Appendix N

Fire Safety Study

Riskcon engineering

Fire Safety Study

129 Mitchell Avenue, Kurri Kurri

Weston Aluminium Pty Limited
Document No. RCE-22206_Weston_FSS_Final_5Dec22_Rev(0)
Date 5/12/2022

Fire Safety Study

129 Mitchell Avenue, Kurri Kurri

Weston Aluminium Pty Limited

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Date 5/12/2022

Quality Management

Rev	Date	Remarks	Prepared By	Reviewed By
A	17th November 2022	Draft issued for comment	Jason Costa	Renton Parker
B	30th November 2022	Draft revised		
C	5th December 2022	Draft revised		
0	5th December 2022	Final issued		

Executive Summary

Background

Weston Aluminium Pty Ltd (WA) have been operating their resource recovery facility since 1998, located at 129 Mitchell Road, Kurri Kurri. The facility was originally established to recover aluminium from dross, which is a by-product of the aluminium smelting process. The site also processes scrap metals and remelts aluminium scrap to produce deoxidant products which are used in the steel making industry. More recently, a dedicated thermal waste treatment plant was established on site, which is currently undergoing commissioning.

Due to changing market conditions, WA are now seeking to further diversify wastes streams which can be stored and treated on site. In addition, WA is seeking approval to establish new physiochemical treatment technologies within the proposed development. The proposal does not include an increase in waste tonnages currently authorised to be received at the facility (i.e. maintain activity within the combined 48,000 tonnes per annum).

To facilitate the storage and treatment of additional waste streams, WA are seeking to repurpose the existing Aldex building. Key aspects of the project include:

- Deletion of the Briquetting Plant (formerly established within the Aldex Building; decommissioned in 2020) from the Project Approval.
- Relocation of the crushing / sizing plant from the Aldex Building for operation at the Front Bay area of the Main Plant Building.
- Discontinuation of the storage and processing of DG Class 4.3 primary aluminium smelter by-products (aluminium dross and spent potlining wastes) at the facility. Only small quantities of secondary aluminium dross (including dross generated in-house as part of approved scrap remelt operations) will be stored, handled and processed within the Main Plant Building.
- Discontinuation of the storage and handling of DG Class 4.3 material (dross and spent pot linings) within the Aldex Building.
- Minor construction additions to the Aldex Building, including the construction of an awning to the north, and the enclosure of the south-eastern portion of the Aldex Building.
- Repurposing of the Aldex building to undertake new activities as provided below.

A review of the application guide to Chapter 3 of the State Environmental Planning Policy – Resilience & Hazards (SEPP-RH) indicates the facility would exceed the threshold criteria for the storage of DGs. For facilities of this nature, the Conditions of Consent generally require the preparation of a Fire Safety Study (FSS) per the requirements of the Hazardous Industry Planning Advisory Paper (HIPAP) No. 2 (Ref.) to meet the requirements of Fire & Rescue NSW (FRNSW).

WA has commissioned Riskcon Engineering Pty Ltd (Riskcon) to prepare the FSS for the facility. This document represents the Fire Safety Study for the site located at 129 Mitchell Avenue, Kurri Kurri.

Conclusions

A Fire Safety Study per the HIPAP No. 2 guidelines was prepared for the site. In addition, the FSS assessed all incidents that could occur at the site and the recommendations made in the previously prepared PHA (Ref.) were reviewed as required.

The analysis performed in the FSS was based on credible fire scenarios to assess whether the protection measures at the site were adequate to combat the hazards associated with the quantities and types of commodities being stored. Based on the assessment, it was concluded that the proposed designs in conjunction with existing fire protection adequately managed the risks.

Recommendations

Based on the analysis, the following recommendations have been made:

- All site personnel are to be trained in specific site procedures, emergency and first aid procedures and the use of fire extinguishers and hose reels.
- An appropriate sprinkler system is to be designed and installed throughout the Aldex Building.
- 9 kg dry powder fire extinguishers shall be located no closer than 2 m and no further than 10 m from DG storage locations.
- Spill kits suitable for the commodities being stored shall be provided for DGs stored in racking.
- Site management to prepare and maintain operational procedures to minimise the number of hazardous incidents and accidents on site and to mitigate the consequences of incidents regarding the handling of dangerous goods and chemicals.
- The existing Emergency Response Plan is to be updated per the requirements of HIPAP No. 1 to reflect the Project addition and shall include measures to advise neighbouring premises in the event of an emergency with potential offsite impacts.
- The FBIM assessment shall be reviewed in conjunction with an FER for consistency.
- A detailed hydraulic and pressure loss analysis be completed by a qualified hydraulic engineer to demonstrate complete compliance with AS 2419.1-2005.

Implementation Commitment

An implementation commitment has been provided and is provided in Appendix E.

Table of Contents

List of Figures

List of Tables

List of Appendix Figures

List of Appendix Tables

Abbreviations

Abbreviation	Description
ADG	Australian Dangerous Goods Code
AS	Australian Standard
CBD	Central Business District
DA	Development Application
DGs	Dangerous Goods
DGS	Dangerous Goods Store
DPE	Department of Planning and Environment
ESFR	Early-Suppression, Fast-Response
FER	Fire Engineering Report
FRNSW	Fire and Rescue New South Wales
HIPAP	Hazardous Industry Planning Advisory Paper
PHA	Preliminary Hazard Analysis
SEARs	Secretary's Environmental Assessment Requirements
SEP	Surface Emissive Power
SEPP	State Environmental Planning Policy
SMSS	Storage Mode Sprinkler System
SSC	Spread Sheet Calculator
VF	View Factor

1.0 Introduction

1.1 Background

Weston Aluminium Pty Ltd (WA) have been operating their resource recovery facility since 1998, located at 129 Mitchell Road, Kurri Kurri. The facility was originally established to recover aluminium from dross, which is a by-product of the aluminium smelting process. The site also processes scrap metals and remelts aluminium scrap to produce deoxidant products which are used in the steel making industry. More recently, a dedicated thermal waste treatment plant was established on site, which is currently undergoing commissioning.

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WA has commissioned Riskcon Engineering Pty Ltd (Riskcon) to prepare the FSS for the facility. This document represents the Fire Safety Study for the site located at 129 Mitchell Avenue, Kurri Kurri.

1.2 Objectives

The objectives of the FSS are to;

- Review the site operations and storages for the potential to initiate or become involved in a fire including flammables liquids and any combustible dusts which may be present at the site.
- Identify heat radiation impacts from potential fire sources at the site and determine the potential impacts on the surrounding areas and fire protection system, and
- Review the proposed fire safety features and determine the adequacy of the fire safety systems based on the postulated fires, and make recommendations for augmentation, as required.

1.3 Scope of Services

The scope of work is for the preparation of an FSS for the WA facility to assess the potential hazards at the site to ensure the fire protection systems are commensurate with the identified hazards. This document follows the methodology recommended in HIPAP No.2 (Ref. [1]).

The FSS focuses on the storage of commodities at the site as required by HIPAP No. 2. A review of the following components of the FSS are within the scope of work:

- Determination of risk and consequences from fire or explosion scenarios throughout the facility;
- The preparation of a report on fire prevention, fire detection, fire alarm and fire suppression systems for the site;
- Firewater storage capacity for compliance with Australian Standards and Regulations and relevant NFPA standards;
- Hydrant hydraulic design screening calculations for the fire water system including the fire main sizing;
- External fire hydrant configuration and locations; and
- Recommendations based upon the study for implementation in the final design.

2.0 Methodology

2.1 Fire Safety Study Approach

The following methodology was used in the preparation of the FSS for the facility. The methodology is to follow items required by HIPAP No. 2 (Ref. [1]).

- The fire hazards associated with the facility were identified to determine whether there were any fire or explosion hazards that may impact offsite or result in a potential to escalate. Where fire hazards with the potential to impact offsite or escalate were identified, these were carried forward for consequence assessment.
- The heat radiation impacts or overpressure impacts (consequences) from each of the postulated incidents from the proposed equipment were then estimated and potential impacts on surrounding areas assessed.
- Impacts of the fires from the proposed equipment were plotted on a layout plan of the proposed facility, to determine whether heat radiation impacts any critical areas (i.e. adjacent storage areas, fire services, safety systems, etc.) and whether such impact affected the ability of fire fighters to respond to the postulated fire. The heat radiation impact from incidents at adjacent sites on the buildings and structures at the facility were then assessed against the maximum permissible levels in HIPAP No. 4 (Ref. [3]).
- The firefighting strategies were then assessed to determine whether these strategies require update in light of the location of the proposed equipment and storage areas.
- The response times for FRNSW in the immediate vicinity were assessed. In addition, further outlying FRNSW stations were included to provide a ‘back-up plan’ in the event that the closest fire brigades were unable to attend.
- A report was then developed for submission to the client and the regulatory authority.

2.2 Limitations and Assumptions

In this instance, the FSS is developed based on applicable limitations and assumptions for the development which are listed as follows:

- The report is specifically limited to the project described in **Section 1.3**
- The report is based on the information provided.
- The report does not provide guidance in respect of incidents that relate to sabotage or vandalism of fire safety systems.
- The assessment is limited to the objectives of the FSS as provided in the guidelines issued as HIPAP No. 2 (Ref. [1]) and does not consider property damage such as building and contents damage caused by fire, potential increased insurance liability and loss of business continuity.
- Malicious acts or arson with respect to fire ignition and safety systems are limited in nature and are outside the scope of this report. Such acts can potentially overwhelm fire safety systems and therefore further strategies such as security, housekeeping and management procedures may better mitigate such risks.

- This report is prepared in good faith and with due care for information purposes only and should not be relied upon as providing any warranty or guarantee that ignition or a fire will not occur.

3.0 Site Description

3.1 Site Location and Surrounding Land Uses

The current operations are located a 129 Mitchell Street, Kurri Kurri (Lot 61 DP 1237125). The site is located approximately 130 km north of Sydney and approximately 30 km west of Newcastle. The site is located on land zoned IN3 Heavy Industry under the *Cessnock Local Environment Plan 2011.* The IN3 zoning identifies development for the purpose of heavy industry and hazardous waste storage as permissible with consent.

The suburb of Kurri Kurri and neighbouring Weston comprise mainly industrial facilities in the area where the Weston Aluminium site is located. The following land uses are located adjacent to the Weston Aluminium Site.

- North – Open rural land, Swamp Creek.
- South – Mitchell Avenue, Alfabs Engineering (steel fabricators) across Mitchell Avenue.
- East – Vacant lands and Allight Sykes (mine lighting structure manufacturer) to the southeast.
- West – Vacant Land, currently owned by Weston Aluminium.

Figure 3-1 shows the regional location of the Weston Aluminium facility and **Figure 3-2** shows the facility layout.

Figure 3-1: Regional Location of the Weston Aluminium Facility. – Kurri Kurri, NSW

Figure 3-2 shows the plant layout, including location of the Aluminium Recycling Plant, Thermal Processing Facility and the Aldex Building which is proposed to be repurposed as a waste storage and processing area. **Figure 3-3** shows the layout of the proposed waste storage area within the Aldex building.

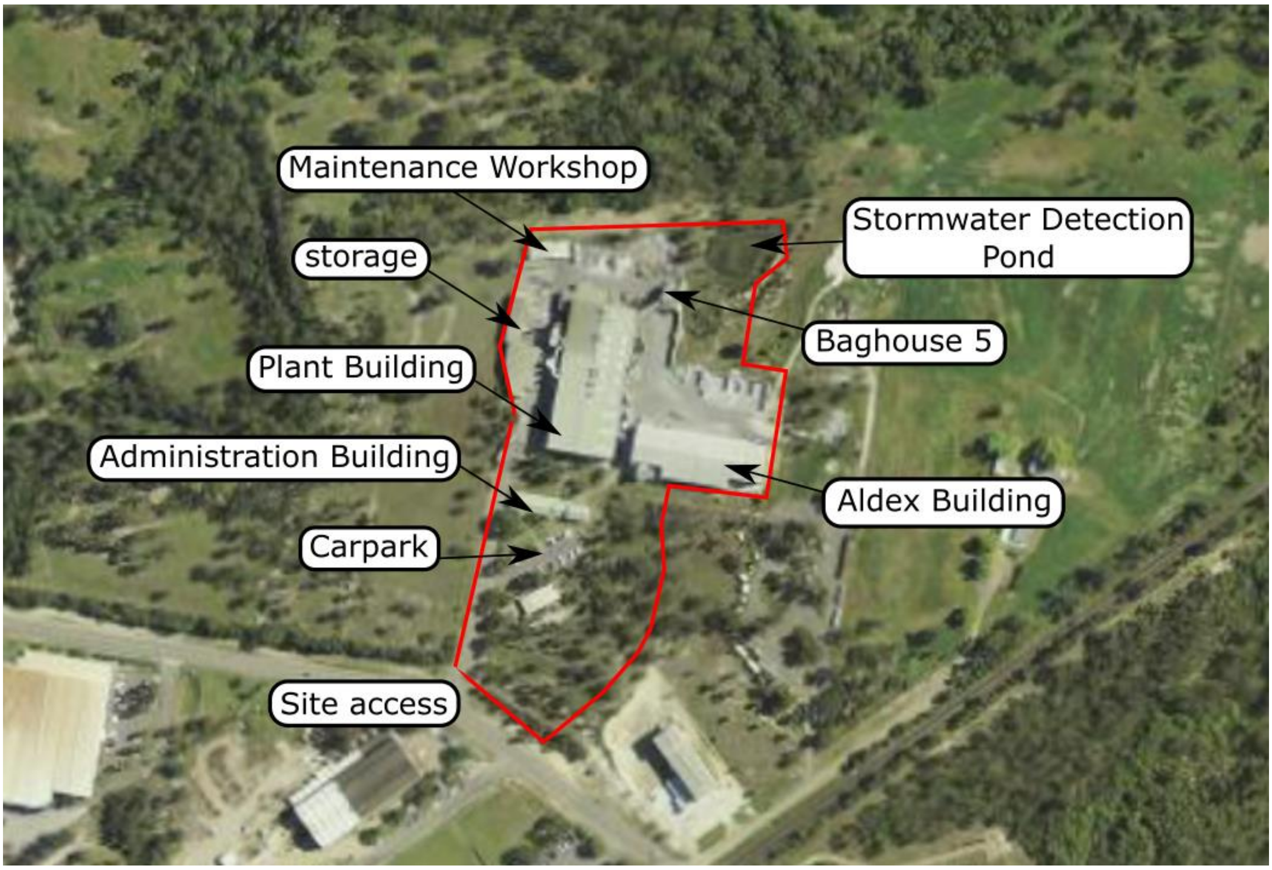


Figure 3-2: Site Layout

Figure 3-3: Proposed Waste Chemical Storage Area (Eastern End)

3.2 Proposed Activities

3.2.1 Aldex Building Repurposing

To facilitate the receipt, consolidation, safe storage and treatment/dispatch of the additional waste streams, the Aldex building will undergo some internal alterations and some minor external additions. Specifically, this is to include:

- Installation of a new full height wall at the centre of the Aldex building with the establishment of a dedicated dangerous goods storage zone in the eastern portion.
- Installation of a new sliding door on the northern wall for bulk storage access.
- Installation of three 50 m^3 pits in the southwestern corner of the building.
- Three new 10 KL silos in the southwestern corner for the storage of reagents.
- Use of three 25 KL storage tanks in the northern western corner for non-Dangerous Good treatment.
- Dedicated dangerous goods storage areas in the eastern portion of the building.
- Installation of fire rated concrete walls around Dangerous Good Class 2 and 3 storage areas.
- Installation of racking for the storage of Dangerous Good Class 8 (acid and bases stored separately).
- Addition of Non-class 3 decant and consolidation area at the south-eastern corner.
- Establishment of Dangerous Good 6.1 storage area.
- Installation of a rollover bund at the entry of the flammable storage area.
- Erection of an awning to the north eastern area of the building and installation of mesh fencing around the awning area.

