43.7 m^2	318.8 m^3
* The area of the Cylinder Cone tanks was not considered for the calculation of the Total Area since these would not displace runoff water contained by bund walls due to the inverted cone shape.							

During the site visit undertaken by Holmes Fire, it was observed the storage of additional palletised products by the entrance of the building. However, it was clarified to us that once the facility is ready to start its operation, a backup pallet racking will be set out on the Ground Floor area under the office space to store 24,000 litres of product. It is expected that this storage will not be required since all products in package and bulk received into the plant will be emptied straight into the holding vats. These containers are considered for the calculation of the capacity of a secondary bund wall, based on AS 1940-2017 (see Section 10.3).

8 FIRE SAFETY ACCEPTANCE CRITERIA

Where the results of the analysis demonstrate that the acceptance criteria have been met, the Fire Safety Upgrade then satisfies the requirements of Clause 94 of the EP&A Regulations. Table 8-1 describes the acceptance criteria for the fire safety issues to be assessed.

Table 8-1: Acceptance Criterion

Fire Safety Consideration	Acceptance Criterion
Clause 94	
Adequate fire protection provided	Adequate fire protection is to be provided, appropriate to the new use, to protect persons using the building, allow for occupant evacuation and restrict the spread of fire from the building to other buildings nearby.
Adequate structural capacity provided	Adequate structural capacity is to be provided, appropriate to the new use, to protect persons using the building and allow for occupant evacuation.

9 PERFORMANCE REQUIREMENTS TO BE CONSIDERED

9.1 CP2 - Spread of Fire

Performance Requirement CP2 states:

"(a) A building must have elements which will, to the degree necessary, avoid the spread of fire-

(i) to exits; and

(ii) to sole-occupancy units and public corridors; and

(iii) between buildings; and

(iv) in a building,

(b) Avoidance of the spread of fire referred to in (a) must be appropriate to-

(i) the function or use of the building; and

(ii) the fire load; and

(iii) the potential fire intensity; and

(iv) the fire hazard; and

(v) the number of storeys in the building; and

(vi) its proximity to other property; and

(vii) any active fire safety systems installed in the building; and

(viii) the size of any fire compartment; and

(ix) fire brigade intervention; and

(x) other elements they support; and

(xi) the evacuation time."

The Guide to the BCA states CP2 deals with the spread of fire both within the building and between buildings, and which does not only result from the structural failure of a building element. CP2 does not make any reference to a fire-resistance level. FRLs are only included as part of the Deemed-to-Satisfy Provisions.

CP2(a)(i), (ii), (iv) are not applicable to this assessment.

CP2(a)(iii) aims to minimise the risk of fire spreading from one building to another that could endanger the occupants of both buildings and impede the actions of the fire brigade. See CV1 and CV2 for two means of verifying, under certain circumstances, whether or not the requirements of CP2(a)(iii) will be achieved. Other assessment methods for determining compliance with the Performance Requirements are in A2.2.

CP2(a) uses the term "to the degree necessary". This word usage is designed to provide flexibility in the way this provision is implemented. It means that the BCA recognises that different building elements

require differing degrees of protection to avoid the spread of fire. The expression is intended to allow the appropriate authority to determine the degree of compliance necessary in each particular case after considering each building scenario.

Building elements must be appropriate to avoid spread of fire, taking into consideration the matters listed in CP2(b) including:

- the likelihood or risk of a fire occurring in the building;
- the size, load or intensity of any fire in the building;
- the difficulty of evacuation and/or rescue;
- the building's exposure to fire in another building, or risk of spreading a fire to another building;
- the fire safety systems in the building, which can affect the rate of fire spread (eg if a sprinkler system is installed in a building, it will either extinguish the fire or reduce its growth rate);
- the size of a fire and the difficulties in effecting an evacuation;
- the fire-fighting operations of the fire brigade and the resources available to it;
- the consequences of the failure of the element (another way of expressing this is to consider that if the element fails, could it result in the failure of another element); and
- the time taken from the start of the emergency to the occupants reaching a safe place.

9.2 CP8 – Openings and Penetrations

Performance Requirement CP8 states:

> *"Any building element provided to resist the spread of fire must be protected, to the degree necessary, so that an adequate level of performance is maintained-*
>
> *(a) where openings, construction joints and the like occur; and*
>
> *(b) where penetrations occur for building services."*

The Guide to the BCA states CP8 requires openings and penetrations in building elements to resist the spread of fire. CP8 should be read in conjunction with CP2. CP8 deals with any opening or penetration within a building element, and CP2 deals with the building element itself.

