Cotton Seed Distributors Ltd

Preliminary Hazard Assessment

CDM Smith

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Preliminary Hazard Analysis

8 July 2016

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Document History and Status

Revision	Date Issued	Reviewed By	Approved By	Date Approved	Revision Type
A	29 June 2016	C Marlowe	M Weston	30 June 2016	Draft
B	6 July 2016	M Weston	M Weston	6 July 2016	Final Draft
C	8 July 2016	M Weston	M Weston	8 July 2016	Final Draft 2

Distribution of Copies

Version	Date Issued	Quantity	Electronic	Issued To

Printed:	8 July 2016
Last Saved:	8 July 2016 03:04 PM
File Name:	RPT PHA Cotton Processing Distributors 6072016 Final Draft.docx
Author:	Miranda Weston
Project Manager:	Miranda Weston
Client:	Cotton Seed Distributors Ltd
Document Title:	SEPP 33 Preliminary Hazard Assessment
Document Version:	Final
Project Number:	BES160264.01

Executive Summary

CDM Smith Australia Pty Ltd (CDM Smith) has been engaged by Cotton Seed Distributors (CSD) to prepare a Preliminary Hazard Assessment (PHA) for the proposed local development to refurbish and upgrade their current cotton seed processing facility at 2952 Culgoora Road, Wee Waa in New South Wales.

A PHA is required. A review against the State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP 33) showed that the proposed hazardous material inventory exceed the screening thresholds for LPG and hydrochloric acid and as such the methodology in the NSW Department of Planning and Environment's guidelines, Hazardous Industry Planning Advisory Paper (HIPAP) No 6, Hazard Analysis was followed for this study. Risk criteria from HIPAP No 4 - Risk Criteria for Land Use Planning are adopted for the risk assessment.

A number of scenarios were identified based on the process design and industry knowledge which included:

- Large spill from the hydrochloric acid tank into the bunded area;
- Moderate spill during the unloading and filling of the tank into a bunded area;
- A LPG release from three various sized holes resulting in toxic clouds and jet fires; and
- An explosion of the LPG tank.

Consequence analysis involved qualitative and /or quantitative review of the identified hazardous scenarios to estimate the potential to cause injury/fatality. Consequence calculations were carried out using the Areal Locations of Hazardous Atmospheres (ALOHA) program, which is the air modelling element of CAMEO, a program suite that assesses the health and safety impacts of emergency releases.

Two scenarios were found to have possible injury and irritation consequences which could occur offsite and impact the population. The frequency of these events occurring were analysed using industry data and were found to comply with all NSW land use planning risk criteria as published in HIPAP No 4.

This was a highly conservative assessment and recommendations for safety controls in the design, operation and emergency management are provided to further reduce the offsite risk to as low as reasonable practical.

Section 1 Introduction

1.1 Background

Cotton Seed Distributors Limited (CSD) have submitted a local development application pursuant to Section 91 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to redevelop a cotton seed processing plant. The cotton seed processing plant is located at 2952 Culgoora Road, Wee Waa. The proposal incorporates industrial processing components involving dangerous goods (Liquid Petroleum Gas (LPG) and Hydrochloric Acid (HCl)) to process the cotton seed.

1.2 Study Objective

The objective of the study was to undertake a Preliminary Hazard Analysis (PHA) of the processing plant in accordance with the guidelines for PHA by the NSW Department of Planning and Environment (DP&E) to evaluate offsite risk levels. The aim of the report is to:

- Document our preliminary risk screening efforts;
- Provide a PHA assessment of the hazards and risks associated with the proposed facility;
- Determine the risk levels associated with the proposed facility;
- Provide guidance and recommendations for mitigation of hazards; and
- Compare the calculated risk levels to the "As Low As Reasonably Practicable" (ALARP) criteria.

1.3 Study Scope

The scope of the study includes:

- Cotton seed processing activity; and
- Chemical storage and handling.

This PHA has been prepared with reference to *State Environmental Planning Policy* (SEPP) 33, and in accordance with the NSW DP&E's Hazardous Industry Planning Advisory Papers (HIPAPs) No 4 - Risk Criteria and No 6 - Hazard Analysis.

1.4 Limitations and Exclusions

The PHA does not cover:

- Vehicle movements within the site;
- Transport of hazardous materials to and from site; and
- Onsite or employee risk or health or safety.

The design of the proposal is preliminary and based on concept designs. Hence the PHA is based on proposed inventories and is a conservative estimate of the hazardous risk.

Section 2 Project Description

2.1 The Proposal

CSD have identified a need to upgrade their production on the existing site utilising existing physical infrastructure and modernising the existing facility to increase efficiency and production periods. The existing administration building, laboratory and parking/manoeuvring areas will be replaced with modern facilities and new modern delinting, treatment and dispatch facilities will replace outdated facilities. The existing system of burning hydrogen and chlorine on site to make HCl gas is to be replaced with a new safer system which makes the gas directly from 33% liquid HCl.

2.2 Site Location and Surround Land Use

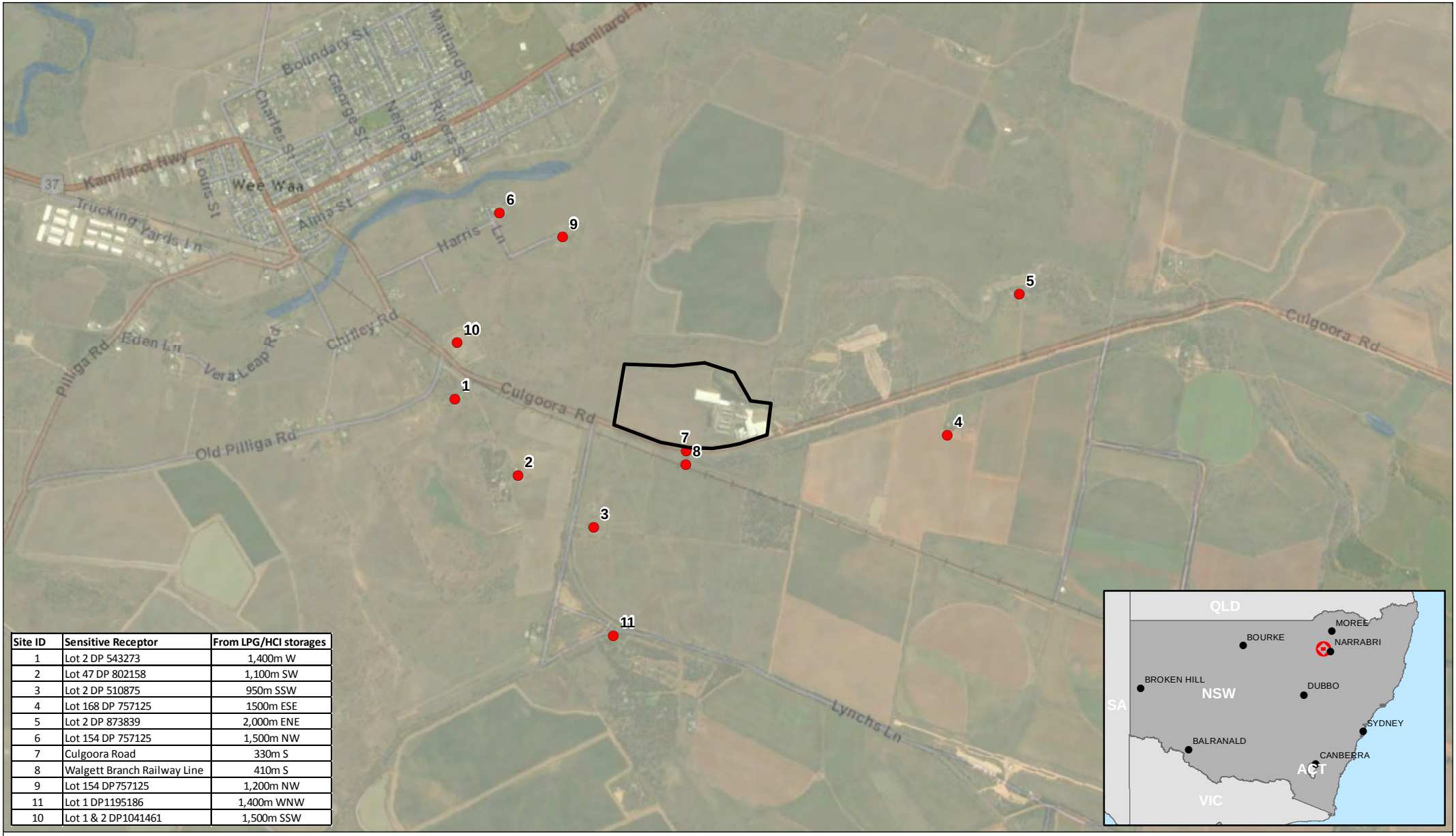
The subject land is Lot 2 DP 612166 and Lot 1 DP 873839 and has a total area of 137.96 hectares. The land is located on the northern side of Culgoora Road, about 2 kilometres (km) southeast of the town of Wee Waa. The existing facility consists of light industrial buildings, warehouses, an administration building, laboratory, gas/chemical storage, driveways/parking areas and detention ponds.

The site is surrounded by rural land used for extensive agriculture (grazing and cropping) and associated residential dwellings are listed in Table 2-1 and shown in Figure 2-1.

Table 2-1 Surrounding sensitive receptors

Site ID	Sensitive Receptor	From LPG/HCl storages
1	Lot 2 DP 543273	1,400 m W
2	Lot 47 DP 802158	1,100 m SW
3	Lot 2 DP 510875	950 m SSW
4	Lot 168 DP 757125	1500 m ESE
5	Lot 2 DP 873839	2,000 m ENE
6	Lot 154 DP 757125	1,500 m NW
7	Culgoora Road	330 m S
8	Walgett Branch Railway Line	410 m S
9	Lot 154 DP757125	1,200 m NW
11	Lot 1 DP1195186	1,400 m WNW

The site is surrounded on three sides by the RU1 – Primary Production zone and to the south (across Culgoora Road) by the R5 – Large Lot Residential zone, which is presently undeveloped and to be rezoned industrial in due course.



