Riskcon engineering

Dangerous Goods Design Report

585-649 Mamre Road, Orchard Hills NSW 2748

Snack Brands Australia
Document No. RCE-21031_SnackBrands_DGDesign_Final_29Jun21_Rev(1)
Date 29/06/2021

Dangerous Goods Design Report

585-649 Mamre Road, Orchard Hills NSW 2748

Snack Brands Australia

Prepared by

Riskcon Engineering Pty Ltd
Unit 618/159 Ross Street
Forest Lodge, NSW 2037
www.riskcon-eng.com
ABN 74 626 753 820

Quality Management

Rev	Date	Remarks	Prepared By	Reviewed By
A	23rd April 2021	Draft issued for comment	Sarah Torrington	Renton Parker
0	8th June 2021	Draft updated to incorporate comments		
1	29th June 2021	Additional updates		

Executive Summary

Background

Snack Brands Australia (SBA) has proposed to expand their warehouse located at 585-649 Mamre Road, Orchard Hills NSW to incorporate an industrial manufacturing facility and wastewater treatment plant (WWTP). Their operations involve the storage and handling of materials classified as Dangerous Goods (DGs); specifically, Class 2.1 Flammable Gases, Class 2.2 Non-flammable Non-toxic Gases, Class 8 Corrosive Substances and Combustible Liquids. The storage of DGs within New South Wales is covered by the Work Health and Safety Regulation 2017 (Ref. [1]) which requires the risks associated with the storage to be minimised So Far As is Reasonably Practicable (SFARP). Compliance with the Regulation may be achieved via the application of suitable design standards.

TMX Global (TMX), on behalf of SBA, has commissioned Riskcon Engineering Pty Ltd (Riskcon) to prepare a DG design brief to communicate the items required for the facility to comply with the DG standards and thus, the Regulation. This document represents Riskcon's assessment and recommendation for the DG storage.

Conclusions

A review of the proposed DG storage within the SBA warehouse was conducted to determine compliance with the Work Health and Safety Regulation 2017 (Ref. [1]) and all relevant standards.

A review of the standards determined that the most applicable standards to govern the storages are:

- AS/NZS 1596:2014 (Ref. [3]) for the LPG cylinder,
- AS 1894-1997 (Ref. [6]) for the liquid nitrogen tank,
- AS 3780-2008 (Ref. [7]) for the corrosive liquid stores; and
- AS 1940-2017 (Ref. [8]) for the combustible liquid store (lubricating oil).

A list of design points for each of the storage types were compiled based on the contents of these standards.

A review of the WHS Regulation was also conducted to determine additional inclusions needed to satisfy the requirements of the regulation. These include additional documentation for the DGs to be stored on site.

Recommendations

The following recommendations have been made based on the assessment within this report:

Design Requirements

- LPG Cylinder store: design in accordance with AS 1596:2014 based on the requirements of **Table 4-1.**
- Nitrogen Bulk Tank in the WWTP: design in accordance with AS 1894-1997 based on the requirements of **Table 4-2**.
- Class 8 Corrosive Liquids cabinet store: design in accordance with AS 3780-2008 based on the requirements of **Table 4-4.**

- Class 8 Corrosive Liquids package store: design in accordance with AS 3780-2008 based on the requirements of **Table 4-5**.
- Class 8 Corrosive Liquids bulk stores within the WWTP and the Heat Exchanger room: design in accordance with AS 3780-2008 based on the requirements of **Table 4-6**.

Work Health and Safety Regulation Requirements:

Ensure the following documentation is prepared in accordance with the WHS Regulation 2017:

- A Dangerous Goods Register, indicating the type of chemical, any notations that may be required from the risk assessment and the Safety Data Sheet for the chemical.
- A Placard Schedule.
- A Manifest.
- A DG Risk Assessment of the storage and handling areas.
- An Emergency Response Plan (ERP) and Emergency Services Information Package (ESIP).

Preparation of a Hazardous Area Classification (HAC) and Hazardous Area Verification Dossier (HAVD).

Table of Contents

List of Figures

List of Tables

Abbreviations

Abbreviation	Description
AGT	Above Ground Tank
AS	Australian Standard
CBD	Central Business District
CIP	Clean in Place
DG(s)	Dangerous Good(s)
ERP	Emergency Response Plan
ESIP	Emergency Services Information Package
HAC	Hazardous Area Classification
HAVD	Hazardous Area Verification Dossier
IBC	Intermediate Bulk Container
NZS	New Zealand Standard
PC	Plastic Container
PCBU	Person Conducting a Business or Undertaking
SFARP	So Far As is Reasonably Practicable
UN	United Nations
WWTP	Wastewater Treatment Plant

1.0 Introduction

1.1 Background

Snack Brands Australia (SBA) has proposed to expand their warehouse located at 585-649 Mamre Road, Orchard Hills NSW to incorporate an industrial manufacturing facility and wastewater treatment plant (WWTP). Their operations involve the storage and handling of materials classified as Dangerous Goods (DGs); specifically, Class 2.1 Flammable Gases, Class 2.2 Non-flammable Non-toxic Gases, Class 8 Corrosive Substances and Combustible Liquids. The storage of DGs within New South Wales is covered by the Work Health and Safety Regulation 2017 (Ref. [1]) which requires the risks associated with the storage to be minimised So Far As is Reasonably Practicable (SFARP). Compliance with the Regulation may be achieved via the application of suitable design standards.

