PSA CONSULTING

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21 September 2020

Department of Planning, Industry and Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Ania Dorocinska – ania.dorocinska@planning.nsw.gov.au

Dear Ania,

RE: BAIADA INTEGRATED POULTRY PROCESSING FACILITY (SSD 9394) – DPIE HAZARDS

I refer to your correspondence dated 27 July 2020 regarding matter identified by the Department relating to potential hazards and risks due to the storage of LNG and the proposed refrigeration system.

In response to the request from DPIE, the applicant commissioned a Preliminary Hazard Assessment Report, which has been prepared by SLR Consulting (**Attachment 1**). The SLR Report undertook a Preliminary Risk Screening, which found the following:

- the substances within Hazardous Class 2.1 being stored on site consist of 240,000 litres (or 122.4 tonnes) of Liquified Natural Gas and 12 x 40kg tanks of Liquified Petroleum Gas (LPG). The total of these gases is the equivalent of 122.9 tonnes. This <u>exceeds the SEPP33 Threshold</u> of 10 tonnes or 16m3 (above ground storage) and therefore requires further assessment;
- the substances within Hazardous Class 2.2 being stored on site consist of 10,000 litres of nitrogen gas, 10,000 litres of oxygen gas and 10,000 litres of carbon dioxide, which totals 30,000 litres of Hazardous Class 8 III substances (which is the equivalent of 45.22 tonnes). There is no SEPP33 threshold for these substances and as such requires no further assessment;
- the substances within Hazardous Class 8 III being stored on site consist of 15,000 litres (or 19.5 tonnes) of ferric sulphate, 13,800 litres (or 17.62 tonnes) of hypochlorite solution and 5,400 litres (or 8.1 tonnes) of sodium hydroxide solution. The total equivalent tonnage for this class of substances is 45.22 tonnes which is below the SEPP33 Threshold of 50 tonnes;
- the substances within Hazardous Class 2.3 being stored on site consists of 10,200 litres (or 6.97 tonnes) of Ammonia Anhydrous. This <u>exceeds the SEPP33 Threshold of 5 tonnes</u> and therefore requires further assessment; and
- the substances within Hazardous Class 8 II being stored on site consist of 4,000 litres (or 5.04 tonnes) of Sulphuric Acid. This is below the SEPP 33 Threshold of 25 tonnes and as such requires no further assessment.

The SLR Report also addresses the transportation of dangerous goods to/from the site. The report found that the transportation of LNG, Ammonia Anhydrous and Hypochlorite, sodium hypochlorite solution and sodium hydroxide solution were each under the SEPP33 Thresholds. As such, no further assessment of the transportation of dangerous goods was required.

The SLR Report then undertook a Hazard Identification (as recommended in HIPAP). The assessment involved step 1 – hazard identification; step 2 – hazard analysis (consequence and probability estimation); and risk evaluation and assessment.

Assessment of the risk of LNG fire found that "*The proposed facility is installed in an open area and the confinement within unit is not significant. Hence any explosion overpressure generated is likely to be small*". Based on the example of heat flux in the BOC LNG Design Dossier it was concluded that the heat flux from the LNG tanks would not exceed the site boundary.

The SLR report was unable to comment on the impact of an LNG fire upon the proposed child care centre on the site.

With respect to the impact of Ammonia Anhydrous, the SLR report found with a range of controls in place, the likelihood of a major incident was within an acceptable residual risk level.

From the assessment undertaken, SLR was able to conclude that the following further assessments were not considered necessary:

- further consequence analysis of an incident involving explosion over pressure from a fire on site;
- a consequence analysis of an incident involving toxic gas emissions from a fire on-site; and
- a further consequence analysis of an incident involving toxic releases into the biophysical environment is not considered necessary.

The report concludes that the development “would not cause any risk, significant or minor to the community”.

As the SLR report was unable to comment on the impact of an LNG fire upon the proposed child care centre, a further report was commissioned by the applicant from Lote Consulting to specifically address this matter.

The Lote Consulting report (**Attachment 2**) identified a range of potential hazardous scenarios which could occur. The report then carried forward some of these scenarios for consequence analysis. Of these scenarios, only the LNG release and ignition causing an explosion was carried forward for frequency analysis and risk assessment.

The assessment found that the probability of fatality observed at the childcare would be 0 chances per million per year. Further, the analysis is considered conservative as the calculations do not take into consideration the impact of the building between the tanks and the childcare, which would divert and dissipate the overpressure resulting in lower observed overpressures at the childcare centre.

In addition, the estimated fatality risk at the site boundary would be 0.5%. Given that there is unlikely to be a person located at the boundary due to the rural nature of surrounding land, the probability of a fatality from an LNG explosion at the site boundary was considered almost negligible.

Notwithstanding these findings, the report provides the following recommendations:

a) the hoses for the transfer of LNG shall be inspected monthly and pressure tested annually in accordance with the Australian Dangerous Goods Code;

b) all equipment shall be inspected and tested in accordance with the Australian Dangerous Goods Code; and

c) The over pressurisation shut off for the supply will be set at not more than 200kPa.

These recommendations can be reasonably and relevantly included as part of the conditions package of an approval.

A response is provided below to each specific item raised by DPIE in the following table. The specialist consultant reports referred to are included as **Attachment 1** and **Attachment 2**.

MATTERS RAISED	APPLICANT’S RESPONSE
1. *The storage and transport of LNG must be included as part of the preliminary risk screening assessment as described in the Department’s Applying SEPP33 guideline.*	The storage and transport of LNG has been included in the Preliminary Risk Screening and Hazard Analysis in the SLR Report **Attachment 1.**
2. *Indication of the location/s for the filling of LNG’s tanks on-site.*	The LNG tanks are existing on site (refer to **Figure 1**) and will remain. They are located adjacent to the boiler house. LNG is used to supplement the natural gas supply for use in the boiler house. There will no change to the process and filling of the tanks.

MATTERS RAISED	APPLICANT'S RESPONSE
	 ***Figure 1: Existing LNG Tanks on the site***
3. *Verification of the standards and codes of practice to which LNG facilities will be designed and operated.*	The LNG storage and delivery system has been designed by BOC Limited (BOC) for Elgas following the following applicable Australian Standards: • AS3961 – The storage and handling of liquefied natural gas • AS1210 – Unfired pressure vessels • AS4041 – Pressure piping (on pad pipework, vaporiser) • AS5601 – Gas installations (gas pipeline) • AS1271 – Safety valves, other valves, liquid level gauges and other fittings for boilers and unfired pressure vessels • AS1345 – Identification of the contents of pipes, conduits and ducts • AS/NZS3000 – Electrical installations • AS/NZS60079.10 – Classification of Areas – Explosive Gas Atmospheres
4. *Indication of the materials of the secondary refrigerant and if these are dangerous goods, include this material as part of the preliminary risk screening.*	The only secondary refrigerants on site will be small amounts in domestic split type air-conditioners that may be installed in some offices. These domestic split type air-conditioners are not considered in dangerous goods assessments.
5. *Verification of the refrigeration system(s) proposed for the facility and clarify if anhydrous ammonia and/or the secondary refrigerant will be distributed throughout the facility.*	Regarding refrigerants used on site, SLR has noted in the SEPP33 Preliminary Risk Screening and Hazard Analysis that: • The only bulk refrigerant used will be ammonia anhydrous. • The only secondary refrigerants on site will be small amounts in domestic split type air-conditioners that may be installed in some offices. These domestic split type air-conditioners are not considered in dangerous goods assessments.

I trust this information provides a full response to the matters raised by DPIE regarding the Hazards. Please do not hesitate to contact either myself or Nicole Boulton on telephone number (07) 3220 0288 should you have any questions or wish to discuss.

Regards,

David Ireland
Director - Planning
PSA Consulting (Australia) Pty Ltd

VERSION	DATE	DETAILS	AUTHOR	AUTHORISATION
V2	21 September 2020	FINAL	Nicole Boulton	David Ireland

APPENDIX 1: SEPP33 PRELIMINARY RISK SCREENING AND HAZARD ANALYSIS (SLR CONSULTING)

ATT01

SEPP 33 - PRELIMINARY RISK SCREENING & HAZARD ANALYSIS

Proposed Baiada Oakburn Poultry Processing Facility
1154 Gunnedah Road, Westdale NSW 2340
SSD-9394

Prepared for:

PSA Consulting (Australia) Pty Limited
PO Box 10824 Adelaide Street
Brisbane QLD 4000

SLR Ref: 610.19171-R02
Version No: -v1.2
September 2020

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with PSA Consulting (Australia) Pty Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.19171-R02-v1.2	18 September 2020	Craig Simpson	Peter Georgiou	Neil Kumar

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DOCUMENT REFERENCES

TABLES

FIGURES

1 Introduction

SLR Consulting Australia Pty Ltd (SLR Consulting) has been engaged by PSA Consulting (Australia) Pty Ltd (PSA) to assess the potential impacts of the proposed construction and operation of the Baiada Oakburn Poultry Processing Facility, Westdale, New South Wales (NSW) 2340.

The Development is located at 1154 Gunnedah Road, Westdale, in the Tamworth local government area and comprises the property titles listed in **Table 1**.

Table 1 Site Identification*

Street Address	Legal Description
1154 Gunnedah Road, Westdale	Lot 100 DP 1097471
	Lot 101 DP 1097471
	Lot 102 DP 1097471

Note: * Source CITEC Confirm

The site is within the local government area of Tamworth Regional Council (Council) - refer **Figure 1**. The Development Site covers two land zonings. Lot 100 and Lot 102 are zoned RU1 Primary Production while Lot 101 is zoned E3 Environmental Management under Tamworth Regional Local Environmental Plan 2010.

Figure 1 Location of Proposed Development

1.1 Development Application re SEPP 33

The Project is undergoing a State Significant Development (SSD) Application in accordance with the NSW Department of Planning, Industry and Environment's (DPIEs) Secretary's Environmental Assessment Requirements (SEARs).

This Preliminary Risk Screening assessment forms part of the supporting documentation for the Development Application (DA) for the Proposal in accordance with Council's Requirements, which included the following in relation to Land Use Safety:

> *A preliminary risk screening completed in accordance with Applying SEPP 33 - Hazardous and Offensive Development Application Guidelines (DoP 2011). Should the screening indicate that the development is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis (DoP, 2011).*
> *The PHA should estimate the cumulative risks from the existing and proposed development.*

The purpose of this report is to provide a screening assessment of the hazards associated with the storage of dangerous goods on the site in accordance with *NSW State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33). The purpose of the initial SEPP 33 risk screening is to exclude from more detailed studies those developments which do not pose significant risk.

Where SEPP 33 identifies a development as potentially hazardous and/or offensive, developments are required to undertake a Preliminary Hazard Analysis (PHA) to determine the level of risk to people, property and the environment at the proposed location and in the presence of controls.

If the risk levels exceed the criteria of acceptability and/or if the controls are assessed as inadequate, or unable to be readily controlled, then the development is classified as 'hazardous industry'. Where it is unable to prevent offensive impacts on the surrounding land users, the development is classified as 'offensive industry'.
A development may also be considered potentially hazardous with respect to the transport of dangerous goods. A proposed development may be potentially hazardous if the number of generated traffic movements (for significant quantities of hazardous materials entering or leaving the site) is above the cumulative annual or peak weekly vehicle movements. *Table 3* in the document *Applying SEPP 33: Hazardous and Offensive Development Application Guidelines* (NSW Department of Planning, 2011), outlines the screening thresholds for transportation.

This report presents information pertaining to the presence of any hazardous materials, flammable substances, and compressed or liquefied gases proposed to be stored or handled in relation to the Development Site, including on site storage, or transported to or from the site.

2 PROPOSED DEVELOPMENT

2.1 Overview

Baiada is seeking a development consent to develop an poultry processing facility known as the Baiada Oakburn Poultry Processing Facility (PPF), within a rural property at Westdale, New South Wales (NSW).

The proposed PPF has been described by Baiada in their request for SEARs (Boulton & Ireland, 2018):

"Baiada is proposing a new, integrated poultry processing plant on the site consisting of the following items:

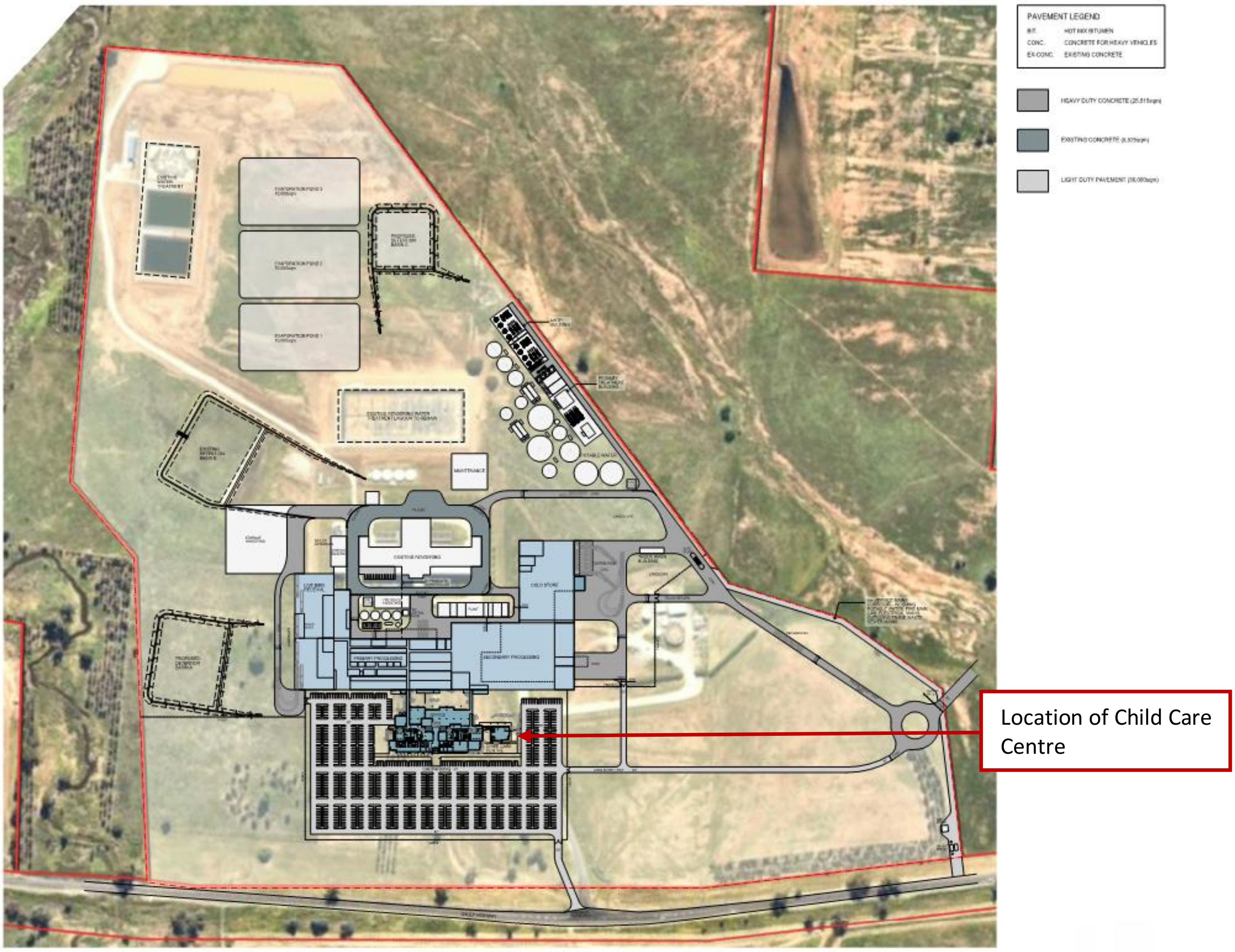
- *Construction of an integrated poultry processing plant consisting of:*
- *35,145 m^2 of Gross Floor Area providing for live bird storage, processing, chilling, cold store and distribution facilities;*
- *2,930 m^{2}of ancillary structures and waste water treatment plant;*
- *2,930m^2 of ancillary administration, staff amenities and childcare space (further details will be set out below);*
- *Expanded Waste Water Treatment Plant;*
- *Installation of ancillary infrastructure, landscaping and services.*
- *Increase the approved level of poultry processing on the site to a maximum of 3 million birds per week;*
- *Increase production at the existing rendering plant to a maximum of 1,680 tonnes of finished product per week (240 tonnes / day 7 days a week)*

As mentioned above the proposal includes an onsite Childcare Centre. The child care centre will provide services between 7am-6pm and accommodate a maximum of 85 children.