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7	Culgoora Road	330m S
8	Walgett Branch Railway Line	410m S
9	Lot 154 DP757125	1,200m NW
11	Lot 1 DP1195186	1,400m WNW
10	Lot 1 & 2 DP1041461	1,500m SSW

N

0 500 1,000

Meters

Legend

- Sensitive receptor
- Study boundary (Lot 2 DP 612166)

Scale @ A4 1:30,000
Date: 28/06/16
Drawn: Marko D.

Figure 2.1
Site and sensitive receptor location

DATA SOURCE
Geoscience Australia, 2014.

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2.3 Site Layout

The proposed development includes the below listed components which are also shown on Figure 2-2, those of relevance to the PHA are described in further detail below.

- Administration building and laboratory;
- Delinter extension and recladding of black seed warehouse;
- Finished goods, treatment and despatch building;
- Fuzzy seed silo and dump pits 6 an 7;
- Staff/visitor car park, access ways and truck loading/unloading areas;
- Augmented flood levee bank and pond filling;
- Fuel depot;
- Fire control centre; and
- HCl gas plant.

Of particular relevance to this PHA are the following areas:

- **Warehouse refurbishment and extension, delinting / bagging room** - This will be a steel framed warehouse with lightweight metal panels on walls and roof with steel frame floor over basement with reinforced concrete slab. The warehouse will cover an area of 2816 m^2 and include the control room and delinting space with the HCl gas plant immediately outside. There will be a bunded pesticide container storage area within the south-west corner of the gas plant area, located approximately 68 m from the HCl plant.
- **Chemical storage areas** - There will be an attached bunded chemical store and chemical and drums storage area on the north-west side of the treatment, finished goods, despatch and loading building.
- **Fuel depot** – This area will be used for diesel re-fuelling and truck wash down and it will be in an open walled and light-weight coloured metal roofed steel frame structure covering 147 m^2. The structure will contain the existing oil shed and existing diesel tank bunded area.
- **Fire control centre** - The building will contain a completely self-contained firefighting capability adequate for the entire plant and fire control equipment to meet Australian Standards and the Building Code Australia (BCA). It will be constructed with a reinforced concrete slab with a steel structure covered with a light-weight metal external cladding and roof. This will include four metal water tanks.
- **HCl gas plant** - This facility will be used to make HCl gas for the delinting process. It will be constructed with a reinforced concrete slab, one bulk HCl liquid storage tank, light-weight metal boiler shed (LPG pressure boiler, glycol driller, dryer, gas accumulation tank and gas absorption system) and two steel-framed HCl Azeotrope and flash evaporator towers 25 m high.

ID	Hazardous Substance
1	Sulphuric Acid
2	Diesel Fuel
3	LPG
4	Hydrogen Chloride (HCl) Liquid
5	Hydrogen Chloride (HCl)
6	Calcium Hydroxide
7	Fertilisers - Awaken ST
	Insecticides – Genero 600
	Fungicides - Dynasty
	Fungicides – Cruiser Extreme (Syngenta)
	Fungicide – Bion Plant Activator

No.	BY	DATE	DESCRIPTION	APPD
A	MD	23/06/16	FOR INFORMTION	

REVISIONS

DESIGNED	-	CHECKED	-
DRAWN	MD	CHECKED	-
APPROVED	-	DATE	23/06/16

DATE PLOTTED: 29 June, 2016 - 11:19am

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REFER TO GRAPHIC SCALE BELOW
1 : 200, 1 : 100, 1 : 50, 1 : 20

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PROJECT BES160264.01 Brown and Krippner SEPP 33 Cotton Seed Plant

TITLE Figure 2.2
Site layout and dangerous goods storage locations

STATUS FOR INFORMATION
DRG No. BES160264 001-DWG
REV. A

2.4 Process Overview

The overall site process involves seed delivery, laboratory testing, seed storage, production of HCl gas, seed delinting, seed treatment, packaging and dispatch. There is also a small scale research and development nursery with seed processing capability. These processes are described in further detail below.

Seed delivery - seed arrives at the processing plant usually in semi-trailers, B-Double combination trucks or occasionally road trains and is unloaded into receiving pits.

Laboratory testing - the seed is sampled and tested for germination purity, oil content and oil composition in onsite labs.

Seed storage - the seed is blown from the dump pit through a piping system controlled by valves into insulated storage sheds. These vary in size from 125 tonne (t) to 1,200 t. When ready for delinting it is loaded out by a bucket loader into a transfer pit where it is blown through piping into the delinting building.

Seed delinting - delinting is the process to remove the cellulose cotton fibre or lint from the outside of the seed without damaging it by making the lint brittle so it can be rubbed off. This process requires hydrogen chloride (HCl) gas made from hydrochloric acid, to degrade the lint without impacting the seed coat. Approximately 700 to 1,000 kg lots of seed are loaded into the delinting barrel, sealed and HCl gas injected under low pressure. The barrel rotates slowly while external LPG burners raise the temperature of the seed inside to approximately 55°C. After approximately 12 to 15 minutes, the HCl gas is absorbed by the lint on the seed and rubbed from the tumbling action of the barrel. Once stopped, the air inside of the barrel is then evacuated through a caustic scrubber to collect any residual HCI gas. The drum contents are tipped into a pit and then elevated to the buffing cylinders to remove the powdered fibre. The seed is then graded, sampled for quality assurance and stored in intermediate packaging.

Seed treatment – a range of treatments are applied to the seed, including fungicides, coloured identification polymer, fluency agent, insecticides and seed nutrient. The seed treatment unit processes batches of 100 kg of seed. The registered seed treatments are supplied in various container sizes from 1 litre (L) through to 1,000 L and once empty, the product seed treatment containers are rinsed and sent to Drum Muster for recycling.

Packaging and dispatch – the treated seed is sampled again, bagged, labelled, palletised and wrapped with a robotic handling system. It is usually held for 10 days for germination testing before being dispatched from site.

Nursery - a small non-commercial seed processing facility is located on the site for the CSIRO and CSD joint venture research and development. This uses very small scale delinting processes which uses concentrated liquid sulfuric acid instead of the HCl gas. The seed is fed into a trough with the acid, which dissolves all the lint in a matter of seconds. The seed is rinsed with water and neutralised, before being dried and graded. The waste acid is neutralised with magnesium oxide and then stored before being evaporated or used on site.

2.4.1 HCl Gas Plant

The current method of producing HCl gas on site is to burn Chlorine (Cl_2) and Hydrogen (H_2) in a gas synthesis unit. These chlorine and hydrogen storages will be removed and replaced with a new process involves distilling HCl gas from 33% liquid hydrochloric acid. The acid is generally delivered in 25 to 38 tonne bulk tankers and unloaded in a 30 m by 4 m bunded area into a vertical cylinder tank located outside the warehouse delinting building.

The acid is fed into the distillation system at a rate of 210 kg/hr and mixed with Calcium Chloride ($CaCl_2$) in an azeotropic breaking tower (see Plate 2-1) which is heated using pressurised steam.

Plate 2-1: HCl Azeotrope and evaporator towers

Plate 2-2: LPG fuelled high pressure boiler

High pressure boiler - The steam will be generated from a skid mounted packaged LPG fuelled boiler (see Plate 2-2) at 12 bar pressure and temperature required and injected into the azeotrope and flash evaporator reboilers at the base of the two towers.

$CaCl_2$ mixing tank and pump - $CaCl_2$ will be added via a small mixing tank and pump to separate the water from the HCl gas and improve the efficiency of gas generation.

HCl azeotrope breaker system – The towers are located within a concrete bund area (5 m x 5 m x 1 m) with an impervious liner. The $CaCl_2$ solution is heated in a second tower using pressurised steam to produce strong concentrated $CaCl_2$ (55%) which is fed into the azeotropic tower to react with the liquid HCl acid. At azeotropic concentration, the molar composition of liquid and gas phase are the same. When you add the $CaCl_2$ salt, the salt dissociation requires water, so water becomes trapped in the liquid phase, breaking the normal vapour-liquid equilibrium. Effectively the boiling point of the water is raised so that most of the liquid water falls in the column but the boiling point of the HCl remains the same so its vapour rises in the column and goes overhead stripping the HCl content in hydrochloric acid (Mersen 2016). This is a continuous cycle producing 70 kg of HCl gas from 210 kg of liquid HCl acid. The hot and moist HCl gas produced and then passed through the glycol chiller.

Glycol chiller – This is a primary condenser using water as the coolant. The HCl gas is passed through a small skid mounted glycol chiller to remove water and reduce temperature at a rate of 0.5 m^3 per

hour. The moist cooled HCl gas under pressure then either goes to the dryer or into the HCl gas absorption system.

Molecular sieve dryer - To remove remaining moisture, nitrogen gas is used in the dryer to produce a dry, non- corrosive gas at a rate of 70 kilograms per hour.

Gas storage - The gas is then stored prior for use in the delinting process in a steel buffer vessel designed to withstand 2 to 3 bar of pressure with a 30 minute supply capacity of 10 cubic metres (4 x 2.5 m).

HCl injection into delinting barrels - HCl gas is then injected at 2 to 3 bar pressure into the delinting barrels for the lint removal process from the cotton seed in volumes of approximately 7 m^3. Virtually all the HCl gas is absorbed by the lint on the seed and through the tumbling process, most of the lint is rubbed off and become a white powder. After the buffing process has completed, the seed and remaining residues are also treated with magnesium oxide to neutralise any remaining acidity.

Gas extraction - The HCl gas is extracted from the barrels and passed through a caustic scrubber which uses magnesium oxide.

Waste water treatment - The process generates a small amount of water containing a very low concentration of HCl acid. This slightly acidic waste water is neutralised with magnesium oxide before release into the on-site detention dam. The process used to create HCl gas is provided in Figure 2-3.

2.4.1.1 Gas Reabsorption System

The HCl distillation system is a continuous process and not designed to be turned on and off. This means during the delinting batch cycles any excess HCl gas produced will be reabsorbed into water in an exothermic reaction and fed back into the distillation system, so there is no wastage of HCl gas produced. The re absorption process can occur from both before and after the drying stage (process diagram shown in Figure 2-4).