CP8 uses the term "to the degree necessary". This word usage is designed to provide flexibility in the way this provision is implemented. It means that the BCA recognises that different building elements require differing levels of protection, depending on the circumstances within which they are used and installed. The expression is intended to allow the appropriate authority to determine the degree of compliance necessary in each particular case.

9.3 DP4 – Number, Dimensions and Distribution of Exits

Performance Requirement DP4 states:

> *"Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to-*
>
> *(a) the travel distance; and*
>
> *(b) the number, mobility and other characteristics of occupants; and*
>
> *(c) the function or use of the building; and*
>
> *(d) the height of the building; and*
>
> *(e) whether the exit is from above or below ground level."*

The Guide to the BCA states DP4 is the Performance Requirement for the number, dimensions and distribution of exits.

DP4(a) recognises that the travel distance will affect the time taken to evacuate the building. Greater distances will require greater evacuation times.

DP4(b) acknowledges that the number of occupants can affect the evacuation time. A greater number of people will require a greater evacuation time through a single exit. This time can be reduced by such means as:

- increasing the number and/or width of the exits, or
- reducing the travel distance to the exits by utilising other options for their location.

DP4(b) also recognises that the mobility and other characteristics of occupants will have a direct effect on the evacuation time. Matters to be considered include whether the occupants are likely to have limited mobility or capacity to find their way unassisted, and the type and the extent of that limitation. For example, people may be in beds or have some kind of ambulatory-related disability, or may be asleep or anaesthetised, or may be under the influence of drugs or otherwise confused.

DP4(c) identifies that the function or use of the building will have an effect on the building's fire load.

DP4(d) acknowledges that the height of the building will affect the distance a person escaping from the building would have to travel. The height therefore has an impact on the evacuation time.

DP4(e) identifies that to ensure the safety of occupants, an exit from a level below ground level needs to satisfy different criteria to that of an exit from levels above ground. For example, an exit from a basement must take account of criteria such as:

- the difficulty in naturally venting smoke from a fire because of the lack of windows; and
- the need for occupants to evacuate in the direction of smoke travel (which will be upwards). This is the opposite to upper storeys, where people would be evacuating downwards and the smoke would be travelling upwards.

10 FIRE SAFETY UPGRADE STRATEGY

The underlying philosophy for the proposed upgrade strategy is to provide early detection of a fire occurring within the building to all building occupants and to provide occupants with safe means of egress from the building by containing the fire to the compartment of origin.

The objective for the proposed fire safety upgrade outlined in this section is to ensure that the fire protection and structural capacity of the building is appropriate to the building's proposed new use.

The fire safety upgrade objectives will take into consideration the existing nature of the building and the works that can be physically undertaken to the building such that there will be very minimal impact to the existing fabric of the building.

10.1 Provision of Portable Fire Extinguishers to the Building

Clause E1.6

Portable Fire Extinguishers suitable for fires involving carbonaceous solids (Class A), flammable and combustible liquids (Class B) and cooking oils and fats (Class F) shall be provided in accordance with AS 2444-32001.

Based on the implementation of the above-mentioned requirements, as detailed within the Schedule of Works in Section 2 of this report, Holmes Fire is of the opinion that compliance with the objectives of Section 4.12(8) of the EP&A Act and Clause 94 of the EP&A Regulation and the Deemed-to-Satisfy Provisions with regard to portable fire extinguishers will be achieved.

10.2 Provision of Smoke Alarm Systems

Clause E2. 2

A smoke detection system complying with AS 1670.1-2018 shall be installed within the building and connected to a fire indicator panel capable of indicating the location of activated smoke detectors. The system should incorporate alarm signalling equipment in accordance with AS 1670.3-2018 to automatically call the fire brigade, such that the response time of the fire brigade to arrive on the scene is expected to be minimised.

Based on the implementation of the above-mentioned requirements, as detailed within the Schedule of Works in Section 2 of this report, Holmes Fire is of the opinion that compliance with the objectives of Section 4.12(8) of the EP&A Act and Clause 94 of the EP&A Regulation and the Deemed-to-Satisfy Provisions with regard to smoke alarm and detection will be achieved.