The Childcare Centre will have a floor space of 360m^2. Of the 360m^2 of Childcare Centre, 80m^2 of this space is proposed to be used for storage, toilets, changing rooms, staff amenities and administration. This will allow approximately 280m^2 of indoor space for play and learning.

The proposed site plan including location of the Child Care Centre can be seen in **Figure 2**.

Figure 2 Proposed Site Plan



Source: Extracted from SKA Site Plan Drawing No. SK 10 dated 22.06.20

2.2 Hours of Operation

The proposed poultry development will operate 24 hours a day, seven days a week.

2.3 Vehicular Access and Parking

Access to the Development Site will be via an extension to Workshop Lane which connects to the Oxley Highway via Goddards Lane-refer **Figure 1**.

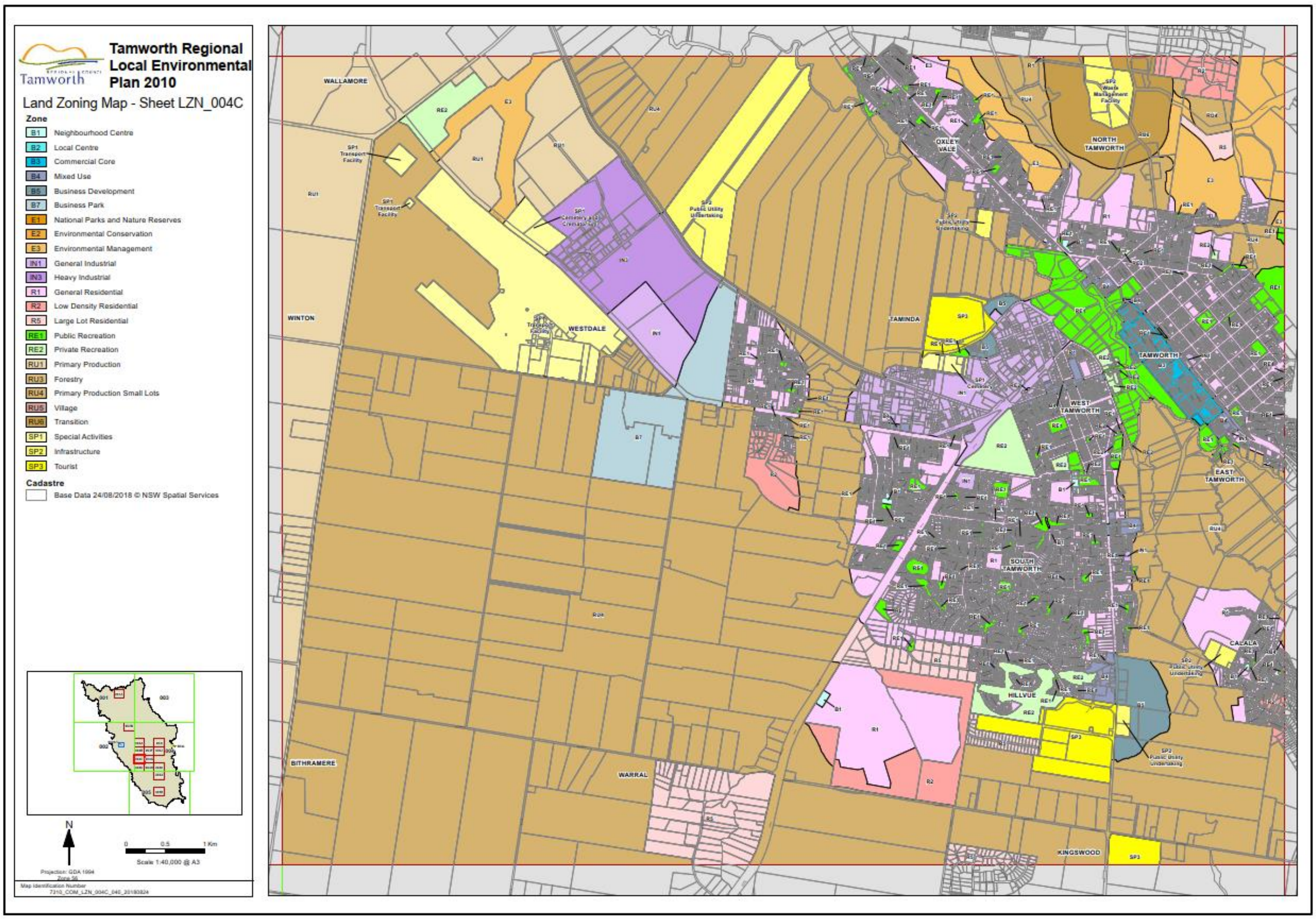
2.4 Surrounding Land Uses and Zoning

The lots surrounding the site have various land zonings – refer **Figure 3**.

- To the south the adjoining land is zoned as SP1 Special Activities and is a transport facility being the airport;

- To the west the adjoining land is zoned RE2 Private Recreation. To the north, the adjoining land is Zoned RU1 Primary Production; and
- To the east, the adjoining land is zoned RU4 Primary Production Small Lots.

Figure 3 Land Zoning Applicable to the Subject Site under Tamworth Regional Local Environmental Plan 2010



Details of neighbouring properties and approximate distance to residential properties have been set out in **Table 2**.

Table 2 Neighbouring Properties and Distance to Properties

Direction	Approximate Distance from Boundary of Development Site	Company/Operations	Use of Premises
North	Adjoining	Rural properties	Primary production
East	300 m	Tamworth Regional Livestock Exchange	Livestock
Southeast	3,800 m	Residential land	
South	180 m	Tamworth Airport	Airport

Direction	Approximate Distance from Boundary of Development Site	Company/Operations	Use of Premises
Southwest	180 m	Tamworth Airport	Airport
Northwest	85 m	Speedway and Motor cycle club	Public recreation

3 PRELIMINARY RISK SCREENING

Preliminary risk screening of the proposed development is required under SEPP 33 to determine the need for a Preliminary Hazard Analysis (PHA). The preliminary screening assesses the storage of specific dangerous goods classes that have the potential for significant, off-site effects. Specifically, the assessment involves the identification of classes and quantities of all dangerous goods to be used, stored or produced on site with respect to storage depot locations as well as transported to and from the site.

3.1 Dangerous Goods Storage

The proposed inventory of Dangerous Goods (DG) in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code) is provided in **Table 4**.

Regarding refrigerants used on site, SLR has been advised that:

- The only bulk refrigerant used will be ammonia anhydrous.
- The only secondary refrigerants on site will be small amounts in domestic split type air-conditioners that may be installed in some offices. These domestic split type air-conditioners are not considered in dangerous goods assessments.

The proposed dangerous goods planned to be stored on site is above the screening thresholds and therefore is considered potentially hazardous.

The technical and management safeguards required in place for LNG systems and ammonia refrigerant system are self-evident and readily implemented as part of plant safety engineering.

Despite consideration of the above engineering controls, the Project may require the preparation of a Preliminary Hazard Analysis.

It should be noted that the above listed dangerous goods are a total inventory for the entire site. However, the storage will be divided into multiple locations.

Natural gas is currently provided to the site via the reticulated gas supply located in the Oxley Highway road reserve. The internal pipeline runs from the street to the Boiler House at the northern end of the Existing Rendering Plant. However, as a result of the unreliability of current reticulated natural gas supply, this is supplemented by LNG which is trucked the site. The LNG is stored within 3 x 80,000L tanks (240,000L) next to the boiler house equating to 122.4 tonnes or 64,8000m^3. This bulk LNG storage already exists on site and is in use on site.

A small amount of LPG is used on site for forklift fuel. The forklifts for the existing rendering plant require 3 x 40kg LPG tanks. The forklifts for the future processing plant will require 12 x 40kg LPG tanks. 80% of these will be stored in a secured enclosure inside the live bird shed, for exchange/use in the forklifts used in that area. The remaining 20% will be in the workshop for exchange/use in the general grounds.

The locations of dangerous good storage have been set out in **Figure 4** and **Figure 5**.

Table 3 Classification of Dangerous Goods Classes in Storage*

Substance	Hazardous Class	Packing Group	Total Storage on Site	Threshold Quantity	SEPP 33 Threshold Level Findings
Liquefied Natural Gas (LNG)	2.1	-	240,000 litres equivalent to 122.4 tonnes or 64,800m^3		
Liquefied Petroleum Gas (LPG)	2.1	-	12 x 40kg tanks		
Total	**2.1**		**122.9 tonnes**	**10 tonne or 16m^3 (above ground storage)**	**Exceeds Threshold**
Nitrogen gas	2.2		10,000 litres		
Oxygen gas	2.2		10,000 litres		
Carbon dioxide	2.2		10,000 litres		
Total	**2.2**		**30,000 litres**	**Not applicable**	**Not applicable**
Ferric Sulphate	8	III	15,000 litres equivalent to 19.5 tonnes		
Hypochlorite solution	8	III	13,800 litres equivalent to 17.62 tonnes		
Sodium hydroxide solution	8	III	5,400 litres equivalent to 8.1 tonnes		
Total	**8**	**III**	**45.22 tonnes**	**50 tonnes**	**Below Threshold**
Ammonia Anhydrous	2.3		10,200 litres equivalent to 6.97 tonnes	5 tonnes	**Exceeds Threshold**
Sulphuric Acid (35%)	8	II	4,000 litres equivalent to 5.04 tonnes	25 tonnes	**Below Threshold**

* Information provided by PSA Consulting Australia.

Figure 4 Proposed Storage Locations of Dangerous Goods (excluding LNG)

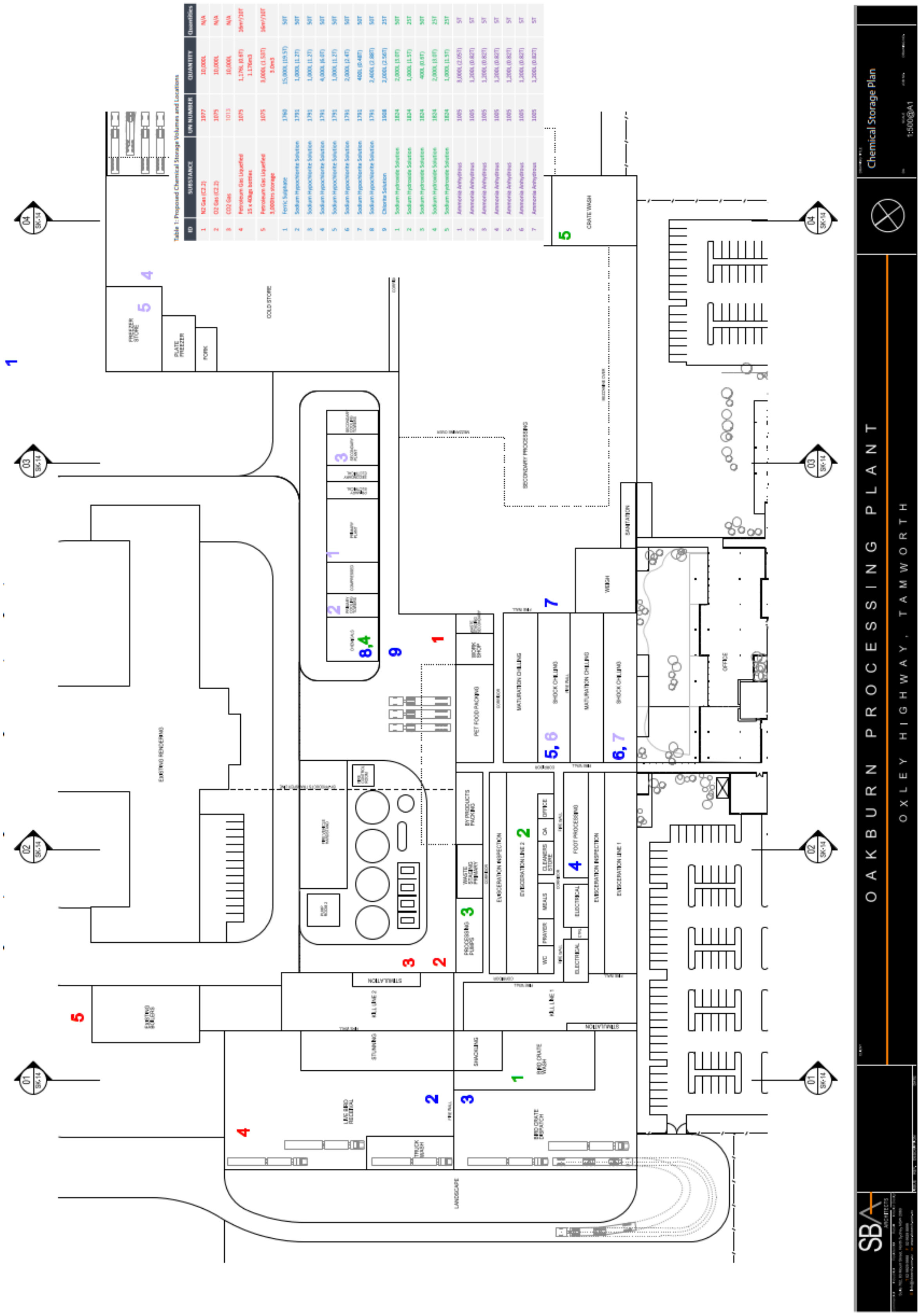
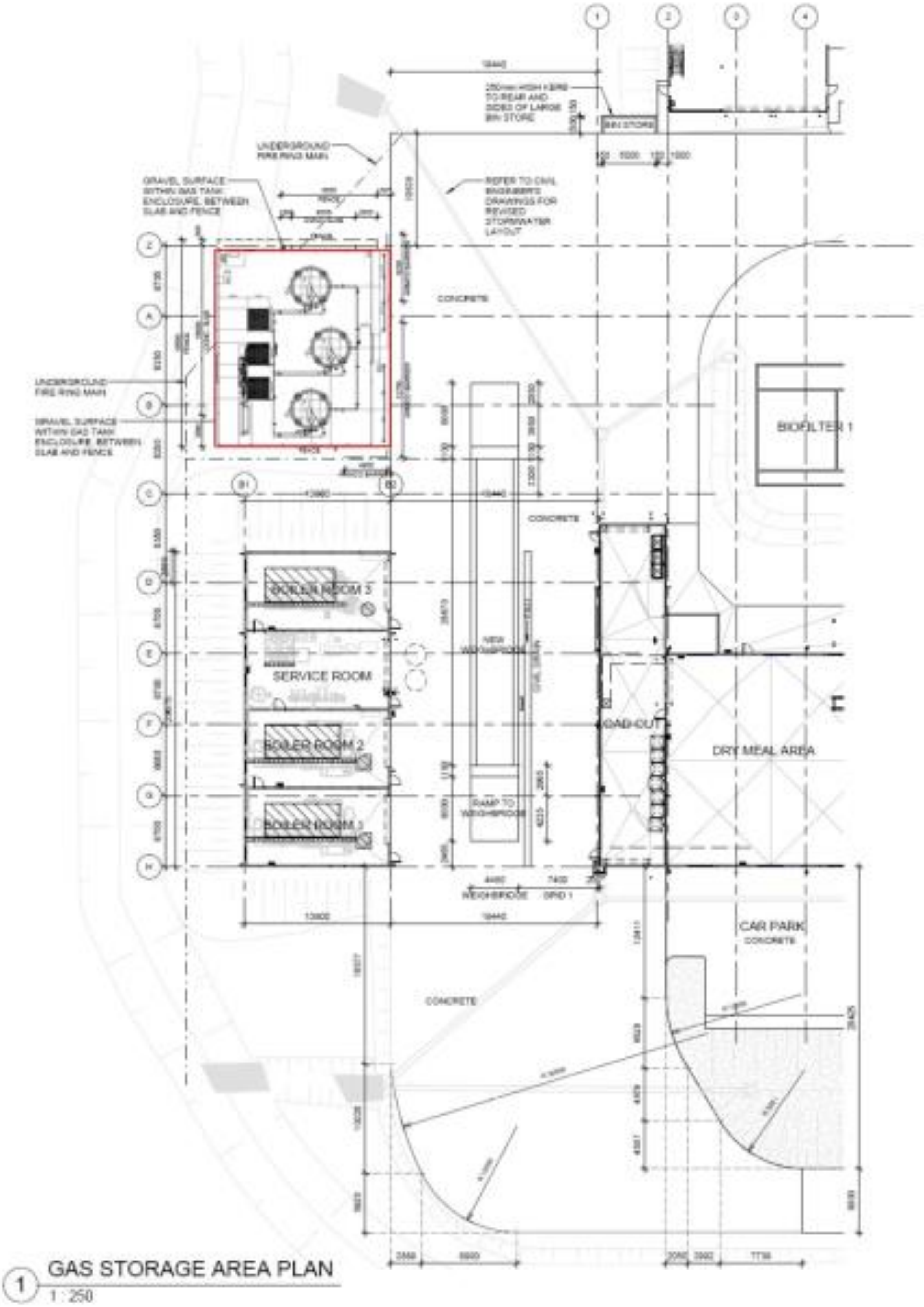