The water or absorption solution forms a falling film that runs along the walls of the ducts inside the heat exchanger. This film is continuously cooled by removal of heat through the walls of the unit to the cooling fluid (Merson 2016). The HCl gas is mixed with nitrogen and piped into the absorption unit (block, shell or tube) where the gases are absorbed into water. The product hydrochloric acid is returned to the product acid tank and any remaining non absorbed gas is piped to the tail tower.

CSD HCL gas production - Option 2

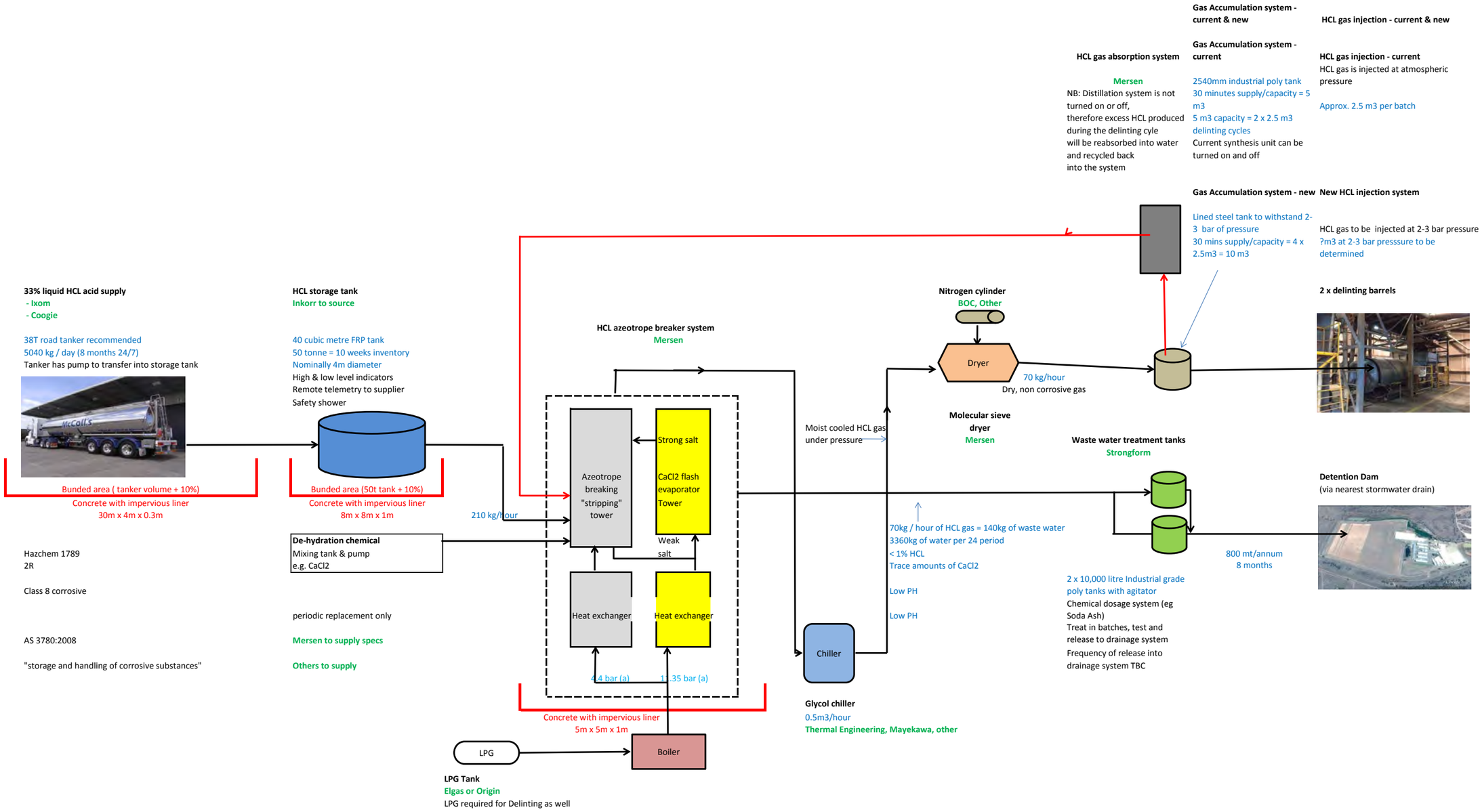


Figure 2-3 HCl gas process

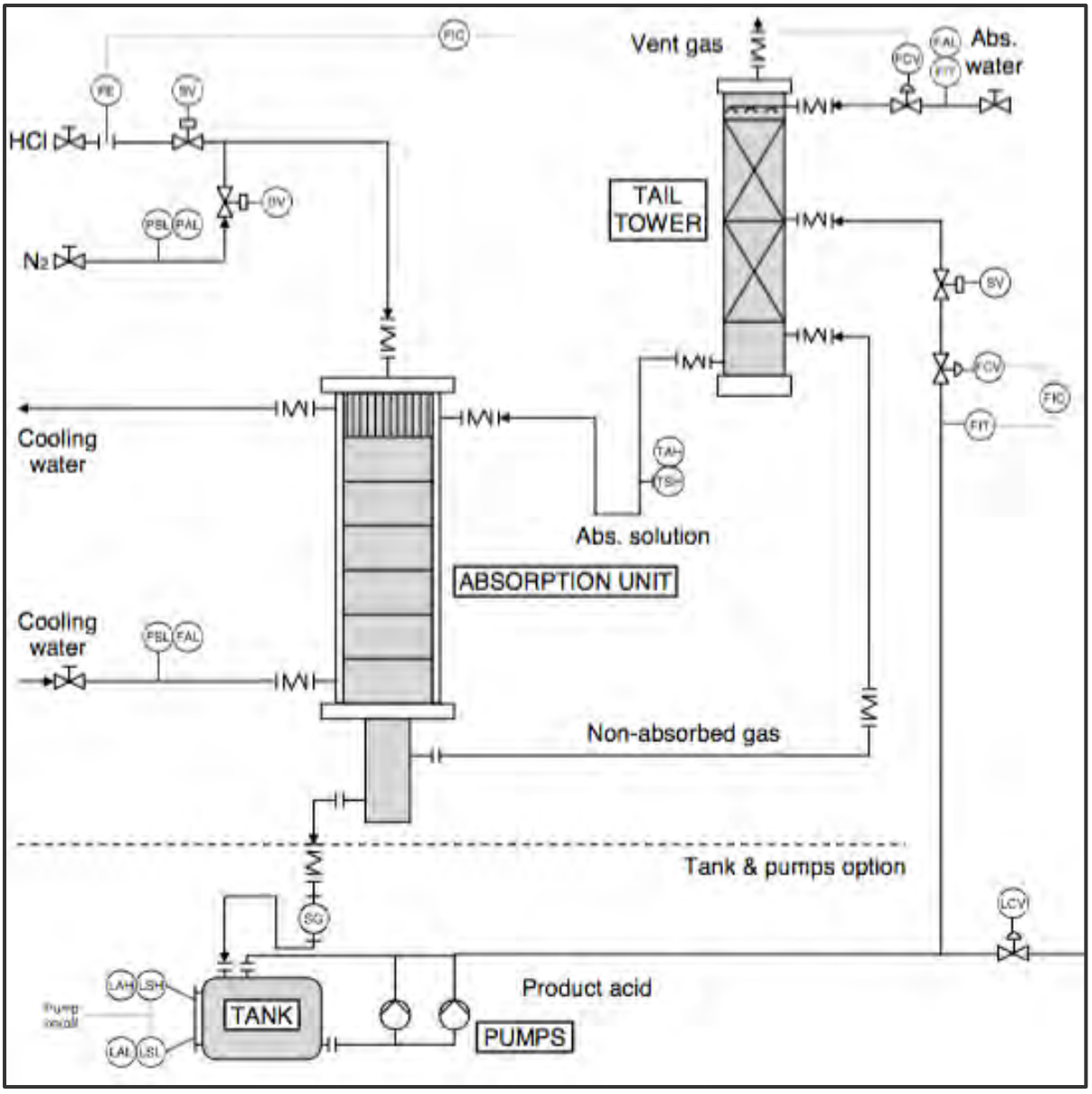


Figure 2-4 Gas reabsorption system process diagram

2.4.2 Non-commercial Scale Seed Processing

Delinting of the small scale seed is undertaken in the nursery facility using concentrated sulfuric acid instead of HCI gas. The fuzzy seed is fed into a trough with the acid, which, dissolves all the lint. The seed is quickly rinsed with water and neutralised with magnesium oxide, before being dried and graded. The waste acid and water is also neutralised and then stored and evaporated or used on site.

Section 3 SEPP 33 Risk Screening

Industries involving chemicals such as fertilisers and pesticides, grain handing, gas processing, storage and handling may be considered potentially hazardous under "Applying SEPP33" by NSW DP&E (2011). This section provides a preliminary risk screen to determine whether the proposed development is potentially hazardous and thus affected by SEPP 33. As part of the preliminary risk screen, the quantities of all classes of hazardous substances included in the proposed development and any adjacent existing inventory is assessed.

The Applying SEPP 33 guidelines provide screening thresholds for hazardous substances. These thresholds identify the quantities below which it can be assumed there is unlikely to be a significant off-site risk. If any of the screening thresholds are exceeded the proposed development is to be considered a 'potentially hazardous industry' and requires a preliminary hazardous assessment under SEPP 33.

3.1 Industry Assessment

The applicable local planning instrument is the *Narrabri Local Environment Plan 2012.* Under this plan the site is zoned RU1 Primary Production and the proposed refurbishment of the cotton seed processing facility is defined as Agricultural Produce Industries and the proposed development is permissible within the subject zone as a Rural Industry.

3.2 Hazardous Substances

Processes and inputs/outputs in the new facility will remain essentially the same as in the existing facility, with the noted exception of the new HCl gas processing facility. The current method of producing HCl gas on site is to burn Chlorine (Cl_2) and Hydrogen (H_2) in a gas synthesis unit to produce HCl gas. As hydrogen poses auto ignition risks when mixed even in small amounts of air, thus removal of the hydrogen from the site significantly increases the site safety.

Table 3-1 details the existing hazardous substances onsite and the proposed total substances upon completion of the refurbishment. The maximum quantity and storage locations for the hazardous substances are shown in Figure 3-3.