10.3 Arrangements for Containing Oil Spillage and Contaminated Fire Fighting Water/Foam

As specified in the Fire Management Plan prepared by Holmes Fire, the facility should have effective means for containing firewater runoff having a capacity of not less than the total hydraulic demand of firefighting systems. This containment is to be impermeable and prevent fire water runoff from entering the ground or any surface water course. In this matter, ATAK Group Services estimated the size of the bunding, as

presented in the Fire Management Plan (140012.00.FMP01e). This estimation was verified in accordance with AS 1940:2017 [6] as follows:

- The capacity of a compound shall be the greater between 110% of the capacity of the largest tank and 25% of the total capacity of all tanks within the bund
    - The largest tanks are Vat 454 and Vat 45 having a volume of ~48.2 m³ each (See Section 7.1). Hence, the 110% of this volume is ~ 53 m³.
    - The total capacity of all tanks is estimated to be 318.8 m³. The 25% of this volume is 79.7 m³. Since this value is greater than the figure calculated before, this is to be the one considered for the calculation of the bunding capacity.
- The total hydraulic demand for firefighting is estimated for a flow rate of 8 L/s for 120 minutes. This results in a volume of 57.6 m³.
- The total capacity of the containment adds up to a net volume of 137.3 m³.

Holmes Fire assessed the required containment volume against the one proposed in the architectural drawings. These plans present a containment area of 189.4 m², as shown in Figure 10-1. Taking into account the displacement area of the proposed tanks, the net area is $189.4\ \mathrm{m}^2 - 43.7\ \mathrm{m}^2 = 145.7\ \mathrm{m}^2$. Holmes Fire estimates that, in order to keep the same containment area shown in the drawings, the primary bund wall should allow at least a height of $137.3\ m^3 / 145.7\ m^2 = 0.94\ m$. In addition, Holmes Fire recommends 100 mm to be incorporated into the bund wall height as a safety margin. This bunding height may be reduced if the containment area is enlarged.

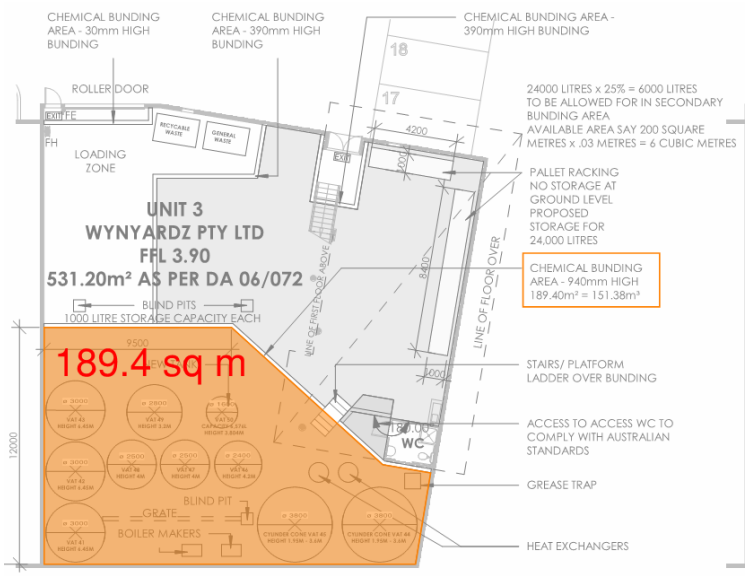

Figure 10-1: Primary Containment Area

Regarding to the secondary bund wall, in order to contain spillages and contaminated firefighting water from the containers under the office space, Holmes Fire estimated the required volume of the bunding utilising 25% of the capacity of the containers in addition to the hydraulic demand for firefighting. This calculation results in a bunding volume of $(24\ m^3 \times 25\%) + 57.6\ m^3 = 63.6\ m^3$. Considering the area shown in the architectural drawings excluding the loading zone (see Figure 10-2), Holmes Fire estimates that the secondary bund wall should be able to contain materials up to a height of $63.6\ m^3 / 165\ m^2 = 0.39\ m$. Should a safety margin be incorporated, the total bunding height will result in 0.49 m.