Table 1: Proposed Chemical Storage Volumes and Locations

ID	SUBSTANCE	UN NUMBER	QUANTITY	Quantities
1	N2 Gas (C2.2)	1977	10,000L	N/A
2	O2 Gas (C2.2)	1075	10,000L	N/A
3	CO2 Gas	1013	10,000L	N/A
4	Petroleum Gas Liquefied 15 x 40kgs bottles	1075	1,176L (0.6T) 1.176m3	16m³/10T
5	Petroleum Gas Liquefied 3,000ltrs storage	1075	3,000L (1.53T) 3.0m3	16m³/10T
1	Ferric Sulphate	1760	15,000L (19.5T)	50T
2	Sodium Hypochlorite Solution	1791	1,000L (1.2T)	50T
3	Sodium Hypochlorite Solution	1791	1,000L (1.2T)	50T
4	Sodium Hypochlorite Solution	1791	4,000L (6.0T)	50T
5	Sodium Hypochlorite Solution	1791	1,000L (1.2T)	50T
6	Sodium Hypochlorite Solution	1791	2,000L (2.4T)	50T
7	Sodium Hypochlorite Solution	1791	400L (0.48T)	50T
8	Sodium Hypochlorite Solution	1791	2,400L (2.88T)	50T
9	Chlorite Solution	1908	2,000L (2.56T)	25T
1	Sodium Hydroxide Solution	1824	2,000L (3.0T)	50T
2	Sodium Hydroxide Solution	1824	1,000L (1.5T)	25T
3	Sodium Hydroxide Solution	1824	400L (0.6T)	50T
4	Sodium Hydroxide Solution	1824	2,000L (3.0T)	25T
5	Sodium Hydroxide Solution	1824	1,000L (1.5T)	25T
1	Ammonia Anhydrous	1005	3,000L (2.05T)	5T
2	Ammonia Anhydrous	1005	1,200L (0.82T)	5T
3	Ammonia Anhydrous	1005	1,200L (0.82T)	5T
4	Ammonia Anhydrous	1005	1,200L (0.82T)	5T
5	Ammonia Anhydrous	1005	1,200L (0.82T)	5T
6	Ammonia Anhydrous	1005	1,200L (0.82T)	5T
7	Ammonia Anhydrous	1005	1,200L (0.82T)	5T

Figure 5 Proposed Storage Locations of LNG



3.2 Dangerous Goods Transport

In applying SEPP 33, a proposed development may be deemed potentially hazardous if the numbers of generated traffic movements for significant quantities of dangerous goods entering and leaving the site, are above the cumulative vehicle movements shown in Table 2 of the SEPP 33 guideline. The levels of maximum proposed movements at the site per week are provided below in **Table 4**. Note that the annual levels directly reflect the weekly vehicle movements.

Table 4 Dangerous Goods Vehicle Movements*

ADG Class	Substance	SEPP 33 Threshold Vehicle Movements (per annum)	SEPP 33 Threshold Minimum Quantity (per load)	Load Type	Vehicle Movements per Annum	SEPP 33 Threshold Level Findings
2.1	LNG	>500	2 tonne	Bulk	156	**Below threshold**
2.3	Ammonia Anhydrous	>100	1 tonne	Bulk	24	**Below threshold**
8	Hypochlorite, sodium hypochlorite solution, sodium hydroxide solution	>500	5 tonne	Package	234	**Below threshold**

* Information provided by PSA Consulting Australia.

3.3 Preliminary Risk Screening Conclusion

This report has reviewed and applied the requirements of SEPP 33 in order to determine whether the policy applies to the Project.

The SEPP 33 screenings for storage of dangerous goods indicate that the development may be classified as a hazardous or offensive industry based on the amount of LNG and ammonia anhydrous stored on site.

A Preliminary Hazard Assessment is therefore indicated to determine risk, if any, to adjoining properties near the facility, or surrounding areas.

4 HAZARD IDENTIFICATION

The hazard analysis and quantified risk assessment approach developed and recommended in HIPAP relies on a systematic and analytical approach to the identification and analysis of hazards and the quantification of off-site risks to assess risk tolerability and land use safety implications. HIPAP advocates a merit-based approach, the level and extent of analysis must be appropriate to the hazards present and therefore, need only progress to the extent necessary for the particular case.

4.1 Methodology

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

Step 1: Hazard identification;

Step 2: Hazard analysis (consequence and probability estimations); and

Step 3: Risk evaluation and assessment against specific criteria.

The following sections of the report discuss the hazard identification and analysis process as prescribed in HIPAP.

4.2 Step 1: Hazard Identification

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

To identify hazards, a survey of operations was carried out to isolate the events which are outside normal operating conditions, and which have the potential to impact outside the boundaries of the Site. In accordance with HIPAP 4, these events do not include occurrences that are a normal part of the operation cycles of the Site but rather the atypical and abnormal, such as the occurrence of a significant liquid spill during product transfer operations.

4.3 Step 2: Hazard Analysis

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

4.3.1 Consequence Estimation

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

4.3.2 Probability Likelihood Estimation

Where necessary, the likelihood of incidents quantified in the hazard analysis as a result of Section 4.3.1 are determined by adopting probability and likelihood factors derived from published data.

4.3.3 Risk Evaluation and Assessment

The risk analysis includes the consequences of each hazardous event and the frequencies of each initiating failure. The results of consequence calculations (radiation and overpressure contours, and toxic exposure levels) together with the probabilities and likelihood's estimated are then compared against the accepted criteria, as specified by the Department of Planning, Infrastructure and Environment applicable for the Site. Whether it is considered necessary to conduct the predictions would depend on the probabilities and likelihood estimated and if the risk criteria are exceeded.

4.4 Step 3: Assessment Criteria

The risk criteria applied is specified by *Hazardous Industry Planning Advisory Paper No 4 - Risk Criteria for Land Use Safety Planning* (HIPAP 4). Following is a general discussion of the criteria that is used to assess the risk of a development on the surrounding community and environment.

4.4.1 Individual Fatality Risk Levels

The following paragraphs are reproduced from HIPAP 4 relating to individual fatality risk levels:

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

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

Table 5 Risk Criteria

Land Use	Risk Criteria x 10^{-6}
Hospitals, Schools, etc	0.5
Residential	1
Commercial	5
Sporting and Active Open Space	10
Industrial	50

4.4.2 Injury Risk Levels

Injury risk levels from HIPAP 4 are stated below for heat of radiation.

- Incident heat flux radiation at residential areas should not exceed 4.7 kW/m^2, at frequencies of more than 50 chances in a million per year.
- Incident explosion overpressure at residential areas should not exceed 7 kPa, at frequencies of more than 50 chances in a million per year.

The requirements for toxic exposure are stated as follows:

- Toxic concentrations in residential areas should not exceed a level that would be seriously injurious to sensitive members of the community following a relatively short period of exposure at maximum frequency of 10 in a million per year.
- Toxic concentrations in residential areas should not cause irritation to the eyes or throat, coughing or other acute physiological responses in sensitive members of the community over a maximum frequency of 50 in a million per year.

It should be noted that a risk hazard assessment only examines events that are considered to have the potential for significant off-site consequences.

4.4.3 Risk of Property Damage and Accident Propagation

HIPAP 4 indicates that siting of a hazardous installation must account for the potential for propagation of an accident causing a “domino” effect on adjoining premises. This risk would be expected within an industrial estate where siting of hazardous materials on one Site may potentially cause hazardous materials on an adjoining premise to further develop the size of the accident.

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

- Incident heat flux at neighbouring potentially hazardous installations or at land zones to accommodate such installations should not exceed a risk of 50 in a million per year for the 23 kW/m^2 heat flux level.
- Incident explosion overpressure at neighbouring potentially hazardous installations, at land zoned to accommodate such installations or at nearest public buildings should not exceed a risk of 50 in a million per year for the 14 kPa explosion overpressure level.

4.4.4 Criteria for Risk Assessment to the Biophysical Environment

HIPAP 4 indicates that siting of potentially hazardous developments also needs to consider the risk from accidental releases into the biophysical environment. Acute and chronic toxicity impacts are considered to be of most relevance.

The assessment of the ultimate effects from toxic releases into the natural ecosystem is difficult, particularly in the case of atypical accidental releases. Consequence data is limited and factors influencing the outcome variable and complex. In many cases, it may not be possible or practical to establish the final impact of any particular release. Because of such complexity, it is inappropriate to provide generalised criteria to cover any scenario. The acceptability of the risk will depend upon the value of the potentially affected zone or ecosystem to the local community and wider society.

The suggested criteria for sensitive environmental areas relate to the potential effects of an accidental release or emission on the long-term viability of the ecosystem or any species within it and are expressed as follows:

- Industrial developments should not be sited in proximity to sensitive natural environmental areas where the effects or consequences of the more likely accidental emissions may threaten the long-term viability of the ecosystem or any species within it; and
- Industrial developments should not be sited in proximity to sensitive natural environmental areas where the likelihood or probability of impacts that may threaten the long-term viability of the ecosystem or any species within it is not substantially lower than the existing background level threat to the ecosystem.

4.5 Potentially Hazardous Incidents Identified for Further Discussion

Following a review of neighbouring properties, a series of potentially hazardous events or scenarios were considered to identify if further comprehensive qualitative analysis is required. Each event or scenario shall be discussed in detail and the need for a further quantitative analysis considered.

The following current potential hazards could not be eliminated through the first review and require further examination:

- LNG Fire
- Ammonia release

These scenarios are discussed below.

4.5.1 LNG

The proposed development will have LNG tanks are required to be at quantities classified as an industrial or commercial site. At the facility, the LNG storage consists of 3 above ground tanks each of 80,000 L capacity, giving a maximum LNG storage at the facility of 240,000 L.

The Elgas Emergency Management Plan states the location of the LNG storage is approximately 600m north from the Oxley Highway and approximately 1,200m from Tamworth Airport runway. It also states that "*Adequate distance is between both infrastructure points to allow for dispersion of any misting or vapour cloud in the case of a major release. Additionally, the prevailing wind direction will push any migration away from the highway and airport*."

BOC have been installing similar LNG storage and delivery systems in locations across Victoria, Tasmania, NSW and Queensland. The systems are standardised and the technology well understood. Elgas will operate and maintain the storage and delivery system.

The LNG storage and delivery system has been designed by BOC Limited (BOC) for Elgas following the following applicable Australian Standards:

- AS3961 – The storage and handling of liquefied natural gas
- AS1210 – Unfired pressure vessels
- AS4041 – Pressure piping (on pad pipework, vaporiser)
- AS5601 – Gas installations (gas pipeline)

- AS1271 – Safety valves, other valves, liquid level gauges and other fittings for boilers and unfired pressure vessels
- AS1345 – Identification of the contents of pipes, conduits and ducts
- AS/NZS3000 – Electrical installations
- AS/NZS60079.10 – Classification of Areas – Explosive Gas Atmospheres
- AS/NZS60079.14 – Explosive atmospheres, electrical installations design, selection and erection
- AS1768 – Lightning Protection

The location of the above-ground storage shall comply with the following requirements for ventilation and access and set up:

a. Above-ground storage tanks shall be in the open air, outside buildings.

b. Nearby construction, fences, walls, vapour barriers, or the like shall permit free access around and cross-ventilation for the tank.

The BOC LNG Design Dossier v1, LNG Storage, Vaporiser and Pressure Control Installation set out all design and maintenance procedures, details hazard assessments and controls for the site. Indicative engineering schematic for the proposed development are set out in Appendix I and Appendix II. Detailed hazard assessments and associated controls for the site are set out in Appendix III. ELgas's detailed Emergency Management Plan for the site is set out in Appendix VII. The Hazardous Areas Classification have been set out in Appendix VIII.

The above documents provide detailed discussion of the hazards, risks and controls. Plus evidence of the technical and management safeguards required in place for LNG systems and readily implemented as part of plant safety engineering.

The BOC LNG Design Dossier has detailed information relating to potential fires. In summary it states three types of fires are possible with NG, LNG.

1. A jet fire. This could occur if a gas leak or a liquid leak from a pipe is ignited.
2. A flash fire. A flash fire is the result of ignition of a well-mixed air-methane cloud. A liquid/two-phase leak of LNG would evaporate and disperse into atmosphere forming a flammable air-vapour mixture on ignition, depending on the degree of congestion and confinement in the flame front, a vapour cloud explosion may result. In its absence, a flash fire would be the result.
3. A pool fire. After flashing off a portion, the remaining leaked LNG may form a pool and if ignited, would form a pool fire.

The above also discusses Vapour Cloud Explosion (VCE) where if a liquefied flammable gas is released to atmosphere, there is a possibility that the ignition of the flammable cloud may result in an explosion, and it is referred to as a Vapour Cloud Explosion (VCE). For a VCE to occur the cloud must have sufficient mass and confinement.

The proposed facility is installed in an open area and the confinement within unit is not significant. Hence, any explosion overpressure generated is likely to be small.

The BOC LNG Design Dossier provides an example of heat flux radiation from a similar storage facility with the difference of two LNG storage tanks, instead for three.

A site specific risk assessment for the Baiada development, relating to fire hazards arising from the development and the adequacy of fire protection systems was undertaken by Lote Consulting. Therefore SLR will not comment further on the risk assessment relating to LNG storage. Rather the risk assessment conclusions should be sourced from the Lote Consulting report, *Risk Assessment 1154 Gunnedah Road, Westdale, NSW 2340, Report Number: 370593-LOteRA-Baiada Poultry Plant RevB, dated 17/09/2020.*

4.5.2 LNG Transportation

The quantities and frequency of LNG transported to site do not exceed SEPP 33 threshold levels for the number of trucks as set out in **Table 5**. As such a further consequence analysis for transport risks is not considered necessary.

4.5.3 Ammonia Anhydrous

The proposed development will have ammonia on site as part of the refrigeration systems. The technical and management safeguards required in place for ammonia refrigerant system are self-evident and readily implemented as part of plant safety engineering.

The AS/NZS 5149 series requires the installation and maintenance of number of safety features for ammonia-based refrigeration plant and equipment specifically designed to reduce the overall risk of operations. The correct operation and maintenance of this equipment has been assumed as part of the likelihood assessments.

Table 6 sets out a summary of potential major incident scenarios relating to ammonia, controls and the residual risks.

Table 6 Summary of Potential Major Incident Scenarios – Ammonia

Major Incident	Description	Potential Outcome	Frequency Estimate	Likely Consequence	Controls	Residual Risk Level
Ammonia Release – Pipe Rupture	Pipe rupture post condenser side ruptures leading to ammonia leak. Plant will shutdown on pressure drop leading to short – 'plug' release of ammonia	Ammonia release over a short period (minutes)	Rare - Very Rare	Some potential for minor, short term off site impacts downwind from a release. Some medical treatment may be required in a worst case scenario Localised evacuation may be required	Automated compressor shutdown on loss of pressure Plant complies with AS/NZS 5149 series. Early level leak detection in plant room Periodic Maintenance and Inspections Ammonia gas detectors to detect lea	**Acceptable**
Ammonia Release – Vessel Failure	Ammonia release inside building/plant room from surge tank. Surge tank contains vapour/liquid mixture of ammonia.	Slow leak from closed building as ammonia vaporises	Very Rare	Some potential for minor, short term off site impacts downwind from a release. Some medical treatment may be required in a worst case scenario Localised evacuation may be required	Periodic vessel inspection and system maintenance	**Acceptable**

Major Incident	Description	Potential Outcome	Frequency Estimate	Likely Consequence	Controls	Residual Risk Level
Ammonia Release – and fire	Release of ammonia and then ignition to start a fire	Site wide fire	Very Rare	Potential for downwind irritation if unburned ammonia is part of smoke plume, potential for generation of high NOx	Ammonia Gas Detection system triggers plant shutdown Plant complies with AS/NZS 5149 series	**Acceptable**
Ammonia Release – pipe leak (corrosion)	Small ammonia leak, local odour noticed on site	Minor leak/plant shutdown and isolation	Rae	Minor irritation/injury to staff present – No off site impacts expected	Periodic Maintenance and Inspections	**Acceptable**
Ammonia Release – Overpressure	Leak or release of ammonia gas		Rare	Minor irritation/injury to staff present – No off site impacts expected	Pressure Safety Valves, Plant design pressure rated	**Acceptable**
Ammonia Release – Pipework Flange/weld failure	Small leak of ammonia gas or liquid under pressure. Will continue until leak is stopped	Localised odour/irritation	Rare	Minor irritation/injury to staff present – No off site impacts expected	Periodic Maintenance and Inspections	**Acceptable**
Ammonia Release Maintenance Operations	Maintenance error or accident	Small localised release of ammonia – most likely inside plant room	Very Rare	Minor irritation/injury to staff present – No off site impacts expected	All maintenance work on refrigeration equipment carried out by licenced and accredited personnel	**Acceptable**

Major Incident	Description	Potential Outcome	Frequency Estimate	Likely Consequence	Controls	Residual Risk Level
Ammonia Release – Fire Impact (external)	Fire starts in another section of the building and impinges on the plant room	Potential for fire to spread to refrigeration system – ammonia would then likely be released and burn/act as additional fumes	Very Rare	Potential for downwind irritation if unburned ammonia is part of smoke plume, potential for generation of high NOx	Plant room is separate from operations.	**Acceptable**
Site Fire	Fire starts in another section of the building and impinges on the plant room	Potential for fire to spread to refrigeration system – ammonia would then likely be released and burn/act as additional Acceptable fumes	Rare	Potential for downwind irritation if unburned ammonia is part of smoke plume, potential for generation of high NOx		**Acceptable**
Ammonia Release mechanical impact on pipe/vessel	Impact causes pipe rupture or leak	Minor leak/plant shutdown and isolation	Very Rare	Minor irritation/injury to staff present – No off site impacts expected	Pipes are lagged and this afford a significant degree of protection from mechanical impact. Pipe work Plant separated from normal operations.	**Acceptable**
Ammonia release heat exchanger leak	Leak at plate heat exchanger of ammonia	Localised ammonia leak in plant room	Very Rare	Minor irritation/injury to staff present	Periodic inspections and maintenance	**Acceptable**

4.6 Assessment Criteria Applicable to the Proposed Development Application

In accordance with HIPAP 4 Risk Criteria for Land Use Safety Planning, the following is a discussion of the risk assessment criteria that shall be applied to the proposed development application.