Table 3-1 Hazardous substances

ID	Hazardous Substance	Composition	UN Number	GHS Class	ADG Class	Sub Class	Hazardous Properties	Maximum Quantity	Storage Type	Use
1	Sulphuric Acid	Sulphuric acid Water	1830	Skin corrosion - category 1A	Class 8 Pk Group 2	N/A	Corrosive		IBC's	Nursery
2	Diesel Fuel	Hydrocarbon mixture	3082	Carcinogenicity - category 2	N/A	N/A	Combustible	9,000 L	1 x 7,000 L road tank and 1 x 2,000 L off road tank. Both aboveground and bunded.	Vehicles
3	LPG	Butane Propane	1011 1978	Flammable gas – category 1 Gas under pressure	Class 2.1	N/A	Flammable gas	30 m^3 gas	Steel cylinder	Heating and gas burners Delinting
4	Hydrochloric Acid	HCl Water	2186	Gas under pressure Acute toxicity – category 3 Skin corrosion – category 1A	Class 8 Pk Group 2	8	Corrosive	52 t liquid	FRP vertical cylinder bulk 65 t capacity	To make HCl gas for delinting
5	Hydrogen Chloride	HCl	1050	Gas under pressure Acute toxicity – category 3 Skin corrosion – category 1A	Class 2.3	8	Toxic gas Corrosive	40 kg gas	Steel buffer vessel at 2 – 3 bar pressure	Delinting
6	Calcium Hydroxide	$Ca(OH)_2$	3262	Eye damage/ Irritation – category 1 Skin corrosion/ irritation – category 2	N/A	N/A	Hazardous to health			Neutralisation of waste water
7	Fertilisers - Awaken ST	Zinc Ammonia Acetate	N/A		N/A	N/A	Mixture – Health and toxic to environment	20 drums	20 L chemical drums	Seed treatment
	Insecticides – Genero 600	Imidacloprid	3082	Acute toxicity – category 3	N/A	N/A	Hazardous to health	170 drums	20 L containers	Seed treatment
	Fungicides - Dynasty	Azoxystrobin, metalaxyl-M and Fludioxonil	3082	Acute toxicity – category 3	Class 9 Pk Group 3	N/A	Hazardous to health Aquatic toxicity Marine pollutant	6 drums	1000 L containers	Seed treatment

ID	Hazardous Substance	Composition	UN Number	GHS Class	ADG Class	Sub Class	Hazardous Properties	Maximum Quantity	Storage Type	Use
	Fungicides – Cruiser Extreme (Syngenta)	Azoxystrobin (0.50%)	3082	Acute toxicity – category 3	N/A		Toxic if inhaled Aquatic toxicity	49 drums	113.5 L containers	Seed treatment
		Fludioxonil (1.25%)		N/A						
		Mefenoxam (1.00%)		Acute toxicity – category 4 Eye damage category 1						
		Thiamethoxam (25%)		N/A						
	Fungicide – Bion Plant Activator	acibenzolar-S-methy	3082	Eye irritation - category 2 Specific target organ toxicity (single exposure) - category 3 Skin irritation - category 2 Skin sensitisation - category 1 Hazardous to the aquatic environment (acute) - category 1 Hazardous to the aquatic environment (chronic) - category 1	N/A	N/A	Aquatic Toxicity	24 drums	1 L packages	Seed treatment

Safety Data Sheets (SDS) for these chemicals have been provided in **Appendix A** of this report.

Other non-hazardous substances assessed and stored onsite include the following substances:

- Liquid Nitrogen - 10,000 L pressure vessel and vaporiser will be located on site and used in the seed delinting process to dry the gas after it has been through the process. It is estimated that a supply of 100,000m^3 will be required per year.
- Inert Seed Treatments - these are liquids (colours and polymers) and a powder (fluency powder) used to aid seed handling, none of these substances are considered dangerous goods.
- Calcium Chloride ($CaC1_2$) - is used in the distillation process to produce HCl gas. It is not considered dangerous goods and therefore not hazardous.
- Causmag TGM (Magnesium Oxide) - 24 to 34 t is stored onsite in 20 kg bags to neutralise waste waters and use in the scrubbers.

3.2.1 Hazardous Substances Storage Thresholds

The relevant hazardous substances onsite have been compared to the SEPP 33 trigger thresholds in the table below. The locations of each of the storage locations for the hazardous goods onsite are shown in Figure 3-3 below.

Table 3-2 SEPP 33 screening trigger levels for current storages

Hazardous Substance	Total Storage	Actual Storage	Trigger Volume	Trigger SEPP 33 Assessment
LPG Class 2.1	Above ground tank of 30 m^3 (at density 493.00 kg/ m^3)	14,790 kg	10 tonne (10,000 kg) or 16 m^3 if in above ground tank	Yes
Hydrochloric Acid Class 8	50 tonnes liquid or 50,000 kg	50,000 kg	Class 8 Pk 2 – 25 t	Yes
Hydrogen Chloride (HCl) Gas Class 2.3	40 kg gas	40 kg	Class 2.3 other poisonous gases <100 kg	No

The risk screening process identifies the LPG storage and HCl storages as potentially hazardous. Clause 12 of SEPP 33 specifies that a PHA must be prepared for development applications for 'potentially hazardous industry'.

3.3 Transportation Thresholds

The proposed development may be potentially hazardous if significant quantities of hazardous materials are entering or leaving the site. Applying SEPP 33 guidelines provides trigger levels of annual or weekly cumulative vehicle movements in which transportation is considered potentially hazardous, these are shown in Table 3-3.

Only LPG and HCl liquid are transported to site as the HCl gas is made and disposed onsite. The hydrochloric acid will be typically delivered in 25 to 38 t bulk tankers (MacKinven 2016) every nine days for an eight month period whilst the delinting is being undertaken. The bulk tankers will be unloaded in a purpose-built bunded area 30 m x 4 m to contain any spillage. LPG usage is estimated to be 1,500 L per 24 hours and is expected to be supplied into a 30,000 L tank via road tankers, typically Elgas, possibly weekly or fortnightly.

Table 3-3 SEPP 33 screening trigger levels for transport

Hazardous Substance	SEPP 33 Triggers		Project Information		Trigger SEPP 33 Assessment
	Cumulative Annual	Peak Weekly	Project Movements	Project Volumes	
LPG Class 2.1	>500 over 2 t each load	> 30	1 every nine days or 26 per year	30,000 L	No
HCl Class 8	>500 over 2 t each load	> 30	1 per week or 2 per fortnight (52 annual total)	38 t	No

The project hazardous substances transportation movements do not trigger a SEPP 33 assessment and as such are not assessed within this PHA.

Section 4 Methodology

4.1 Study Overview

The methodology for undertaking the PHA was based on the NSW DP&E Guidelines HIPAP No 6 - Hazard Analysis (HIPAP No 6) and HIPAP No 4 - Risk Criteria for Land Use Safety Planning (HIPAP No 4). The PHA is required for the Development Application for a potentially hazardous industrial development. In order to make informed land use safety planning decisions, the results of any risk evaluation need be assessed against appropriate qualitative and quantitative risk criteria. While some jurisdictions focus on worst case consequences in setting land use criteria, the approach adopted in NSW is risk-based.

The basic methodology for a hazard analysis process required under the HIPAP No 6 guideline is shown in Figure 4-1.

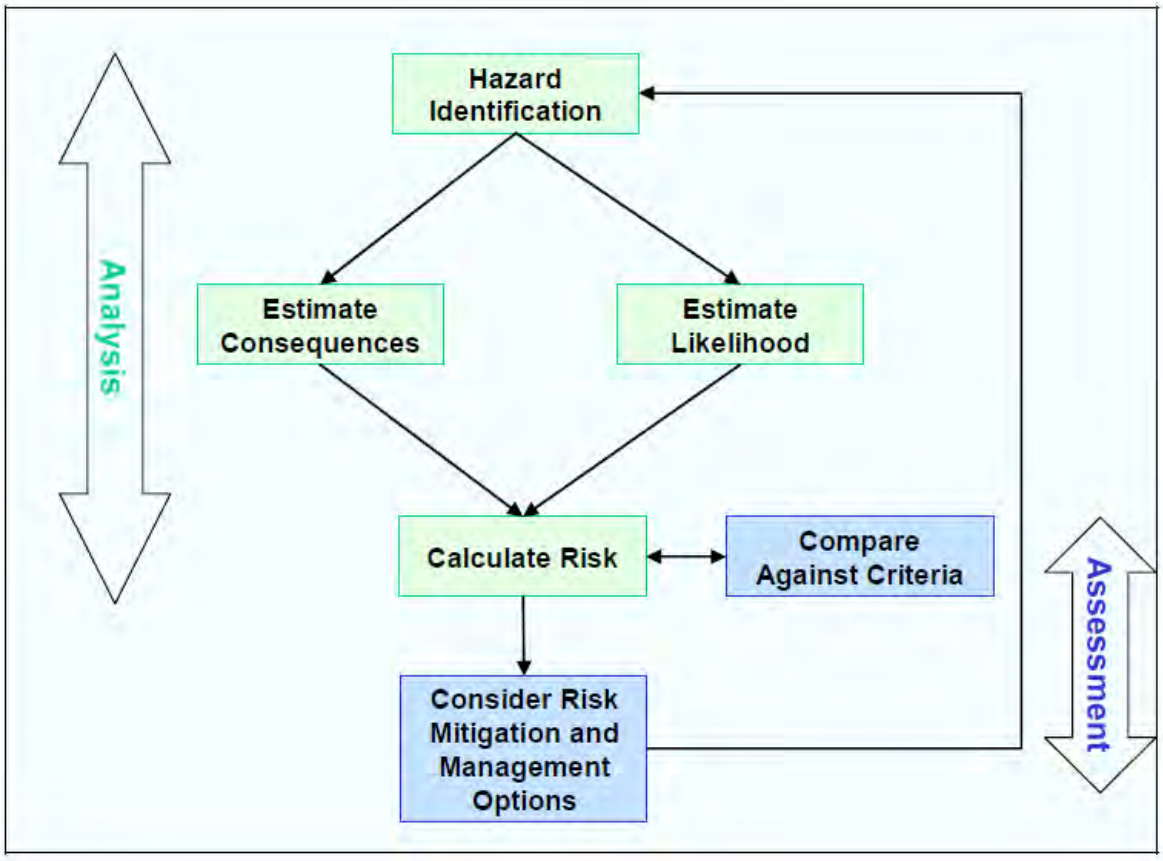


Figure 4-1 Basic methodology for hazard analysis

The analysis includes the following stages:

1. Establish the context, methodology of assessment and relevant risk tolerability criteria;
2. Review of the design, location and activities associated with the facility to identify potential risks and hazardous events as a result of the operations and the proposed controls;
3. Identify credible scenarios to progress consequence and likelihood quantification;

4. The consequence and risk of each identified scenario was analysis through modelling and identify if any offsite impacts are found to have the potential to occur;

5. The frequency (likelihood) of the potentially hazardous event for scenarios with offsite impact was then analysed;

6. Undertake a qualitative risk assessment by combining consequence and likelihood of offsite scenarios to generate risk contours for the development; and

7. Assess the offsite risk profile against the risk tolerability criteria outlined in HIPAP No 4.

4.2 Risk Criteria

The HIPAP No 4 risk criteria take account both the physical magnitude of a given risk and community concerns over risks that are imposed rather than voluntarily accepted. Two aspects of risk need to be considered:

- Individual risk, which considers the acceptability of a particular level of risk to an exposed individual; and
- Societal risk, which takes into account society's aversion to accidents which can result in multiple fatalities. (HIPAP No 4).