TMX Global (TMX), on behalf of SBA, has commissioned Riskcon Engineering Pty Ltd (Riskcon) to prepare a DG design brief to communicate the items required for the facility to comply with the DG standards and thus, the Regulation. This document represents Riskcon's assessment and recommendation for the DG storage.

1.2 Objectives

The objectives of the DG design report are to assist the builder in constructing a DG storage which complies with the Work Health and Safety Regulation 2017 and all applicable DG standards.

1.3 Scope of Work

The scope of work is to prepare a comprehensive design assistance document for the proposed SBA warehouse expansion at 585-649 Mamre Road, Orchard Hills NSW to assist in preparing a compliant design. The assessment does not include any other sites nor additional work which may be identified in the course of the assessment.

2.0 Methodology

2.1 General Methodology

The following methodology was used:

- The classes, quantities and specific UN numbers of the DGs proposed to be stored was reviewed to fully identify the risks and sub-risks (if present) to inform the direction of the design including all warehouse storage and ancillary DG storages.
- The compliance requirements based on the applicable design standards for each store were documented to assist the builder in incorporating the required design items into the design of the warehouse.
- The findings were documented in a draft report for submission to TMX.
- Any comments were incorporated into a finalised version.

3.0 Site Description

3.1 Site Location and Layout

The SBA warehouse is located at 585-649 Mamre Road, Orchard Hills, approximately 40 km west of the Sydney Central Business District (CBD). **Figure 3-1** shows the regional location of the site in relation to the Sydney CBD. Provided in **Figure 3-2** is the proposed layout of the warehouse within the site, with the DG storage areas marked on the image.

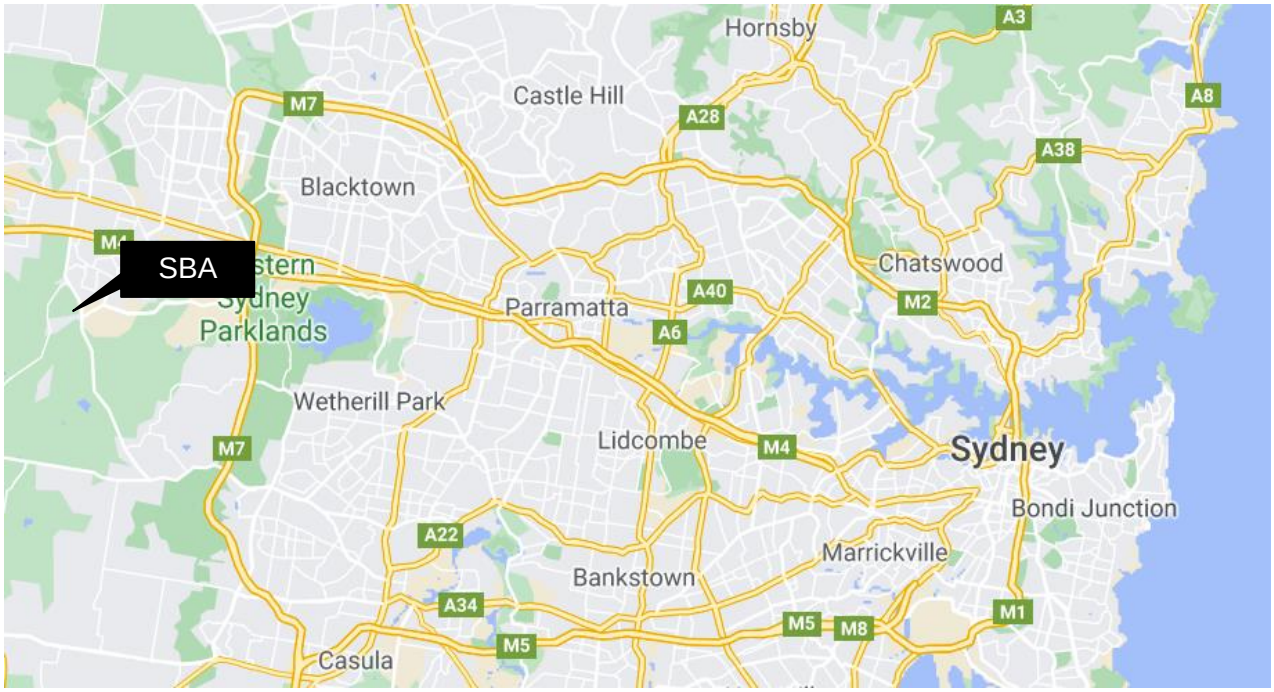

Figure 3-1: SBA Site Location

3.2 General Description

The SBA facility has proposed to expand their current warehouses to include an industrial manufacturing facility and wastewater treatment plant (WWTP). The proposed upgrade is designed to increase the total land area of the site by 51,000 m^2. The existing building consists of a high bay warehouse, low bay warehouse, office and dock office areas and external loading dock and car park. The proposed additions would include a warehouse processing facility of 15,612 m^2 for the manufacturing of corn and potato based products, a new office area (1,800 m^2), additional recessed docks and car parks as well as a Wastewater Treatment Plant (WWTP). These new additions to the facility which require the storage or handling of DGs have been discussed in the following sub-sections.

3.2.1 Processing Facility

The processing facility will include an office area, workshop and lab, maintenance shop, recessed docks and the larger processing facility. The facility is designed to produce corn and potato based products, which are received at the recessed dock and unloaded in the unloading areas. From there, the product is sent through the processing facility and then to the packaging area before being stored in the existing warehouse area.

DGs will be used throughout this processing area for the cleaning of equipment. These DGs are all Class 8 substances in small 5 to 15 L packages and will be stored in a dedicated package store as well as in Class 8 DG cabinets. Both methods of storage shall provide separation between acids and bases.