4.6.1 Heat-Flux Radiation Criteria

As discussed above, further consequence analysis of an incident involving heat radiation from a fire from neighbouring sites should be sourced from the Lote Consulting report, Risk Assessment 1154 Gunnedah Road, Westdale, NSW 2340, Report Number: 370593-LOteRA-Baiada Poultry Plant RevB, dated 17/09/2020.

4.6.2 Explosion Over-Pressure Criteria

As discussed above, further consequence analysis of an incident involving explosion over pressure from a fire on-site should be sourced from the Lote Consulting report, Risk Assessment 1154 Gunnedah Road, Westdale, NSW 2340, Report Number: 370593-LOteRA-Baiada Poultry Plant RevB, dated 17/09/2020.

4.6.3 Toxic Exposure Criteria

The proposed development does store LNG and ammonia at quantities to be classified as an industrial or commercial site. The technical and management safeguards to reduce or eliminate the risks of toxic exposure are well understood and readily implemented as part of plant safety engineering.

Consequently, a consequence analysis of an incident involving toxic gas emissions from a fire on-site is not considered necessary.

4.6.4 Biophysical Environment Risk Criteria

The proposed development will store volumes of dangerous goods, in the form of LNG and ammonia. This may generate toxic releases in the event of a large spill or large scale fire.

Consequently, a further consequence analysis of an incident involving toxic releases into the biophysical environment is not considered necessary.

4.7 Concluding Remarks

It is considered that the operation of the proposed development with the safeguards as stipulated would not cause significant off-site risks.

The development is considered to be potentially hazardous based on the SEPP 33 screening thresholds, given the quantity of LNG and ammonia stored on site. However, the technical and management safeguards required in place for LNG systems and ammonia refrigerant systems are self-evident and readily implemented as part of plant safety engineering. In addition, it should be noted that the LNG storage and delivery system has been designed by BOC Limited (BOC) for Elgas following all of the relevant applicable Australian Standards. Furthermore. BOC Limited has installed similar facilities in many locations across four Australian states. Finally, the surrounding area is lightly populated with the closest potential residence approximately 3.8 km from the boundary.

A site specific risk assessment for the Baiada development, relating to fire hazards arising from the development and the adequacy of fire protection systems was undertaken by Lote Consulting. Therefore the risk assessment conclusions should be sourced from the Lote Consulting report, Risk Assessment 1154 Gunnedah Road, Westdale, NSW 2340, Report Number: 370593-LOteRA-Baiada Poultry Plant RevB, dated 17/09/2020.

In consideration of all these factors, the development does not pose a significant offsite risk.

5 CONCLUSION

This report has reviewed and applied the requirements of SEPP 33 in order to determine whether the policy applies to the Project.

The SEPP 33 screening has shown that:

- In relation to the transportation of dangerous goods, all quantities are below the relevant threshold levels.
- In relation to the storage of dangerous goods, the development may be classified as a potentially hazardous or offensive industry based on the amount of LNG and ammonia anhydrous stored on site.

A Preliminary Hazard Assessment was therefore indicated to determine risk, if any, to adjoining properties near the facility, or surrounding areas.

The Preliminary Hazard Analysis has found that the operation of the proposed development meets the criteria laid down in HIPAP 4 Risk Criteria for Land Use Safety Planning and would not cause any risk, significant or minor, to the community.

A risk assessment relating to fire hazards arising from the development and the adequacy of fire protection systems was undertaken by Lote Consulting. Therefore the risk assessment conclusions should be sourced from the Lote Consulting report, Risk Assessment 1154 Gunnedah Road, Westdale, NSW 2340, Report Number: 370593-LOteRA-Baiada Poultry Plant RevB, dated 17/09/2020.

Other spill, fire and incident events are not likely to extend significantly beyond the boundary of the site, with the exception of a major facility fire where, regardless of the type of operation there will always be a risk of potentially harmful smoke plumes downwind from a fire. In the majority of large fires, the buoyant nature of a smoke plume means any potentially harmful materials are rapidly dispersed.

LNG storage, whilst significant, is well within the storage and handling requirements of the relevant Australian standards (listed above).

It is the conclusion of this PHA that the proposed development meets all the requirements stipulated by the Department of Planning and Environment, and hence would not be considered, with suitable engineering and design controls in place, to be an offensive or hazardous development on site or would not be impacted by any hazardous incidents from adjoining facilities off site.

6 REFERENCES

AS/NZS 1596:2014 The storage and handling of LP Gas

BOC LNG Design Dossier v1, LNG Storage, Vaporiser and Pressure Control Installation

Commonwealth Government, 2020, Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Number 7.7).

Commonwealth Government, 2014, Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Number 7.3).

Department of Planning NSW, 2011, Applying SEPP 33 - Hazardous and Offensive Development Application Guidelines.

Lote Consulting report, Risk Assessment 1154 Gunnedah Road, Westdale, NSW 2340, Report Number: 370593-LOteRA-Baiada Poultry Plant RevB, dated 17/09/2020.

Planning NSW, 2011 Rick Criteria for Land Use Safety Planning – Hazardous Industry Planning Advisory Paper No 4, New South Wales Government

Planning NSW, 2011 Hazard Analysis – Hazardous Industry Planning Advisory Paper No 6, New South Wales Government

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ATTACHMENT 2: RISK ASSESSMENT (LOTE CONSULTING)

ATT02

Commercial in Confidence

Risk Assessment

1154 Gunnedah Road, Westdale, NSW 2340

Report Number: 370593-LoteRA-BaiadaPoultryPlant-RevB

Date: 17/09/2020

Client:

Baiada Poultry

Conditions of Use

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Quality Information

Ref: 370593-LoteRA-BaiadaPoultryPlant-RevB

Revision History:

Revision	Revision Date	Details	Document Details		
			Prepared	Reviewed	Authorised
A	11/09/20	Draft for Client review only	Renton Parker	Steve Sylvester	Dr S A Magrabi Principal Fire Engineer BPB No: 0240
B	17/09/20	Update of assessment based on LNG location	Renton Parker	Steve Sylvester	Dr S A Magrabi Principal Fire Engineer BPB No: 0240

Report Reading Guide

The scope of this Risk Assessment (RA) is to assess the potential hazards at the site to determine the adequacy of fire protections systems against the identified hazards. This RA is divided into the following sections

The project stakeholders will have varying degrees of involvement in the fire engineering process with an interest in different sections. It is recommended that each stakeholder read the entire document, paying particularly attention to the sections indicated in Table 0.

Table 0 – Recommended reading guide table for project stakeholders

Stakeholder	Executive Summary	1	2	3	4	5	6	7	Appendices
Client	✓	✓	✓	✓	✓			✓	✓
Architect	✓	✓	✓	✓	✓			✓	✓
Certifying Authority	✓	✓	✓	✓	✓	✓	✓	✓	✓
Project Manager	✓	✓	✓	✓	✓			✓	
Services Engineers	✓	✓	✓	✓	✓			✓	
Fire Brigades	✓	✓	✓	✓	✓	✓	✓	✓	✓
Managing Contractor	✓	✓	✓	✓	✓			✓	
Sub-Contractor	✓	✓	✓	✓	✓			✓	

Table of Contents

Executive Summary

Background

Baiada Poultry has proposed to construct a poultry processing facility on land located at 1154 Gunnedah Road, Westdale, NSW 2340. Part of the design has been to incorporate childcare facilities within the facility to assist employees with childcare needs while working. The site also includes Dangerous Goods (DGs) which exceeded the State Environmental Planning Policy No. 33 (SEPP 33) resulting in the preparation of a Preliminary Hazard Analysis (PHA) dated 3/08/20. In particular, large quantities of Liquefied Natural Gas (LNG).

The Hazardous Industry Planning Advisory Paper (HIPAP) No. 4[1] has a range of criteria for sensitive populations which must be complied with to demonstrate that a facility is not potentially hazardous. While the childcare is located within the confines of the site property, the Department of Planning, Industry and Environment (DPIE) has requested additional assessment to demonstrate that the risks posed by the LNG storage do not exceed the applicable criteria at the childcare. This document has been prepared as an addendum to the existing PHA dated 3/08/202 prepared by SLR Consultants to assess the risk at the childcare based upon the storage of LNG.

Conclusions

A hazard identification table was developed for the facility to identify potential hazards that may be present at the site as a result of operations or storage of materials. Based on the identified hazards, scenarios were postulated that may result in an incident with a potential for offsite impacts. Postulated scenarios were discussed qualitatively and any scenarios that would not impact offsite were eliminated from further assessment. Scenarios not eliminated were then carried forward for consequence analysis.

Incidents carried forward for consequence analysis were assessed in detail to estimate the impact distances. Impact distances were developed into scenario contours and overlaid onto the site layout diagram to determine if an offsite impact would occur. The consequence analysis showed that one of the scenarios (vapour cloud explosion) would impact over the site boundary and into the adjacent land use and the onsite childcare; hence, this incident was carried forward for frequency analysis and risk assessment.

The frequency analysis and risk assessment showed that the fatality rate at the childcare would be 0 while the fatality rate at the site boundary would be 0.5%. Given the location of the facility it would be unlikely for a person to be located at the boundary. Hence, it was concluded that it would be incredibly unlikely for a fatality to occur at the site boundary. Therefore, the probability of a fatality from an LNG explosion at the site boundary is within the acceptable risk criteria.

Based on the analysis conducted, it is concluded that the risks at the site boundary are not considered to exceed the acceptable risk criteria. Therefore, the facility would only be classified as potentially hazardous and would be permitted within the current land zoning for the site.

Recommendations

a) The hoses for the transfer of LNG shall be inspected monthly and pressure tested annually in accordance with the Australian Dangerous Goods Code.

b) All equipment shall be inspected and tested in accordance with the Australian Dangerous Goods Code.

c) The over pressurisation shut off for the supply will be set at not more than 200 kPa.

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

1.0 Introduction

1.1 Background

Baiada Poultry has proposed to construct a poultry processing facility on land located at 1154 Gunnedah Road, Westdale, NSW 2340. Part of the design has been to incorporate childcare facilities within the facility to assist employees with childcare needs while working. The site also includes Dangerous Goods (DGs) which exceeded the State Environmental Planning Policy No. 33 (SEPP 33) resulting in the preparation of a Preliminary Hazard Analysis (PHA) dated 3/08/20. In particular, large quantities of Liquefied Natural Gas (LNG).

The Hazardous Industry Planning Advisory Paper (HIPAP) No. 4[2] has a range of criteria for sensitive populations which must be complied with to demonstrate that a facility is not potentially hazardous. While the childcare is located within the confines of the site property, the Department of Planning, Industry and Environment (DPIE) has requested additional assessment to demonstrate that the risks posed by the LNG storage do not exceed the applicable criteria at the childcare. This document has been prepared as an addendum to the existing PHA dated 3/08/202 prepared by SLR Consultants to assess the risk at the childcare based upon the storage of LNG.

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

2.0 Methodology

The following methodology has been adopted in this assessment:

a) The LNG tanks were subject to a hazard identification to identify the potential scenarios which may occur from a failure of the LNG systems.

b) Identified scenarios were subject to a consequence analysis to identify the extent of the impacts.

c) The impact contours were overlaid on the site layout to determine whether impact at the childcare would occur.

d) Where an impact was identified, a frequency and risk analysis was conducted to determine whether the risk criteria for childcare facilities within HIPAP No. 4 was exceeded.

e) The review of the SLR Consulting PHA is outside the scope of this commission and has not been undertaken.

3.0 General Description

An overview of the LNG systems installed at the site is provided in the following subsections. Description of the process and system has been extracted from the BOC Technical Documents for the system dated 21/07/2013.

3.1 LNG Quantities

The LNG is stored in three (3) vertical tanks which are located on the northern eastern side of the facility as shown in Figure 3-1. The total quantity of LNG stored within the tanks is summarized in Table 3-1.

Table 3-1 – Summary of LNG Quantities at the Site

Storage Type	Number of Tanks	Volume of Each Storage (L)	Total Volume (L)
Vertical tank	3	80,000	240,000

3.2 Gas Controls

The primary gas control is the OPSO valve(s) which lets the pressure down from the operating pressure of the LNG storage vessel, normally 5 Barg, to 0.7 to 1.4 Barg for supply to the gas fired appliances. The over pressure shut off for the supply will be set at 200kPa, possibly lower if requested by a customer but no higher.

3.3 Safety Controls

The LNG storage vessel is fitted with ESOV’s on all entry and exit lines with instrument impulse lines fitted with a 1.4 mm orifice. The gas supply line is over pressure protected by the OPSO valve panel with the over pressure set to 2 Barg. The OPSO valve panel is protected by a low temperature shutdown set at -20C. The overall facility is protected by two gas detection units (in a polling configuration) which shut the ESOV’s in the event of a gas detection event.

The gas will be stenched immediately downstream of the vaporisers, via injection of Spotleak 1009 odourant (see MSDS in section below). This removes the need for electronic gas detection downstream at the usage points. Spotleak 1009 is a mixture of tertiary-butyl mercaptan and isopropyl mercaptan. Odourant injection is achieved via pump injection, proportional to the mass flow rate of natural gas.

The LNG storage vessel is protected from over pressure through a pair of safety valves, the first valve is set at the maximum allowable operating pressure and the second valve is set to 120% of the maximum allowable operating pressure.

The pipework between isolation valves is fitted with thermal relief valves to protect the pipework from trapped cryogenic liquid, which will boil off to create an expanding vapour increasing in pressure until the thermal safety valve lifts at 31 Barg.

As additional safety measure, the LNG supply system has a dial in DCS that alerts the on-call engineer via sms in case of E-Stop trip or a fault condition. The engineer can then dial in and diagnose/rectify the issue with customer assistance where necessary. The dial in system also comes complete with a surveillance camera so that a visual check may be carried out before resetting the system remotely.