The proposed development is defined in *Narrabri Local Environmental Plan 2012* as 'agricultural produce industry', a type of rural industry. As the site is surrounded Primary Production zone and Large Lot Residential zone, the risk criteria for residential and industry is relevant. The acceptable risk criteria for these use types are outlined in HIPAP No 4 and presented in Table 4-1.

Table 4-1 NSW risk criteria

Description	Risk Criteria (per year)	
	Residential	**Industrial**
Individual fatality risk	1 x 10^{-6} per year	50 x 10^{-6} per year
Injury (fire/explosion)		
Heat Radiation	Risk injury criteria is 4.7 kW/m^2 considered high enough to injure people who can't evacuate or shelter. Would cause injury after 30 seconds' exposure at 50 x 10^{-6} per year.	Heat radiation levels of 23 kW/m^2 as the result of fire incidents at a hazardous plant may affect a neighbouring installation to the extent that unprotected steel can suffer thermal stress that may cause structural failure.
Explosion overpressure	Explosion overpressure of 7 kPa is the criteria level above which significant effects to people and properly damage may occur.	Explosion overpressure levels of 14 kPa may damage piping and (low-pressure) equipment at a neighbouring plant. Accepted frequency is 50 x 10^{-6} per year.
Injury/irritation (toxic impacts of gas, smoke or dust exposure)		
Toxic exposure	Toxic exposure in residential and sensitive use areas should not be seriously injurious to sensitive members of the community following a relatively short period of exposure at 10 x 10^{-6} per year.	
Toxic irritation	Toxic irritation - should not cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community at 50 x 10^{-6} per year	

Description	Risk Criteria (per year)	
	Residential	Industrial
Property damage and accident propagation		
Heat radiation	Heat radiation levels of 23 kW/m^2 may affect a neighbouring installation to the extent that unprotected steel can suffer thermal stress that may cause structural failure at 50 x 10^{-6} per year.	
Explosion overpressure	The explosion overpressure level of 14 kPa is also sufficient to cause significant damage to buildings at 50 x 10^{-6} per year.	

4.3 Societal Risk

Societal risk considers the tolerability of risks for hazards giving rise to societal concerns. If risk calculations show there is a risk of multiple fatalities occurring in one event the risk will be assessed against the DP&E's provisionally adopted indicative criteria in HIPAP No 4.

Section 5 Hazard Identification

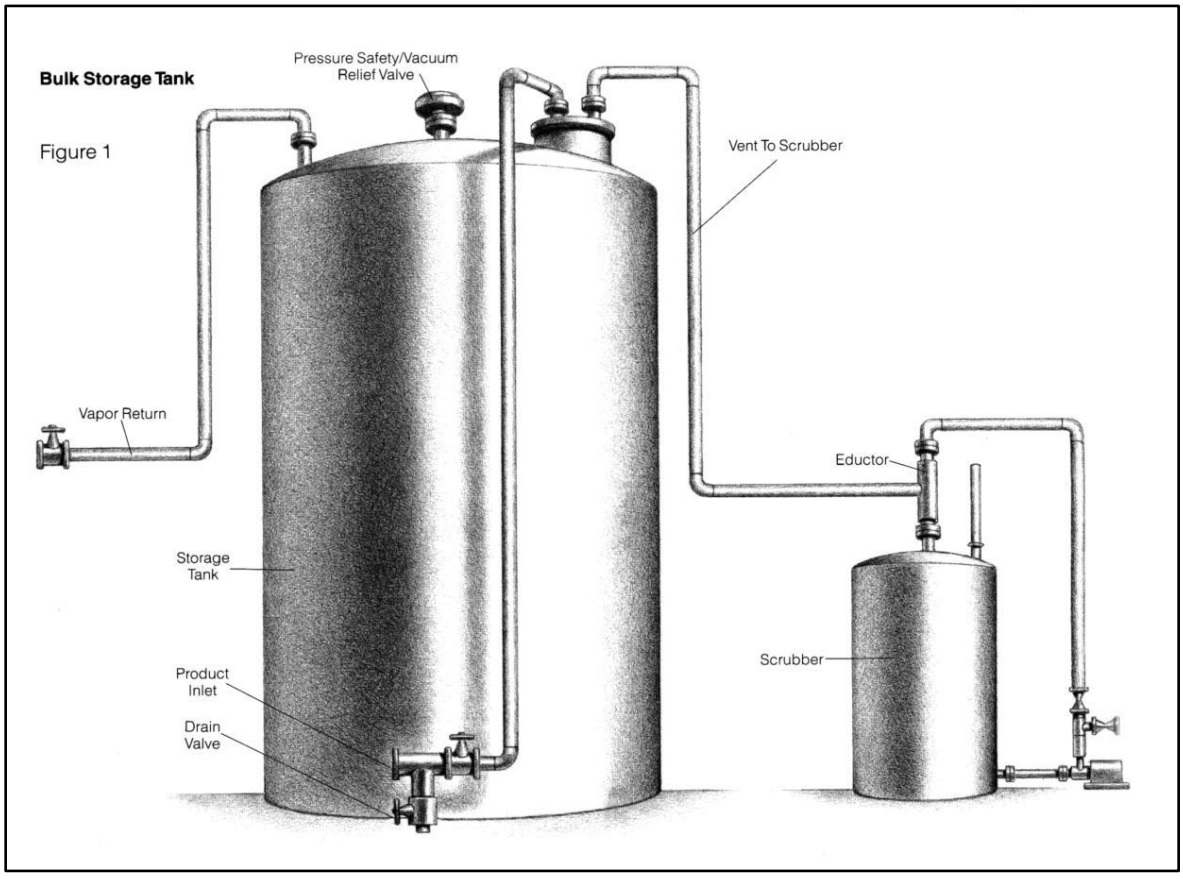
5.1 Hazardous Materials

5.1.1 Hydrochloric Acid

Up to 50 t of HCl will be stored on site to produce the HCl gas required for use in the seed delinting process. It will be a 33% concentration of HCl (MacKinven 2016) and in ADG Class 8, Packaging Group II (Ixom 2013). The acid will be fed into the distillation system at a rate of 210 kg/hour.

5.1.1.1 Storage

The acid will be pumped into a 65 t (56 m^3) storage tank which will be housed outside within a bunded area with a safety shower and other safety control systems. The tank will be a fiberglass-reinforced plastic (FRP). FRP is inert to acid and widely used as a construction material for chemical process equipment and storage solutions in chemical industries. Fiberglass storage tanks are generally equipped with two 24-inch manways, 3-inch flanged nozzles and 3-inch flanged product inlet line. The current design calls for FRP lined steel pipe, a typical HCl store is shown in Figure 5-1.



(Source: OCC 2013)

Figure 5-1 Typical hydrochloric acid store

5.1.1.2 Composition and Physical Properties

Table 5-1 provides the composition of the hydrochloric acid stored onsite and Table 5-2 provides the physical and chemical properties of hydrochloric acid.

Table 5-1 Hydrochloric acid composition

Component	Composition
Hydrochloric acid	33%
Water	67%

(Source: Ixom 2013)

Table 5-2 Hydrochloric acid physical and chemical properties

Parameter	Properties
Appearance: - Physical state at 20°C / 101.3kPa - Colour	Clear liquid - colourless to slightly yellow
Odour	Pungent
Odour threshold	N/A
pH value	<1
Molar mass (g/mol)	36.5
Melting point	<-20°C
Boiling point	109°C
Flash point	N/A
Evaporation rate	As for water
Flammability range (vol% in are)	N/A
Vapour pressure	2.3 kPa
Relative density	1.161
Volatile component (%vol)	100

(Source: Coogee Chemicals 2015)

5.1.1.3 Physical Hazards

The aqueous solution is a strong acid which is a highly corrosive and hazardous chemical. It is highly corrosive to most metals, including: carbon steel, stainless steel, nickel, bronze, brass, copper, and aluminium (OCC 2013). It also attacks some plastics, rubber, and coatings (Pohanish 2012). Thus it has the potential to impact plant or property affected by the spill.

Upon exposure to air, there is an immediate release of toxic HCl gas. As a strong corrosive acid, HCl reacts with many metals producing flammable hydrogen gas that can become an explosion hazard.

GHS classification identifies HCl as being a specific target organ/systemic toxicant which may present a potential for adverse health impact to people who are exposed to it. (International Labour Organisation 2016). HCl is corrosive to skin, mucous membranes, causes eye damage and respiratory irritation. As the acid storage and plant are within bunded areas, that employees almost never enter, the only likely offsite exposure would be from vapours. The corneas of the eyes are especially sensitive to HCl and exposure to it or its vapours immediately causes severe irritation (OCC 2013).

5.1.1.4 Exposure Standards

The US National Advisory Committee (NAC) for Acute Exposure Guideline Levels (AEGLs) for Hazardous Substances (NAC/AEGL Committee) have developed AEGLs for high-priority, acutely toxic chemicals. AEGLs represent threshold exposure limits for the general public and are applicable to emergency exposure periods ranging from 10 minutes to 8 hours (NAC/AEGL Committee 2012). These are provided in Table 5-3 below.