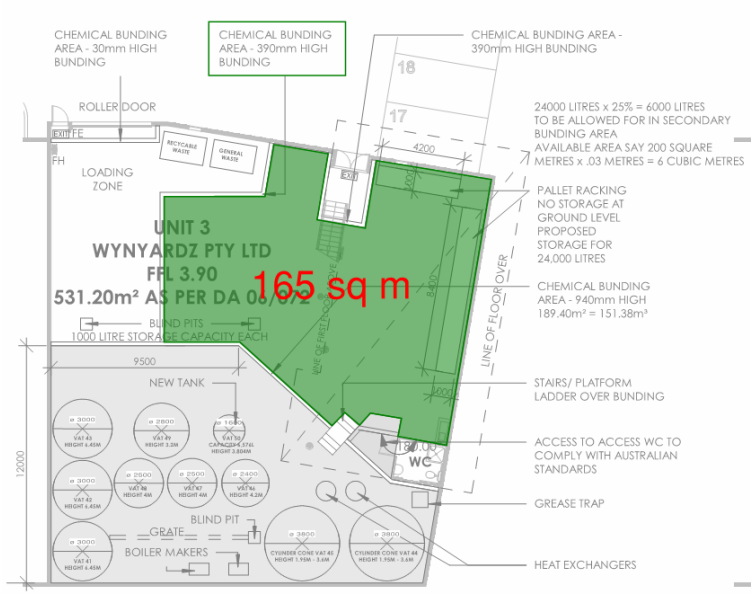

Figure 10-2: Secondary Containment Area

The loading zone is proposed to be protected by a bund wall 30 mm high. The area surrounded by the proposed bund wall is approximately 71.7 m² as shown in Figure 10-3. Therefore, the containment will have a total capacity of 2.2 m³.

The maximum capacity of the delivery truck is estimated on 19 m³ (19,000 L) which equates to 17 tonnes of product. Holmes Fire has been advised that the vehicle will usually be filled up to 15 tonnes (approximately 16.8 m³). Therefore, the containment area will have a capacity to contain spillages up to 13% of the expected load in the delivery truck.

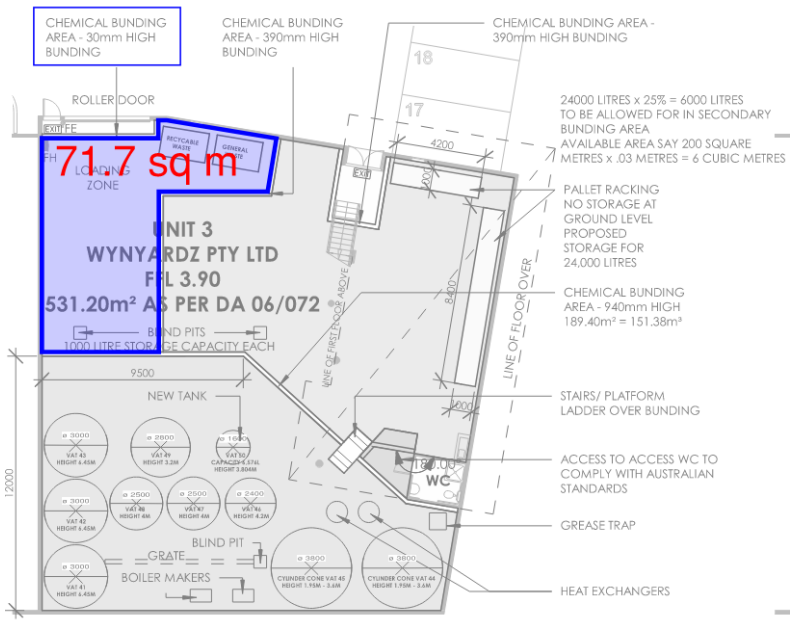

Figure 10-3: Loading Zone Containment Area

11 PERFORMANCE SOLUTIONS

11.1 Issue 1 – Unprotected Openings in External Walls

Clause C3.2 requires openings in external walls that are required to be fire rated to be protected in accordance with Clause C3.4 if they are located within 3 m of an allotment boundary. The building contains openings in the frontal external wall located approximately 1.2 m and 3.0 m from a fire source feature in the adjacent building (Unit 2), as shown in Figure 11-1. These openings are proposed to be protected by a blade wall.

Figure 11-1: Location of unprotected openings.

11.1.1 Analysis

The purpose of this analysis is to assess the levels of radiation received at the allotment boundary and at various locations over the allotment boundary in the neighbouring property, as required by BCA Verification Method CV1 of the BCA, as noted in Table A-1.

Table A-1: Table CV1 from BCA

Location	Heat Flux (kW/m²)
On Boundary	80
1m from Boundary	40
3m from Boundary	20
6m from boundary	10

Background

The analysis is based upon equations to calculate radiant heat spread as set out in the Fire Engineering Design Guide [7]. External flame projection is accounted for. It is assumed that the windows break such that no reduction factor to the emitted radiation is applied. To estimate the horizontal flame projection and the vertical flame height, the following formulae are used:

$$Z = 12.8(\dot{m}/w)^{2/3} - h$$

$$P = 0.314h^{1.53}w^{-0.53}$$

Where Z is the total flame height, P is the projection length outside the window, h is the window height, $\dot{m}$ is the peak burning rate in the room, and w is the window width.