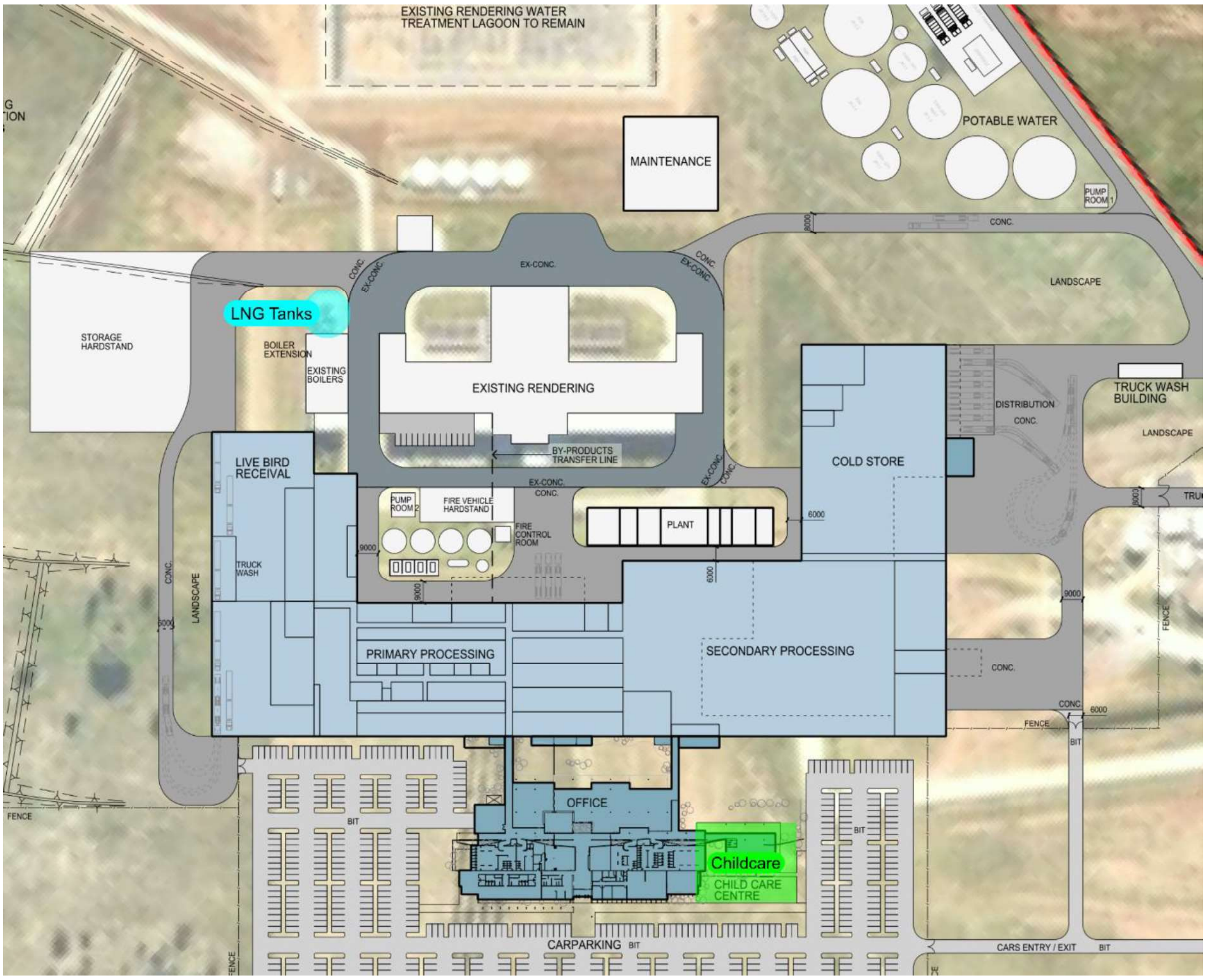


Figure 3-1 – Existing Site Layout

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[3]. 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.

4.2 Identified Hazards

The following hazardous scenarios were identified as part of the hazard identification:

a) LNG Release, Ignition and Pool Fire

b) LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire

c) LNG Release and Ignition Causing Flash Fire or Explosion

d) LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Delivery Tanker and BLEVE

e) LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Tank and BLEVE

Each has been discussed further in the following sections.

4.3 LNG Release, Ignition and Pool Fire

In the event of a small leak from a vessel or pipework a pool of LNG may form when the rate of evaporation of LNG is less than the flow rate of LNG from the leak. If the pool were to ignite an LNG pool fire would occur.

A leak sufficient to cause a release that exceeds the evaporation rate to develop a pool large enough to ignite (noting the area is zoned per the requirements of AS/NZS 60079.10.1:2009[4]) and the subsequent fire is considered very low. This is substantiated by numerous similar sized LNG tanks installed throughout Australia with very low incidences of leaks and fires occurring from such installations.

Furthermore, based upon the location of the LNG tanks in relation to the site boundaries and the childcare, an impact offsite would not be expected from these scenarios. Given the potential for the incident to happen is low and the childcare would be unlikely to be impacted by such an incident due to its location at the site this incident has not been carried forward for further analysis.

4.4 LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire

As the site LNG is depleted, it will be refilled by a delivery tanker at the site. During loading of the tank there is the potential for the hose to rupture which may be the result of a puncture of the hosing or deterioration through general wear and tear. It is considered the hoses are inspected monthly and pressure tested annually in accordance with the Australian Dangerous Goods Code[5] (ADG).

Notwithstanding this, there is the potential for a hose to become damaged between inspection and test periods which may lead to sufficient deterioration resulting in a hose rupture when transferring pressurised LNG. Excess flow and non-return valves will isolate the flow of LNG. However, if these fail in addition to a hose rupture, LNG will be released resulting in an LNG vapour cloud. The operator may be able to respond and isolate the LNG transfer by activating an emergency stop button located on the tanker.

If the operator is incapacitated or unable to stop the transfer, the LNG will continue to flow developing a substantial cloud which may contact an ignition source and ignite which would result in a flash fire or explosion which would

3 Department of Planning, "Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis," Department of Planning, Sydney, 2011.
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 Road Safety Council, The Australian Code for the Transport of Dangerous Goods by Road and Rail Edition 7.4, Canberra: Road Safety Council, 2016.

burn back to the release point and subsequent jet fire. It is noted the area is unconfined. Hence, an explosion is unlikely to occur and would likely result in a flash fire.

The impacts from a jet fire may be substantial although unlikely to impact the childcare due to the location of the tank on the site. Nonetheless, this incident has been carried forward for further analysis as to confirm an offsite impact will not occur.

4.5 LNG Release and Ignition Causing Flash Fire or Explosion

In the event of an LNG release, LNG will vapourise forming a flammable cloud which may ignite. A review of the area indicates the tank will not be stored in an area where confinement will occur. Hence, the cloud is unlikely to ignite as an explosion but is likely to result in a flash fire. Nonetheless, due to the large volumes of gas stored within each tank, in a full release scenario there is the potential for a dense cloud to form which if ignited may be sufficient to detonate as an explosion. Therefore, both a flash fire and explosion have been carried for further analysis as both an offsite impact or impact at the childcare may occur.

4.6 LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Delivery Tanker and BLEVE

Similarly, to the scenario described in Section 4.4 the hose may rupture resulting in a jet fire. If this jet fire were aimed at the delivery tanker, the tanker shell would begin to heat, transferring the heat into the LNG within the tank which would begin to vaporise and increase the pressure within the tanker. At the design pressure of the tank, the pressure relief valve will begin to lift to relieve pressure within the tanker.

As the liquid level within the tanker drops, the impact zone of the jet fire may impact the vapour space in the tanker. The vapour will absorb less energy than the liquid which will result in localised heating of the tanker shell at the point of the jet fire impact. This may compromise the structural integrity of the tanker shell which may rupture resulting in a blast overpressure as the vessel fails and formation of an LNG vapour cloud which may also ignite resulting in a vapour cloud explosion known as a Boiling Liquid Expanding Vapour Explosion (BLEVE). This incident has been carried forward to assess the potential impact zone.

4.7 LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Tank and BLEVE

Similarly, to the scenario described in Section 4.4 the hose may rupture resulting in a jet fire. If this jet fire were aimed at the tank, the tank shell would begin to heat, transferring the heat into the LNG within the tank which would begin to vaporise and increase the pressure within the tank which may result in a BLEVE as described in Section4.5. Hence this incident has been carried forward for further analysis.

5.0 Consequence Analysis

Incidents carried forward for Consequence Analysis

a) LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire

b) LNG Release and Ignition Causing Flash Fire or Explosion

c) LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Delivery Tanker and BLEVE

d) LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Tank and BLEVE

Each has been discussed further in the following sections.

5.1 LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire

There is the potential for a hose to rupture and release high pressure LNG if the excess flow valve on the tanker fails and operator intervention does not occur. If this stream ignited, a jet fire could occur. A detailed analysis has been conducted in Appendix B6 for this scenario which indicates the jet fire would have an impact of distance of 31.8 m. The impact distances for this incident are shown in Figure 5-3.

There are several protection systems to prevent hose rupture including hose pressure testing and inspections, non-return valves on the tank and vehicle, excess flow valves on the tanker, earthing connections, ignition source controls. Therefore, it is unlikely that a release of LPG would occur and subsequent ignition.

A review of the impact distance indicates it would not impact over the site boundary which is 237 m away and nor would it impact the childcare which is 284 m away. Therefore, this incident has not been carried forward for further analysis.

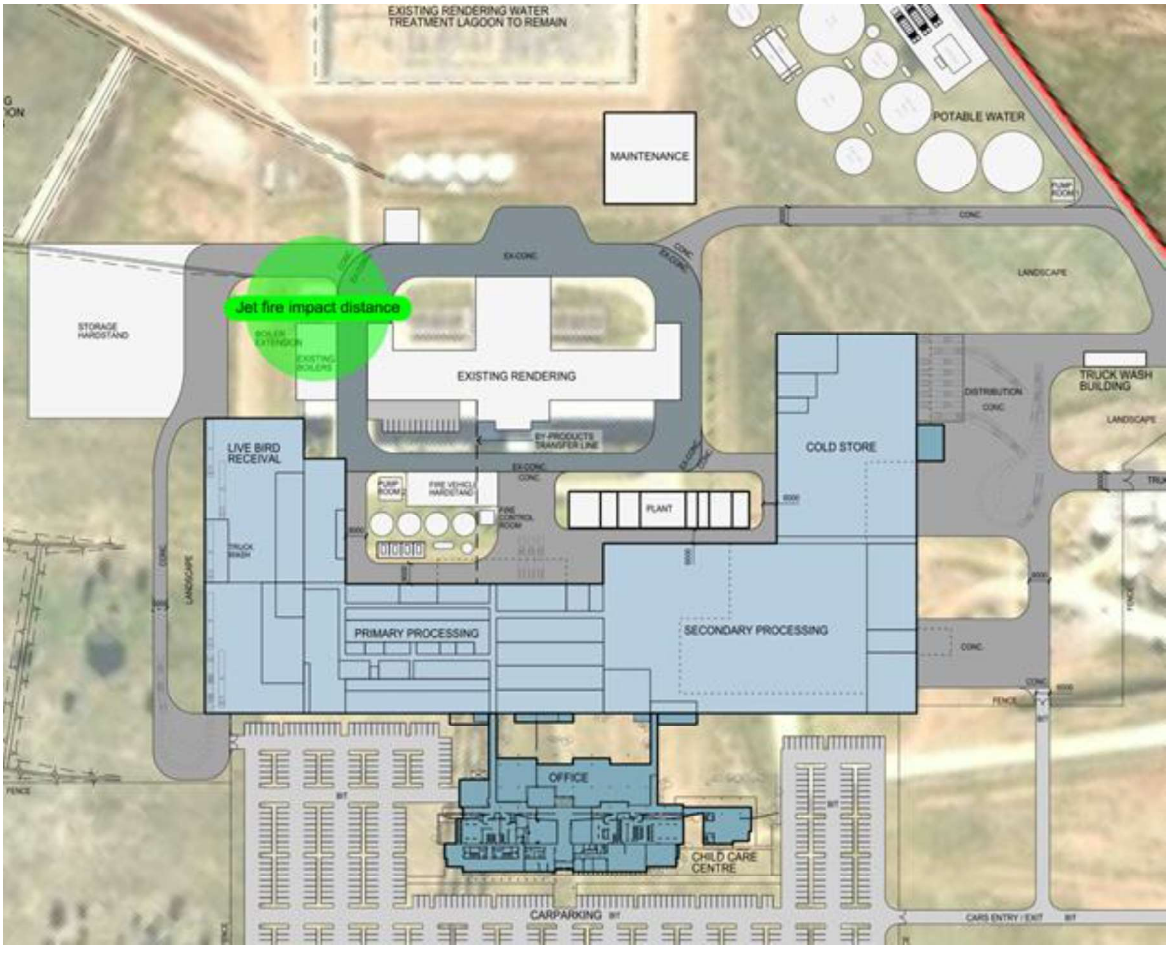


Figure 5-1: Impact from a Jet Fire

5.2 LNG Release and Ignition Causing Flash Fire or Explosion

In the event of an LNG release, a vapour cloud will form which may migrate away from the source of release and ignite. Depending upon the confinement and mass of the vapour within the cloud, it may explode or result in a flash fire. A detailed analysis has been conducted in Appendix B7 with the results summarised in Table 5-1.

A review of the impact distances shown in Figure 5-1 indicates the overpressure at 7 kPa would impact over the site boundary and would impact the childcare which may result in a fatality. Hence, this incident has been carried forward for further analysis.

The methodology developed by ICI[6] for estimating flash fire impact distances (i.e. the 70 kPa contour) does not impact over the site boundary nor the childcare. Hence, the flash fire component has not been carried forward for further analysis.

Table 5-1 – Overpressure from a Vapour Cloud Explosion

Overpressure (kPa)	Distance (m)
70	65
35	134
21	179
14	224
7	359

6 ICI Australia Engineering Pty Ltd, "Hazard Analysis Course Notes," ICI Australia Engineering Pty Ltd, 1988.

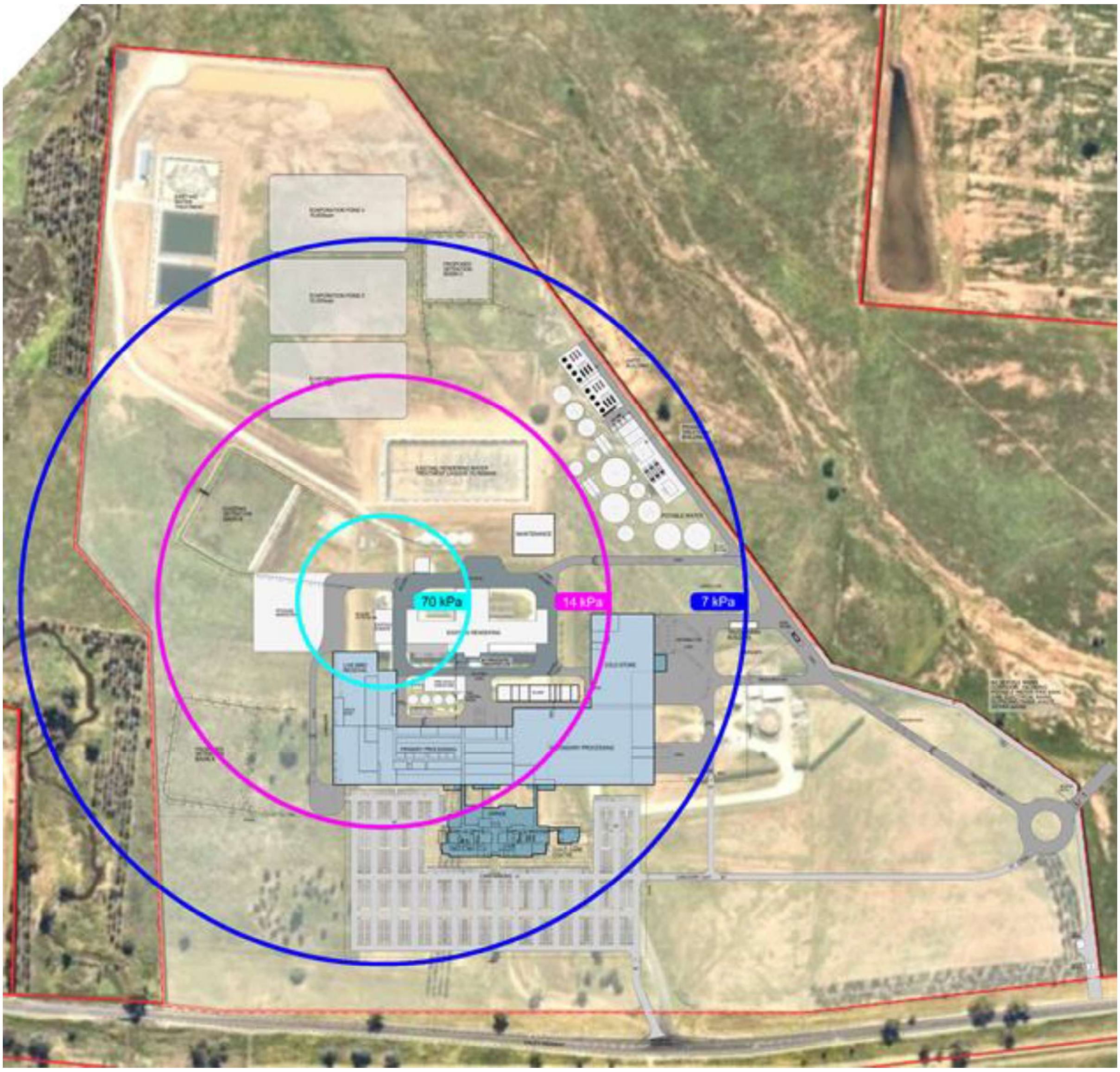


Figure 5-1 – Overpressure Contours from a Vapour Cloud Explosion

5.3 LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Delivery Tanker and BLEVE

In the event of a jet fire and impingement on the delivery tanker there is potential for the LNG in the tanker to boil escalating to a BLEVE if intervention measures fail. A detailed analysis has been conducted in Appendix B8 which indicates the diameter of the BLEVE would be 119 m and would last for 8.0 seconds. The impact distances for this incident are shown in Figure 5-2.