Within the processing facility is a Heat Exchanger room. As part of the operations, this room will contain up to 300 L of lubricating oil stored in 20 L containers, which is classified as a Combustible Liquid.

3.2.2 Wastewater Treatment Plant

The WWTP will be an external treatment process for the wastewater generated during the product processing and manufacturing operations. The WWTP will contain three Class 8 bulk tanks with aggregate quantity of 30,000 L of bases and 5,000 L of acids. These will be separated as per the requirements of AS 3780-2008 and have separate spillage containment systems to prevent the mixing of acids and bases (Ref. [4]).

The WWTP will also contain a refrigerated liquid nitrogen tank of up to 10,000 L capacity for use in tank blanketing and product packaging in the processing facility.

3.2.3 LPG Cylinder Store

Liquefied Petroleum Gas (Class 2.1) will be stored in a 210 kg (411 L water equivalent) cylinder external to the northern wall of the processing facility (see **Figure 3-2**). The cylinder will be used to decant LPG into smaller cylinders which are used to power forklifts. The area will be naturally ventilated and caged per the requirements of AS/NZS 1596:2014 (Ref. [5]).

3.3 Quantities of Dangerous Goods Stored and Handled

The DGs proposed to be stored at the site are Class 2.1 Flammable Gases, Class 2.2 Non-toxic, Non-flammable Gases, Class 8 Corrosive Substances and Combustible Liquids. The Class 2.1 Gas (LPG) will be stored externally to the processing facility along the northern wall. The Class 2.2 gas will be stored in the wastewater treatment plant (WWTP) in a 10,000 L tank.

The Class 8 substances will be stored in a package store (Potato Lab area) as well as DG storage cabinets within the processing facility in small < 15 L packages. There will also be three bulk tanks of Class 8 substances of up to 20,000 L individual capacity within the WWTP. It is noted that there will also be a bulk tank of 30% ethylene glycol in water mixture however, due to the low concentration of ethylene glycol within the mixture this is not classified as a DG.

A breakdown of the combined quantities of DGs is provided in **Table 3-1.**

Table 3-1: Quantities of DGs Stored and Handled

Class	PG	Description	Max. Quantity (L)
2.1	-	Liquefied Petroleum Gas (LPG) cylinder	210*
2.2	-	Nitrogen, refrigerated liquid tank	10,000
8	II & III	Packaged Corrosive Substances – acids and bases	1,960
8	II	Sulphuric acid bulk tank (acid)	5,000
8	II	Sodium Hydroxide bulk tank (base)	10,000
8	II	Glissen bulk tank (base)	20,000

*The LPG cylinder contains 210 kg of LPG, which has an equivalent water capacity of 411 L.