3.2.2 Waste Receipt

Each type of waste would be produced at its source industry and packaged in accordance with the storage packaging and labelling requirements of the relevant codes and guidelines. The tracking of the waste during transportation would also be undertaken in accordance with the requirements of the NSW EPA. All waste would be transported to the Project Area by road. Depending on the type of waste, its source location, business/industry and the transport contractor being used, the size and type of vehicle being used to transport waste to the WA Site may vary.

All waste delivered to site will be via road entering from Mitchell Avenue, utilising Government Road and Hart Road to access the Hunter Expressway via the Loxford Interchange. Upon delivery to the Project Area, trucks or vehicles carrying waste would proceed through the site's weighbridge for recording and then to the waste drop off zone and loading bay located on the southern side of the Aldex building, where the wastes will undergo QC screening and inspection prior to storage..

Wastes which are proposed to be accepted as part of the Project are provided in **Table 3-1**.

Table 3-1: Waste Types

Waste Type	Waste Code	Class	Treatment	tonnes per annum (tpa)
Acidic solutions or acids in solid form	B100	8	PC, S	250-500
Antimony: antimony compounds	D170	6	PC, S	<20
Arsenic; arsenic compounds	D130	6	PC, S	<20
Barium compounds (excluding barium sulphate)	D290	6	PC, S	<20
Basic solutions or bases in solid form	C100	8	PC, S	250-500
Beryllium; beryllium compounds	D160	6	PC, S	<20
Boron compounds	D310	6	PC, S	<20
Cadmium; cadmium compounds	D150	6	PC, S	<20
Chlorates	D350	5.1	S	<20
Chromium compounds	D140	6	PC, S	100-250
Cobalt compounds	D200	6.1	PC, S	<20
Containers and drums that are contaminated with residues of substances referred to in this list	N100	9	R	100-200
Copper compounds	D190	6.1	PC, S	100-200
Cyanides (inorganic)	A130	6.1	S	<20
Cyanides (organic)	M210	6.1	S	<20
Filter cake contaminated with residues of substances that are referred to in this part	N190	NA	PC, S	250-500
Fire debris and fire wash waters	N140	NA	PC,S	250-500
Fly ash	N150	NA	PC, S	100-200
Highly odorous organic chemicals (including mercaptans and acrylates)	M260	NA	S	<20
Inorganic fluorine compounds excluding calcium fluoride	D110	NA	PC, S	250-500
Inorganic sulfides	D330	NA	PC, S	<20
Isocyanate compounds	M220	6.1	PC, S	20-100
Lead; lead compounds	D220	6.1	PC, S	250-500
Mercury; mercury compounds	D120	6.1	PC, S	<20
Nickel compounds	D210	6.1	PC, S	<20
Organic phosphorous compounds	H110	6.1	S	20-100
Oxidising agents	E100	5.1	PC, S	20-100
Perchlorates	D340	5.1	PC, S	<20

Waste Type	Waste Code	Class	Treatment	tonnes per annum (tpa)
Per- and poly-fluoroalkyl substances (PFAS) contaminated materials, including waste PFAS-containing products and contaminated containers	M270	9	S	100-200
Phenols, phenol compounds including chlorophenols	M150	NA	S	<20
Phosphorous compounds excluding mineral phosphates	D360	6.1	S	20-100
Residues from industrial waste treatment / disposal operations	N205	NA	PC, S	500-1000
Soils contaminated with a substance or waste referred to in this table	N120	NA	PC, S	1000-2000
Surface active agents (surfactants), containing principally organic constituents and which may contain metals	M250	NA	PC, S	500-1000
Thallium; thallium compounds	D180	6.1	PC, S	<20
Vanadium compounds	D270	6.1	PC, S	100-200
Waste containing peroxides other than hydrogen peroxide	E100	NA	PC, S	<20
Waste from manufacture, formulation and use of wood-preserving chemicals	H170	NA	PC, S	100-200
Waste from manufacture, formulation and use of biocides and phytopharmaceuticals	H100	NA	PC, S	100-200
Waste resulting from surface treatment of metals and plastics	A100	NA	PC, S	100-250
Waste substances and articles containing or contaminated with polychlorinated biphenyls, polychlorinated naphthalene's, polychlorinated biphenyls and/or polybrominated biphenyls	M100	9	S	100-200
Zinc compounds	D230	NA	PC, S	<20

3.2.3 Waste Storage

All wastes received will be stored under cover inside the Aldex building in appropriate containers relevant to the type of waste. As per current operations, there would be no freestanding waste stockpiles or waste stores in the open air. All waste storage areas will be appropriately signposted and designed in accordance with the appropriate guidelines.

The entire Aldex building will be subject to an Emissions Control Unit (ECU), which will provide suitable negative pressure in the building to avoid fugitive emissions and manage the occupational hygiene of the workforce operating within the building. All air will be cleaned by the ECU filtration process.

3.2.4 Waste Treatment

It is proposed that a number of new physio-chemical treatment activities be established within the Aldex building to enhance the treatment capability at the WA site. These include established waste treatment processes including:

1. Waste consolidation;
2. Chemical Immobilisation and Solidification; and
3. Chemical Neutralisation.

The existing thermal treatment process would also be used for those wastes where this treatment pathway is acceptable.

3.2.4.1 Consolidation

Consolidation is a term used to describe the removal of a waste type from a smaller receptacle to be placed with other similar and compatible waste types in a larger receptacle. The process of consolidation involves the decanting either manually or using mechanical aids (eg shredders) from small package waste containers (typically <20L) into a larger receptacle such as an Intermediate Bulking device (1,000L capacity). It is proposed that the consolidation will be undertaken both manually and also using mechanical aids such as pumps, and automated de-packaging technologies including shredders. Consolidated wastes would either be subject to further treatment onsite (e.g. in existing Thermal Treatment Facility) or otherwise dispatched offsite for further treatment or disposal.

3.2.4.2 Chemical Immobilisation and Solidification

Chemical immobilisation and/or Solidification may be used in combination or separately in the treatment process. This would depend on the nature of the contaminants and their physical properties. Chemical immobilisation would involve the introduction of chemical reagents, which would convert the target contaminants contained in the waste so that they would be chemically stable and suitable for landfill disposal. Stabilisation or solidification would involve the mixing of cement (or other suitable solidification reagents), which would transform the waste into a stabilised form suitable for landfill disposal. Wastes would be mixed with reagents using either an excavator or front end loader, or using an approved high shear mixing device.

3.2.4.3 Chemical Neutralisation

Chemical Neutralisation is a term where a particular chemical characteristic (e.g. corrosivity) is neutralised to produce an inert by-product. It is proposed that small scale Chemical Neutralisation be undertaken focussed largely on packaged waste. The infrastructure would include a small tank farm including a filtration system for the recovered solids. The resultant liquid waste would either be disposed to trade waste or transferred off site for disposal. The resultant solids would be solidified and sent to landfill or treated by Chemical immobilisation and/or Solidification.

3.2.5 Waste Disposal

Prior to disposal at an appropriate and licenced landfill facility, the wastes would undergo sampling and analysis in accordance with the Waste Classification Guidelines Part 1: Classifying waste and/or Waste classification guidelines (Ref. [4]) and/or Part 2: Immobilisation of waste (Ref. [4]) as required by the EPA.

3.3 General Description of Storage Areas

The proposed storage area will be housed within the eastern end of the former Aldex Building. The area will house a range of DG classes which have been summarised in **Section 3.4**. **Figure 3-3** may be used to assist in understanding the description provided below.

The flammable waste materials will be separated from the rest of the storage areas by an FRL 240/240/240 wall. Flammable gas waste receptacles will further be separated from the flammable liquid waste receptacles by the inclusion of a chain mesh fence to prevent rocketing of aerosols or cylinders in the event of a fire originating in the flammable gas area. Also contained within the bunker is a flammable liquid decanting area. Liquids in small containers (i.e. <20 L) will be decanted and aggregated into Intermediate Bulk Containers (IBCs; typically 1,000L capacity). The bunker and decanting areas are proposed to be designed in accordance with AS 1940:2017 (Ref. [3]) including bunding, fire walls, ventilation, and hazardous area rated electrical equipment in accordance with AS/NZS 60079.14:2022 (Ref. [7]).

The other DG storages will contain discrete bays for each class that is stored. They will have racking to store IBCs or drums on pallets and the area will be bunded to contain any spills. Each store will comply with the applicable standard covering the class of good stored.

In the rear of the building will be a reactor for the treatment of non-flammable wastes, predominantly neutralisation of corrosive substances prior to disposal.

Wastes will be received within the unloading areas and transported to the class specific storage area associated with the goods that have been received. Wastes will be stored here until they can be sent out for additional treatment / disposal.

3.4 Dangerous Goods Stored and Handled

The DG classes and quantities proposed to be stored and handled at any one time as part of the waste treatment operation within the former Aldex building are summarised in **Table 3-2**. **Figure 3-3** may be used to assist in understanding where the DG storages will be located within the building.

Table 3-2: Classes and Quantities of Dangerous Goods Stored and Handled

Class	Quantity (T)
2.1	30
2.2	
3	30
5.1	40
6.1	80
8 (acids)	80
8 (alkali)	80
9	80

4.0 Hazard Identification

4.1 Introduction

A hazard identification table has been developed and is presented at **Appendix A**. This table has been developed following the recommended approach in Hazardous Industry Planning Advisory Paper No .6, Hazard Analysis Guidelines (Ref. [2]). The Hazard Identification Table provides a summary of the potential hazards, consequences and safeguards at the site. The table has been used to identify the hazards for further assessment in this section of the study. Each hazard is identified in detail and no hazards have been eliminated from assessment by qualitative risk assessment prior to detailed hazard assessment in this section of the study.

This hazard identification and subsequent consequence analysis were initially completed in the Preliminary Hazard Analysis (PHA) prepared for the site in August 2022 (Ref. [8]).

In order to determine acceptable impact criteria for incidents that would not be considered for further analysis, due to limited impact offsite, the following approach has been applied:

- *Fire Impacts* - It is noted in Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 (Ref. [2]) that a criterion is provided for the maximum permissible heat radiation at the site boundary (4.7 kW/m^2), above which the risk of injury may occur and therefore the risk must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk, for this study, incidents that result in a heat radiation less that at 4.7 kW/m^2, at the site boundary, are screened from further assessment.

  Those incidents exceeding 4.7 kW/m^2 at the site boundary are carried forward for further assessment (i.e. frequency and risk). This is a conservative approach, as HIPAP No. 4 (Ref. [1]) indicates that values of heat radiation of 4.7 kW/m^2 should not exceed 50 chances per million per year at sensitive land uses (e.g. residential). It is noted that the closest residential area is more than several hundred meters from the site, hence, by selecting 4.7 kW/m^2 as the consequence impact criteria (at the adjacent industrial site boundary) the assessment is considered conservative.

- *Explosion* - It is noted in HIPAP No. 4 (Ref. [1]) that a criterion is provided for the maximum permissible explosion over pressure at the site boundary (7 kPa), above which the risk of injury may occur and therefore the risk must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk, for this study, incidents that result in an explosion overpressure less than 7 kPa, at the site boundary, are screened from further assessment. Those incidents exceeding 7 kPa, at the site boundary, are carried forward for further assessment (i.e. frequency and risk). Similarly, to the heat radiation impact discussed above, this is conservative as the 7 kPa value listed in HIPAP No. 4 relates to residential areas, which are over more than several hundred meters from the site.

- *Toxicity* – Toxic substances have been proposed to be stored at the site; hence, toxicity has been assessed.

- *Property Damage and Accident Propagation* - It is noted in HIPAP No. 4 (Ref. [1]) that a criterion is provided for the maximum permissible heat radiation/explosion overpressure at the site boundary (23 kW/m^2/14 kPa) above which the risk of property damage and accident propagation to neighbouring sites must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk to incident propagation, for this study, incidents that result in a heat radiation heat radiation less than 23 kW/m^2 and explosion over pressure less than 14 kPa, at the site boundary, are screened from further assessment. Those incidents exceeding 23 kW/m^2 at the site boundary are carried forward for further assessment with respect to incident propagation (i.e. frequency and risk).

- *Societal Risk* – HIPAP No. 4 (Ref. [1]) discusses the application of societal risk to populations surrounding the proposed potentially hazardous facility. It is noted that HIPAP No. 4 indicates that where a development proposal involves a significant intensification of population in the vicinity of such a facility, the change in societal risk needs to be taken into account. In the case of the facility, there is currently no significant intensification of population around the proposed site, nor is a significant intensification anticipated. The adjacent land uses are zoned heavy industrial; hence, there will be no residential housing located in proximity of the site; therefore, societal risk has not been considered in the assessment.

4.2 Properties of Dangerous Goods

The type of DGs and quantities stored and used at the site has been described in **Section 3**. **Table 4-1** provides a description of the DGs proposed to be stored and handled at the site, including the Class and the hazardous material properties of the DG Class.

Table 4-1: Properties* of the Dangerous Goods and Materials Stored and proposed to be stored at the Site

Class	Hazardous Properties
2.1 – Flammable Gas	Class 2.1 includes flammable gases which are ignitable when in a mixture of 13 per cent or less by volume with air or have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit. Ignited gas may result in explosion or flash fire. Where gas released under pressure from a hole in a pressurised component is ignited, a jet fire may occur.
2.2 – Non-Flammable, Non-Toxic Gas	Class 2.2 includes non-flammable and non-toxic gases which are asphyxiant (dilute or replace the oxygen normally in the atmosphere).
3 – Flammable Liquids	Class 3 includes flammable liquids which are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc.) which give off a flammable vapour at temperatures of not more than 60°C closed-cup test or not more than 65.6°C open-cup test. Vapours released may mix with air and if ignited, at the right concentration, will burn resulting in pool fires at the liquid surface.
4.3 – Substances Which in Contact with Water Emit Flammable Gases	Certain substances in contact with water may emit flammable gases that can form explosive mixtures with air. Such mixtures are easily ignited by all ordinary sources of ignition, for example naked lights, sparking hand tools or unprotected lamps. The resulting blast wave and flames may endanger people and the environment.
5.1 -Oxidising Agents	Class 5.1 materials will not combust, but these materials include substances which can, in a fire event liberate oxygen, and could accelerate the burning of other combustible or flammable materials. Releases to the environment may cause damage to sensitive receptors within the environment.
6.1 – Toxic	Substances liable either to cause death or serious injury or to harm human health if

Class	Hazardous Properties
Substances	swallowed or inhaled or by skin contact.
6.2 – Infectious Substances	Substances which are known or are reasonably expected to contain pathogens. Pathogens are defined as micro-organisms (including bacteria, viruses, parasites, fungi) and other agents such as prions, which can cause disease in humans or animals.
8 – Corrosive Substances	Class 8 substances (corrosive substances) are substances which, by chemical action, could cause damage when in contact with living tissue (i.e. necrosis), or, in case of leakage, may materially damage, or even destroy, other goods which come into contact with the leaked corrosive material. Releases to the environment may cause damage to sensitive receptors within the environment.