For conservatism, the radiator size is taken to be the calculated flame height including the height of the opening. This is considered conservative as a flame typically only projects out the top of the opening, as air is drawn in at the bottom. Figure A-1 illustrates the flame projection through an opening, where the radiator height used is z + H.

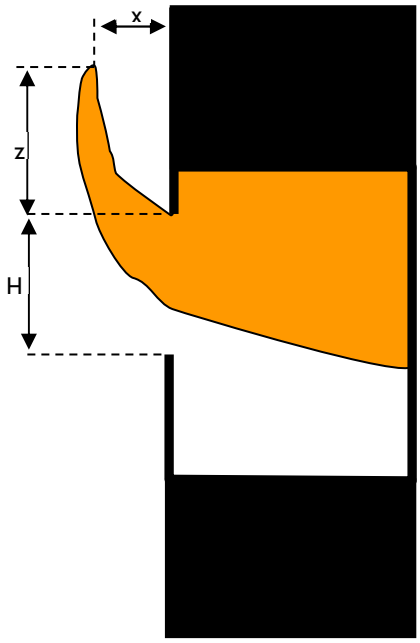

Figure A-1: Flame Projection

The peak burning rate for a ventilation controlled fire can be calculated as per:

$$\dot{m} = 1.5(0.092hw\sqrt{h})$$

Emitted radiation [8] from an object is calculated as per:

$$q = \emptyset\sigma T^4\varepsilon$$

where ∅ is the configuration factor;

σ is Stefan-Boltzmann constant of 5.6696 x 10^{-8} W/m²K⁴;

T is the temperature of the object in K; and

ε is the emissivity of the flame, assumed to be 1.0 as for a black body.

The configuration factor is for a rectangular radiator is based on the following [8].

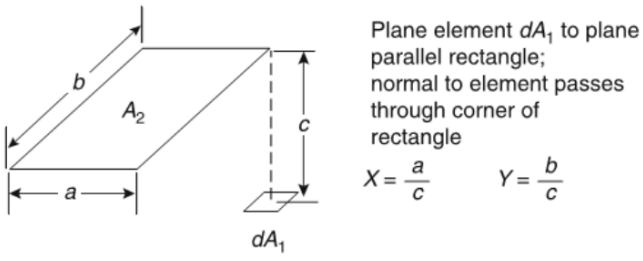

Figure A-2: Configuration Factor for Parallel Radiator / Receiver Pair

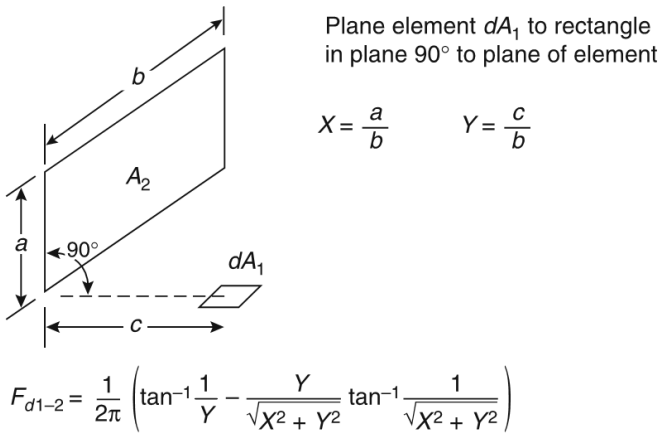

Figure A-3: Configuration Factor for Perpendicular Radiator / Receiver Pair

Input Values and Assumptions

A flame can be divided into a continuous flame region slightly above the base of the fire and an intermittent flame region, where the temperature decreases as moving towards the top of the flame. These temperatures may change depending on the fuel. If the flaming is internal, the maximum flame temperature can be expected to be within the range of 800 to 1,000°C [9] [10]. For internal flaming, a temperature of 1,000 °C is assumed for conservatism.

For external flames, the decrease in flame temperature is directly proportional to the distance along the centreline of the flame [10]. Yokoi [11] conducted research where the average flame height and flame

temperatures were investigated, where the flame height was correlated to a flame tip temperature of 540°C. The temperature closer to the source will be greater than this.

When external flaming is considered the temperature of the emitting area should reflect that of an external flame, rather than the temperature inside the fire room. Therefore, an external flame temperature of 800°C will be adopted [7].