Similarly, to the jet fire scenario, several layers of protection are required to fail before the initiating event could occur. In addition, the jet fire would need to be impinged on the tanker before it could BLEVE which takes considerable time as the LPG must boil off such that the liquid level is below the impact point.

A review of the BLEVE impact distance indicates the fireball would not impact over the site boundary nor would it impact the childcare. Therefore, this incident has not been carried forward for further analysis.

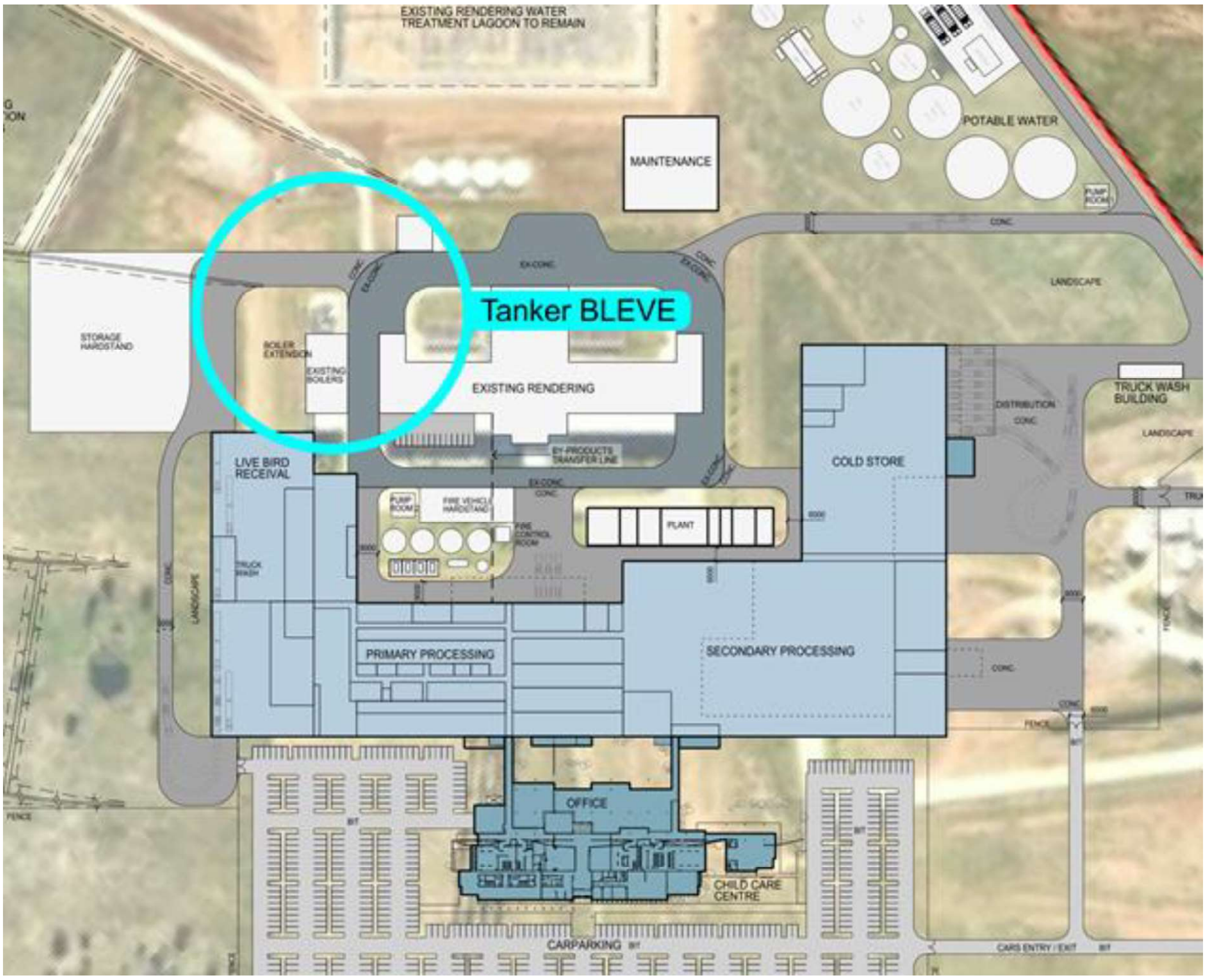


Figure 5-2 – BLEVE Impact from a Tanker

5.4 LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Delivery Tanker and BLEVE

In the event of a jet fire and impingement on the storage tank there is potential for the LNG in the tanker to boil escalating to a BLEVE if intervention measures fail. A detailed analysis has been conducted in Appendix B9 which indicates the diameter of the BLEVE would be 130.6 m and would last for 8.6 seconds. The impact distances for this incident are shown in Figure 5-3.

Similarly, to the jet fire scenario, several layers of protection are required to fail before the initiating event could occur. In addition, the jet fire would need to be impinged on the tanker before it could BLEVE which takes considerable time as the LPG must boil off such that the liquid level is below the impact point.

A review of the BLEVE impact distance indicates the fireball would not impact over the site boundary nor would it impact the childcare. Therefore, this incident has not been carried forward for further analysis.

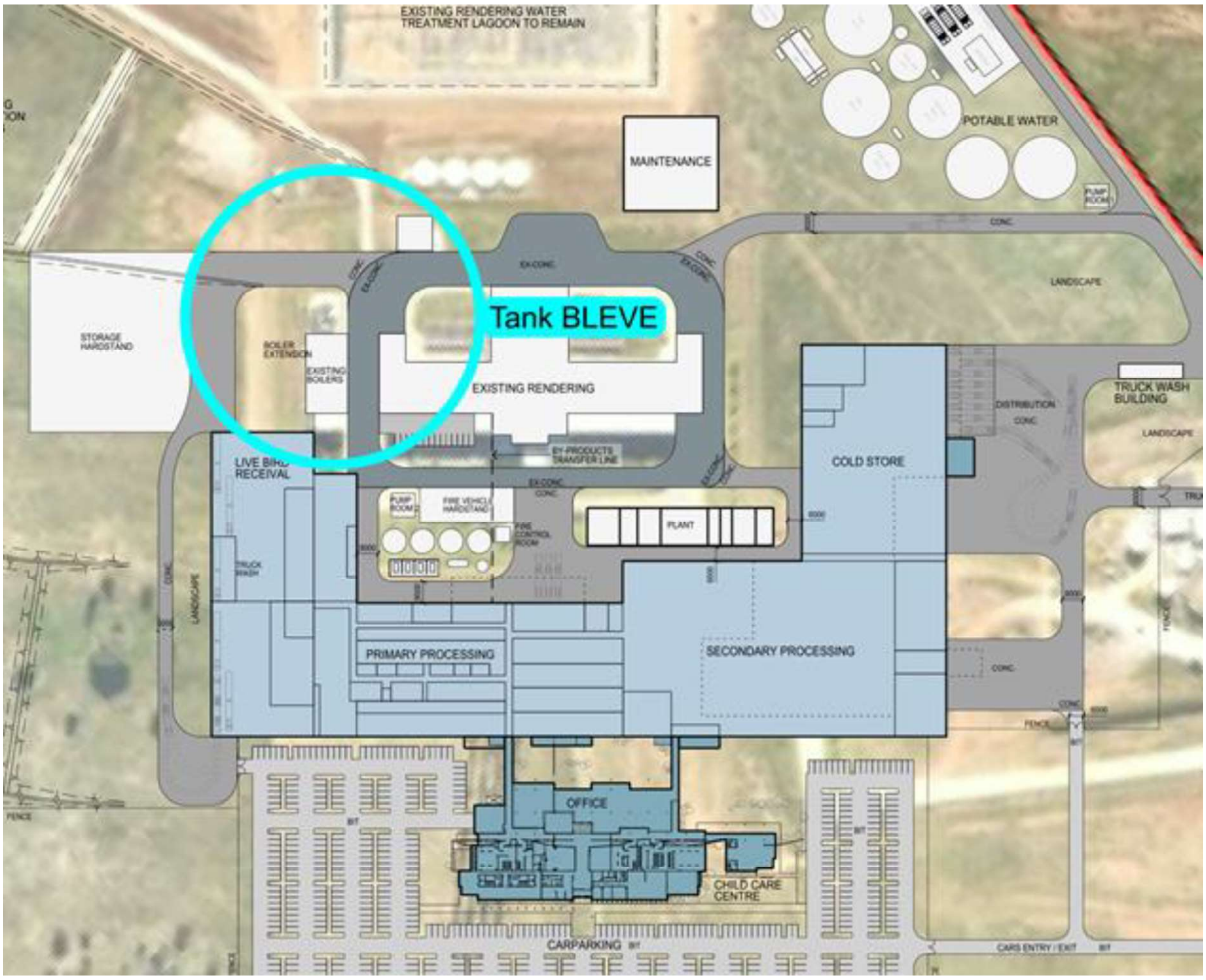


Figure 5-3 – BLEVE Impact form a Storage Tank

6.0 Frequency Analysis and Risk Assessment

6.1 Incident(s) Carried Forward for Frequency Analysis and Risk Assessment

The following incident(s) have been carried forward for further analysis:

d) LNG Release and Ignition Causing an Explosion

This incident has been assessed in the following section.

6.2 LNG Release and Ignition Causing an Explosion

Based upon the potential offsite impact and impact at the childcare, a probit analysis has been conducted on the overpressure experience at the receptors to determine whether a fatality would occur.

To estimate the probability of fatality it is necessary to review the susceptibility to personnel exposed to overpressure which may occur at the site boundary and the childcare. Tolerance to an exposure (i.e. overpressure) differs across a population which may be estimated using Probit analysis. For explosion overpressure, the Probit equation is shown in Eqn 6-1.

$$Y = K_1 + K_2 lnP \qquad \text{Eqn 6-1}$$

Where:

- K1 = 5.13
- K2 = 1.37
- P = overpressure (bar)

The value obtained from the Probit equation is then read from the graph shown in Figure 6-1. Which yields the percentage of fatality for personnel exposed to the input overpressure.

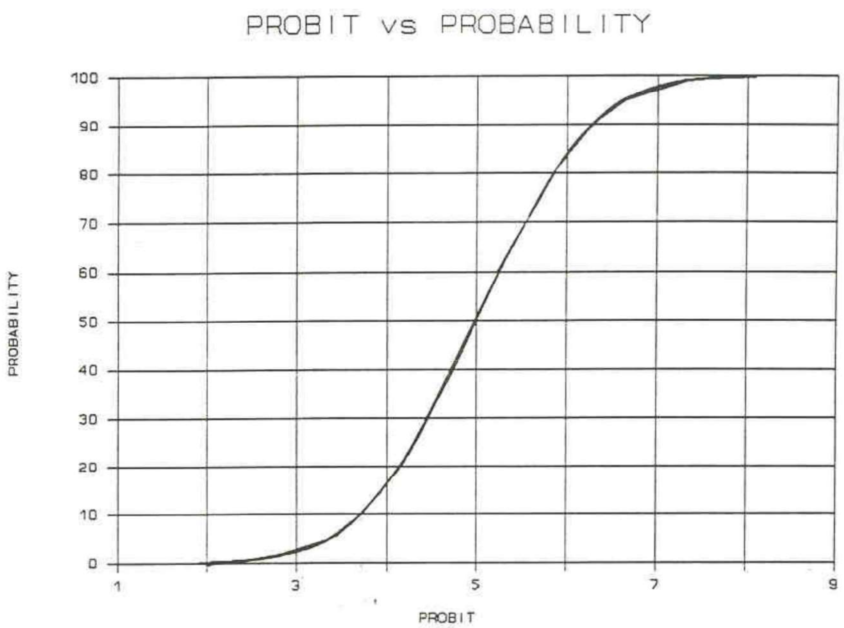


Figure 6-1 – Probit vs Probability

The distances from the childcare and the site boundary are 288 m and 237 respectively. Which when input into the model results in the overpressures displayed in Table 6-1 based upon Figure 6-2.

Table 6-1: Overpressure at Sensitive Receptors

Receptor	Distance (m)	Scaled Distance (Z)	Overpressure (kPa)
Site boundary	237	10.5	13
Childcare	284	12.8	9

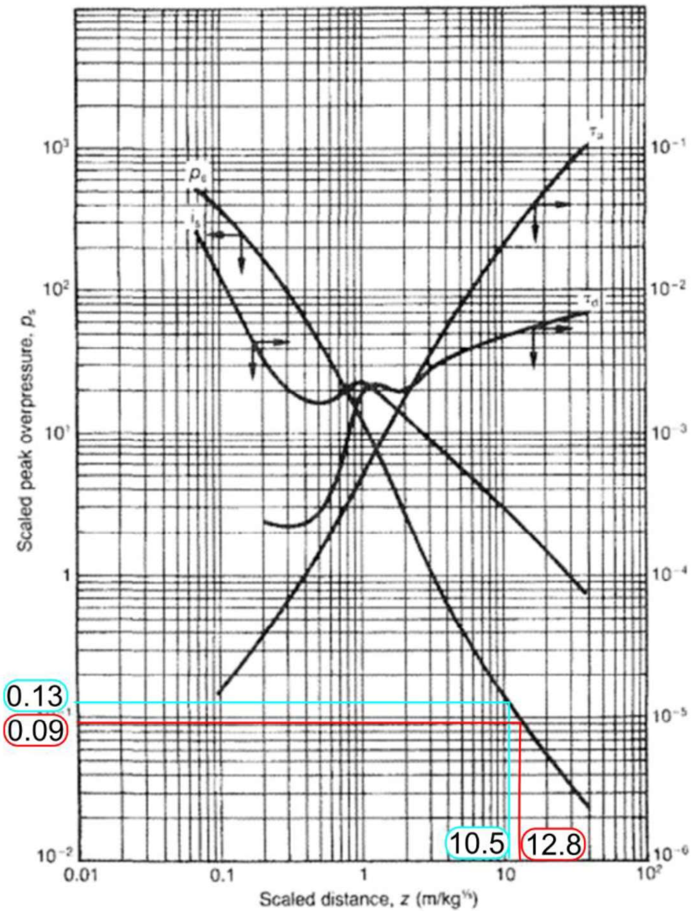


Figure 6-2: Scaled Distance vs Overpressure (bar)

Substituting the overpressures in Table 6-1 into the results in the probits and probability of fatalities as shown in Table 6-2.

Table 6-2: Probability of Fatality from VCE Overpressure

Receptor	Probit	Fatality (%)
Site boundary	2.62	0.5
Childcare	1.83	0

The probability of fatality observed at the childcare would be 0 chances pmpy based upon the probit calculation. However, the analysis is considered incredibly conservative as the calculations don't take into account the impact of the building being between the tanks and the childcare which would divert and dissipate the overpressure resulting in lower observed overpressures at the childcare than observed.

With respect to the site boundary, a 0.5% fatality risk was observed at the boundary. However, a review of the area indicates it is in a very rural location; hence, the potential for someone to be at the site boundary would be almost negligible and thus a fatality at the site boundary would not be expected to occur with lower fatality potential farther afield. Furthermore, the protection systems incorporated into the gas design limit the potential for large and uncontrolled releases which would result in the required vapour cloud mass to form the explosive overpressures calculated.

Therefore, it is considered that the probability of fatality at the site boundary is 0 pmpy.

6.3 Comparison to Risk Criteria

The NSW Department of Planning and Environment has issued a guideline on the acceptable risk criteria[7]. The acceptable risk criteria published in the guideline relates to injury, fatality and property damage. The values in the guideline present the maximum levels of risk that are permissible at the land use under assessment.

The adjacent land use would be classified as a rural / industrial site as it is restricted access and only industrial operations are permitted to occur in this area. For industrial facilities, the maximum permissible fatality risk is 50 pmpy. While the childcare is within the same location, a separate criterion of 0.5 pmpy year has been adopted due to the sensitive nature of the occupants[7].