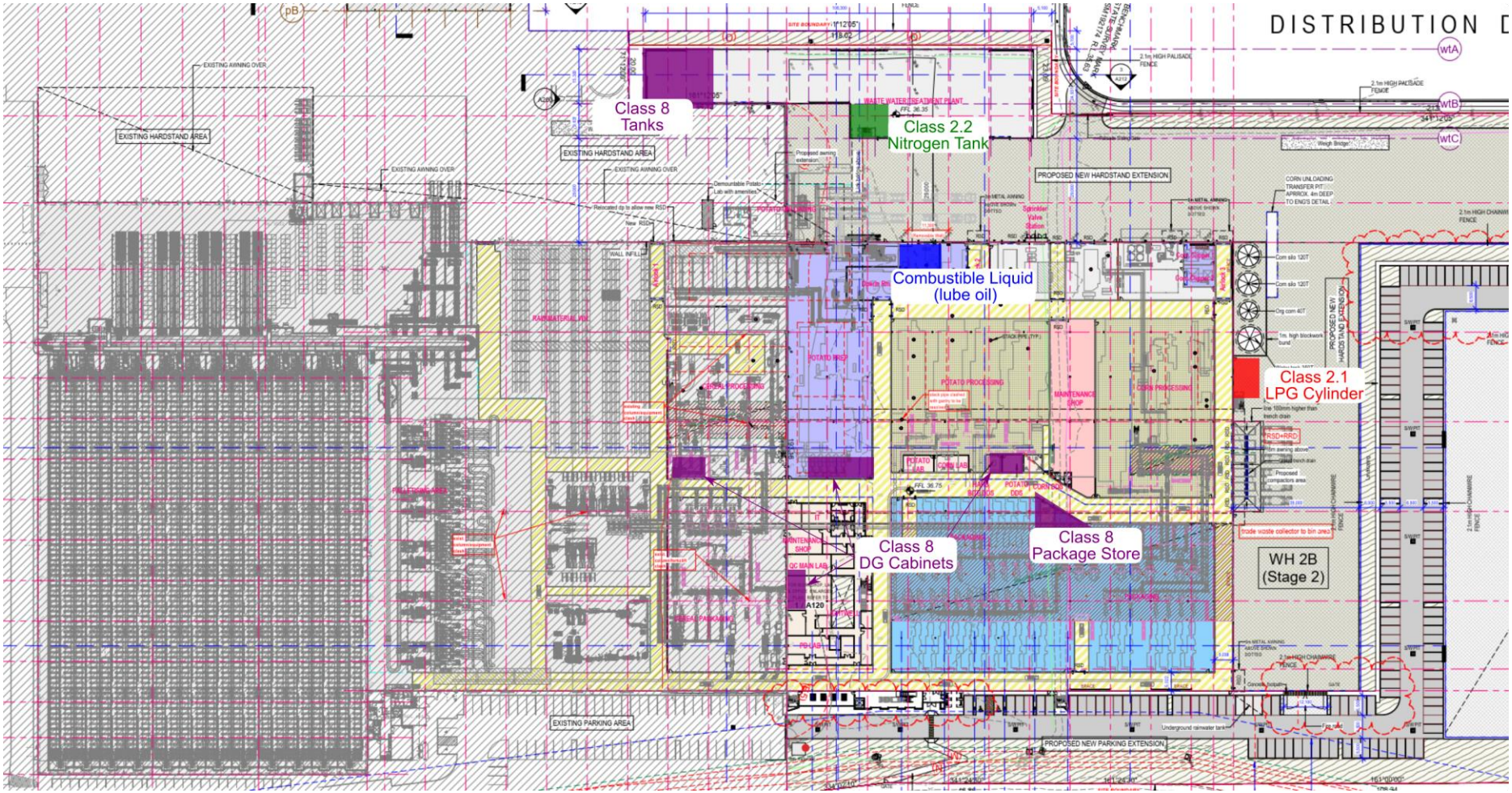

Figure 3-2: Proposed Warehouse Layout

4.0 Dangerous Goods Storage Requirements

Based upon the materials stored, there are five main DG storage and handling areas which include:

- Class 2.1 – Cylinder Store
- Class 2.2 – Bulk Tank
- Class 8 – DG Cabinets
- Class 8 – Package Store
- Class 8 – Bulk Tanks
- Combustible Liquid – Minor Store

The processing warehouse will contain a number of packages of Class 8 substances stored in dedicated DG storage cabinets and within a Class 8 package store. There will also be 300 L of lubricating oil (combustible liquid) stored within the heat exchanger room. External to the facility will be an LPG cylinder (Class 2.1) for filling forklifts.

The WWTP will consist of three Class 8 above-ground bulk storage tanks containing Sodium Hydroxide, Sulphuric Acid and Glissen. The Class 2.2 Nitrogen tank will also be stored at the WWTP.

Each of the separate storages have been discussed in further detail in the following sections.

4.1 Class 2.1 LPG Cylinder Store

The 210 kg LPG cylinder is to be located outside along the northern wall of the processing warehouse, as per **Figure 3-2**. A review of the design standards determined that the most applicable standard for governing the LPG store was AS/NZS 1596:2014 (Ref. [3]) as this standard specifically caters for the storage of LPG. Based on the volume of the LPG cylinder, this storage would be classified as a cylinder store, outlined in in Sections 3 and 4 of the standard. The design points to be included for this installation have been summarised in **Table 4-1.**

Table 4-1: LPG Cylinder Storage Requirements, in Accordance with AS/NZS 1596:2014

Item	Requirement
Ignition Sources	• A Hazardous Area Classification (HAC) shall be performed in accordance with AS 60079.10.1:2009 (Ref. [4]) • Sources of ignition are not permitted within a hazardous area, and shall be controlled in accordance with AS 60079.14:2017 (Ref. [5])
Location	• Where cylinders are adjacent to a building, and any opening into the building is below the level of the cylinder's pressure relief valve, the nearest cylinder shall be at least 1 m away, measured horizontally. • Where a cylinder is installed beneath a window, the distance between the top of any cylinder valve and the bottom of the window's opening shall be at least 0.5 m.
Pipes, Valves and Fittings	All pipes, valves and fitting for service with LPG shall have a minimum design pressure rating of 2.4 MPa.
Control of Access	All installations shall be appropriately secured against unauthorized access

Item	Requirement
Separation Distances	There are no minimum separation distance requirements between the cylinder and public places or protected places.
Installation Considerations	• Cylinders shall be installed on a firm, level, non-combustible base, not resting on soil. The floor of the base shall be constructed so that water cannot accumulate within any enclosure or recess. • Any cylinder shall be restrained to prevent from falling.
Physical Damage	The cylinder shall be protected from physical damage by the use of bollards, or fully contained frame.
Fire Protection	Fire protection requirements shall be obtained from, and be implemented in conjunction with, the relevant regulatory authorities, including the fire authority.

4.2 Class 2.2 Nitrogen Tank (Refrigerated)

The 10,000 L refrigerated nitrogen tank is to be located in the WWTP, as per **Figure 3-2**. A review of the design standards determined that the most applicable standard for governing the nitrogen store was AS 1894-1997 (Ref. [6]) as this standard caters for the storage of cryogenic and refrigerated liquids. Based on the volume of the nitrogen tank, this storage would be classified under 'storage vessels' in Section 3 of the standard. The design points to be included for this installation have been summarised in **Table 4-2.**

Table 4-2: Refrigerated Nitrogen Tank Storage Requirements, in Accordance with AS 1894-1997

Item	Requirement
Damage Protection	• Storage vessels shall be protected from accidental damage from vehicles and forklift trucks by a guardrail or traffic bollards. Where a guardrail is installed, it shall be of heavy construction and installed so as to provide a clear floor area of at least 1 m all around the vessel. • Filling points shall be similarly protected.
Relief Valves and Vents	• All vents and relief valves on storage vessels and pipelines shall discharge to a safe open place. They shall not impinge on any personnel, buildings, structural steelwork, air-conditioning intakes or combustible materials. • Colour coding of valves shall be in accordance with **Figure 4-1.**
Ventilation	Ventilation may be achieved by natural means, which requires at least two sides of the tank completely open to the atmosphere.
Filling Point	An outdoor filling point shall be provided. It shall be located so as to enable connection with the filling tanker with the minimum practical single length of flexible hose (having no joints).
Separation Distances	The following minimum separation distances from the tank shall be achieved: • Building or structure with non-combustible exterior: 1 m • Property boundary, street, other DG stores, areas where open flames/smoking is permitted: 2 m • High voltage electrical equipment, process equipment or machinery (that is not part of the installation), openings to underground drains, pits, ducts, openings in walls of adjacent buildings: 2 m