Table A-2 summarises the input values used in the assessment to demonstrate compliance with CV1 for fire spread to the boundary from the subject building. The outgoing (emitted) heat radiation is calculated at the boundary, and 1 m, 3 m, and 6 m from the boundary.

Table A-2: Input Parameters for Spreadsheet Analysis

Parameter	Value	Comment
Dimensions	Height x Width	Dimensions of openings
Window Breakage	Y	Subject openings are doorways that will be assumed to be open at the time of a fire.
Radiator Dimension	Height x Width	Where H = opening height + flame height
Temperature	800 °C	External flaming allowing for vertical flame height and horizontal flame projection, for sensitivity purposes[1]
Emissivity	1	For conservatism an emissivity of 1 will be considered
Distance to Boundary	X m	As per architectural plans
Configuration Factor	-	As relevant for the geometrical relationship between the emitting surface and the receiver

Note 1: When external flaming is considered the temperature of the emitting area should reflect that of an external flame, rather than the temperature inside the fire room.

Results from the assessment are listed in Table A-3. The spreadsheet used to generate these results has been verified with the radiant heat spread calculation within the computer model FireWind [12]. All spreadsheets are available upon request.

Results

Table A-3: Results of Assessment of Fire Spread to Adjacent Allotment

Fire Source and Distance from Boundary	Heat Flux Values at Boundary (not to exceed 80 kW/m²)	Heat Flux Values 1.0 m into Adjacent Allotment (not to exceed 40 kW/m²)	Heat Flux Values 3.0 m into Adjacent Allotment (not to exceed 20 kW/m²)	Heat Flux Values 6.0 m into Adjacent Allotment (not to exceed 10 kW/m²)
Openings Unit 3 + Flame projection • **Roller door 4 m (w) x 17 m (h) 1.2 to the boundary** • **Exit door 1 m (w) x 7.5 m (h) 0.2 m to the boundary**	87.03 kW/m²	50.80 kW/m²	23.39 kW/m²	11.64kW/m²

The results show that the adjoining building may be subjected to radiation levels above the requirements specified by CV1. It is assumed that the construction of the external walls is fire resistant in accordance with the BCA requirements. Therefore, the main concern in this scenario is the risk of fire spread to the adjacent building through the unprotected openings. Therefore, a blade wall and slab achieving an FRL of not less than -/60/- is to be provided in front of the unprotected opening and above the roller door as shown in Figure 11-2. This blade wall/slab will also protect the subject building from incoming radiation from a fire in the neighbouring building.

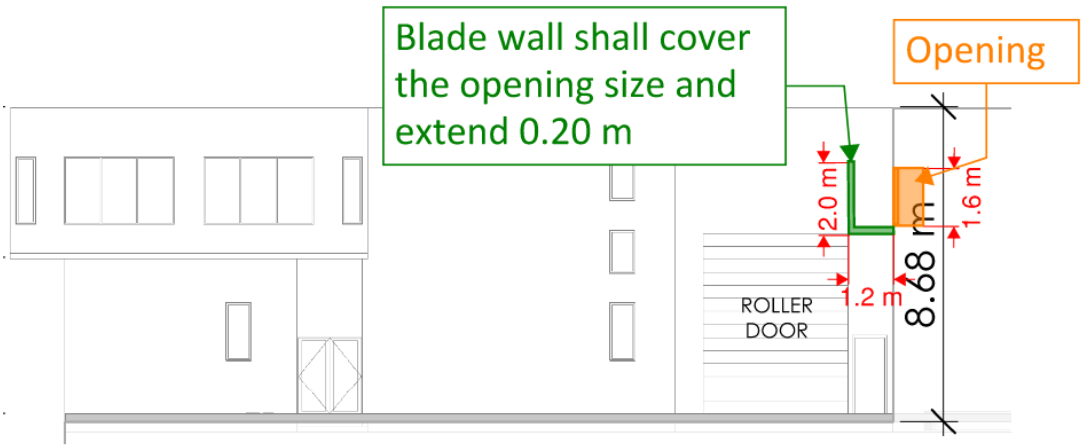

Figure 11-2: Location and Dimensions of Blade Wall and Slab

11.1.2 Conclusion

This assessment has demonstrated that the provision of a fire-rated blade wall/slab provides a level of fire safety that complies with the Performance Requirements CP2 and CP8 in relation to fire spread between buildings.