Table 5-3 AEGLs exposure standards for hydrochloric acid

Classification	Unit	10 min	30 min	1 h	4 h	8 h	Potential impacts
AEGL-1 (Non-disabling)	ppm (mg/m3))	1.8 (2.7)	1.8 (2.7)	1.8 (2.7)	1.8 (2.7)	1.8 (2.7)	Concentrations of 0.3 parts per million (ppm) can be detected by smell, and concentrations above five ppm will cause discomfort and trigger people to relocate to a safe area. Exposure for 45 minutes at 1.8 ppm had no observable effects on asthma patients.
AEGL-2 (Disabling)	ppm (mg/m3))	100 (156)	43 (65)	22 (33)	11 (17)	11 (17)	Potential for severe nasal or pulmonary histopathology (based on studies on rats and baboons).
AEGL-3 (Lethal)	ppm (mg/m3))	620 (937)	210 (313)	100 (155)	26 (39)	26 (39)	There is no data concerning human lethality from HCl exposure located in literature. Potential to cause disabling effects and lethality in guinea pigs.

5.1.2 LPG

LPG is stored under pressure in a liquefied state and is composed primarily of propane. A new central storage cylinder of LPG gas of approximately 30 m^3 is proposed for heating purposes and reticulated throughout the buildings requiring gas with branch pipes and isolation valves. The main building supply pipe would be reticulated to the building then regulated down to a usable pressure to serve hot water plant, kitchen and various items of equipment requiring gas supply.

LPG is also used in the delinting process by burning the gas in an external burner to raise the temperature of the HCl gas and seed in the barrel under low pressure.

5.1.2.1 Composition, Physical and Chemical Properties of LPG

The typical composition of LPG in Australia is provided in Table 5-4 and physical and chemical properties in Table 5-5.

Table 5-4 LPG composition

	Components	Composition / CAS Number
Major components	Propane	0074-98-6 (98%)
	Propene	115-07-1 <1%
	n-Butane	106-97-8 ≤1%
	Iso-butane	75-28-5 <1%
Minor components	1.3-Butadiene	106-99-0 <0.1%
	Ethane	74-84-0 ≤1%
	Ethyl Mercaptan (Odourant)	75-08-1 25 ppm

(Source: Elgas 2013)

Table 5-5 LPG physical and chemical properties

Parameter	Propane C_3H_8
Appearance: - Physical state at 16°C / 637 kPa - Colour	Colourless liquid
Odour	Characteristic odour
Boiling point (ºC)	-42
Flash point (ºC)	-104
Ignition temperature (ºC)	493-549
Heat combustion (MJ/m^3)	93.3
Volume of air needed to burn 1m^3 of gas (m^3)	23.7
Max flame temperature (ºC)	1970
Flammability range (% by vol)	2.4 to 9.6
Relative density (kg/m^3, at STP)	1.53

(Source: Elgas 2013)

5.1.2.2 Physical Hazards

At ambient pressure and temperature LPG exists as a flammable gas. Mixtures of LPG and air within the flammable range may ignite and explode. The resulting explosion is typically a deflagration rather than a detonation associated with high explosives. It is required to be stored away from ignition sources and in a well ventilated place as exposure to fire may cause vessels to rupture or explode. It is incompatible with oxidising agents, acids, heat, and ignition sources and also incompatible (potentially violently) with oxygen, halogens and metal halides.

If the liquid leaks it will quickly evaporate and form a relatively large cloud of gas which will drop to the ground, as it is heavier than air. LPG vapours can run for long distances along the ground and can collect in drains or basements. When the gas meets a source of ignition it can burn or explode. The lower explosive limit is 2.3% (NAC/AEGL Committee 2016).

The gas is not known to cause any adverse health effects or injury to humans from exposure of living tissue (Air Liquide Australia Ltd 2012), however, may cause minor injury to asphyxiation from oxygen displacement (Elgas 2013). Exposure to pressurized propane can cause cryogenic injuries. It will not cause long term adverse effects in the environment and is not dangerous to the ozone layer (Elgas 2013).

5.1.2.3 Exposure Standards

Table 5-6 outlines the NAC/AEGL Committee's AEGL exposure limits.

Table 5-6 AEGL exposure limits

Classification	10 min	30 min	1 h	4 h	8 h
AEGL-1 (non-disabling)	10,000 ppm[a] (18,000 mg/m^3)	6,900 ppm[a] (12,000 mg/m^3)	5,500 ppm[a] (9,900 mg/m^3)	5,500 ppm[a] (9.900 mg/m^3)	5,500 ppm[a] (9,900 mg/m^3)
AEGL-2 (Disabling)	17,000 ppm (31,000 mg/m^3)	17,000 ppm (31,000 mg/m^3)	17,000 ppm (31,000 mg/m^3)	17,000 ppm (31,000 mg/m^3)	17,000 ppm (31,000 mg/m^3)
AEGL-3 (Lethal)	33,000 ppm (59,000 mg/m^3)	33,000 ppm (59,000 mg/m^3)	33,000 ppm (59,000 mg/m^3)	33,000 ppm (59,000 mg/m^3)	33,000 ppm (59,000 mg/m^3)

Airborne concentrations above the AEGL-1 represent exposure concentrations that could produce mild and progressively increasing but transient and non-disabling odour, taste, and sensory irritation or certain asymptomatic, non-sensory effects. The AEGL-2 values for all time periods is 17,000 ppm (31,000 mg/m^3), which is greater than 50% of the lower explosive limit for propane in air of 23,000 ppm. The AEGL-3 values for all time periods is 33,000 ppm (59,000 mg/m^3), which is greater than the lower explosive limit for propane in air of 23,000 ppm. Therefore, extreme safety considerations against the hazard of explosion must be taken (NAC/AEGL Committee 2012).

The toxicity of propane is low and mortality data from exposure is sparse and predominantly related to inhalant abuse (NAC/AEGL Committee 2012). The SDS for Elgas reports that the median lethal concentration for inhalation of gas, that is, a statistically derived concentration of a substance that can be expected to cause death during exposure or within a fixed time after exposure in 50% of animals exposed for a specified time is 50,000 ppm. Prominent impacts are related to asphyxiation from the displacement of oxygen.

5.2 Potential Major Hazardous Incident Scenarios

Potentially hazardous incident scenarios were identified based on a review of the facility Process Flow Diagrams (PFDs) and experience with hazard identification work undertaken for industrial facilities. Table 5-7 outlines the potential major hazardous incident scenarios which were identified.

Table 5-7 Potential major hazardous incident scenarios

Area Description	Substance	Hazardous Impact		Scenario Description	Typical Causes	Controls and Safeguards	Consequence Model?	PHA?
		Flammable	Toxic					
Acid storage and distribution	HCl	No	Yes	Release of hydrochloric acid from storage tanks	Generic mechanical failures (including corrosion, impact, leaks from fittings and flanges) Significant increases in pressure occur when storage tanks are being filled creating a vacuum with can cause cracking of collapse. Over-pressuring FRP and other low pressure design tanks when using air pressure unloading is especially high	- Concrete bund with impervious liner in place (8 m x 8 m x 1 m equals capacity of 50 t tank plus 10%) - High and low level indicators with remote telemetry to supplier - Safety shower - Site security with CCTV and remote control monitoring of external doors (Section 8.6) - PLC and SCADA automation control systems	Toxic dispersion (Scenario 1)	Yes
	HCl			Release of hydrochloric acid from distribution piping or plant	Generic mechanical failures (including corrosion, impact, leaks from fittings and flanges)	- Ventilation system which meets AS1668.2 - Site spill procedures to contain leaks - Concrete bund with impervious liner 5 m x 5 m x 1 m under the stripping and evaporator towers and heat exchanger plant - Site Emergency Response Plan - Causemag storage onsite for neutralisation - PLC and SCADA automation control systems	No, small spills have localised impacts only and do not contribute to offsite risk	No
Loading bay	HCl	No	Yes	Release of HCl in loading area	Generic mechanical failures (including corrosion, impact, leaks from fittings and flanges) Leak from loading arm	- Concrete bund with impervious liner for transfer 30 m x 4 m x 0.3 m - PLC and SCADA automation control systems	Toxic dispersion (Scenario 2)	Yes

Area Description	Substance	Hazardous Impact		Scenario Description	Typical Causes	Controls and Safeguards	Consequence Model?	PHA?
		Flammable	Toxic					
LPG storage and distribution	LPG	Yes	No	Release from storage tank	Generic mechanical failures of small tapping, corrosion in the tank shell, complex welds or significant stress concentration points, supports or mounting points and tubing bases	- Extensive fire hydrant coverage, internal and external as per AS2419.1 - Firewalls to be constructed where hydrant located adjacent the building - LPG tank positioned to comply with the required separation distance from a "protected workplace" - PLC and SCADA automation control systems - Explosion-safe equipment for a distance of 15 metres. - Fire-resistant (concrete and brick) construction for a distance of 15 metres.	<u>Chemical not burning as it escapes</u> - toxic effects - vapour cloud flash fire - overpressure (blast force) (Scenario 3) <u>Chemical burning as a jet fire</u> - thermal radiation - toxic effects of fire by-products (Scenario 4) - explosion if heat causes the tank to fail (Scenario 5)	Yes

Area Description	Substance	Hazardous Impact		Scenario Description	Typical Causes	Controls and Safeguards	Consequence Model?	PHA?
		Flammable	Toxic					
				Leak from piping	Generic mechanical failures (including corrosion, impact, leaks from fittings and flanges)	- The entire installation would be designed to be compliant with AS 5601-2000/AG 601-2000 – Australian Standard for Gas Installations - isolation valves on branch lines to the proposed buildings - Fire Sprinkler System installation would be designed to be compliant with the Building Code of Australia, AS/NZS 3500.1.2 – Australian Standard for Water Supply, The New South Wales Code of Practice for Plumbing and Drainage and AS 2118.1 – Fire Sprinkler System - PLC and SCADA automation control systems See safeguards above.	Chemical escaping not burning with isolation values and low pressure through regulation in piping this is unlikely to have offsite impacts.	No
Loading bay	LPG	Yes	No	Release of LPG during tank filling	Generic mechanical failures (including corrosion, impact, leaks from fittings and flanges) Leak from loading arm	- Explosion-safe equipment for a distance of 15 metres. - Fire-resistant (concrete and brick) construction for a distance of 15 metres.	This would have similar if not less impact then the leak in the tank thus modelling for scenarios 3 and 4 would encompass any impacts from this event.	No

5.3 Incident Scenarios Assessed

A review of the plant process diagram, storage vessel specifications and relevant literature was undertaken to identify typically and likely scenarios which could occur on site.