* The Australian Code for the Transport of Dangerous Goods by Road and Rail (Ref. [5]).

4.3 Hazard Identification

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

- Flammable liquid or gas release, delayed ignition and flash fire or explosion.
- Flammable material spill, ignition and fire.
- Decanting release, ignition and flash fire or explosion.
- Decanting release, ignition and pool fire.
- Dangerous goods liquid spill, release and environmental incident.
- Entire building fire and radiant heat.
- Entire building fire and toxic smoke emission.
- Warehouse fire, sprinkler activation and potentially contaminated water release.
- Neutralisation reaction, exothermic reaction, and escalation.

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

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

As noted in **Section 3.0**, it is proposed that flammable liquids will be held at the site for storage and aggregation. During storage, there is the potential that a flammable liquid spill could occur due to an accident (packages dropped from forklift, punctured by forklift tynes) or deterioration of packaging. If a flammable liquid spill occurred, the liquid may begin to evaporate (depending on the material flashpoint and ambient temperature). Where materials do evaporate, there is a potential for accumulation of vapours, forming a vapour cloud above the spill. Should spills to ground occur, the Spill Response and Clean Up Procedure would be implemented immediately.

If the spill is not identified (considered unlikely, since the facility will be manned at all times), the cloud may continue to accumulate, eventually contacting an ignition source. If the cloud is confined (i.e. block stacked IBCs and stored products) the vapour cloud may explode if ignited, or, if it is unconfined, it may result in a flash fire which would burn back to the flammable liquid spill, resulting in a pool fire.

A similar scenario could occur with the release of flammable gases (predominantly Liquefied Petroleum Gas (LPG) from aerosols; however, cylinders may also be stored); however, the formation of a gas cloud would occur immediately as the flammable gas would instantly flash to gas following release from the canister.

It is proposed that the store will contain waste storage ranging up to Intermediate Bulk Containers (IBCs; typically up to 1,000L); hence, the release of flammable liquid could result in a substantial spill which could generate sufficient vapour to form a vapour cloud. Similarly, if a release occurred from a flammable gas cylinder, this could result in a sufficient flammable atmosphere that if ignited could result in a flash fire or explosion.

A review of the area indicates that it is naturally and actively ventilated in accordance with AS 1940:2017 (Ref. [3]); hence, following a release the vapours will be extracted and dispersed from the store by movement of the air minimising the potential for accumulation.

For ignition to occur, a suitable ignition source must be present at the same time that a flammable atmosphere occurs. The area will be subject to hazardous area classification in accordance with AS/NZS 60079.10.1:2022 (Ref. [10]) with electrical equipment operating within the zone installed in accordance with AS/NZS 60079.14:2022 (Ref. [7]); therefore, the potential for ignition to occur is low. No smoking or any other hot work would be permitted within the hazardous area.

For an explosion to occur, stagnant air would be required along with an ignition source; however, the area also requires sufficient confinement. By virtue of the natural and active ventilation design, the store is relatively open; hence, there would be insufficient confinement for the incident to result in an explosion. Therefore, it is considered that an explosion is not a credible outcome; however, such an incident could result in a flash fire.

The same conditions would be required for a flash fire to occur; however, for the flash fire to impact offsite, it must be dispersed downwind which would not occur in the scenario where the ventilation is stagnant (i.e. downwind dispersion would result in air movement through the store preventing accumulation to above the flammable limit). Therefore, it is considered that a flash fire impacting over the site boundary is unlikely to occur.

As the potential for offsite impacts are not considered to be likely outcomes, this incident has not been carried forward for further analysis.

4.5 Flammable Material Spill, Ignition and Fire

As noted in **Section 4.4**, there is the potential for loss of containment to occur of a flammable material (gas or liquid) which could ignite. In the event that ignition does occur, the fire would propagate throughout the store resulting in a full bunker fire. The existing bunker is designed in accordance with AS 1940:2017 (Ref. [3]) which includes walls with an FRL of 240/240/240 separating the bunker from the rest of the building; hence, propagation outside of the bunker is not expected to occur.

In addition, regardless of whether the fire initiates in the flammable gas or liquid side of the warehouse, as these areas are only separated by a chain mesh fence, it is expected that propagation between the stores will occur resulting in a substantially sized fire.

Due to the proximity of the store to the site boundary, there is the potential for radiant heat to impact over the site boundary which could result in a fatality offsite. Therefore, this incident has been carried forward for further analysis.

4.6 Decanting Release, Ignition and Flash Fire or Explosion

Flammable liquids will be decanted from small containers received at the site into IBCs. While decanting, there is the potential for vapours to be displaced from the IBCs and also arising from the small containers themselves. In addition, there is the potential for a loss of containment of a flammable liquid which could result in an evaporating pool which could ignite resulting in a flash fire or explosion.

A review of the design indicates the area will have dedicated mechanical ventilation extracting away from the decanting area capturing vapours and discharging them externally. Therefore, the potential for accumulation of vapours would be negligible. In the event of a spill, a trained operator is present and is able to clean up the spill, noting that while this occurs the ventilation will remain active preventing accumulation of vapours.

Based upon the protection systems in place for the decanting area (including high rate of mechanical extraction; up to 28 m^3/s), the potential for vapour accumulation is considered negligible. In addition, the volume of vapour produced would be unlikely to result in a sufficient atmosphere to ignite and explode based upon the lack of confinement in the area and a vapour barrier exists between the decanting area and the site boundary which would prevent the potential for a flash fire to impact off site.

As the potential for vapour accumulation and offsite impacts to occur are considered negligible, this incident has not been carried forward for further analysis.

4.7 Decanting Release, Ignition and Pool Fire

As noted in **Section 4.6,** there is the potential for a flammable liquid spill to occur while decanting liquids within the building. In the event such a spill is ignited, it would result in a pool fire that would emit radiant heat which could impact offsite. As small containers (i.e. 20 L) are being decanted into IBCs, the volume of liquid that could potentially be spilled would only result in a small pool.

The area is mechanically ventilated which would prevent the accumulation of vapours while the spill is cleaned up and the area will be subject to hazardous area classification in accordance with AS/NZS 60079.10.1:2022 (Ref. [10]) with electrical equipment operating within the zone installed in accordance with AS/NZS 60079.14:2022 (Ref. [7]); therefore, the potential for ignition to occur is low.

Based upon the small spill size and the other protections in place, the potential for a fire to occur that would result in sufficient radiant heat to impact over the site boundary is considered negligible. Therefore, this incident has not been carried forward for further analysis.

4.8 Dangerous Goods Liquid Spill, Release and Environmental Incident

There is potential that a spill of the liquid DGs (Class 3, 5.1, 6.1, and 8) could occur at the site which, if not contained, could be released into the public water course resulting in a potential environmental incident.

To prevent spills escaping from the site, the dedicated DG storages have been bunded in accordance with the applicable standards to contain spills within the local area of the spill. In addition, the site has a stormwater containment and detention area which captures site runoff allowing it to be tested and treated as necessary. No environmental discharges occur from this containment system (flows are detained for Trade Waste discharge).

Based upon the proposed design and existing site protections, it is considered that the potential for an offsite environmental release is not considered credible; hence, this incident has not been carried forward for further analysis.

4.9 Entire Building Fire and Radiant Heat

As flammable materials are stored and handled at the site, there exists a greater potential for fire to occur. In the event a fire occurs, it could propagate throughout the building resulting in an entire building fire.

The flammable wastes are proposed to be located in a dedicated bunker which will be designed in accordance with AS 1940:2017 (Ref. [3]) which consists of walls having an FRL of 240/240/240 which separates this storage area from the rest of the building. Therefore, in the event of a fire, it would be expected that the fire would be contained within this bunker and be unable to impact the storages in the rest of the building. Additionally, first response firefighting equipment such as extinguishers and hose reels will be used to fight small, localised fires, and an ESFR system is proposed for inclusion in the Aldex building which will control a larger fire in the event of major incident.

Therefore, it is considered that incident propagation beyond the immediate flammable storage area is unlikely to occur; hence, an entire building fire has not been carried forward for further analysis.

4.10 Entire Building Fire and Toxic Smoke Emission

As discussed in Section 4.9, the potential for an entire building fire to occur is not considered a credible scenario given the containment and isolation of the flammable materials within the warehouse as well as fire protection to be provided. Therefore, if an entire building fire cannot occur, the associated toxic smoke generated from the fire would also not occur. Accordingly, this incident has not been carried forward for further analysis.

4.11 Warehouse Fire, Sprinkler Activation and Potentially Contaminated Water Release

In the event of a fire, the Storage Mode Sprinkler System (SMSS) will activate discharging fire with water to control and suppress the fire. Contact of the fire water with DGs may result in contamination which, if released to the local watercourse, could result in environmental damage. The SMSS system delivers approximately 5 m^3/min of water which, if operated for a long period, may result in overflow of site bunding and potential release. The facility has been designed to be able to contain all DG spills and liquid effluent resulting from the management of an incident (i.e. fire) within the premises.

The site will hold 60 minutes of water storage on site as required by FM Global standards; hence, to allow for additional conservatism, following a risk assessment methodology as outlined by the Department of Planning document "*Best Practice Guidelines for Potentially Contaminated Water Retention and Treatment Systems"* (Ref. [7]), an allowance of 90 minutes of potentially contaminated water containment has been selected noting this includes all sources of application (i.e. onsite storage and towns mains) thus far exceeding the 60 minute on site storage. In a DG fire scenario, the following systems would be discharging:

- SMSS at 6 m^3/min.

- 4 hydrant hoses at 2.4 m^3/min.

The quantity of flow for each source has been summarised in **Table 4-2** which also summarises the total discharged volume.

Table 4-2: Potentially Contaminated Water Volumes

Source	Rate (m^3/min)	Duration (min)	Volume (m^3)
Sprinkler	6	60	360
Hydrant	2.4	90	216
		Total Volume (m^3)	576

The site has a stormwater detention area which has a volume of 650 m^3 which would be able to contain the full volume; hence, an offsite incident is not expected to occur. Notwithstanding this, the storages are designed in accordance with applicable standards which requires the bund surrounding the storage to be able to contain 20 minutes of sprinkler water. Therefore, there is an additional leeway of approximately 120 m^3 of storage in the immediate vicinity which has not been considered.

As the potential for an offsite incident from potentially contaminated water is contained by the existing system and the DG storage bunds, this incident has not been carried forward for further analysis. Furthermore, the contaminated water retention would be considered to comply with the '*Best Practice Guidelines for Contaminated Water Retention and Treatment Systems*" (Ref. [7]).

4.12 Neutralisation Reaction, Exothermic Reaction, and Escalation

A reactor will be used to neutralise product as part of proposed waste treatment activities within the facility. As chemicals will be mixed, there is the potential for incorrect mixing of chemicals to occur (i.e. high pH with low pH) which could result in an exothermic reaction.

A review of the process indicates that chemicals will be tested prior to mixing to understand the pH of the chemicals prior to addition into the reactor. The reactor will dose the chemicals into the reactor via a controlled and automated system, which will monitor the pH and add acid or base accordingly to minimise the potential for a strong incompatible reaction to occur.

In the event the system fails, the reaction could result in rapid boiling of the liquid which could boil over, resulting in discharge of hot product into the vicinity. The reactor is located within the building; hence, any boil-over or loss of containment in the immediate vicinity of the reactor would be contained within the building itself and would therefore not be able to impact offsite.

As no offsite impact would be expected to occur from this area, this incident has not been carried forward for further analysis.

5.0 Consequence Analysis

5.1 Incidents Carried Forward for Consequence Analysis

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

- Flammable material spill, ignition and fire.

Each incident has been assessed in the following sections.

5.2 Flammable Material Spill, Ignition and Racking Fire

There is the potential for a fire to develop involving flammable material stored within bunker resulting in a bunker fire. A detailed analysis has been conducted in **Appendix B** and the radiant heat impact distances estimated for this scenario are presented in **Table 5-1** with the contours illustrated in **Figure 5-1.**

Table 5-1: Heat Radiation from a Flammable Material Fire

Heat Radiation (kW/m^2)	Distance (m)
35	5.4
23	8.5
12.6	12.6
4.7	25.4

A review of the contours illustrated in **Figure 5-1** indicates that both the 4.7 and the 23 kW/m^2 contours impact over the site boundary; hence there is the potential for fatality or incident propagation across the site boundary.

However, WA have adopted a recommendation to install FRL 240/240/240 fire wall around the area of concern, as well as Early Suppression Fast Response (ESFR) sprinklers throughout the facility. The combination of the protection provided by the firewall and provision of hydrant coverage will adequately prevent an off-site impact even in the event of sprinkler inactivation. Additional external hydrant coverage is also available and unimpeded in the event of a fire and would be utilised by FRNSW as necessary.