Item	Requirement
	• Areas where personnel can congregate (e.g. offices, lunchrooms): 2 m • Places of public assembly: 3 m
Other Design Considerations	The design and layout of the facility shall include, where appropriate, provision of – • Space around vessels to allow access for maintenance and during emergencies • Installation of monitored alarms or alarms connected directly to the fire brigade • Water supplies • Fire protection equipment • Access routes for fire brigade • Containment of leaks, spills and run-off of firefighting water
Weather Protection	Equipment that is susceptible to corrosion or degradation by weather, ultraviolet light, fumes, and similar, shall be protected by a sheltered location, or by a protective enclosure carrying the appropriate signage.
Fire Protection	Fire protection requirements shall be obtained from, and be implemented in conjunction with, the relevant regulatory authorities, including the fire authority.

TABLE 3.1

VALVE COLOURS AND FUNCTIONS

Valve colour	Intended function
White	Gas
Black	Liquid
Green	Customer supply
Blue	Instrument valving
Red	Venting
Yellow	Pressure building and vapour return
Orange	Safety circuit changeover

NOTE: Reference should be made to AS 2700. Practical colour equivalents noted therein may also be used.

Figure 4-1: Valve Colours and Functions for Nitrogen Tank, from AS 1894-1997 (Ref. [6])

4.3 Class 8 DG Stores

Corrosive substances of varying container sizes will be stored within the SBA facility. A review of the relevant standards determined that AS 3780-2008 (Ref. [7]) would be the most applicable standard for governing the store of corrosive substances. Based on the volumes and location of the DGs stored, the storage can be broken down into three types:

- Storage Cabinets (processing area)
- Package Store (processing area)
- Bulk Tank Store (WWTP)

Table 4-3 summarises the quantities, container sizes and types of corrosive substances being stored within each DG store, thereby classifying each store. The design points to be included for each of these storage types are summarised in the subsections below.

Table 4-3: Summary of Corrosive Liquids Storage Types

Storage Area	DG Class	Container Type*	Container/Tank Sizes (L)	Max. Quantity (L)	Storage Type
Processing Warehouse	8	PC	< 15	60*	Cabinet
Processing Warehouse	8	PC	15, 200, 1,000	1,900	Package
WWTP	8	AGT	5,000, 10,000, 20,000	35,000	Bulk

AGT = Above Ground Tank, PC = Plastic Container

*60 L max will be stored within any one cabinet based on the type of cabinet chosen for the site.

4.3.1 Storage Cabinets

Small packages of corrosives will be stored within dedicated DG storage cabinets within the processing warehouse. The design points to be included for the storage cabinets have been based on the requirements of Section 4.6 of AS 3780-2008 and are summarised in **Table 4-4** below.

Table 4-4: Corrosive Liquid Storage Cabinet Requirements, in Accordance with AS 3780-2008

Item	Requirement
Maximum Quantities	Maximum storage quantities in a single cabinet are as follows: • Total quantity: 1,000 L • PG II: 250 L • PG I: 50 L
Materials of Construction	All materials used for the construction of the cabinet shall have corrosion resistance appropriate to the type of store and the materials to be kept, or lined with corrosion-resistant materials.
Cabinet Location	• Cabinets shall be located so that they will not impede the scape of persons in the event of a fire • Cabinets shall be located near to a provision for the washing of hands • Where there is more than one cabinet in any building or area, either ○ the aggregate quantity kept in all cabinets shall not exceed that described in the 'maximum quantities' row; or ○ the cabinets shall be separated by at least 5 m.
Segregation	Incompatible materials shall be segregated as per **Table 4-8.** This requires separate storage cabinets for acids and bases.
Fire Protection	The base build fire protection (i.e., hose reels, extinguishers and sprinklers exceed the minimum requirements for fire protection) – no additional fire protection requirements

4.3.2 Package Store

The package store of corrosives contains packages ranging from 5 L to 15 L, located within the packaging area of the processing facility (see **Figure 3-2**). The design points to be included for the package store have been based on the requirements of Section 4 of AS 3780-2008 and are summarised in **Table 4-5** below.

Table 4-5: Corrosive Liquid Package Store Requirements, in Accordance with AS 3780-2008

Item	Requirement
Location	• Stores shall be located on a floor that has immediate access from outside the building. • At least two means of access shall be provided to stores having a floor area greater than 25 m^2.
Materials of Construction	All materials used for the construction of the stores shall have corrosion resistance appropriate to the type of store and the materials to be kept, or lined with corrosion-resistant materials.
Separation Distances	The minimum separation distance to protected places shall be: • 3 m where packages remain closed. • 5 m where packages are opened. These distances may be measured laterally around an intervening screen wall provided that: • it extends at least 1 m above the highest container in the store • the wall and roof, if any, has an FRL of not less than 120/120/120.
Segregation	Incompatible materials shall be segregated as per **Table 4-8.**
Ventilation	Adequate ventilation shall be provided in all stores and at places where packages are opened. Ventilation should be sufficient to maintain exposure levels in the storage area below recommended workplace exposure standards. Adequate ventilation may be achieved by the following means: • The ventilation system shall exhaust 0.3 m^3 per square metre of floor area per minute or 5 m^3/min, whichever is greater. The velocity of the air at the entry point must exceed 300 m/min. • The distance between any two inlets or any two outlets shall be less than 5 m. • Any exhaust duct (i.e. discharge point external to the building) shall terminate in the open air at least 2 m from any opening into the building and at least 3 m above ground. • The external termination of any inlet duct shall be at least 5 m from the termination of any external exhaust duct. • An airflow failure warning device shall be installed. The warning shall be able to be detected from outside the store.
Bunds and Compounds	• Stores shall be provided with a means of containing a spill or diverting it to a compound within the boundaries of the premises. The net capacity of the compound shall not be less than 25% of the aggregate volume of liquids (approx. 500 L aggregate).