The assessed highest fatality risk is 0 pmpy at both the site boundary and the childcare. Hence, the highest risk is within the permissible criteria and therefore all other risk points beyond the boundary would be within the acceptable criteria.

Based on the estimated injury risk, conducted in the analysis above, the risks associated with injury and nuisances at the closest sensitive receptors are not considered to be exceeded.

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

7.0 Conclusions and Recommendations

7.1 Conclusions

A hazard identification table was developed for the facility to identify potential hazards that may be present at the site as a result of operations or storage of materials. Based on the identified hazards, scenarios were postulated that may result in an incident with a potential for offsite impacts. Postulated scenarios were discussed qualitatively and any scenarios that would not impact offsite were eliminated from further assessment. Scenarios not eliminated were then carried forward for consequence analysis.

Incidents carried forward for consequence analysis were assessed in detail to estimate the impact distances. Impact distances were developed into scenario contours and overlaid onto the site layout diagram to determine if an offsite impact would occur. The consequence analysis showed that one of the scenarios (vapour cloud explosion) would impact over the site boundary and into the adjacent land use and the onsite childcare; hence, this incident was carried forward for frequency analysis and risk assessment.

The frequency analysis and risk assessment showed that the fatality rate at the subject childcare would be 0 while the fatality rate at the site boundary would be 0.5%. Given the location of the facility it would be unlikely for a person to be located at the boundary; hence, it was concluded that it would be incredibly unlikely for a fatality to occur at the site boundary. Therefore, the probability of a fatality from an LNG explosion at the site boundary is within the acceptable risk criteria.

Based on the analysis conducted, it is concluded that the risks at the site boundary are not considered to exceed the acceptable risk criteria. Hence, the facility would only be classified as potentially hazardous and would be permitted within the current land zoning for the site

7.2 Recommendations

a) The hoses for the transfer of LNG shall be inspected monthly and pressure tested annually in accordance with the Australian Dangerous Goods Code.

b) All equipment shall be inspected and tested in accordance with the Australian Dangerous Goods Code.

c) The over pressurisation shut off for the supply will be set at not more than 200 kPa.

8.0 Documents Considered

This assessment is based on the following documentation:

a) Preliminary Hazard Analysis (PHA) undertaken by SLR Consulting dated 3/08/2020

b) BOC Technical Documents for the system dated 21/07/2013

c) Annual Fire Safety Statement (AFSS) as shown in Appendix C.

d) P&ID drawings as per Table 8-1.

e) Architectural drawings by SBA Architects as per Table 8-2.

Table 8-1 – P&ID Drawings

Drawing No.	Title	Date/Issue
C505-74	LGN installations	28/12/14
C508-107	Bulk LGN Supply Systems	3/11/14
C508-108	3x VIE 80,000 LNG Tank Manifold System	3/11/14

Table 8-2 – Architectural Drawings

Drawing No.	Title	Date/Issue
SK10	Site Plan	22/06/2020

9.0 Validity & Limitations

The reader's attention is drawn to the following limitations with respect to the fire engineering assessment undertaken in this report:

a) This report is provided in accordance with the Lote Consulting Pty Ltd (hereafter referred to as "Lote") Fee Proposal and Agreement for the provision of Consulting Engineer Services executed between Lote and the Client on the subject project. No obligation in contract exists between Lote and any other party.

b) The report is limited to the assessment of BCA DtS variations identified in Section 4.2 of this report for compliance with relevant BCA Performance Requirements. With the exception of these Performance Solutions, all other fire safety aspects of the building are to comply with the BCA DtS Provisions.

c) This assessment deals with the fire safety provisions of the BCA only and does not consider amenity or non-fire related matters in the building such as health, amenity, security, energy efficiency, occupational health & safety, compliance with Disability Discrimination Act (DDA) etc., which are to be addressed by others. Consequently, the outcomes of this assessment have not been checked or verified for their fitness for purpose of any non-fire safety related matters including the ones outlined above.

d) This assessment is not a full compliance or conformance audit for any fire safety system. Therefore, operational checks of fire safety equipment, verification of construction techniques, fire resistance levels or the witnessing of fire drills or exercises are specifically excluded from the scope of this assessment. The operational status of systems, items of equipment and staff training should be addressed as part of the inspection, commissioning, enforcement, maintenance, testing, training and management procedures for the building.

e) This assessment will be consistent with the objectives and limitations of the BCA and therefore specifically excludes arson (other than as a source of initial ignition), multiple ignition sources, acts of terrorism, protection of property (other than adjoining property), business interruption or losses, personal or moral obligations of the owner/occupier, reputation, environmental impacts, broader community issues etc.

f) Arson has been shown statistically to contribute to fire. This report has addressed the incidence of minor forms of arson as a single ignition source. However major arson involving accelerants and/or multiple ignition sources are beyond the scope of this assessment and have been excluded.

g) Egress and fire safety provisions for persons with disabilities have only been considered to the same degree as the BCA DtS Provisions.

h) Reports marked 'Draft' are subject to change and Lote accepts no liability pending release of the final version of the report.

i) The design concepts outlined in this report are for a complete and operational building and do not address protection of the building during construction, renovation or demolition.

j) Any change in building, occupant or fuel conditions from those considered in this report, or any deviation from the implementation of the fire safety strategy outlined in this brief, may result in outcomes not anticipated by the proposed strategy and should be reviewed.

k) Evaluation of the expected level of fire induced property damage with respect to the contents and building structure is specifically excluded.

l) The recommendations in this assessment are based on information provided by others. Lote has not verified the accuracy and/or completeness of this information and accepts no responsibility or liability for any errors or omissions which may be incorporated into this assessment as a result.

m) It is considered that the scope of works arising from this report and limitations of this report are read, understood and implemented. Lote shall be contacted in relation to any queries on the report content and takes no responsibility for misinterpretation of the report content by others.

n) The recommendations, data and methodology documented in this assessment are based on the documentation in Section 8.0 and specifically apply to the subject building / project and must not be utilised for any other purpose. Any modifications or changes to the building, fire safety management system, or building usage from that described may invalidate the findings of this assessment necessitating a re-assessment. No warranty is intended or implied for use by any other third party and no responsibility is undertaken to any other third party for material contained herein.

o) The scope of this report is limited to the assessment in this report. Lote has not approved or verified any base building Performance Solutions or assessments.

p) The architectural and engineering drawings referenced or listed in this report have been utilised for purposes of formulating and assessing the Performance Solutions nominated in this Report. Lote have not reviewed the drawings for compliance with the BCA, Australian Standards or the Fire Engineering Report.

Appendix A – Hazard Identification

ID	Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
1	LNG Tanks	• Releases from pipework due to corrosion, flange leaks, hose/pump leaks, weld failure, operator error, maintenance error, mechanical damage (e.g. tanker impact on fill point) etc. • Overfilling of tank due to operator error (incorrect tank reading) • Overfilling of tanker due to equipment fault or procedures not followed (e.g. leaving operation unattended). • Hose failure or coupling failure or coupling not properly engaged during transfers due to mechanical damage or undetected wear and tear or operator error. • Drive away with hoses attached.	• Minor leak (5 mm hole) • Major leak (50 mm hole) • If ignition then: ○ Flash fire, jet fire, pool fire, VCE or BLEVE (tanker), possible explosion if enters drains, and potentially hazardous heat radiation, direct fire involvement, and/or overpressure/ projectiles. • Potential fire propagation to adjacent sites.	• Tanks designed per the following standards: ○ AS3961 – The storage and handling of liquefied natural gas ○ AS1210 – Unfired pressure vessels ○ AS4041 – Pressure piping (on pad pipework, vaporiser) ○ AS5601 – Gas installations (gas pipeline) ○ AS1271 – Safety valves, other valves, liquid level gauges and other fittings for ○ boilers and unfired pressure vessels ○ AS1345 – Identification of the contents of pipes, conduits and ducts ○ AS/NZS3000 – Electrical installations ○ AS/NZS60079.10 – Classification of Areas – Explosive Gas Atmospheres ○ AS/NZS60079.14 – Explosive atmospheres, electrical installations design, selection ○ and erection ○ AS1768 – Lightning Protection • Tank and associated pipework/fitting will be pressure tested in accordance with the requirements of the pressure vessels code

ID	Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
				• Ignition source control including earthing to prevent static sparks. • Hoses tested annually as per AS/NZS 1596:2014 and the ADG[8] • Excess flow valves installed in pipework. • Valves to fill point closed until air connected to truck. • Valves shut on breaking of air connection to truck. • All staff including contract drivers will be trained in the specific transfer operations at the site. • Tanker fitted with Emergency Shut Down • Excess flow valve on tanker • Manual shutdown valve • Non-return valve on delivery line • Emergency Shutdown on delivery line • Manual valve on delivery line • Overfill protection device • Fusible link on tanker and vessel

8 Road Safety Council, The Australian Code for the Transport of Dangerous Goods by Road and Rail Edition 7.4, Canberra: Road Safety Council, 2016.

Appendix B – Consequence Analysis

B1. Incident Carried Forward for Consequence Analysis

The following incidents have been carried forward for consequence analysis:

a) LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire

b) LNG Release and Ignition Causing Flash Fire or Explosion

c) LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Delivery Tanker and BLEVE

d) LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Tank and BLEVE

B2. Jet Fire Modelling

The flow rate of a liquid from a hole may be calculated from Equation 1[9].

$$m = C_d A(2\rho\Delta P)^{0.5}$$ Equation 1

Where:

- m = Mass flow rate (kg/s)
- C_d = Discharge coefficient (0.6 for irregular holes)
- A = area of the orifice (m^2)
- ρ = Density of the material (kg/m^3)
- ΔP = Pressure difference across the orifice (Pa).

The flame length and width, as a result of a release, can be estimated from the empirical formula published by Lees[10]. The equations for the length and width are shown in Equation 2 and Equation 3.

$$L = 9.1{G_L}^{0.5}$$ Equation 2

Where:

- L = Length (m)
- G_L = Mass flow rate (kg/s)

$$W = 0.25L$$ Equation 3

Where:

- W = Width (m)
- L = Length (m)

B3. BLEVE Modelling

The diameter of the fireball and the duration of the BLEVE may be estimated using the following formulae[9]:

$$D = 6.48m^{0.325}$$ Equation 4

$$t = 0.852m^{0.25}$$ Equation 5

9 I. R. R. Cameron, Process Systems Risk Management, Sydney: Elsevier Academic Press, 2005.
10 F. P. Lees, Loss Prevention in the Process Industries, London: Butterworth-Heinemann, 2005.

Where:

- D = diameter of the fire ball (m)
- m = mass of LNG in the tank (kg)
- t = duration of the BLEVE (seconds)

B4. Overpressure Modelling

To estimate the explosion overpressure, the TNT equivalent method is used. This method equates the quantity of a material involved in the explosion to an equivalent quantity of TNT. The equivalent mass of TNT is estimated using Equation 6.

$$W_{TNT} = \alpha\left(\frac{WH_c}{H_{TNT}}\right)$$ Equation 6

The other parameters required in this equation are;

- W = mass of fuel in the vapour cloud (kg)
- H_c = heat of combustion of the fuel (kJ/kg)
- H_{TNT} = TNT blast energy (4,600 kJ/kg)[11])
- a = explosion efficiency (conservatively estimated to be 0.04 for hydrocarbons[11])

Overpressure is now calculated using a scaled distance curve, based on actual distance from the blast and the TNT equivalent, this is given Equation 7.

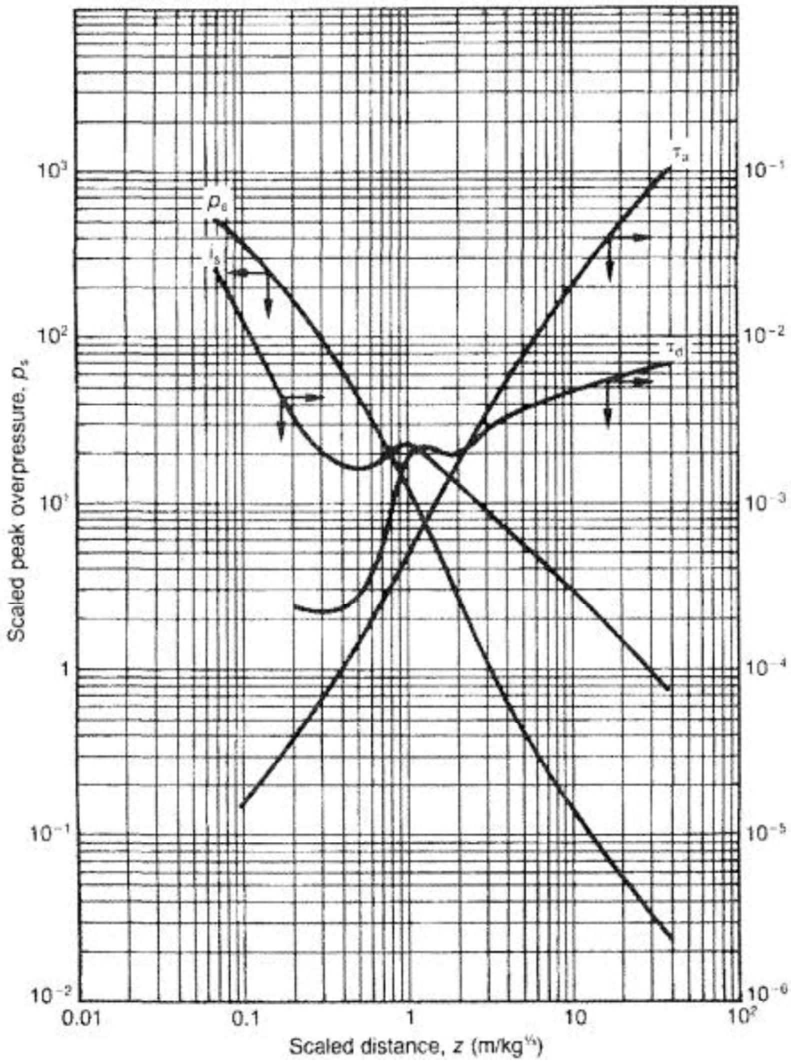
$$Z = \frac{R}{(W_{TNT})^{\frac{1}{3}}}$$ Equation 7

Where:

- Z Scaled distance (unit less)
- R Distance from the blast (m)
- W_{TNT} Equivalent weight of TNT (kg)

Appendix Figure 1 shows the scaled distances and pressures which is used to determine the impact distance at a specific overpressure.

11 ICI Australia Engineering Pty Ltd, "Hazard Analysis Course Notes," ICI Australia Engineering Pty Ltd, 1988.



Appendix Figure 1 – Scaled Parameter plots for TNT Explosions[12]

B5. Flash Fire Modelling

ICI Engineering developed a method for estimating the impact distance of a flash fire by linking the impact to the 70 kPa overpressure as if the vapour cloud exploded (noting that for a flash fire an explosion with overpressure does not occur)[13]. The methodology used to estimate overpressure as shown in Appendix B4 is used with the distance selected at 70 kPa to estimate the impact distance of the flash fire boundary.

B6. LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire

A hose rupture could occur and ignite which would result in a jet fire. To estimate the dimensions of a jet fire, the flow rate of the liquid from the hose must be estimated. The following data was input into Equation 1 to estimate the flow rate through the ruptured hose:

- C_d = Discharge coefficient (0.6 for irregular holes)
- A = 50 mm hose = $\frac{\pi D^2}{4} = \frac{\pi \times 0.050^2}{4} = 0.002\ m^2$
- ρ = 430 kg/m^3
- ΔP = 5 bar = 500,000 Pa

12 I. Cameron and R. Raman, Process Systems Risk Management, San Diego: Elsevier, 2005.
13 ICI Australia Engineering Pty Ltd, "Hazard Analysis Course Notes," ICI Australia Engineering Pty Ltd, 1988.

Substituting the information into Equation 1 gives a flow rate of 24.4 kg/s.

$$m = 0.6 \times 0.002 \times (2 \times 430 \times 500000)^{0.5} = 24.4\ \frac{kg}{s}$$

Now, a liquid LNG release would be too fuel dense to ignite as it would be above the Upper Explosive Limit (UEL) so the only portion that could ignite would be the liquid that vapourises upon release. Assuming a flash fraction of 50%, the vapour flow rate from the release would be 0.5 x 24.4 = 12.2 kg/s.