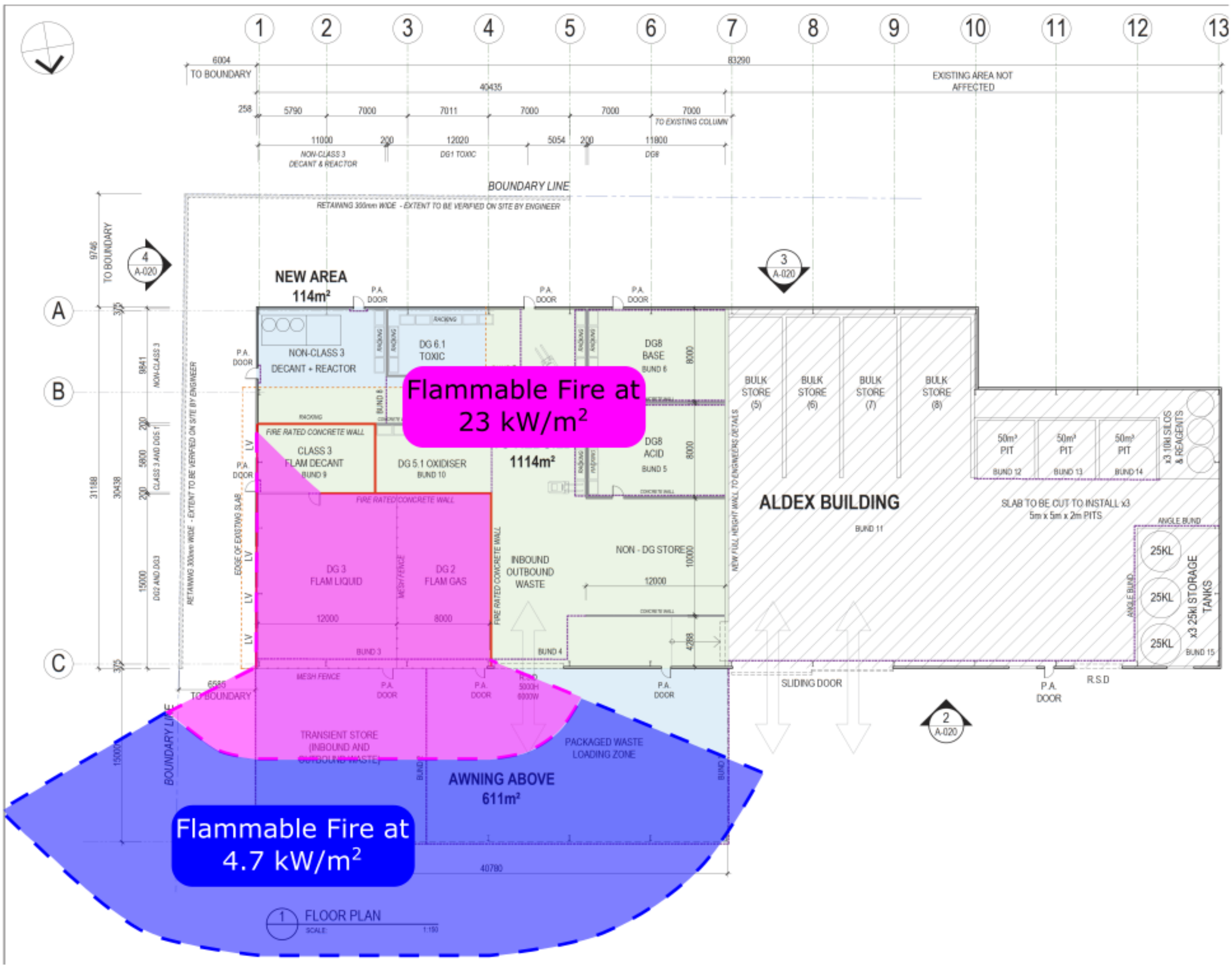


Figure 5-1: Flammable Material Fire Radiant Heat Contours

6.0 Details of Prevention, Detection, Protection and Mitigation Measures

The fire safety systems at the site can be split into four main categories:

- **Fire Prevention –** systems, installed to prevent the conditions that may result in initiating fire.
- **Fire Detection –** systems installed to detect fire and raise alarm so that emergency response can be affected (both evacuation and firefighting)
- **Fire Protection –** systems installed to protect against the impacts of fire or explosion (e.g. fire walls)
- **Fire Mitigation –** systems installed to minimise the impacts of fire and to reduce the potential damage (e.g. fire water application)

Each category has been reviewed in the following sections, with respect to the existing systems incorporated into the design and those to be provided as part of the recommendations herein.

6.1 Fire Prevention

This section describes the fire prevention strategies and measures that will be undertaken at the site.

6.1.1 Control of Ignition Sources

The control of ignition sources reduces the likelihood of igniting a release of material. The site has several controls for ignition sources. These include controls for fixed potential ignition sources and controls for introduced ignition sources.

- A permit to work or clearance system will be used - hot work will be controlled as part of the permit to work system.
- Hazardous area classification for areas containing flammable liquids, gases or combustible dusts per the requirements of AS/NZS 60079.10.1:2009 (Ref. [4]) and AS/NZS 60079.10.2:2011 (Ref. [16]).
- Electrical equipment selected for the classified hazardous area. Equipment is installed per the requirements of AS/NZS 60079.14:2017 (Ref. [5]).
- Designated smoking areas within the site (i.e. external from warehouse areas).

Table 6-1 presents the potential ignition sources and incidents for the facility which may lead to ignition and fire. The table also summarises the controls that will be used to reduce the likelihood of these potential sources of ignition and incidents resulting in a fire.

Table 6-1: Summary of Control of Ignition Sources

Ignition Source	Control
Smoking	No smoking policy for the site (i.e. within the warehouse) including processing and storage areas. Note: Designated smoking areas are provided.
Housekeeping	The site will operate a housekeeping procedure to ensure accumulation of dust in delivery and processing areas does not occur. Limiting the accumulation of dust is an important method for minimising the potential for fires or dust dispersions.

Ignition Source	Control
Electrical	Fixed electrical equipment to be designed and installed to AS/NZS 3000:2007 (Ref. [17]). Equipment in hazardous areas installed per AS/NZS 60079.14:2017 (Ref. [5]).
Arson	The site will have a security fence and will be staffed during business hours.
Hot Work	A permit to work system and risk assessment prior to starting work will be provided for each job involving the introduction of ignition sources.

6.1.2 Separation of Dangerous Good Classes

The separation of incidents is used to minimise the impacts of a hazardous incident on the surrounding operations or the generation of potential "domino" effects. The DG storages have been separated per the requirements of AS 1940-2017 (Ref. [6]) and the Work Health and Safety Regulations 2017 (Ref. [10]) to minimise the potential for interaction between products which may lead to a fire.

Bulk storage, manufacturing and finished goods have all been separated from each other by the inclusion of FRL 240/240/240 walls to contain incidents within their specific operational areas. This minimises the potential for domino effects to cascade throughout the warehouse.

6.1.3 Housekeeping

The risk of fire or explosion (i.e. removal of combustible waste such as packaging) can be significantly reduced by maintaining high standards of housekeeping. The site shall maintain a high housekeeping standard, ensuring all debris (e.g. waste packaging, etc.) that is released during transport, storage and processing is cleaned up and removed from the areas.

6.1.4 Work Practices

The following work practices will be undertaken to reduce the likelihood of an incident. They include;

- DG identification
- Placarding & signage within the site
- Forms of chemical and DG information
- Availability of Safety Data Sheets
- HAZCHEM code adherence
- Procedures for unlabelled containers
- Procedures for reporting damaged goods/accidents
- Safe work practices adhered to
- Personal Protective Equipment
- Emergency response plan and procedures
- First aid fire equipment
- Security

- Training of personnel
- Compatibility, segregation, and safe storage of Dangerous Goods
- Hazardous area dossier (detailing zones, equipment, protection types and certification, etc.)
- Maintenance of low stock levels

6.1.5 Emergency Plan

Weston Aluminium currently have an Emergency Response Plan, prepared in accordance with HIPAP No. 1 – Industry Emergency Planning Guidelines (Ref. [18]). This resource would be reviewed and updated as required by the Work Health and Safety Regulations 2017 (Ref. [10]). The emergency plan will clearly identify potential hazardous fire or explosion incidents and develop procedures fire response. The plan will also include evacuation procedures and emergency contact numbers as well as an onsite emergency response structure with allocated duties to various personnel on site. This will provide readiness response in the unlikely event of an incident at the site.

Additionally, trained site personnel should be available at all times in order to facilitate FRNSW access to the site and to the affected area.

6.1.6 Site Security

Maintaining a secure site reduces the likelihood either of a fire being started maliciously by intruders or by accident. Access to the site will be restricted at all times and only authorised personnel will be permitted within the site.

The following additional and upgraded site security features exist on site:

- 1800- and 2400mm high chain wire perimeter fencing with 3-barbed strands;
- Augmented and extensive network of CCTV cameras positioned internally within the facility, and along each boundary;
- Site manning;
- Back-to-base security monitoring;
- Routine third-party security patrols; and
- Routine inspection and preventative maintenance of security assets to verify condition and integrity.

6.2 Detection Procedures and Measures

This section discusses the detection and protection from fires for the hazardous incidents previously identified. These include detection of fire pre-conditions, detection of a fire suppression activated condition and prevention of propagation. This assessment includes identification of the detection and protection systems required.

6.2.1 Detection of Leaks

The detection of leaks and spills minimises the likelihood of a hazardous incident. All products delivered to the site, including the condition and integrity of packaging, are inspected prior to storage and all products produced at the site are inspected before being transferred to the warehouse storage area.

6.2.2 Smoke Detection

The eastern portion of the Aldex Building is proposed to be fitted with smoke detectors as part of the Project to identify the early stages of fire growth which, if activated, will raise the alarm at the FIP and notify FRNSW.

6.2.3 Fire Detection

The warehouse is proposed to be fitted with an ESFR sprinkler system as part of the Project which will activate when the sprinkler head bulbs break. The bulbs are designed to rupture at temperatures of 68ºC which will result in activation of the sprinklers and subsequent pressure loss activating the sprinkler pump. The loss of pressure and activation of the sprinkler pump will be alerted at the FIP notifying FRNSW to the presence of a fire.

6.3 Fire Protection

6.3.1 Fire Hydrants

A network of fire hydrants is established on site. Augmentation of the fire hydrant system shall be installed in accordance with Clause E1.3 of the BCA, and the relevant provisions of AS 2419.1:2005, except:

- Dual hydrant valves external to the building envelope but positioned under the awning shall be treated as external hydrants for the purpose of coverage. They are to be provided with permanent all-weather fade resistant signs which state in text not less than 25 mm in height:
    - “External Hydrant – 2 Hose Lengths Required”
- When internal hydrants are required for coverage as per Clause 3.2.3.3 of AS 2419.1:2005 the hydrants shall be positioned to allow progressive movement of fire fighters from at least one entry point. Spacing shall be not more than 50 metres from an external hydrant, and then not more than 25 m to the next hydrant.
- When internal hydrants are provided a localised block plan should be provided at every hydrant pictorially and numerically illustrating the location of the next available additional hydrant. These localised block plans should be at least A4 size and be of all-weather fade resistant construction.

The fire hydrant booster assembly connections and all fire hydrant valves shall be fitted with Storz aluminium alloy delivery couplings manufactured and installed in accordance with Clauses 7.1 and 8.5.11.1 of AS 2419.1:2005. All hydrant valves shall possess a forging symbol and manufacturers mark and shall comply with Fire & Rescue NSW Fire Safety Guideline Technical Information (D15/45534).

6.3.2 Fire Hose Reels

A fire hose reel system shall be installed throughout the Aldex Building in accordance with Clause E1.4 of the BCA, and the relevant provisions of AS 2441:2005 except that 50 m hose lengths (54 m coverage) may be utilised in the warehouse(s).

Coverage shall be achieved by providing not more than 2 changes in direction on any hose run.

6.3.3 Portable Fire Extinguishers

Portable fire extinguishers shall be installed throughout the Aldex Building in accordance with Clause E1.6 of the BCA, and the relevant provisions of AS 2444:2001.

In the warehouse, ABE type portable fire extinguishers are to be provided on each forklift or other manually operated piece of picking machinery or equipment.

6.3.4 Fire Sprinkler System

A sprinkler system is proposed to be installed in accordance with Building Code of Australia (NCC Vol. 1) Clause E1.5 and AS 2118.1:2017. The sprinkler system shall meet the following performance criteria:

- The sprinkler response time index (RTI) is to be no greater than $50m^{0.5}s^{0.5}$.
- Sprinkler activation temperature no greater than 68°C (below the ceiling) in the office. Higher temperature sprinkler heads are permitted directly below the roof covering in these areas as stipulated in AS 2118.1:2017.
- Early Suppression Fast Response (ESFR) sprinklers with activation temperature no greater than 101°C (below the ceiling) in the warehouse.
- A dry or pre-action system may be provided to the communications room in the office(s) if required in accordance with AS 2118.1:2017.

6.3.5 Building Occupant Warning System

A building occupant warning system is proposed to be installed in accordance with Building Code of Australia (NCC Vol. 1) Clause E2.2 and AS1670.1:2018.

The evacuation signal 1 shall include the words such as “Fire” and “Evacuate” inserted in the time period provided in ISO 8201, or a site-specific voice message as provided for in AS 4428.16.

6.3.6 Smoke Hazard Management

An aspirated smoke detection system (e.g. VESDA) complying with AS 1670.1:2018 is proposed to be provided.

6.3.7 Emergency Lighting and Exit Signs

Emergency lighting and exit signs shall be installed in accordance with Clauses E4.2, E4.4, E4.5, E4.6 and E4.8 of the BCA, and the relevant provisions of AS 2293.1:2005.

6.3.8 Perimeter Access

Gates and security checkpoints in the emergency vehicle travel path are currently secured with a loose chain and 003 type padlock. Pedestrian access for fire fighters is to be provided around the perimeter of the site, with personal access gates located at the Mitchell Avenue site entrance.

A designated hardstand area is currently provided adjacent to the fire sprinkler tank suction connections in accordance with FRNSW Policy Guide Sheet No. 5.

All drawings associated with the fire protection systems are provided in **Appendix D**.

6.4 Fire Mitigation

6.4.1 Fire Water Supply

The street mains will provide fire water supply to the hydrant ring main. The sprinkler system will be serviced by an onsite pump set which consists of 2 diesel pumps operating with a primary duty pump and a secondary standby pump. The location of the hydrant main, fire hydrants and hose reels are shown in **Figure 7-2**. Pumps will be started monthly, and a complete test of the hydrants, pumps and sprinklers systems is to be conducted each year and a fire safety statement is to be produced in accordance with Environmental Planning and Assessment Regulation 2000 (Ref. [19]), as is currently assessed and prepared by an independent specialist..

7.0 Local Brigade Access and Egress

7.1 Overview

In order to assess the likely fire brigade response times, an indicative assessment of fire brigade intervention has been undertaken based on the methods defined in the Fire Brigade Intervention Model (FBIM, Ref. [20]). **Figure 7-2** illustrates the sprinkler arrangement at the site and **Figure 7-3** shows the fire services infrastructure.

The site is located within the Fire and Rescue New South Wales (FRNSW) jurisdictional turnout area. The two closest stations to the site are described in **Table 7-1** and the expected route from the closest station to the project site is illustrated in **Figure 7-1**.