11.2 Issue 2 – Clear Width of Path of Travel and Potential Trip Hazards

The clear width of paths of travel to exits is required to be at least 1,000 mm. However, the clear width is reduced to 800 mm between Vat 45 & Vat 46 and 700 mm between Vat 42 & Vat 48. This is shown in Figure 11-3.

Figure 11-3: Reduced Clear Width of Path of Travel Between Vat 45 & Vat 46 (Left) and Vat 42 & Vat 48 (Right)

11.2.1 Analysis

Potential trip hazards at floor level are to be ameliorated by the installation of stainless steel steps and catwalk type raised flooring. Note: The design is to be done by others.

Consideration is made to ergonomics in relation to occupant body size and the ability for occupants to use the path of travel to an exit. Data based on various studies [13] [14] [15] is used to determine the limiting factor for adult men and women. Shoulder width is assessed as this the fence along the egress path may extend the full height of a person.

According to data based on adult men aged between 19-65 years, the 5th, 50th, and 95th percentile of the studied population does not exceed a shoulder width of 414 mm, 462 mm, and 509 mm respectively. These dimensions are listed in Table 11-1.

Table 11-1: Summary of Male Shoulder Widths

Source	Male Shoulder Width (mm)		
	5 %ile	50 %ile	95 %ile
British 19-65 yrs	420	465	510
Swedish	420	465	510

Source	Male Shoulder Width (mm)		
	5 %ile	50 %ile	95 %ile
Dutch 20-60 yrs	430	475	520
French	425	470	515
Polish	405	440	475
United States	425	470	515
Brazilian	400	445	490
Assorted	442	-	526
Projected 1985	444	-	529
Assorted 18-40 yrs	420	462	504
Average	**414**	**462**	**509**
Average + 200 mm	**614**	**662**	**709**

According to the data based on adult women aged between 19-65 years, the 5th, 50th, and 95th percentile of the studied population do not exceed a shoulder width of 366 mm, 401 mm, and 443 mm respectively. These dimensions are listed in Table 11-2.

Table 11-2: Summary of Female Shoulder Widths

Source	Female Shoulder Width (mm)		
	5 %ile	50 %ile	95 %ile
British 19-65 yrs	355	395	435
Swedish	355	390	425
Dutch 20-60 yrs	355	400	445
French	380	425	470
Polish	350	380	410
United States	360	400	440
Assorted	378	-	432
Projected 1985	386	-	468
Assorted 18-40 yrs	376	418	460
Average	**366**	**401**	**443**
Average + 200 mm	**566**	**601**	**643**

Russian studies on egress have shown that 100 mm should be added to each side to allow for a personal buffer including body sway and personal space [16]. By including this allowance for body sway and personal space, the limiting factors increase to 614 mm (men) and 566 mm (women) for the 5th percentile, 662 mm and 601 mm for the 50th percentile, and 709 mm and 643 mm for the 95th percentile.

Additionally, a 460 mm by 600 mm body ellipse has been used to determine the practical standing capacity of New York City subway cars [17] (see Figure 11-4). A US Army human factors design manual also recommends the use of these dimensions. The larger design ellipse allows for the fact that many pedestrians are carrying personal articles, natural psychological preferences to avoid bodily contact with others, and body sway.

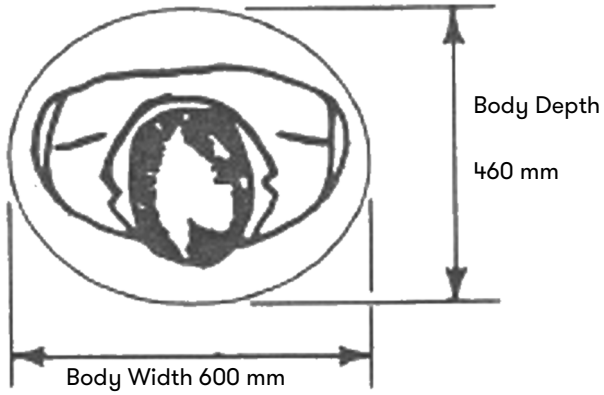

Figure 11-4: Body Ellipse

It is assumed that when a single-file travel is applicable during egress, the buffer for personal space is not relevant, although some additional space is still needed to allow for body sway. AJ Metric Handbook recommends a minimum width of 550-600 mm to permit one person to walk comfortably along a path of travel [15].

The subject path may be utilised during occupant egress by occupants exiting the building. The clear width is reduced to 800 mm between Vat 45 & Vat 46 and 700 mm between Vat 42 & Vat 48, which is less than the minimum 1,000 mm required by the BCA Deemed-to-Satisfy Provisions.