Substituting the mass flow rate of vapour into Equation 3 gives a jet fire length of 31.8 m.

$$L = 9.1 \times 12.2^{0.5} = 31.8\, m$$

B7. LNG Release and Ignition Causing Flash Fire or Explosion

If an uncontrolled LNG release occurs it will result in a vapour cloud which may cause a flash fire or explosion if ignited. The tankers which fill the LNG tanks have a volume of 80,000 L or 34,400 kg using a density of 430 kg/m^3. The LNG will be released with a portion flashing to the gaseous state with the unflashed fraction forming an LNG pool which will begin to evaporate further enhancing the cloud. The cold liquid LNG will evaporate relatively slowly due to the thermal mass of the liquid; hence, it has been assumed the vapour cloud will be composed of the 50% flashed fraction plus an additional 25% of the evaporated pool in the worst case once the cloud contacts an ignition source. Therefore, there is 75% of the released mass in the vapour cloud 0.75 x 34,400 = 25,800 kg.

The overpressure from the ignited vapour cloud has been estimated using Equation 6 and the following inputs:

- W = mass of fuel in the vapour cloud (25,800 kg)
- H_c = heat of combustion of the fuel (50,200 kJ/kg[14])
- H_{TNT} = TNT blast energy (4,600 kJ/kg) [15]
- a = explosion efficiency (conservatively estimated to be 0.04 for hydrocarbons[15])

$$W_{TNT} = 0.04\left(\frac{25{,}800 \times 52{,}000}{4{,}600}\right) = 11{,}262\ kg$$

Using Equation 7 and the scaled parameters shown in Appendix Figure 1 the impact distances for the key overpressure values can be obtained (i.e. selecting the pressure and reading Z from the figure and using this in Equation 7 to obtain the impact distance).

Provided in Appendix Table 1 is a summary of the impact distance for each of the overpressures of interest.

Appendix Table 1 – Overpressure from an LNG Explosion

Overpressure (kPa)	Distance (m)
70	85
35	134
21	179
14	224
7	359

B8. LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Delivery Tanker and BLEVE

In the event of a jet fire and impingement on the delivery tanker there is potential for the LNG in the tanker to boil escalating to a BLEVE if intervention measures fail. It is assumed that impingement will occur at the 30% fill level

14 Engineering Toolbox, "Heat of Combustion," 2017. [Online]. Available: https://www.engineeringtoolbox.com/standard-heat-of-combustion-energy-content-d_1987.html . [Accessed 23 October 2019].
15 ICI Australia Engineering Pty Ltd, "Hazard Analysis Course Notes," ICI Australia Engineering Pty Ltd, 1988.

of the tanker and that the tanker holds a maximum 60,000 L. A BLEVE will only occur once the liquid level falls below the impingement level; hence, the maximum volume of LNG that could be involved in the BLEVE is 18,000 L. As noted, the density of LNG is 430 kg/m^3; therefore, the mass of LNG involved in the BLEVE is 7,740 kg.

Inputting the mass into Equation 4 and Equation 5 yields an impact diameter of 119 m and a resonance time of 8 seconds.

$D = 6.48 \times 9{,}144^{0.325} = 119\ m$

$t = 0.852 \times 9{,}144^{0.25} = 8\ s$

B9. LNG Unloading Incident, Hose Rupture, LNG Release, Ignition and Jet Fire and Impact on LNG Tank and BLEVE

In the event of a jet fire and impingement on the delivery tanker there is potential for the LNG in the tanker to boil escalating to a BLEVE if intervention measures fail. It is assumed that impingement will occur at the 30% fill level of the tank which holds a maximum 80,000 L. A BLEVE will only occur once the liquid level falls below the impingement level; hence, the maximum volume of LNG that could be involved in the BLEVE is 24,000 L. As noted, the density of LNG is 430 kg/m^3; therefore, the mass of LNG involved in the BLEVE is 10,320 kg.

Inputting the mass into Equation 4 and Equation 5 yields an impact diameter of 130.6 m and a resonance time of 8.6 seconds.

$D = 6.48 \times 10{,}320^{0.325} = 130.6\ m$

$t = 0.852 \times 10{,}320^{0.25} = 8.6\ s$

Appendix C – Annual Fire Safety Statement

Fire Safety Statement

Part 9 of the Environmental Planning and Assessment Regulation 2000

NSW GOVERNMENT

Please note:

Information to assist building owners to complete each section of the statement is provided on pages 3, 4 and 5.

Section 1: Type of statement

This is (mark applicable box): ☒ an annual fire safety statement (complete the declaration at Section 8 of this form)

☐ a supplementary fire safety statement (complete the declaration at Section 9 of this form)

Section 2: Description of the building or part of the building

This statement applies to: ☒ the whole building ☐ part of the building

Address

1154 GUNNDEDAH ROAD, WESTDALE NSW 2340

Lot No. (if known)	DP/SP (if known)	Building name (if applicable)
100	1094741	BAIADA

Provide a brief description of the building or part (building use, number of storeys, construction type etc)

RENDERING PLANT WITH ASSOCIATED OFFICES AND BOILER HOUSE

Section 3: Name and address of the owner(s) of the building or part of the building

Name

BAIADA (TAMWORTH) PTY LTD

Address

1154 GUNNEDAH ROAD, TAMWORTH NSW 2340

Section 4: Fire safety measures

Fire safety measure	Minimum standard of performance	Date(s) assessed	CFSP *
AUOTMATIC FIRE DETECTION AND ALARM SYSTEMS	BCA 2013 CLAUSE E2.2, AS1670.1-2004, AS1670.4-2004	16/01/2020	RF
EMERGENCY LIGHTING	BCA 2013 CLAUSE E4.2 AND AS2293.1-2005	16/01/2020	RF
EXIT SIGNS	BCA 2013 CLAUSES E4.5, E4.6 & E4.8 & AS2293.1-2005	16/01/2020	RF
FIRE HOSE REEL SYSTEMS	BCA 2013 CLAUSE E1.4, AS2441-2005	16/01/2020	RF
FIRE HYDRANT SYSTEMS	BCA 2013 CLAUSE E1.3 AS2419.1-2005	16/01/2020	RF
PERIMETER VEHICLE ACCESS FOR EMERGENCY VEHICLES	BCA CLAUSE C2.3, C2.4	16/01/2020	RF
PORTABLE FIRE EXTINGUISHERS	BCA CLAUSE E1.6, AS2444-2001	16/01/2020	RF
GASEOUS FIRE EXTINGUISHING SYSTEMS	AS4214-2002	20/02/2020	RF

* See notes on page 4 about how to correctly identify a Competent Fire Safety Practitioner (CFSP).

Section 5: Inspection of fire exits and paths of travel to fire exits (Part 9 Division 7)

Section 8: Annual fire safety statement declaration

- The person completing this section is the person who is issuing the annual fire safety statement in accordance with clause 175 of the Regulation and is the same person as detailed in section 7. The person issuing the statement must identify if they are the owner or the owner's agent.
- In issuing the statement, the building owner or agent is not declaring that each fire safety measure meets the minimum standard of performance, but rather that each fire safety measure has been assessed, and was found by a CFSP to be capable of performing to that standard, as listed in section 4. In performing this function, the building owner or owner's agent could obtain documentation from each CFSP to verify that the standard of performance has been met, prior to completing the form and issuing the statement.
- The person who issues the statement by completing section 8 or section 9 of the form must not be a CFSP who was involved in the assessment of any of the fire safety measures, or inspection of the building for the purposes of the statement. This is to ensure that building owners, who are ultimately responsible, remain engaged in the fire safety statement process.

Section 9: Supplementary fire safety declaration

- The person completing this section is the person who is issuing the supplementary fire safety statement in accordance with clause 178 of the Regulation and is the same person as detailed in section 7. The person issuing the statement must identify if they are the owner or the owner's agent.
- The information provided above in relation to section 8 on what the owner is declaring also applies to a supplementary fire safety statement.

- For supplementary fire safety statements, the table in section 4 must list each of the relevant critical fire safety measures that apply to the building or part and the relevant standard of performance. The date(s) on which these measures were assessed and inspected must be within 1 month prior to the date the supplementary fire safety statement is issued.
- The accreditation number of the CFSP who assessed a fire safety measure listed in section 4 must be nominated against the relevant measure(s) in the column titled 'CFSP'. If the CFSP is not required to be accredited, the name of the CFSP must be listed. Further information on the accreditation number is provided at section 6.

Section 5: Inspection of fire exits and paths of travel to fire exits (Part 9 Division 7)

- This section applies only to an annual fire safety statement.
- The purpose of this section is to identify that a CFSP has inspected the fire exits, fire safety notices, doors relating to fire exits and paths of travel to fire exits in the building or part of the building and found there has been no breach of Division 7 of Part 9 of the Regulation.
- The table in section 5 must detail the parts of the building that were inspected. The date(s) of the inspection(s) must be within the 3 months prior to the date the annual fire safety statement is issued.
- The accreditation number of the CFSP who inspected the whole or part of the building listed in section 5 must be nominated against the relevant part in the column titled 'CFSP'. If the CFSP is not required to be accredited, the name of the CFSP must be listed. Further information on the accreditation number is provided at section 6.

Section 6: Name and contact details of competent fire safety practitioners (CFSPs)

- A CFSP is a person engaged by the building owner(s) to undertake the assessment of fire safety measures in section 4 and the inspection of the buildings exit systems in section 5 (for an annual fire safety statement). Under clause 167A of the Regulation, the building owner(s) must form the opinion in writing that the person is a CFSP unless the person is required to be accredited (see below).
- The purpose of this section is to record the name and contact details of each CFSP who assessed a fire safety measure listed in section 4 or inspected the building or part of the building as specified in section 5.
- Each CFSP listed in the table must also sign the fire safety statement. Alternatively, a CFSP could provide the building owner or agent with a separate signed document to endorse the relevant part of the fire safety statement.
- An accreditation scheme for CFSPs is expected to start in January 2020.
- After the accreditation scheme begins, CFSPs will need to be selected from a register of recognised practitioners. The accreditation number of each relevant CFSP must be listed on the form. Until the accreditation scheme commences, or if a practitioner is of a class of persons that is not required to be accredited under clause 167A of the Regulation, there is no requirement to include an accreditation number on the form.
- Further information about the accreditation scheme can be found at www.fairtrading.nsw.gov.au.

Section 7: Name and contact details of the person issuing the statement

- The purpose of this section of the form is to detail the name and contact details of the person who is issuing the statement i.e. the person who completes and signs section 8 or section 9 of the form. This could be the owner(s) of the building or a nominated agent of the owner(s).
- Where a person issues the statement on behalf of an organistation (as the owner of the building), the name of the organisation and the title/position of the person must be provided. The person issuing the statement as a representative of the organisation must have the appropriate authority to do so.
- Where a person issues the statement on behalf of the owner(s) (as the owner's agent), this person must have the appropriate authority from the building owner(s) to undertake this function.
- In the case of a building with multiple owners, one owner may issue the statement, however each of the other owners must authorise the owner who issues the statement to act as their agent.
- The person issuing the statement must not be a CFSP who is listed in section 6. This recognises the different roles and responsibilities for building owner(s) and CFSPs in the fire safety statement process. This is important because the Regulation makes building owners responsible for declaring that fire safety measures have been assessed and the building inspected (for the purposes of section 5) by a CFSP. This ensures that building owners, who are ultimately responsible, remain engaged in the fire safety statement process.
- In addition, until an accreditation scheme commences and accredited practitioners are recognised as CFSPs under the Regulation, or if a practitioner is not required to be accredited, only the building owner(s) can determine that a person is competent to perform the fire safety assessment functions. The building owner(s) are also responsible for ensuring that essential fire safety measures are maintained in accordance with clause 182 of the Regulation. An agent cannot be made responsible for these requirements.

1154 GUNNDEDAH ROAD, WESTDALE NSW 2340

Fire Safety Statement

Information to help building owners complete the Fire Safety Statement form

NSW GOVERNMENT

Please note:

The following information has been provided to help building owners complete the fire safety statement template and does not comprise part of the form. The following pages do not have to be displayed in the building and need not be submitted to the local council and the Commissioner of Fire and Rescue NSW.

General

- Please print in CAPITAL LETTERS and complete all relevant sections in full.
- A reference to 'the Regulation' is a reference to the *Environmental Planning and Assessment Regulation 2000.*
- A 'CFSP' is a competent fire safety practitioner recognised under clause 167A of the Regulation.
- The completed fire safety statement form must be submitted to both the local council and Fire and Rescue NSW.
- Please contact your local council for further information about how to submit the completed statement.
- Completed statements can be emailed to Fire and Rescue NSW at afss@fire.nsw.gov.au. Alternately, statements can be posted to Fire and Rescue NSW, Locked Bag 12, Greenacre NSW 2190. For further information about this process, please visit the 'Lodge a fire safety statement' page at www.fire.nsw.gov.au.
- As soon as practicable after issuing the fire safety statement, the building owner must display a copy (together with a copy of the current fire safety schedule) in a prominent location within the building.
- Further information about building fire safety is available on the 'Fire safety' page of the Department's website at www.planning.nsw.gov.au.

Section 1: Type of statement

- Mark the applicable box to identify if the statement being issued is an annual fire safety statement or a supplementary fire safety statement.
- An annual fire safety statement is issued under clause 175 of the Regulation and relates to each essential fire safety measure that applies to the building.
- A supplementary fire safety statement is issued under clause 178 of the Regulation and relates to each critical fire safety measure that applies to the building.

Section 2: Description of the building or part of the building

- Mark the applicable box to identify whether the statement relates to the whole building or part of the building.
- In addition to the address and other property identifiers, a brief description of the building or part is to be provided. This could include the use(s) of the building (e.g. retail, offices, residential, assembly, carparking), number of storeys (above and/or below ground), construction type or other relevant information.
- If the description relates to part of a building, the location of the part should be included in the description.

Section 3: Name and address of the owner(s) of the building or part of the building

- Provide the name and address of each owner of the building or part of the building.
- The owner of the building or part of the building could include individuals, a company, or an owner's corporation.

Section 4: Fire safety measures

- The purpose of this section is to identify all of the fire safety measures that apply to a building or part of a building.
- Fire safety measures include both essential fire safety measures and critical fire safety measures. They include items such as portable fire extinguishers, fire hydrants, fire sprinklers, fire detection and alarm systems and lightweight construction.
- Essential fire safety measures are those fire safety measures which are assessed on an annual basis, while critical fire safety measures are those which are required to be assessed at more regular intervals (as detailed on the fire safety schedule). These terms are defined in clause 165 of the Regulation.
- For annual fire safety statements, the table in section 4 must list each of the essential fire safety measures that apply to the building or part of the building and the relevant standard of performance. The date(s) on which these measures were assessed and inspected must be within the 3 months prior to the date the annual fire safety statement is issued.

Fire Safety Statement

Information to help building owners complete the Fire Safety Statement form

Note:

A current fire safety schedule for the building must be attached to the statement in accordance with the Regulation.

Fire Safety Statement

Part 9 of the Environmental Planning and Assessment Regulation 2000

[redacted]

Part of the building inspected	Date(s) inspected	CFSP *

* See notes on page 4 about how to correctly identify a Competent Fire Safety Practitioner (CFSP).

Section 6: Name and contact details of competent fire safety practitioners (CFSPs)

Full name	Phone	Email	Accreditation No.*	Signature
RODNEY FENSBO	1300896499	rod@dynamicfire.com.au	IT44478	

* Where applicable – see notes on page 4 for further information.

Section 7: Name and contact details of the person issuing this statement

Full name

Paul Grima

Organisation (if applicable)

Baiada Poultry Pty Ltd

Title/Position (if applicable)

Site Manager - Oakburn

Phone

0428 118 150

Email

Paul_Grima@baiada.com.au

The person issuing the statement must not be a CFSP listed in section 6.

Section 8: Annual fire safety statement declaration

I, Click here (insert full name) being the: ☒ owner ☐ owner's agent

declare that:

a) each essential fire safety measure specified in this statement has been assessed by a competent fire safety practitioner and was found, when it was assessed, to be capable of performing:

  i. in the case of an essential fire safety measure applicable by virtue of a fire safety schedule, to a standard no less than that specified in the schedule, or

  ii. in the case of an essential fire safety measure applicable otherwise than by virtue of a fire safety schedule, to a standard no less than that to which the measure was originally designed and implemented, and

b) the building has been inspected by a competent fire safety practitioner and was found, when it was inspected, to be in a condition that did not disclose any grounds for a prosecution under Division 7 of Part 9 of the Regulation.

Owner/Agent Signature

Paul Simon Camilleri

Date issued

30-03-2020

Section 9: Supplementary fire safety statement declaration

I, Click here (insert full name) being the: ☐ owner ☐ owner's agent

declare that each critical fire safety measure specified in the statement has been assessed by a competent fire safety practitioner and was found, when it was assessed, to be capable of performing to at least the standard required by the current fire safety schedule for the building for which this statement is issued.

Owner/Agent Signature

Date issued