Table 7-1: Station Locations

Station Name	Station Address	Distance (km)
Kurri Kurri Fire Station	119 Lang St, Kurri Kurri NSW 2327	1.6
Abermain Fire Station	Cessnock Rd &, Charles St, Abermain NSW 2326	5.1

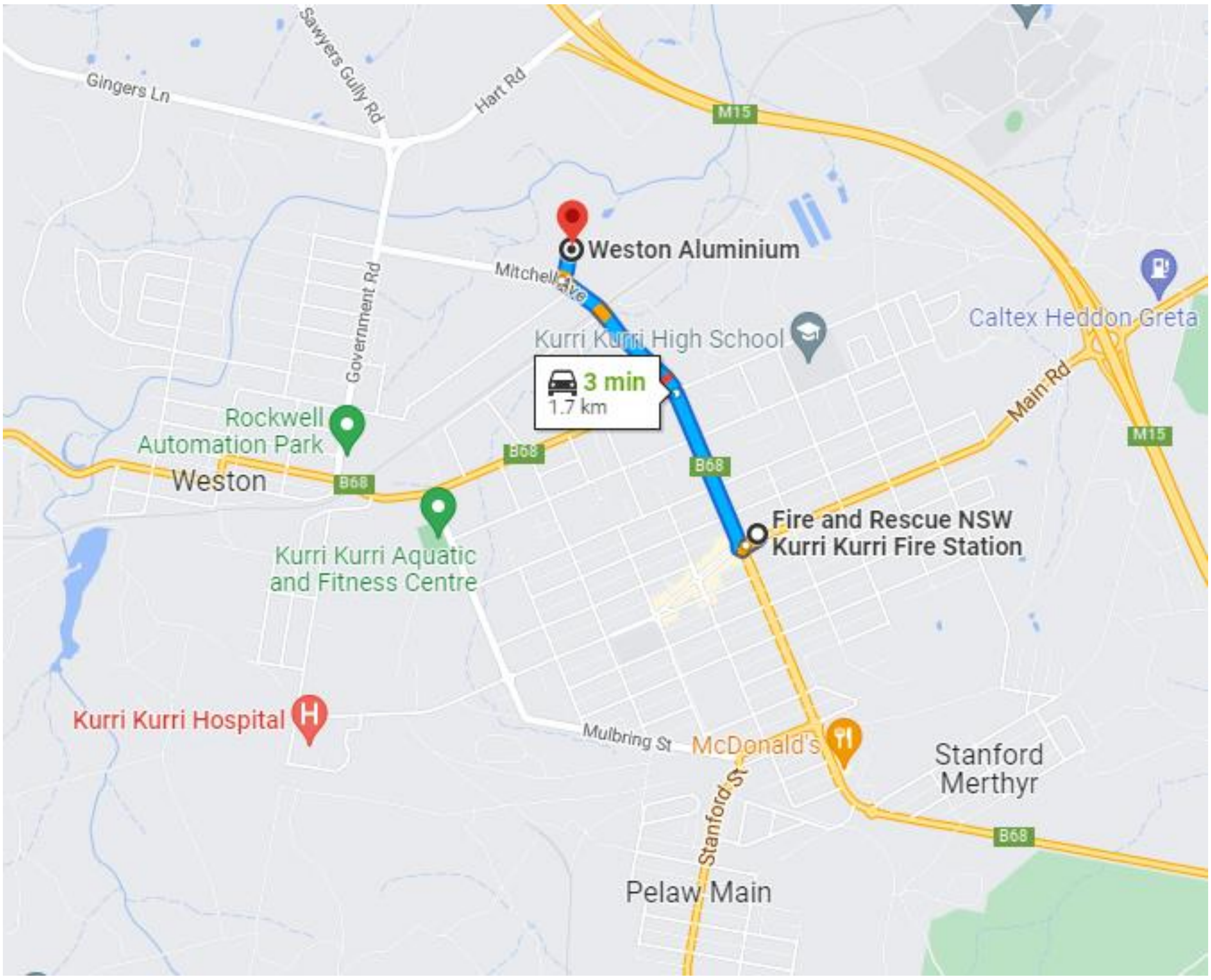


Figure 7-1: Location of Site with Respect to Closest Fire Brigade Stations

Figure 7-2: Site Sprinkler Arrangement

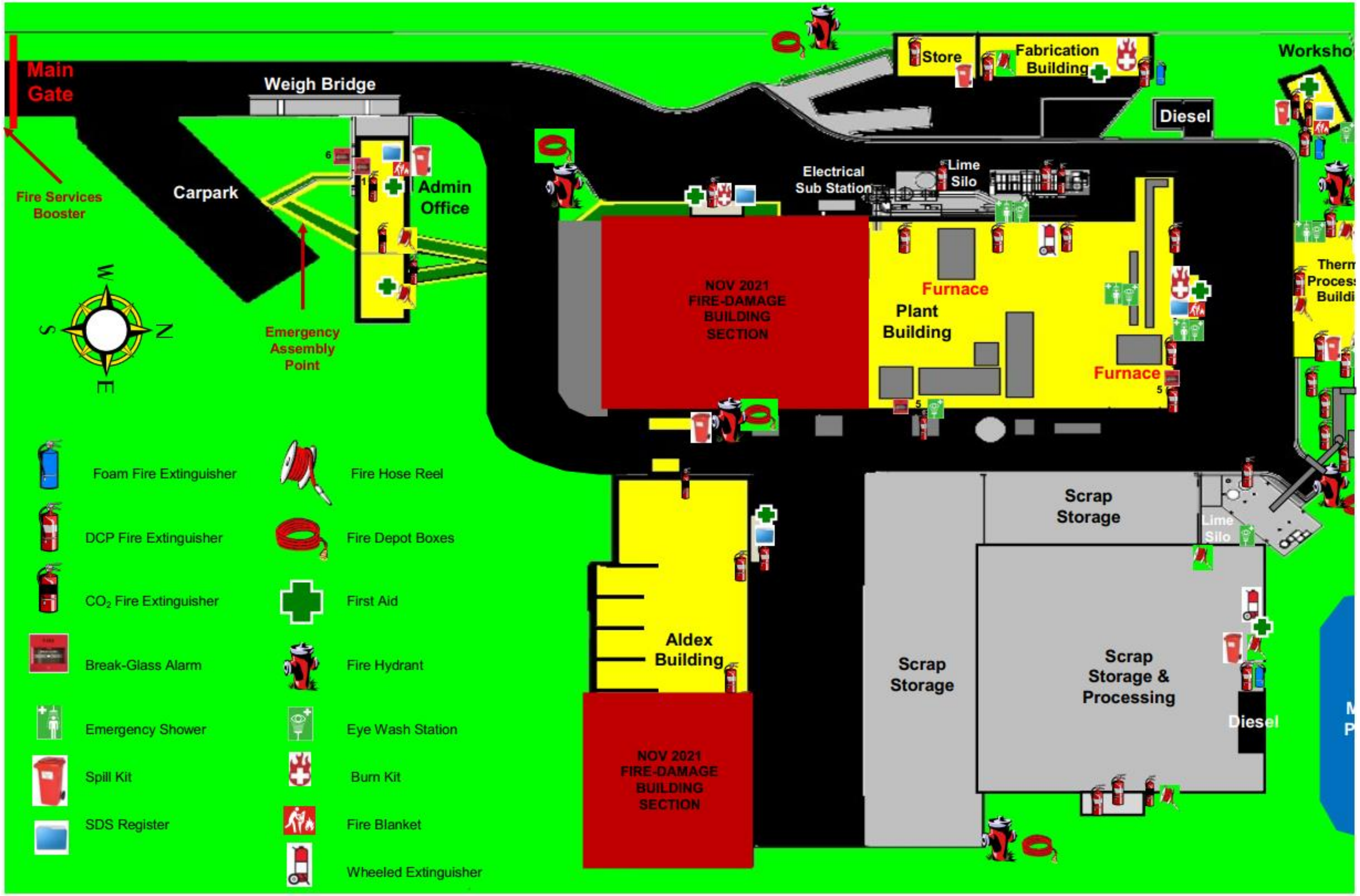


Figure 7-3: Fire Services Infrastructure

Due to the nature of the Fire Brigade Intervention Model (FBIM, Ref. [20]), it is necessary to justify the results through the inclusion of assumptions. The accuracy of results weighs heavily upon the measure of which assumptions are made and the sources from which they are derived. The model details the time it will take for brigade personnel within the aforementioned location to receive notification of a fire, time to respond and dispatch resources, time for resources to reach the fire scene, time for the initial determination of the fire location, time to assess the fire, time for fire fighter travel to location of fire, and time for water setup such that suppression of the fire can commence. The following are details of the assumptions utilised in this FBIM.

7.1.1 Location of Fire

This FBIM will only be an indicative model of one fire scenario within the facility. For conservative purposes, the FBIM will consider a fire in the furthest incident from the point of entry.

7.1.2 Time between Ignition and Detection

It is assumed that the initial brigade notification will be via activation of the proposed warehouse sprinkler system and FIP. Time from ignition to alarm is taken to be 270 seconds based on assumption of typical warehouse response times.

7.1.3 Time for Initial Brigade Notification

- Fire brigade notification is expected to occur via a direct monitored alarm.
- Time for alarms/fire verification and any notification delays is 20 seconds based on Table B of the Fire Brigade Intervention Model (Ref. [20]).
- Therefore, the time from ignition at which the fire brigade will be notified is (270+20) = 290 seconds after flaming combustion has commenced.

7.1.4 Time to Dispatch Resources

- The fire station is assumed to be manned at the time of the fire.
- Based on FRNSW statistics of response times from the 2020/2021 annual report (Ref. [21]), the average time for the fire brigade to respond to an emergency call (including call processing, turnout time and travel time) is approximately 8 minutes. Further, the 90th percentile is approximately 12 minutes which is **Figure 7-4** and as the site is within the FRNSW jurisdictional turnout area, a time of 12 minutes (720 seconds) has been conservatively assumed to represent the time required to react to a fire signal and reach the site.

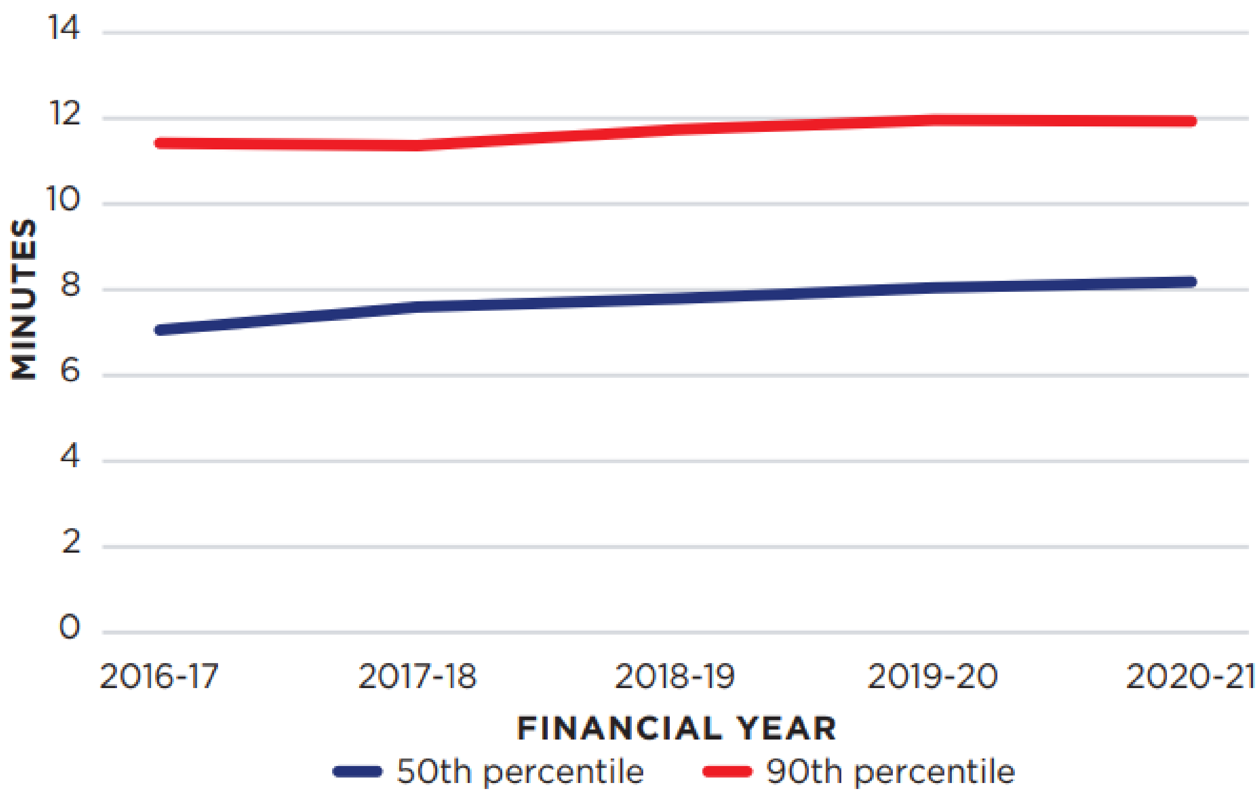


Figure 7-4: FRNSW Response Time from 2020/21 Annual Report

- Therefore, with a brigade call out time of 290 seconds fire brigade can be expected to arrive on site 1010 seconds (i.e. 17 minutes) after fire ignition.

7.1.5 Time for Initial Determination of Fire Location

- On arrival, the fire location is not visible to the approaching brigade personnel, thus requiring information to be obtained from the Fire Indicator Panel (FIP) and evacuating occupants.
- Fire brigade personnel assemble at the FIP in the office area where clear signage is provided.
- Fire brigade tactical fire plans will be provided.
- It is assumed that a fire would occur during business hours and that staff are present on-site aiding fire brigade personnel in relation to identifying the fire location and entry into the building. As such, forced entry into the building will not be required.

7.1.6 Time to Assess the Fire

- Horizontal egress speeds have been based on fire brigade personnel dressed in turnout uniform in BA. An average travel speed of 1.4m/s with a standard deviation of 0.6m/s are utilised. As such, for the purposes of the calculations, a horizontal travel speed of 1.40-(1.28x0.6) = 0.63m/s is utilised as shown in **Table 7-2**.

Table 7-2: FBIM data for Horizontal Travel Speeds

Graph	Travel Conditions	Speed	
		Mean	SD*
Q1	Dressed in turnout uniform	2.3	1.4

Q2	Dressed in turnout uniform with equipment	1.9	1.3
Q3	**Dressed in turnout uniform in BA with or without equipment**	**1.4**	**0.6**
Q4	Dressed in full hazardous incident suit in BA	0.8	0.5

*Standard Deviation

Horizontal travel distances will include the following:

- Travel from kerb side adjacent to the building and to Fire Indicator Panel is 20 m.
- Travel from FIP to the farthest point is 87 m.
- Based on the above, the total horizontal travel distance of 107 m coupled with an egress speed of 0.63 m/s results in a horizontal travel time of up to 170 seconds.

7.1.7 Time for Water Setup

- The first appliance would be expected to commence the initial attack on the fire.
- Time taken to connect and charge hoses from on-site hydrants to the fire area is based on V3 Table V of the Fire Brigade Intervention Model Guidelines, which indicates an average time of 45.3 seconds, and a standard deviation of 17.1 seconds. Using a 90th percentile approach as documented in the FBIM (Ref. [20]), the standard deviation is multiplied by a constant *k*, in this case being equal to 1.28. Therefore, the time utilised in this FBIM is 45.3 + (1.28 x 17.1) = 68 seconds.

7.1.8 Search and Rescue

Search and Rescue of the site will consist of a perimeter search of storage and processing areas. This will provide firefighting personnel with an additional 400 m of travel. At a speed of 0.63 m/s, this will take firefighting personnel approximately 635 seconds.