Scenario 1 – Toxic dispersion of HCl from a leak from storage tank caused by a complete failure of 50 mm valve (flanged outlet which allows complete tank drainage) which creates a loss of 75% volume of the tank (tank not full). Vehicle impact scenarios are not likely due to the 1 m concrete bunding around the tank storage.

Scenario 2 - Toxic dispersion of HCl from release in loading area caused by a failure on the coupling that attaches to the fill point on the tank. Largest bulk tanker expected would be 38 tonnes. Filling is monitored by two personnel thus it is expected that spill would be identified within five minutes and emergency shut off activated.

Scenario 3 – Propane gas leaking from various sized holes in the LPG storage tank has occurred due a failure with a small tapping from a pressure gauge or a crack in a complex weld. Gas leaking and not burning (toxic effects, vapour cloud flash fire, overpressure (blast force)).

Scenario 4 - Propane gas leaking from various sized holes in the LPG storage tank with ignition source to cause the chemical to burn (thermal radiation, explosion if heat causes the tank to fail).

Scenario 5 - Tank explodes and chemical burns in a fire ball (BLEVE). BLEVEs occur when a tank is heated by an external fire. The fire causes the tank to heat and pressure to increase until the tank shell bursts. The gas boils and burns very quickly producing thermal radiation and risks from hazardous fragments and blast force from explosion and downwind toxic effects of fire by-products. This is a worst case outcome and unlikely to occur onsite.

5.4 External Events

External events also have the potential to trigger major hazard scenarios, the potential for external events to affect the site have been considered in Table 5-8.

Table 5-8 Assessment of external events

External Event	Assessment
Major flood event	Potential flooding impacts were reviewed by Tahlee Consulting Services which showed that with the current levee height, the lowest shed would be inundated in a 1 in 50 year flood event (1955), and a 1 in 100 year flood event would cause significant inundation of sheds with depths of 300 to 700 mm in buildings. Floods that would over-top the one-metre bunds would occur even less frequently. Floods would not initiate a hazardous materials incident. An increase of the height of the existing levee banks to have a 0.3 m freeboard over the flood contours modelled for a 1 in 100 ARI event is proposed. In addition drainage improvements and access culverts installed to ensure that flooding does not pose a risk to the refurbished facility.
Earthquakes	Since 1969 there have been 23 earthquakes recorded in the 100 km area around the project site. These have ranged from a magnitude of 1.8 to 5 with only 3 being considered significant. There has been no earthquakes recorded within a 50 km radius of Wee Waa (Geoscience Australia 2016).
Land slip subsidence	The site is relatively flat and not subject to land slip or subsidence risks. It is unknown if there are any underground mines beneath the site.
Lighting	The average annual total lightning flash density is approximately 10 to 15 lighting flashes per km^2 per year in the Wee Waa area, which is a medium range across Australia (Kuleshov, Mackerras and Darveniza 2006). It is assumed that the systems will comply with relevant Australian Standards to be installed to manage the risks associated with lightning.
Plane crash	Wee Waa airport is located 9.6 km south-west. Private air strips are present on land surrounding the site, however, the likelihood of a plane crash is extremely low and not considered significant.
Vehicle crash	The LPG and HCl storages are set back from the highway behind buildings and would not be at risk from highway traffic accidents. The assumed the site speed limits and plant protection for structures are in installed to prevent vehicle impact on critical infrastructure.
Sabotage/vandalism	The site will have security with CCTV and remote control monitoring of external doors (Section 8.6).
Utilities failure	Assumed that power failure will result in 'fail safe' condition and plant operations are not possible in the event of a power loss.
Bushfire	Site is in an open area surrounding by predominantly cleared agricultural landscape. Possibility of minor grass fires which are unlikely to impact facility due with cleared buffer areas.

Section 6 Consequence Analysis

Consequence analysis involved qualitative and /or quantitative review of the identified hazardous scenarios to estimate the potential to cause irritation, injury and fatality. Consequence calculations were carried out using the Areal Locations of Hazardous Atmospheres (ALOHA) program, which is the air modelling element of CAMEO, a program suite that assesses the health and safety impacts of emergency releases. It was produced as a joint effort of the US Environmental Protection Agency (US EPA) and the US National Oceanic and Atmospheric Administration (NOAA). It has been successfully used for decades and is currently in revision 5.4.4. The CAMEO program is recognised and supported within industry and ALOHA is widely used for the purposes required in this assessment. The Australian Government has not produced any modelling or endorsed specific modelling packages. This modelling program was recently used and accepted for SEPP 33 PHA's CDM Smith completed for biogas storages and ammonia storages at abattoir cold plants.

The model provides outputs of the gas dispersion, thermal radiation from jet fire, blast overpressure and vapour cloud. The toxicity effects were then calculated from the consequence results and exposure times.

6.1 Meteorological Data

The closest weather station to Wee Waa is located at Narrabri West Post Office (053030) 33.8 km away. Historical data from 1891 collect by the weather station was analysed to determine the climatic trends for the area. The mean average rainfall is 600 to 700 mm per year with most of the rainfall occurring in December to February (BoM 2016a. In winter the mean maximum and minimum temperatures ranges from 18°C to 15.2°C and in the summer months 33.8°C to 28.3°C. Winds are most frequently from the north-east, east, north-west and north (77% of winds) (BOM 2016b).

Atmospheric stability is defined in terms of the tendency of a parcel of air to move upward or downward after it has been displaced vertically by a small amount (Woodward 1998). The Pasquill-Gifford scheme identifies six stability classes, "A" to "F" to categorise the degree of atmospheric stability. Class F is reflective of a stable atmosphere typically associated with clear skies, light winds and the presence of a temperature inversion. Such conditions tend to suppress vertical updrafts and reduce turbulence intensity, thus is considered the worst-case meteorological condition in a toxic gas release situation. Class C and D are reflective of the normal or typical weather conditions, these were determined through an analysis of historic Bureau of Metrology records for the Narrabri Weather Station (Site Number 053030). The data is presented in **Appendix B.**

The frequency of occurrence of stability class at the Narrabri Airport weather station was analysed for the year 2005 for the Narrabri Coal Project Air Quality Assessment (Heggies Pty Ltd 2007), see Figure 6-1. The results are typical and reflect annual occurrences of weather stability. The results indicate a high frequency of conditions typical of Stability Class D throughout the year.

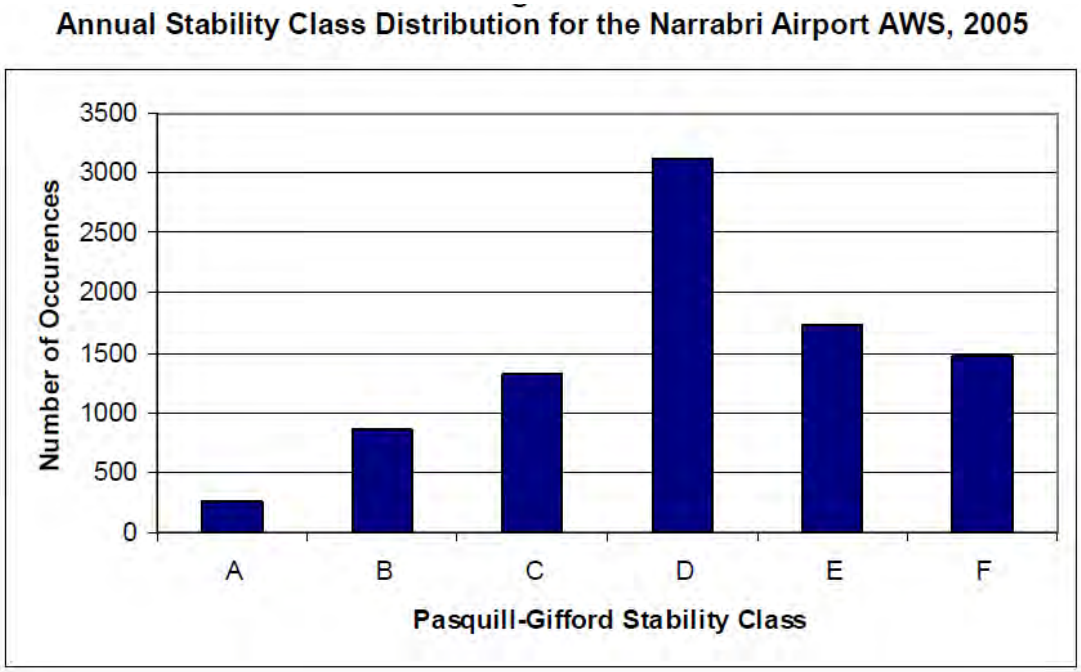


Figure 6-1 Annual stability class frequency for Narrabri in 2005

As such, Stability Class D was modelled for all scenarios to determine likely impacts in normal weather and typical ambient temperature and humidity. This was represented by mean 9 am weather conditions during February with the wind direction from the east. Stability Class F was also modelled for toxic dispersion scenarios, this being worst conditions for toxic dispersion. Stability Class F weather conditions are generated automatically by the modelling program.

6.2 Vulnerability - Toxic Effects Rule Set

Table 4-1 summarises the criteria used for the assessment of acutely toxic materials considered in this PHA. HIPAP No 4 provides risk criteria for toxic gas exposure which are provided in Section 4.2. For the purposes of this assessment serious injury is taken to be AEGL-2 concentration and irritation is taken to be AEGL-1.

AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

The HIPAP definitions in the risk criteria consider a relatively short period of exposure, therefore the AEGL values for a 10 minute exposure have been selected. Table 6-1 contains the values used in this quantitative risk assessment to assess toxic injury and irritation risks.