As noted in Section 4.2 of this report, a single worker is expected in this facility. Visitors are expected to be accompanied by a member of staff unless that person has been appropriately inducted. Occupants are expected to be awake and alert, and generally able bodied. The facility employee is expected to be familiar with the pinch points between the vats and be able to move between them without the need of extra space for body sway.

As detailed above, anthropometric data indicates that the studied population does not exceed a shoulder width of 509 mm for male and 443 mm for female. Furthermore, the minimum required clear width of the path must be at least 600 mm to enable the expected population to use the path in a single-file manner. Therefore, the 700 mm between vats is expected to allow the majority of occupants to pass the vats without their egress being impeded.

In order to highlight the obstruction on Vat 46, the protruding valve is to be provided with a black and yellow striped adhesive hazard tape to be installed on the circular ring surrounding the valve.

11.2.2 Conclusion

This assessment has demonstrated that a clear width of at least 700 mm provides a level of fire safety that complies with the Performance Requirement DP4 in relation to exit width. Potential trip hazards at floor level are to be ameliorated by the installation of stainless steel steps and catwalk type raised flooring

12 REPORT BASIS INFORMATION

The report is based on the following:

1) Fire Safety Upgrade Concept Report (140012.00.CFSUSR01a), prepared by Holmes Fire and issued on 14 October 2020;
2) Fire Management Plan (140012.00.FMP01e) prepared by Holmes Fire and issued on 14 October 2020;
3) Inspection of the building, carried out on 26 February 2020 by Holmes Fire;
4) Planning Secretary's Environmental Assessment Requirements (SEARs) by Department of Planning & Environment NSW, dated 5 March 2019;
5) Statutory Compliance Report (J3176) by DP Property Consulting Pty Ltd, dated 16 January 2020, outlining BCA Deemed-to-Satisfy non-compliances;
6) Architectural drawings, prepared by JMH Living Design as listed in Table 12-1.

Table 12-1: Referenced Architectural Drawings

Dwg no.	Title	Date
18_13 – Sheet 01	Site Plan	8 April 2020
18_13 – Sheet 02	Unit 3	8 April 2020

13 CONCLUSION

This report addressed the existing building located at Unit 3 located at 5 Clerke Place, Kurnell, NSW for compliance with the proposed fire safety upgrade. With reference to the proposed fire safety upgrade strategies contained within this report, it is considered that the objectives of Section 4.12(8) of the Environmental Planning and EP&A Regulation Clause 94 have been met.

While satisfaction of the Performance Requirements of BCA 2019 is not applicable in this instance, consideration has been given to them in determining the appropriate fire safety upgrade measures.

In order that the building design can satisfy the assumptions made in this analysis, the items listed in the Schedule of Works section are to be carried out in the building.

Where building alterations or a change of occupancy occurs, subsequent to the measures mentioned above being provided, the validity of the fire safety upgrade analysis may be compromised and further analysis will be required by a suitably qualified fire safety engineer.

14 REFERENCES

[1] The Australian Building Codes Board, National Construction Code, Volume One, Building Code of Australia 2019, ACT, Australia: The Australian Building Codes Board, 2019.

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[11] Yokoi, S., "Study on the Prevention of Fire-Spread Caused by Hot Upward Current.," The Building Research Institute, Ministry of Construction, Japanese Government, 1960.

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[14] Panero, J, and Zelnik, M., “Human Dimension & Interior Space,” Witney Library of Design, New York, United States, 1979.

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[17] Fruin, J., “Pedestrian Planning and Design, Revised Edition,” 1987.

Appendix A Fire Safety Upgrade Notice

Holmes Fire

Holmes Fire LP

Level 2, 414 Kent Street, Sydney, NSW 2000
Level 8, 757 Ann Street, Fortitude Valley, QLD 4006

holmesfire.com

Unit 3, 5 Clerke Place

Kurnell, NSW

A Fire Safety Upgrade has been applied to this building.

The issues relate to:

- Unprotected Openings in External Walls
- Clear Width of Path of Travel and Potential Trip Hazards

Refer to Fire Safety Upgrade Report, 140012.00.FSUR01b, Version B, dated 19 October 2020, by Holmes Fire.

This report specifies building works and services which are required to be inspected as part of the Annual Fire Safety Certification process.

Where building alterations or a change of occupancy occurs, the validity of this fire safety analysis may be compromised.

Please contact Holmes Fire prior to undertaking any alterations and to assist with the annual certification process.