Table 7-3: Summary of the Fire Brigade Intervention Model (FBIM)

Fire Station	Alarm Time	Travel Time	Time for Access & Assessment	Set-up Time	Time of Attack	Time for Search & Rescue
Closest Fire stations	290 s	720 s	170 s	68 s	1248 s (21 Minutes)	635 s

As summarised in **Table 7-3**, the FBIM (Ref. [20]) indicates that the arrival times of the brigade from the nearest fire stations is approximately 17 minutes after fire ignition, and it is estimated that it takes another 4 minutes for the fire brigade to carry out activities including the determination of fire location and preparation of firefighting equipment. As such, the initial attack on the fire is expected to commence approximately 21 minutes after fire ignition (note rounding affects the basic addition of the reported figures).

7.2 Fire Scenarios and the Availability for Intervention

To understand the possible fire scenarios expected in the subject development the fuel load, storage configuration and manual and active fire suppression systems in the building are considered. The following discussion outlines possible fire scenarios, the expected actions to be undertaken by building occupants and FRNSW. Through determination of the possible fire scenarios, the fire safety systems can be assessed to establish if they are adequate for fire brigade intervention.

It is considered that while there are an infinite number of fire scenarios that could be considered, they can primarily be grouped into four categories. The four scenarios discussed below are manual suppression by building occupants, automatic sprinkler suppression, fire growth controlled by sprinklers with final suppression required by fire brigade, or a sprinkler failure scenario requiring significant fire brigade intervention.

1) **Occupant Fire Suppression:** Ignition occurs due to human error, i.e. machinery/ electrical fault, hot works, smoking etc. Due to staff presence at the time of ignition, the fire is controlled by occupants removing objects from the vicinity of the fire base and then the fire either self-extinguishes or manually suppressed using fire hose reels and portable fire extinguishers. In this event, the incident is likely to be resolved prior to arrival of FRNSW.

Fire hose reels: Fire hose reels are provided to combat small incidents by occupants. Sufficient training shall be provided to staff to ensure the use of the hose reels.

Fire hydrant system: Fire brigade can connect to any of the external fire hydrants to undertake an attack.

Smoke clearance system: Manually operated smoke clearance system providing approximately 3 air changes per hour in the Aldex building.

Vehicular access: Access is currently limited along the southern side of the Aldex building, however approval is being sought for construction of a project which will ensure all BCA requirements are met.

2) **Sprinkler Suppression:** As per scenario 1), except the fire grows rapidly and is unable to be controlled by manual suppression, or conversely staff are not present to undertake manual suppression activities. The fire activates the storage mode sprinkler system, or the in-rack sprinkler system (as applicable), and as identified by fire statistics, the sprinkler system controls the fire to the point where suppression is almost certain. In this event, fire brigade are automatically notified to attend to the incident through the smoke detection and/or sprinkler system. The fire size is minimal, if not fully suppressed upon fire brigade arrival.

Fire hose reels: Fire hose reels shall assist in fire suppression if deemed safe by staff.

Fire hydrant system: Fire brigade are able to connect to any of the external fire hydrants to undertake an attack.

Smoke clearance system: Manually operated smoke clearance system providing approximately 3 air changes per hour in the Aldex building.

Vehicular access: Access is currently limited along the southern side of the Aldex building, however approval is being sought for construction of a project which will ensure all BCA requirements are met.

3) **Fire Brigade Suppression:** As per scenario 2), except the fire is permitted to grow and spread beyond the point where the sprinkler system can readily suppress the fire. The sprinkler system controls the fire to a degree; however, the fire brigade is required to undertake full intervention activities to extinguish the fire. The fire is substantial, however not large enough to threaten the structural integrity of the building. In this event, the fire brigade are required to have adequate conditions to enter the building and undertake intervention activities.

Fire hose reels: Fire hose reels shall assist in fire suppression if deemed safe by staff.

Fire hydrant system: As the fire is sprinkler controlled, the structure is not expected to be compromised and as such, the fire brigade are able to connect to any of the external or internal fire hydrants to undertake an attack.

Smoke clearance system: Manually operated smoke clearance system providing approximately 3 1 air changes per hour in the Aldex building.

Vehicular access: Access is currently limited along the southern side of the Aldex building, however approval is being sought for construction of a project which will ensure all BCA requirements are met.

4) **Fire Brigade Control:** The sprinkler system fails to operate, and the fire is provided with uncontrolled growth until fire brigade arrival. The fire size is significant. Safe entry into the building is not available regardless of the conditions maintained by the fire suppression systems.
   In this event, the fire brigade are not expected to enter the building and will attempt to control the fire from spreading further to neighbouring buildings and structures.

Fire hose reels: Fire hose reels shall assist in fire suppression if deemed safe by staff.

Fire hydrant system: As the fire is expected to compromise the building structure local to the fire base, the fire brigade must attach to external hydrants distant from the fire. As the building is provided with external hydrants around the perimeter, there is expected to be adequate hydrant point access in a safe location away from the fire, enabling fire intervention to be undertaken. The brigade will possibly be required to use additional hose lengths to achieve coverage where an external hydrant is compromised by the fire, however with the wide range of hydrant locations and multiple staging locations available, mitigation of fire spread from the allotment is expected to be achievable.

Isolation valves for the hydrant system have been provided around the site to allow brigade access at multiple points to isolate sections of the hydrant network.

Smoke clearance system: Manually operated smoke clearance system providing approximately 3 air changes per hour in the Aldex building.

Vehicular access: The fire is not expected to be contained within the building. This may render a portion of the vehicular access unusable. Notwithstanding this, most of the access path should be available for brigade staging to be undertaken in optimal locations away from the fire hazards.

8.0 Fire Water Supply & Contaminated Fire Water Retention

8.1 Detailed Fire Water System Assessment

A hydrant system has been designed for the facility to comply with the BCA and in consultation with FRNSW to ensure all credible scenarios can be combatted in the event of a fire. A review of the Worst Credible Case Fire Scenario (WCCFS) determined that the most demanding fire water scenario for the hydrant system would be a warehouse fire requiring application from 6 hydrant hoses. This is based upon a general assessment of the fire scenarios and installed fire protection. It is noted that the site has capacity for greater than 60 L/s of flow from 6 hydrants, which is 40 L/s greater than the requirements of AS 2419.1-2017 as dictated by AS 1940:2017 and the prepared DG Report.

Based on the WCCFS scenario, the highest fire water demand would be where four hydrant hoses are operating discharging a minimum 0.6 m^3/min each totalling 2.4 m^3/min.

A detailed pressure loss analysis has been performed and is shown in **Appendix C** to ensure the pressure at the most hydraulically disadvantaged hydrants is above the minimum requirements of the BCA and AS 2419.5-2017 (Ref. [22]). Hydrant water is supplied directly from the street mains.

The minimum pressure required per Table 2.2 of AS 2419-2017 (Ref. [22]) for the installation is 250 kPa at the most disadvantaged hydrants while unassisted. The results of the analysis show that at the required 30 L/s, the system will operate all hydrants at pressures exceeding 250 kPa and with total friction losses below the 150 kPa limitations of AS 2419-2017 and will therefore be compliant.

Notwithstanding the above, the following recommendation has been made:

- A detailed hydraulic and pressure loss analysis shall be completed by a qualified hydraulic engineer to demonstrate complete compliance with AS 2419.1-2017.

8.2 Contaminated Water/Fire Water Retention

Where materials are combusted in a fire, they may become toxic (i.e. formation of volatile organic compounds and aromatic hydrocarbons). Hence, when fire water is applied the materials may mix with the water resulting in a contaminated run off. To ensure environmental damage does not occur, the facility is designed to contain a volume of liquid generated within the site catchment. A detailed analysis is provided in **Section 4.11**.

The total volume generated for all systems in the event of the SMSS operating for 60 minutes and 4 hydrants operating for 90 minutes is 576 m^3. The required water containment will be provided in a combination of recess dock storage, drainage systems, pit and detention pond systems, and has a total capacity of more than 650 m^3.

9.0 FRNSW Fire Safety in Waste Facility Guidelines Review

It is necessary to review the facility against the Fire & Rescue NSW (FRNSW) Fire Safety in Waste Facilities Guidelines (Ref. [23]), to ensure the facility is designed with the appropriate fire protection per the SEARs. A detailed review of the guidelines has been carried out in **Appendix C** and has been summarised in **Table 9-1.**

Table 9-1: Summary of FRNSW Fire Safety in Waste Facility Guidelines Requirements

Clause	Waste Facility Guidelines Requirement	Details of Compliance
7.2	Preparation of an FSS	This report satisfies the requirement for an FSS.
7.4	Firefighting Intervention Firefighter access should be provided to the facility, including to any fire safety system or equipment provided for firefighting intervention. The facility should cater for large emergency service response, including containment of fire water run-off.	These requirements have been addressed in the following sections: • **Section 7.0** – Brigade access • **Section 6.2**– Fire detection and alarm • **Section 6.3** – Fire protection • **Section 8.2** – Recommended that a hydraulic pressure analysis is conducted.
7.5	Fire Hydrant System The fire hydrant system should consider facility layout and operations, with fire hydrants being located to provide compliant coverage and safe firefighter access during a fire. The fire hydrant system is to have a minimum water supply and capacity providing the maximum hydraulic demand (i.e. flow rate) for not less than four hours.	The consequences and risk contours of credible fire scenarios have been outlined in **Section 5.0**, indicating recommended areas in which hydrants should not be located. The details of fire water supply have been outlined in **Section 6.4** and **Section 8.2.** It is recommended that a detailed hydraulic pressure assessment is conducted once the hydrant layout is finalised (**Section 8.1**).
7.6	Automatic Fire Sprinklers Systems The waste facility is to have an automatic fire sprinkler system installed in any fire compartment that has a floor area greater than 1,000 m^2 and contains combustible waste materials. The fire sprinkler system is to have minimum water supply and capacity providing maximum hydraulic demand for not less than two hours.	ESFR system is proposed to be installed. The sprinkler system shall be designed by qualified fire engineers. The details of fire water supply have been outlined in **Section 6.4** and **Section 8.2.**
7.7	Fire Detection and Alarms The waste facility is to have a fire detection and alarm system installed appropriate to the risks and hazards identified. The alarm should activate any required alarm (warning occupants of fire, evacuation etc.), and activate fire suppression system and warn all occupants of the fire.	Details of detection have been outlined in **Section 6.2.**
7.8	Smoke Hazard Management Buildings containing combustible waste	Details of smoke hazard management have been outlined in **Section 6.3.6.**

Clause	Waste Facility Guidelines Requirement	Details of Compliance
	material are to have an automatic smoke hazard management system appropriate to the potential fire load and smoke production rate installed within the building.	It is recommended that an automatic smoke hazard management system is designed by a qualified fire engineer.
7.9	Fire Water Run-off Containment The facility should have effective and automatic means of containing fire water run-off, with primary containment having a net capacity not less than the total hydraulic demand of installed fire safety systems.	Details of containment and recommendations have been outlined in **Section 8.2.**
8.2/8.3	Storages and Stockpiles The guidelines limit of the size, volume and location of combustible waste stockpiles to ensure FRNSW access in the event of a fire. It also outlines requirements for monitoring the temperature of self-heating stockpiles to minimise the risk of autoignition	The site will not contain stockpiles of combustible materials.
8.6	Operations Plan The waste facility should develop and implement a written operations plan outlining the daily operations for the waste facility.	An operations plan shall be prepared, as recommended in **Section 10.2.**
9.3	Emergency Plan The PCBU is required to develop an emergency plan for the waste facility, in accordance with AS 3745-2010.	An Emergency Response Plan (ERP) shall be prepared, as recommended in **Section 6.1.5.**
9.4	Emergency Services Information Package (ESIP) An ESIP, as detailed in FRNSW guideline Emergency services information package and tactical fire plans, should be developed and provided by the PCBU.	An ESIP shall be prepared, as recommended in **Section 6.1.5.**

10.0 Conclusion and Recommendations

10.1 Conclusions

A Fire Safety Study per the HIPAP No. 2 guidelines was prepared for the site. In addition, the FSS assessed all incidents that could occur at the site and the recommendations made in the previously prepared PHA (Ref. [8]) were reviewed as required.

The analysis performed in the FSS was based on credible fire scenarios to assess whether the protection measures at the site were adequate to combat the hazards associated with the quantities and types of commodities being stored. Based on the assessment, it was concluded that the proposed designs in conjunction with existing fire protection adequately managed the risks.

10.2 Recommendations

Based on the analysis, the following recommendations have been made:

- All site personnel are to be trained in specific site procedures, emergency and first aid procedures and the use of fire extinguishers and hose reels.
- An appropriate sprinkler system is to be designed and installed throughout the Aldex Building.
- 9 kg dry powder fire extinguishers shall be located no closer than 2 m and no further than 10 m from DG storage locations.
- Spill kits suitable for the commodities being stored shall be provided for DGs stored in racking.
- Site management to prepare and maintain operational procedures to minimise the number of hazardous incidents and accidents on site and to mitigate the consequences of incidents regarding the handling of dangerous goods and chemicals.
- The existing Emergency Response Plan is to be updated per the requirements of HIPAP No. 1 to reflect the Project addition and shall include measures to advise neighbouring premises in the event of an emergency with potential offsite impacts.
- The FBIM assessment shall be reviewed in conjunction with an FER for consistency.
- A detailed hydraulic and pressure loss analysis be completed by a qualified hydraulic engineer to demonstrate complete compliance with AS 2419.1-2005.

11.0 References

[1] Department of Planning, "Hazardous Industry Planning Advisory Paper No. 2 - Fire Safety Study Guidelines," Department of Planning, Sydney, 2011.

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

[3] Environmental Protection Authority, "Waste Classification Guidelines Part 1: Classifying Waste," Environmental Protection Authority, Sydney, 2014.

[4] Environmental Protection Authority, "Waste Classification Guidelines Part 2: Immobilisation of Waste," Environmental Protection Authority, Sydney, 2014.

[5] Standards Australia, AS 1940:2017 - Storage and Handling of Flammable and Combustible Liquids, Sydney: Standards Australia, 2017.

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

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

[8] Riskcon Engineering, "Weston Aluminium PHA," Riskcon Engineering, Sydney, 2022.

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

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

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

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

[13] Standards Australia, "AS/NZS 60079.10.2:2011 - Explosive Atmospheres Part 10.2: Classification of Areas - Combustible Dust Atmospheres," Standards Australia, Sydney, 2011.

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

[15] Standards Australia, "AS/NZS 3000:2007 - Wiring Rules," Standards Australia, Sydney,

2007.

[16] Standards Australia, AS 1940-2017 - Storage and Handling of Flammable and Combustible Liquids, Sydney: Standards Australia, 2017.

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

[18] Department of Planning, “Hazardous Industry Planning Advisory Paper No. 1 - Industry Emergency Planning,” Department of Planning, Sydney, 2011.

[19] New South Wales Government, “Environmental Planning and Assessment Regulation 2000,” New South Wales Government, Sydney, 2000.

[20] Australasian Fire Authorities Council, “Fire Brigade Intervention Model V2.2,” Australasian Fire Authorities Council, 2004.

[21] Fire & Rescue NSW, “Annual Report 2020/21,” Fire & Rescue NSW, Sydney, 2021.

[22] Standards Australia, “AS 2419.1-2017 - Fire Hydrant Installations - System Design, Installation and Commissioning,” Standards Australia, Sydney, 2017.