Item	Requirement
	• Acids and bases must not be kept within the same compound nor in compounds which share the same drainage system.
Emergency Facilities	The following items shall be provided within 10 m of, but not nearer than 2 m to, stores where packages are opened: • safety shower complying with AS 4775 or a plunge bath, • eye-wash facilities complying with AS 4775, • water for the washing of hands. For stores where packages remain closed at all times, appropriate gloves and water for the washing of hands shall be provided.
Fire Protection	The base build fire protection (i.e., hose reels, extinguishers and sprinklers exceed the minimum requirements for fire protection) – no additional fire protection requirements

4.3.3 Bulk Tank Store

The bulk tank store is to be located within the WWTP. This store shall comply with the design points from Section 5 of AS 3780-2008 which are summarised in **Table 4-6** below.

Table 4-6: Corrosive Liquid Bulk Store Requirements, in Accordance with AS 3780-2008

Item	Requirement
Location	• Tanks shall be completely above ground. • Tanks and their bases shall be resistant to corrosion. • The tanks shall be positioned on a foundation which can support the full load of the tank, and any distorting forces.
Separation Distances	The following minimum separation distances shall be achieved: • Between containers: 0.6 m. • From protected places and premises boundaries: ○ > 3,000 L tank: 5 m • Top inside perimeter of a bund and any protected place or boundary: 3 m. • From tank to the bund: as satisfying the crest locus limit (i.e. at least half of the tank height). See **Figure 4-2**, for details. If separation distances cannot be achieved, they can be measured laterally around an intervening screen wall of at least 1 m above the tank (or to the roof) that has an FRL of 120/120/120.
Segregation	• To incompatible substances: the substances shall be kept in separate compounds or segregated by at least 5 m. • To substances that may react dangerously: the substances shall be segregated by at least 5 m and be kept in a separate compound with its own drainage system. It is noted that although they share the same DG class, acids and bases undergo an exothermic reaction when in contact and thus are considered to react dangerously. Hence, acids and bases must be separated by at least 5 m and have separate spillage containment compounds.

Item	Requirement
Ventilation	At least two external sides completely open to the atmosphere.
Bunds and Compounds	The capacity of the compound shall be 110% of the capacity of the largest container. These may be separated as follows: • WWTP Acids: 5,500 L • WWTP Bases: 22,000 L Bunds and compounds shall be constructed of material resistant to corrosion. Spills from one bund (i.e. acids) shall not be capable of entering the adjacent bund (i.e. bases). This may be achieved by a perspex screen or other compliant material as a barrier between the separate bunds.
Fire Protection	Hydrant fire protection provided around the site would be sufficient to protect against the potential for fire to occur at the site.