[23] Fire and Rescue NSW, “Fire Safety Guideline: Fire Safety in Waste Facilities,” Fire and Rescue NSW, Sydney, 2020.

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

[25] I. Cameron and R. Raman, Process Systems Risk Management, San Diego: Elsevier, 2005.

[26] F. P. Lees, Loss Prevention in the Process Industries, London: Butterworth-Heinemann, 2005.

[27] Crane Ltd, “Crane Technical Paper No. 410M - Flow of Fluids Through Valves, Fittings and Pipes,” Crane Ltd, London, 1983.

[28] NSW Department of Planning and Environment, “Applying SEPP33 – Hazardous and Offensive Developments,” NSW Department of Planning and Environment, Sydney, 2011.

Appendix A

Hazard Identification Table

A1. Hazard Identification Table

ID	Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
1	Main building storage areas (Former Aldex)	• Dropped IBC • Punctured IBC with forklift tynes	• Release of Class 3, 5.1, 6.1, 8 to the environment	• Inspection of packages upon delivery to the site. • Trained forklift operators (including spill response training). • Bunded storage areas prevent release from immediate vicinity. • Site stormwater containment system. • Storage of DGs compliant with applicable standards.
2			• Spill of flammable liquids, evolution of flammable vapour cloud ignition and vapour cloud explosion/flash fire • Spill of flammable liquids, ignition and pool fire/racking fire	• Inspection of packages upon delivery to the site • Hazardous area classification in accordance with AS/NZS 60079.10.1:2022 (Ref. [10]). • Control of ignition sources according to AS/NZS 60079.14:2022 (Ref. [7]) • Automatic fire protection system (in-rack and SMSS per AS 2118.1:2017 (Ref. [10])) • First attack fire-fighting equipment (e.g. hose reels & extinguishers) • Fire detection systems • Ventilated storage area • Storage of DGs compliant with applicable standards.
3		• Damaged Class 2.1 packages (i.e. cylinders or aerosols)	• Release of flammable gas, ignition and vapour cloud explosion/flash fire • Rupture, ignition and	• Inspection of packages upon delivery to the site • Hazardous area classification in accordance with AS/NZS 60079.10.1:2022 (Ref. [10]). • Control of ignition sources according to AS/NZS

ID	Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
			explosion/rocketing of cylinders and fire	60079.14:2022 (Ref. [7]) • Automatic fire protection system (in-rack and SMSS per AS 2118.1:2017 (Ref. [10])) • First attack fire-fighting equipment (e.g. hose reels & extinguishers) • Fire detection systems • Ventilated storage area • Storage of DGs compliant with applicable standards. • Caged area
4	Sprinkler activation	• Fire activates SMSS resulting in fire water and potential release of contaminated fire water offsite	• Environmental impact to surrounding areas (e.g. stormwater drainage)	• All storage areas within the Aldex Building to be bunded for spill and primary fire water containment • Maintain detention pond at low-level at all times to optimise secondary containment volume • Site drainage to comply with the Best Practice Guide for Potentially Contaminated Water Retention and Treatment Systems (Ref. [7])
5	Pallet Loading/Unloading	• Leaks from poor-integrity containers • Dropped containers from the pallet • Impact damage to containers on the pallet (collision with racks or other forklifts)	• QC inspections of wastes, including of container condition and integrity, upon receipt and prior to storage. Poor quality containers to be quarantined and returned to point of origin • Spill of flammable liquids, evolution of flammable vapour cloud ignition pool, fire under the pallet	• Trained & licensed forklift drivers • Trained operators in relation to QC inspections and quality standards • First attack fire-fighting equipment (hose reels & extinguishers) • SMSS if incident occurs internally • No potential for fire growth beyond the single pallet

ID	Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
			• Full pallet fire as a result of fire growth	
6	Decanting	• Transfer of flammable liquids from small containers into larger IBCs	• Spill of flammable liquids, evolution of flammable vapour cloud ignition and vapour cloud explosion/flash fire • Spill of flammable liquids, ignition and pool fire	• Hazardous area classification in accordance with AS/NZS 60079.10.1:2022 (Ref. [10]). • Control of ignition sources according to AS/NZS 60079.14:2022 (Ref. [7]) • Automatic fire protection system (in-rack and SMSS per AS 2118.1:2017 (Ref. [10])) • First attack fire-fighting equipment (e.g. hose reels & extinguishers) • Fire detection systems • Ventilated storage area • Storage of DGs compliant with applicable standards. • Static earthing • Trainer operators • Routine quality control inspections
7	Neutralisation Tank	• Mixing of acids, bases, etc.	• Potential for incompatible mixing resulting in exothermic reaction	• pH testing of substances • Automated dosing to balance pH in a safe level • Emergency stop systems

Appendix B

Consequence Analysis

B1. Incidents Assessed in Detailed Consequence Analysis

The following incidents are assessed for consequence impacts.

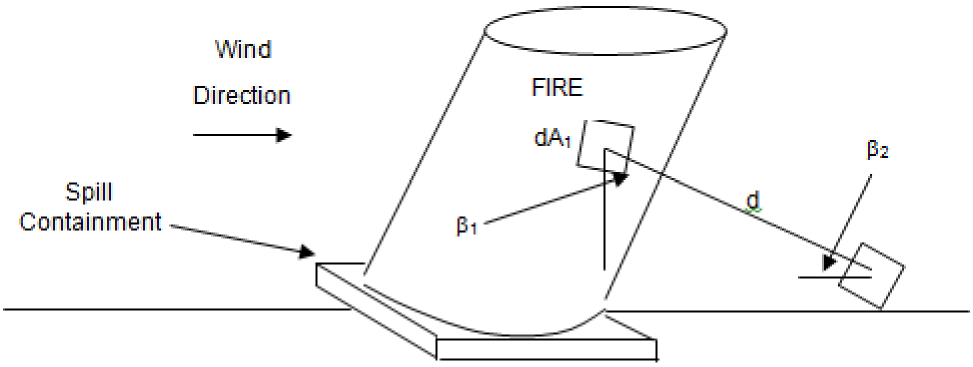
- Flammable material spill, ignition and fire.

Each incident has been assessed in the sections below.

B2. Spreadsheet Calculator (SSC)

The SSC is designed on the basis of finite elements. The liquid flame area is calculated as if it is a circle to find the radius for input into the SSC model.

The SSC is designed on the basis of finite elements. The liquid flame area is calculated as if it is a circle to find the radius for input into the SSC model. **Appendix Figure B-1** shows a typical pool fire, indicating the target and fire impact details.



Appendix Figure B-1: Heat Radiation on a Target from a Cylindrical Flame

A fire in a bund or at a tank roof will act as a cylinder with the heat from the cylindrical flame radiating to the surrounding area. A number of mathematical models may be used for estimating the heat radiation impacts at various distances from the fire. The point source method is adequate for assessing impacts in the far field; however, a more effective approach is the view factor method, which uses the flame shape to determine the fraction of heat radiated from the flame to a target. The radiated heat is also reduced by the presence of water vapour and the amount of carbon dioxide in air. The formula for estimating the heat radiation impact at a set distance is shown in **Equation B-1** (Ref. [23]).

$$Q = EF\tau$$ **Equation B-1**

Where:

- Q = incident heat flux at the receiver (kW/m^2)
- E = surface emissive power of the flame (kW/m^2)
- F = view factor between the flame and the receiver
- τ = atmospheric transmissivity

The calculation of the view factor (F) in **Equation B-2** depends upon the shape of the flame and the location of the flame to the receiver. F is calculated using an integral over the surface of the flame, S (Ref. [23]). The formula can be shown as:

$$F = \int\int_S \frac{\cos\beta_1 \cos\beta_2}{\pi d^2}$$ **Equation B-3**

Equation B-3 may be solved using the double integral **or** using a numerical integration method in spread sheet form. This is explained below.

For the assessment of pool fires, a Spread Sheet Calculator (SCC) has been developed, which is designed on the basis of finite elements. The liquid flame area is calculated as if the fire is a vertical cylinder, for which the flame diameter is estimated based on the fire characteristics (e.g. contained within a bund). Once the flame cylindrical diameter is estimated, it is input into the SSC model. The model then estimates the flame height, based on diameter, and develops a flame geometric shape (cylinder) on which is performed the finite element analysis to estimate the view factor of the flame. **Appendix Figure B-1** shows a typical pool fire, indicating the target and fire impact details.

The SSC integrates the element dA_1 by varying the angle theta θ (the angle from the centre of the circle to the element) from zero to 90^o in intervals of 2.5 degrees. Zero degrees represents the straight line joining the centre of the cylinder to the target (x0, x1, x2) while 90^o is the point at the extreme left hand side of the fire base. In this way the fire surface is divided up into elements of the same angular displacement. Note the tangent to the circle in plan. This tangent lies at an angle, gamma, with the line joining the target to where the tangent touches the circle (x4). This angle varies from 90^o at the closest distance between the liquid flame (circle) and the target (x0) and gets progressively smaller as θ increases. As θ increases, the line x4 subtends an angle phi Φ with x0. By similar triangles we see that the angle gamma γ is equal to 90- θ - Φ . This angle is important because the sine of the angle give us the proportion of the projected area of the plane. When γ is 90^o, sin(γ) is 1.0, meaning that the projected area is 100% of the actual area.

Before the value of θ reaches 90^o the line x4 becomes tangential to the circle. The fire cannot be seen from the rear and negative values appear in the view factors to reflect this. The SSC filters out all negative contributions.

For the simple case, where the fire is of unit height, the view factor of an element is simply given by the expression in **Equation B-4** (Derived from **Equation B-3**):

$$VF = \Delta A \frac{\sin\gamma}{\pi \times X4 \times X4}$$ **Equation B-4**

Where ΔA is the area of an individual element at ground level.

Note: the denominator (π. x4. x4) is a term that describes the inverse square law for radiation assumed to be distributed evenly over the surface of a sphere.

Applying the above approach, we see the value of x4 increase as θ increase, and the value of sin(γ) decreases as θ increase. This means that the contribution of the radiation from the edge of the circular fire drops off quite suddenly compared to a view normal to the fire. Note that the SSC adds up the separate contributions of **Equation B-4** for values of θ between zero until x4 makes a tangent to the circle.

It is now necessary to do two things: (i) to regard the actual fire as occurring on top of a fire wall (store) and (ii) to calculate and sum all of the view factors over the surface of the fire from its base to its top. The overall height of the flame is divided into 10 equal segments. The same geometric technique is used. The value of x4 is used as the base of the triangle and the height of the flame, as the height. The hypotenuse is the distance from target to the face of the flame (called X4'). The angle of elevation to the element of the fire (alpha α) is the arctangent of the height over the ground distance. From the cos(α) we get the projected area for radiation. Thus there is a new combined distance and an overall equation becomes in **Equation B-5 (**(Derived from **Equation B-4**):

$$VF = \Delta A \frac{\sin\gamma \times \cos\alpha}{\pi \times X4 \times X4}$$ **Equation B-5**

The SCC now turns three dimensional. The vertical axis represents the variation in θ from 0 to 90º representing half a projected circle. The horizontal axis represents increasing values of flame height in increments of 10%. The average of the extremes is used (e.g. if the fire were 10 m high then the first point would be the average of 0 and 1 i.e. 0.5 m), the next point would be 1.5 m and so on).

Thus the surface of the flame is divided into 360 equal area increments per half cylinder making 720 increments for the whole cylinder. Some of these go negative as described above and are not counted because they are not visible. Negative values are removed automatically.

The sum is taken of the View Factors in **Equation B-4**. Actually the sum is taken without the ∆A term. This sum is then multiplied by ∆A which is constant. The value is then multiplied by 2 to give both sides of the cylinder. This is now the integral of the incremental view factors. It is dimensionless so when we multiply by the emissivity at the "face" of the flame (or surface emissive power, SEP), which occurs at the same diameter as the fire base (pool), we get the radiation flux at the target.

The SEP is calculated using the work by Mudan & Croche (Ref. [24] & Ref. [23]) which uses a weighted value based on the luminous and non-luminous parts of the flame. The weighting is based on the diameter and uses the flame optical thickness ratio where the flame has a propensity to extinguish the radiation within the flame itself. The formula is shown in **Equation B-6**.

$$SEP = E_{max}e^{-sD} + E_s(1 - e^{-sD})$$ **Equation B-6**

Where;

E_{max} = 140

S = 0.12

E_s = 20

D = pool diameter

The only input that is required is the diameter of the pool fire and then estimation for the SEP is produced for input into the SSC.

The flame height is estimated using the Thomas Correlation (Ref. [23]) which is shown in **Equation B-7**.

$$H = 42d_p\left[\frac{\dot{m}}{\rho_a\sqrt{gd_p}}\right]^{0.61}$$ **Equation B-7**

Where;

d_p = pool diameter (m)

ρ_a = density of air (1.2 kg/m^3 at 20ºC)

$\dot{m}$ = burning rate (kg/m^2.s)

g = 9.81 m/s^2

The transmissivity is estimated using **Equation B-8** (Ref. [23]).

$$\tau = 1.006 - 0.01171(\log_{10} X(H_2O) - 0.02368(\log_{10} X(H_2O))^2 - 0.03188(\log_{10} X(CO_2) + 0.001164(\log_{10} X(CO_2))^2 \quad \textbf{Equation B-8}$$

Where:

- τ = Transmissivity (%)
- X(H$_2$O) = $\frac{R_H \times L \times S_{mm} \times 2.88651 \times 10^2}{T}$
- X(CO$_2$) = $\frac{L \times 273}{T}$

and

- R_H = Relative humidity (% expressed as a decimal)
- L = Distance to target (m)
- S_{mm} = saturated water vapour pressure in mm of mercury at temperature (at 25^{o}C S_{mm} = 23.756)
- T = Atmospheric temperature (K)

B3. Radiant Heat Physical Impacts

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

Appendix Table B-1: Heat Radiation and Associated Physical Impacts

Heat Radiation (kW/m^2)	Impact
35	• Cellulosic material will pilot ignite within one minute's exposure • Significant chance of a fatality for people exposed instantaneously
23	• Likely fatality for extended exposure and chance of a fatality for instantaneous exposure • Spontaneous ignition of wood after long exposure • Unprotected steel will reach thermal stress temperatures which can cause failure • Pressure vessel needs to be relieved or failure would occur
12.6	• Significant chance of a fatality for extended exposure. High chance of injury • Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure • Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
4.7	• Will cause pain in 15-20 seconds and injury after 30 seconds exposure (at least second degree burns will occur)
2.1	• Minimum to cause pain after 1 minute

B4. Flammable Material Spill, Ignition and Fire

In the event that a flammable material is released in the storage area and ignited, a pool fire could occur which would impact adjacent packages and IBCs. Therefore, in the event of such a fire, it is expected that the fire would propagate throughout the storage resulting in a full bunker fire.