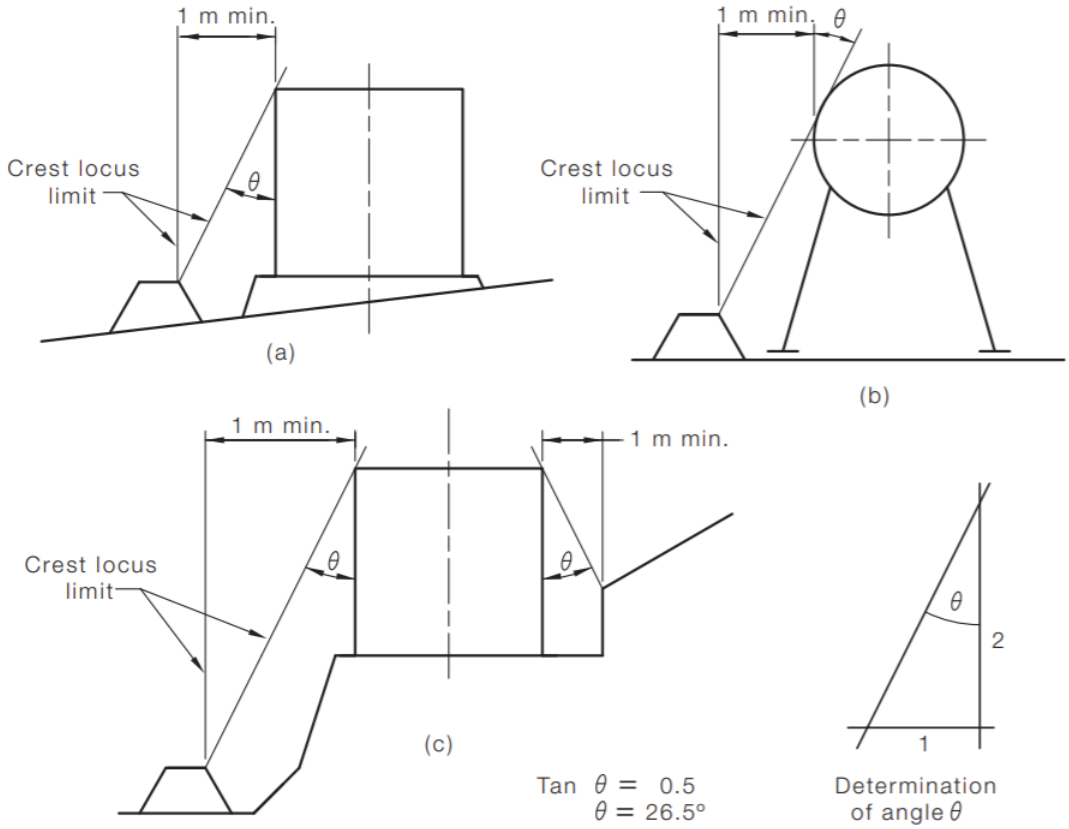

Figure 4-2: Crest Locus Limit, extracted from AS 3780-2008 (Ref. [7])

4.4 Combustible Liquids

The small packages of lubricating oil (combustible liquid) will be stored within the Heat Exchanger room in the processing facility. The design points to be included for the combustible liquid store are based on the requirements of AS 1940-2017 (Ref. [8]). Based on the volume of combustible liquid to be stored, this store would be classified as a minor store per the requirements of Section 2 of this standard. The design points to be included are summarised in **Table 4-7.**

Table 4-7: Combustible Liquids Minor Store Requirements, in Accordance with AS 1940-2017

Item	Requirement
Quantity of Minor Store	The quantity of the minor store shall not exceed 2000 L of combustible liquids based on 4 L per 1 m^2 of floor space with no more than 2000 L in any 500 m^2 area.
Storage Considerations	Liquids shall not be kept near any hot surfaces or where they might be accidentally exposed to heat (e.g. from steam pipes or escaping steam).
Ventilation	No additional ventilation would be required above what is needed for occupational purposes as combustible liquids do not emit vapours. Therefore, ventilation required for occupational purposes would be considered to be adequate and thus comply with the standard.
Spillage Control	A spill-response kit shall be provided to assist in cleaning any spill which may occur. This spill kit shall be based on the loss of contents of the largest container kept (i.e. 20 L).
Separation Distances	Any materials that might react dangerously if mixed shall be kept apart so that the possibility of reaction is minimized (See **Table 4-8**)
Fire Protection	Based upon Table 11.3: 1 x dry powder type extinguisher is required for the combustible oil store.

4.5 Separation Requirements

The separation distance required between the classes proposed to be stored are provided in **Table 4-8.** The values in the table have been extracted from AS/NZS 3833:2007 (Ref. [9]) based on whether the goods are classified as 'incompatible substances' or 'substances that may react dangerously'. It is important to note that Class 8 corrosive substances only require separation between acids and bases. Acids require no separation from other acids and bases require no separation from other bases.

Table 4-8: Separation Distances for DG Classes

	2.1	2.2	8 (acids)	8 (bases)	C2
2.1	n/a	3 m	3 m	3 m	5 m
2.2	3 m	n/a	3 m	3 m	3 m
8 (acids)	3 m	3 m	n/a	5 m	3 m
8 (bases)	3 m	3 m	5 m	n/a	3 m
C2	5 m	3 m	3 m	3 m	n/a

5.0 Work Health and Safety Regulation 2017

5.1 Introduction

In addition to meeting the requirements of the relevant standards, a Person Conducting a Business or Undertaking (PCBU) must also satisfy several obligations outlined in Chapter 7 of the NSW Work Health and Safety (WHS) Regulation 2017 (Ref. [1]). The relevant requirements are dependent on the quantities of DGs stored on site. The DG quantities and the placard and manifest thresholds are outlined in **Table 5-1**. As the Nitrogen and Class 8 PG II corrosive substances exceed the manifest threshold, the site will be classified as a manifest site.

Table 5-1: Placard and Manifest DG Quantities

Class	PG	Description	Stored Qty (L)	Placard Qty (L)	Manifest Qty (L)	Classification
2.1	n/a	Flammable gas (LPG) cylinder	411*	200	5,000	Placard
2.2	n/a	Non-flammable, non-toxic gases	10,000	1,000	10,000	Manifest
8	II	Corrosive substances	34,675	250	2,500	Manifest
8	III	Corrosive substances	285	1,000	10,000	Below thresholds
C2	n/a	Combustible liquid	300	10,000	100,000	Below thresholds

*The LPG cylinder contains 210 kg of LPG, which has an equivalent water capacity of 411 L.

5.2 Applicable WHS Clauses

The applicable clauses are outlined in **Table 5-2**.

Table 5-2: Relevant WHS clauses and requirements (Ref. [1])

Clause	WHS Requirement
346	A Hazardous Chemicals [*Dangerous Goods*] register shall be prepared which must include; • A list of hazardous chemicals stored, used or handled • The current Safety Data Sheet (SDS) for DGs stored, used or handled The register must be readily accessible to workers involved in handling or storing the chemicals, and anyone who is likely to be affected by the chemicals.
347	A manifest of chemicals stored on site shall be prepare in accordance with Schedule 11 of the regulation.
348	A notification shall be made to the regulator of the DGs that exceed the manifest quantities detailed in Schedule 11 of the Regulation.
349 & 350	PCBU shall ensure placards are displayed for all chemicals which exceed placard quantity of Schedule 11, and that placards comply with Schedule 13. A Placard Schedule shall be prepared. An outer warning placard shall be prominently displayed at the site. The placard is to show the words “HAZCHEM” in red lettering on white or silver background and must have minimum dimensions 120 mm x 600 mm, in compliance with Schedule 13, as shown in **Figure 5-1.**
351	A PCBU must manage the risk to health and safety associated with using and storing a hazardous chemical [*Dangerous Good*] and have regard of the following:

Clause	WHS Requirement
	• Hazardous properties of the chemical • Reactions between chemicals (physical) or between the chemical and other substances/materials; • The nature of the work to be carried out with the hazardous chemical; • Any structure, plant or system of work used in the handling, generation or storage of the hazardous chemical [Dangerous Good] or that could react with the hazardous chemical [Dangerous Good] at the workplace. In order to comply with this requirement, it is necessary to conduct a risk assessment and to identify those hazards and risks associated with the storage and handling of the hazardous chemicals [*Dangerous Goods*]. The following recommendation has been made: • A risk assessment of the hazardous chemical [*Dangerous Good*] storage areas be conducted, including the use of the chemicals in the manufacturing areas; or • If there is an existing risk assessment, it should be reviewed.
355	A PCBU must ensure ignition sources are not introduced to areas which where there is a possibility of fire or explosion in a hazardous area. In the flammable liquids containers, there is potential for vapours to accumulate and ignite. Therefore, the following recommendation has been made: • A Hazardous Area Classification (HAC) report and associated drawings should be prepared for flammable liquid in accordance with AS/NZS 60079.10.1:2009. A Hazardous Area Dossier shall be prepared prior to occupation in accordance with AS/NZS 3000:2007.
358	A PCBU must ensure containers of hazardous chemicals are protected against impact damage and damage from excessive load.
361	A PCBU must prepare an emergency response plan (ERP) and submit it to the primary service organisation (Fire and Rescue NSW).

Figure 5-1: HAZCHEM Placard

5.3 Summary of Requirements

The site will require the following documentation in order to comply with the WHS Regulation (Ref. [1]):

- A Dangerous Goods Register, indicating the type of chemical, any notations that may be required from the risk assessment and the Safety Data Sheet for the chemical.
- A Placard Schedule.
- A Manifest.
- A DG Risk Assessment of the storage and handling areas.

- An Emergency Response Plan (ERP) and Emergency Services Information Package (ESIP).
- Preparation of a Hazardous Area Classification (HAC) and Hazardous Area Verification Dossier (HAVD).

6.0 Conclusions and Recommendations

6.1 Conclusions

A review of the proposed DG storage within the SBA warehouse was conducted to determine compliance with the Work Health and Safety Regulation 2017 (Ref. [1]) and all relevant standards.

A review of the standards determined that the most applicable standards to govern the storages are:

- AS/NZS 1596:2014 (Ref. [3]) for the LPG cylinder,
- AS 1894-1997 (Ref. [6]) for the liquid nitrogen tank,
- AS 3780-2008 (Ref. [7]) for the corrosive liquid stores; and
- AS 1940-2017 (Ref. [8]) for the combustible liquid store (lubricating oil).

A list of design points for each of the storage types were compiled based on the contents of these standards.

A review of the WHS Regulation was also conducted to determine additional inclusions needed to satisfy the requirements of the regulation. These include additional documentation for the DGs to be stored on site.

6.2 Recommendations

The following recommendations have been made based on the assessment within this report:

Design Requirements

- LPG Cylinder store: design in accordance with AS 1596:2014 based on the requirements of **Table 4-1.**
- Nitrogen Bulk Tank in the WWTP: design in accordance with AS 1894-1997 based on the requirements of **Table 4-2**.
- Class 8 Corrosive Liquids cabinet store: design in accordance with AS 3780-2008 based on the requirements of **Table 4-4.**
- Class 8 Corrosive Liquids package store: design in accordance with AS 3780-2008 based on the requirements of **Table 4-5**.
- Class 8 Corrosive Liquids bulk stores within the WWTP and the Heat Exchanger room: design in accordance with AS 3780-2008 based on the requirements of **Table 4-6**.

Work Health and Safety Regulation Requirements:

Ensure the following documentation is prepared in accordance with the WHS Regulation 2017:

- A Dangerous Goods Register, indicating the type of chemical, any notations that may be required from the risk assessment and the Safety Data Sheet for the chemical.
- A Placard Schedule.
- A Manifest.
- A DG Risk Assessment of the storage and handling areas.

- An Emergency Response Plan (ERP) and Emergency Services Information Package (ESIP).
- Preparation of a Hazardous Area Classification (HAC) and Hazardous Area Verification Dossier (HAVD).

7.0 References

[1] SafeWork NSW, "Work Health and Safety Regulation," SafeWork NSW, Lisarow, 2017.

[2] Standards Australia, "AS 3780-2008 - Storage and Handling of Corrosive Substances," Standards Australia, Sydney, 2008.

[3] Standards Australia, AS/NZS 1596:2014 - The Storage and Handling of LP Gas, Sydney: Standards Australia, 2014.

[4] 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.

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

[6] Standards Australia, "AS 1894-1997 The Storage and Handling of Non-flammable Cryogenic and Refrigerated Liquids," Standards Australia, Canberra, 1997.

[7] S. Australia, "AS 3780-2008 - The storage and handling of corrosive substances," Standards Australia, Sydney, 2008.

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

[9] Standards Australia, "AS/NZS 3833:2007 - Storage and Handling of Mixed Classes of Dangerous Goods, in Packages and Intermediate Bulk Containers," Standards Australia, Sydney, 2007.