The bunker has dimensions of 20 m x 14 m which has been used to calculate an equivalent circular diameter:

$$D = \sqrt{\frac{4 \times 20 \times 14}{\pi}} = 18.9\,m$$

- Equivalent fire diameter: 18.9 m
- Burning rate – 0.085 kg/m^2.s (burning rate for benzene has been selected which would be considered to conservatively cover most flammable materials that would be expected to be received, Ref. [24])

The results for flame height and SEP for each scenario are summarised in **Appendix Table B-2.**

Appendix Table B-2: Flame Height and SEP for a Flammable Material Fire

Output	Result
Flame Height (m)	32.0
SEP (kW/m^2)	32.5

The inputs summarised in **Appendix Table B-2** were input into the SSC with the results for each scenario shown in **Appendix Table B-3.**

Appendix Table B-3: Heat Radiation from a Flammable Material Fire

Heat Radiation (kW/m^2)	Distance (m)
35	5.4
23	8.5
12.6	12.6
4.7	25.4

Appendix C

Hydraulic Analysis

C1. Hydraulic Analysis

A review of the Worst Credible Case Fire Scenario (WCCFS) determined that the most demanding fire water scenario for the hydrant system would be a warehouse fire requiring application from four hydrant hoses. Based on the WCCFS scenario, the highest fire water demand would be where the four hydrant hoses are discharging 0.6 m^3/min each totalling 2.4 m^3/min.

The most hydraulically disadvantaged fire hydrant on the site is located towards the eastern boundary of the site. The hydrant locations are shown in **Figure 7-3**.

The assessment has been completed on the relevant hydrants to calculate the pressure drop and to determine whether they meet the requirements of AS 2419.1-2005 (Ref. [21]) which requires that fire hydrants have an operating pressure not less than 150 kPa at 30 L/s.

Shown in **Appendix Table C-1** are the distances for each of the relevant pipes measured from the pump room to the most disadvantaged hydrant.

Appendix Table C-1: Hydrant Pipe Distances

Pipe	Distance (m)
# (150 mm)	230

Appendix Table C-2 shows the number of restrictions along the line.

Appendix Table C-2: Valve Restrictions

Valve	Restrictions
#	8

Appendix Table C-3 shows the number of bends along the lines for both directions. The bends are 90-degree angles.

Appendix Table C-3: Bend Restrictions

Hydrant	Bends
#	5

In order to calculate the pressure drop down the fire main line, it will be necessary to calculate the pressure drop from friction in the line itself, friction through the bends, and friction through the valves throughout the line.

Assumptions:

The full flow of 10 L/s discharges from the most disadvantaged fire hydrant.

Density of water is 1000 kg/m^3.

$$\Delta P_f = \frac{(0.00225 K \rho Q^2)}{d^4}$$ **Equation C-1**

where: ΔP_f = pressure drop due to friction losses in the pipe (bar)

K = resistance co-efficient

ρ = density of the fluid (kg/m^3)

Q = Flow Rate (litres/minute)

d = internal diameter of the pipe (mm)

Calculation of Friction Losses in the Pipe

Pipe: K = f (L/D) (Ref. [25])

Where: f = friction factor in plastic pipe = 0.017 (Page A26, Ref. [25])

The friction losses in the pipes for each of the distances are shown in **Appendix Table C-4**.

Appendix Table C-4: Hydrant Pipe Distances

Hydrant	Pressure Drop
# (150 mm pipe)	= 0.017 x (230/0.15) = 26.1

Calculation of Friction Losses in the Valves

Valves: Globe

Globe Valve – K = 340 ft, where: ft = friction factor of associated pipe to which the valve is attached.

$K_{Globe\ Valve}$ = 340 x 0.017 = 5.78 per valve

Calculation of Friction Losses in the Bends

K_{bends} = 30 ft = 30 x 0.017 = 0.51 per bend

Total Friction Losses

The total friction losses for each hydrant are shown in **Appendix Table C-5**.

Appendix Table C-5: Friction Losses

Hydrant	Friction Loss
# (150 mm pipe)	= 26.1 + (8 x 5.78) + (5 x 0.51) = 74.9

Pressure Drop Calculations

The pressure drop for each hydrant was calculated using **Equation C-1**. The total pressure at the outlet of the hydrant is shown in **Appendix Table C-6**.

Appendix Table C-6: Friction Losses

Hydrant	Pressure Loss (bar)
# (150 mm pipe)	$= \frac{0.00225 \times 74.9 \times 1000 \times 600^2}{150^4} = 1.08$

Summary of Pressure Losses

The pressure losses in the system for each hydrant, when three hydrants are operating, is summarised in **Appendix Table C-7**.

Appendix Table C-7: Pressure Drop Summary

Hydrant	Pressure Loss (kPa)
#	= 1.08 x 100 = 108

The residual pressure required at the most hydraulically disadvantaged hydrant after all losses according to AS 2419.1-2005 is 250 kPa at 30 L/s. In order to account for 108 kPa of losses, the operating pressure at each hydrant must therefore be greater than or equal to 358 kPa. In addition, pressure drop in the system does not exceed 150 kPa which complies with AS 2419.1:2005 (Ref. [23]), Clause 2.2.1.

Based on previous hydraulic analyses of warehouses of similar size, the head at 30 L/s will be approximately 80 m or 800 kPa. The operating pressure for this site is to be confirmed but must exceed 358 kPa.

To ensure that the system complies with row 3 of Table 2.2 of AS 2419.1-2005 (Ref. [22]), it has been assumed that the brigade is capable of boosting the hydrants to 1000 kPa. The residual pressure at the most hydraulically disadvantaged hydrants would be 1000 – 108 = 892 kPa which is above the minimum residual pressure requirement of 700 kPa.

It is recommended that a detailed hydraulic and pressure loss analysis be completed by hydraulic engineers to demonstrate complete compliance with AS 2419.1-2005. A hydrant flow report prepared by Sicada in 2019 is shown in **Appendix Figure C-1**.

SICADA Fire & Safety (NSW) Pty Ltd

FIRE HYDRANT FLOW REPORT

Company Name: Weston Aluminium

Company Location: N/A

Site Location: 129 Mitchell Ave Kurri Kurri

Hydrant Location	Rear RHS of site

Test Description	Requirement	Test Result	Pass / Fail
Static System Pressure (kPa)	≤ 1300 KPA	650 KPA	PASS
Flow Rate (L/Sec)	≥ 10L / Second	10.8L/S	PASS
Residual System Pressure (Kpa) Flow Pressure	Must meet design requirements (MIN 250KPA)	400 KPA	PASS
5 yearly hydrostatic test	1700KPA For a period of 2 hours	1700KPA	PASS

This test was carried out in accordance with the requirements of AS1851 – 2005 and AS2419.1 – 2005

Technician Name: Scott Garven

Date: 01/07/2019

FPA Australia

Appendix Figure C-1: Sicada Fire Hydrant Flow Report

Appendix D

Fire System Drawings

D1. Dual Head Hydrant and Fire Hose Reel Arrangement

D2. SMSS Arrangement

D3. In-Rack Sprinkler Arrangement

D4. Sprinkler Compliance Certificates

D5. Warehouse Sprinkler Arrangement

D6. Potentially Contaminated Water Containment

Appendix E

Implementation Commitment

E1. Implementation Commitment

Appendix F

Detailed Review of FRNSW Fire Safety in Waste Facility Guidelines

F1.Review of FRNSW Fire Safety in Waste Facility Guidelines

Appendix Table F-1: Detailed Review of FRNSW Fire Safety in Waste Facility Guidelines

Clause	FRNSW Waste Facility Guideline Requirement	Details of Compliance
	7.2 Designing for Special Hazard	
7.2.1	Combustible waste should be considered a special hazard and consent authorities should impose the conditions on development that Clause E1.10 and E2.3 of the NCC be complied with to the satisfaction of the fire brigade.	To be reviewed pending receival of Conditions.
7.2.3	All fire risks and hazards of the waste facility should be identified. A fire safety study is the be done in accordance with HIPAP No. 2 if deemed appropriate by the relevant consent authority.	This report satisfies the requirement for an FSS. **Sections 4.0** and **Section 5.0** identify and assess all fire risks and hazards.
7.2.5	All reasonable and foreseeable combustible waste materials should be identified and considered in any performance solution.	Combustible materials have been identified in **Section 3.0.**
	7.4 Firefighting Intervention	
7.4.1	The waste facility is to provide safe, efficient, and effective access as detailed in FRNSW guideline *Access for fire brigade vehicle and firefighters*.	Access is to be reviewed pending construction project discussed in **Section 7.2.**
7.4.4	The facility should cater for large emergency service response, if the potential hazard may result in a large emergency, including containment of fire water run-off.	Details of detection and alarm have been outlined in **Section 6.2,** fire protection details have been outlined in **Section 6.3,** and details of containment have been outlined in **Section 8.2.**
7.4.6	Any development application should be accompanied by a flow rate and pressure test of the water main connected to the fire hydrant system.	Existing hydrant flow report provided in **Appendix C** and additional hydraulic analysis recommended.
7.4.7	Firefighter access should be provided to buildings, structures, and storage areas, including to any fire safety system or equipment provided for firefighting intervention	Details of brigade access have been outlined in **Section 7.0.**
	7.5 Fire Hydrant System	
7.5.1	The waste facility is to have a fire hydrant system installed appropriate to the risk and hazard for the waste facility.	Hydrant system shown in **Figure 7-3**.
7.5.2	The fire hydrant system should consider facility layout and operations, with fire hydrants being located to provide compliant coverage and safe firefighter access during a fire, including having external fire hydrants to protect any open yard storage	**Section 5.0** outlines the risk contours of credible fire scenarios, and the recommended areas in which hydrants should not be located.
7.5.4	Fire hydrants are not to be located within 10 m of stockpiled storage and must be accessible to	Recommendation has been included in **Section 10.2.**

Clause	FRNSW Waste Facility Guideline Requirement	Details of Compliance
	firefighters entering from the site and/or building entry points.	
7.5.5	Where appropriate to protect against high risks and hazards, suitable on-site fixed external fire monitors may be provided as part of the fire hydrant system.	Monitors are not considered a requirement for the site given the fire protection provided which is already deemed commensurate with the risk posed.
7.5.6	The fire brigade booster assembly is to be located within sight of the designated site entry point, or other location approved by the fire brigade, and be protected from radiant heat from any nearby stockpile.	Fire protection systems shown in **Figure 7-3**.
7.5.7	The fire hydrant system is to have a minimum water supply and capacity providing the maximum hydraulic demand (i.e. flow rate) for not less than four hours.	The details of fire water supply have been outlined in **Section 6.4** and **Section 8.2.** It has been recommended that a detailed hydraulic pressure assessment is conducted in **Section 8.1.**
7.5.8	The fire hydrant system should incorporate fire hose reels installed in accordance with Clause E1.4 of the NCC to enable effective first attack of fires by appropriately trained staff.	Compliance requirements from the NCC has been outlined in **Section 6.3.5.**
	7.6 Automatic Fire Sprinklers Systems	
7.6.1	The waste facility is to have an automatic fire sprinkler system installed in any fire compartment that has a floor area greater than 1000 m^2 and contains combustible waste materials	ESFR system is proposed to be installed.
7.6.5	The fire brigade booster assembly for the fire sprinkler system should be co-located with the fire hydrant system booster within sight of the designated site entry point, or in a location approved by the fire brigade	Fire protection systems shown in **Figure 7-3**.
7.6.6	The fire sprinkler system is to have minimum water supply and capacity providing maximum hydraulic demand for not less than two hours.	The details of fire water supply have been outlined in **Section 6.4** and **Section 8.2.** It has been recommended that a detailed hydraulic pressure assessment is conducted in **Section 8.1.**
	7.7 Fire Detection and Alarms	
7.7.1	The waste facility is to have a fire detection and alarm system installed appropriate to the risks and hazards identified for each area of the building.	Details of detection and alarm have been outlined in **Section 6.2.**
7.7.2	The fire detection and alarm system should warn all occupants of fire and to evacuate the facility, with each component being appropriate to the	Details of detection and alarm have been outlined in **Section 6.2.**

Clause	FRNSW Waste Facility Guideline Requirement	Details of Compliance
	environment.	
7.7.3	Upon positive detection of fire, the system is to activate any required alarm, fire suppression system, passive measures (e.g., fire door, fire shutter) or plant/machinery override as appropriate to the detector.	Details of detection and alarm have been outlined in **Section 6.2.**
7.7.4	Manual alarm points should be provided in clearly visible locations as appropriate to the environment so that staff can initiate early alarm of fire.	Details of detection and alarm have been outlined in **Section 6.2.**
	7.8 Smoke Hazard Management	
7.8.1	Buildings containing combustible waste material are to have an automatic smoke hazard management system appropriate to the potential fire load and smoke production rate installed within the building	Details of smoke hazard management have been outlined in **Section 6.3.6.**
7.8.4	Any smoke exhaust system installed should be capable of continuous operation of not less than two hours in a sprinkler-controlled fire scenario, or four hours in any non-sprinkler-controlled fire scenario.	
	7.9 Fire water run-off containment	
7.9.1	The waste facility should have effective and automatic means of containing fire water run-off, with primary containment having a net capacity not less than the total hydraulic demand of installed fire safety systems	The required containment has been outlined in **Section 8.2.**
7.9.4	The containment system, which includes the base of any storage area, should be impermeable (i.e. sealed) and prevent fire-water run-off from entering the ground or any surface water course.	The required containment has been outlined in **Section 8.2.**
7.9.6	Pollution control equipment such as stormwater isolation valves, water diversion, booms, drain mats, should be provided as necessary for the facility's emergency response procedures, and be kept readily accessible for the event of fire.	The required containment has been outlined in **Section 8.2.**
	8.2 Storages and Stockpiles / 8.3 Movement of Stockpiles	
8.2.3	The maximum height of any stockpile, loose piled or bales, should not exceed 4 m.	Combustible materials will not be kept in stockpiles.
8.3.1	Stockpiles of combustible waste material should be rotated to dissipate any generated heat and minimise risk of auto-ignition as required.	Combustible materials will not be kept in stockpiles.
8.3.2	Any stockpile of combustible waste material prone to self-heating should have appropriate temperature monitoring to identify localised hotspots; procedures outlined in the operations plan should be	Combustible materials will not be kept in stockpiles.

Clause	FRNSW Waste Facility Guideline Requirement	Details of Compliance
	implemented to reduce identified hotspots.	
8.3.4	Procedures for stockpile rotation and monitoring of temperature during hot weather are to be included in the operations plan.	An operations plan shall be prepared, as recommended in **Section 10.2.**
	8.6 Operations Plan	
8.6.1	The waste facility should develop and implement a written operations plan outlining the daily operations for the waste facility, including describing the combustible waste materials likely, and the method of storage, handling or process at the facility.	An operations plan shall be prepared, as recommended in **Section 10.2.**
	9.3 Emergency plan	
9.3.1	The PCBU is required to develop an emergency plan for the waste facility, in accordance with AS 3745-2010	An ERP shall be prepared, as recommended in **Section 10.2.**
	9.4 Emergency Services Information Package (ESIP)	
9.4.1	An ESIP, as detailed in FRNSW guideline Emergency services information package and tactical fire plans, should be developed and provided by the PCBU	An ESIP shall be prepared, as recommended in **Section 10.2.**