Table 6-1 Toxicity criteria for hydrogen chloride

Material	Concentration		
	Irritation (AEGL-1, 10 min)	Serious Injury (AEGL-2, 10 min)	1% Fatality at 15 mins exposure
	ppm	ppm	ppm
Hydrogen Chloride (HCl)	5[1]	100	2223

1 – The AEGL-1 level of HCl of 1.8 ppm corresponds with no observed effects, so 5 ppm was chosen for irritating effects as identified in the AEGL definition.

Propane gas is highly dispersive and only short period of exposure is likely, therefore the AEGL values for a 10 minute exposure have been applied to the risk assessment, these are provided Table 6-2 below.

Table 6-2 Toxicity criteria for propane

Material	Concentration		
	Irritation (AEGL-1, 10 min)	Injury (AEGL-2, 10 min)	Fatality (AEGL-3, 10 min)
	ppm	ppm	ppm
Propane	10,000	17,000	33,000

6.3 Vulnerability - Flammability Effects Rule Set

The risk criteria outlined in Table 4-1 from HIPAP No 4 have been applied.

Table 6-3 Flammability risk criteria

Risk	Irritation	Injury	Fatality
Thermal Radiation	2.1 kW/m^2	4.7 kW/m^2 (Residential injury criteria)	23kW/m^2 (industrial injury criteria)
	causes pain after 60 secs (HIPAP No 4)	Will cause pain in 15-20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur) (HIPAP No 4).	Likely to cause fatality for extended exposure and chance of fatality for instantaneous exposure and cause thermal stress in unprotected steel. It would also cause failure of a pressure vessel if not relieved.
Explosion Overpressure	3.5 kPa (0.5 psi)	7 kPa (1 psi) (residential) 14 kPa (2 psi) (industrial)	35 kPa (5 psi)
	90% glass breakage with very low probability of injury.	Residential risk criteria in which significant effects to people may occur (HIPAP No 4) Impacts include damage to internal partitions and joinery but can be repaired and a probability of injury is 10%. No fatality.	50% chance of fatality for a person in a building and 15% chance of fatality for a person in the open.

6.4 Scenario 1 – HCl Pool Loss from Bulk Storage

6.4.1 Overview

Failure of a 50 mm valve (flanged outlet which allows complete tank drainage) and there is a loss of 75% volume of the tank (tank not full). The tank is under atmospheric pressure and has a diameter of 4 m and a height of 10 m.

6.4.2 Assumptions and Calculations

The assumptions used in the modelling were based on common situations and typical industry specifications for similar equipment.

6.4.2.1 Tank Specification and Release Sources

- Tank specifications were not finalised at the time of assessment, so an assumption was made that the vertical FRP tank has a diameter of 4 m and a height of 10 m; and
- The drain valve is located at the bottom of the tank to allow for complete drainage. The size of the outlet for the drain valve was assumed to be 50 mm based on review of common HCl acid tank specifications of the nominated capacity.

6.4.2.2 Release Inventory and Duration

- The release inventory tank volume was assumed to be at 75% volume at the time of the event, based a likely inventory; and
- There is no mechanism to reduce the quantity released such as automatic shutoff values or emergency de-inventory and that the leak would not be able to be stopped prior to the contents draining.

6.4.2.3 Release Rate

The release rate equation from US EPA's *Risk Management Program Guidance for Offsite Consequence Analysis* (1999) has been applied to determine the release rate and time.

$$QR_L = HA \times \sqrt{LH} \times LLF$$

where:

- *QRL* = Liquid release rate (kilograms / minute)
- *HA* = Hole or puncture area (cm^2) *(39 cm^2)*
- *LH* = Height of liquid column above hole (cm) *(750 cm)*
- *LLF* = Liquid Leak Factor incorporating discharge coefficient and liquid density (listed in Exhibit B-3, Appendix B of the guideline) (56)

At 75% volume of 50,000 kg total storage, a volume of 37,500 kg would be released, at a release rate of 2,619 kg per minute it would take 14.3 minutes to empty. This equation does not consider the decrease in release rate with the reduction of the liquid height, and as such is a conservative estimate.

6.4.2.4 Evaporation Rate

The bund will contain all of the liquid, so an evaporating pool model was used. The evaporating pool parameters entered into the model were consistent with the concrete bunded area with impervious liner (8 x 8 x 1 m) with a capacity of 64 m^3, sufficient to contain the full tank volume.

6.4.2.5 Exposure Duration

The exposure duration is used in the calculation of toxicity effects. The maximum exposure duration was set to an hour as it was assumed that emergency response action would have already occurred, particularly for toxic chlorine gases with good odour warning properties. The toxicity effects rules in Section 6.2 were applied to create the threat zones.

6.4.3 Results

In this failure scenario, a loss of 75% volume of the tank would take 14.3 minutes and be contained within the bunded area. The contained hydrochloric acid spill would evaporate at a rate of 3.42 kg per minute at the air temperature of 24° C releasing 183 kg of hazardous component over an hour period. At 16° C air temperature the spill would evaporate at 878 grams per minute, releasing of 50.8 kg of total hazardous components. The impact of this evaporate release was examined under normal (Stability Class D) and worst case (Stability Class F) weather conditions and the results provided in Table 6-4.

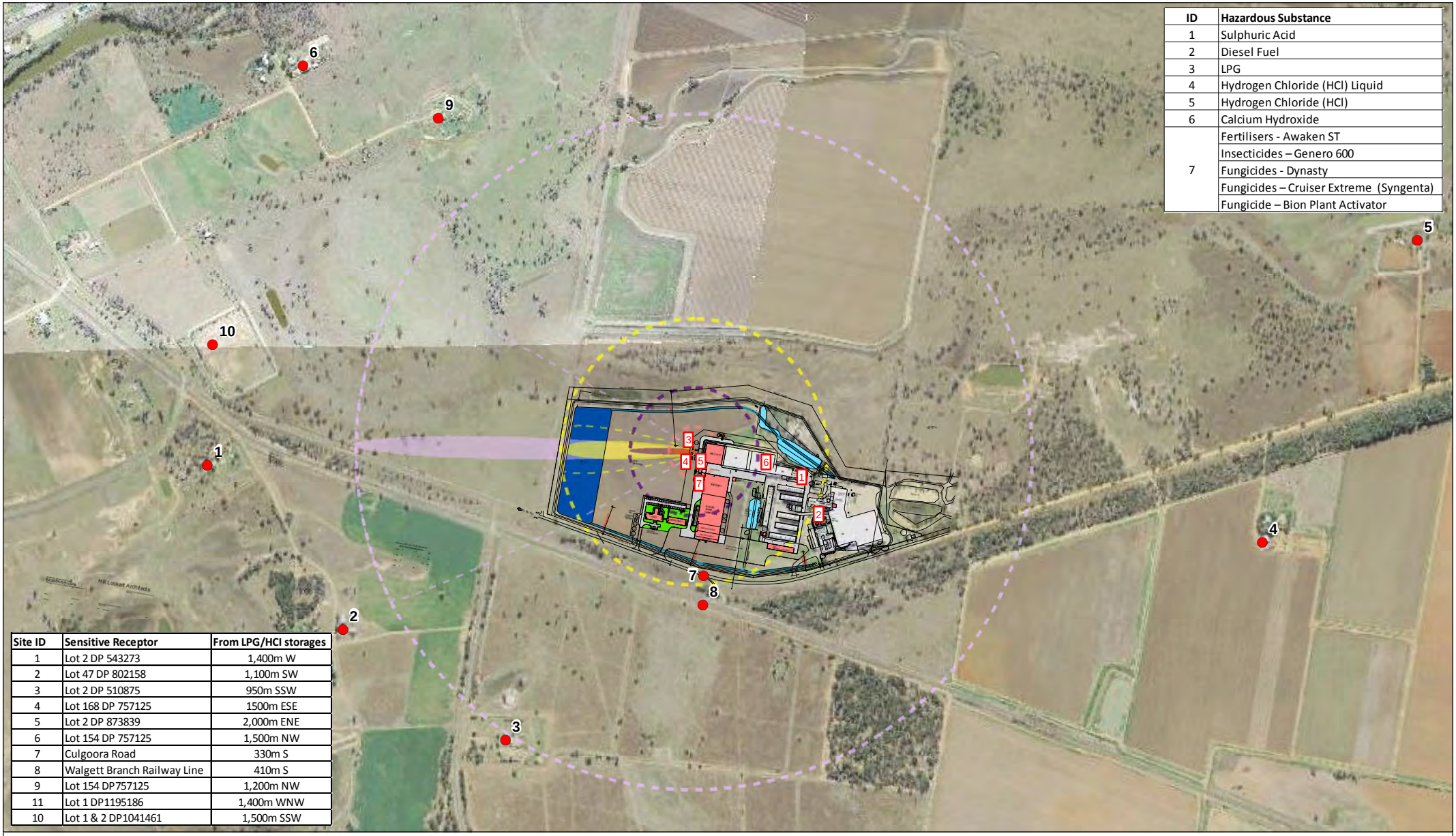
Table 6-4 Consequence results for loss of HCl tank contents

AEGL Limits	Stability Class D		Stability Class F		Offsite Impacts	Offsite Population Impacted
	Length	Width	Length	Width		
Irritation (5 ppm)	< 361 m	20 m	< 917 m	40 m	Minor if wind from N, E or S	5 – all in vehicles
Serious Injury (100 ppm)	< 68 m	10 m	< 174 m	20 m	No	N/A
Fatality (2223 ppm)	< 10 m	Patchy	< 17 m	Patchy	No	N/A

The results show there is no offsite risk of fatality or serious injury to the community if such an incident were to occur in normal weather conditions. Under worst case, Stability Class F conditions there would be no offsite risk of fatality, however, there could be some exposure to injury 50 m beyond the northern border if the event occurred in an infrequent southerly wind.

There are potential areas of irritation offsite under both weather conditions modelled, as shown in Figure 6-2. Under normal weather conditions, the irritation area could extend 100 m beyond the southern boundary and up to 250 m beyond the northern boundary depending on the wind direction at the time of the incident. The Culgoora Road could be impacted and there are currently no residential homesteads within this area. Under Stability Class F weather conditions, irritation effect plume could extend to 600 m with a width of 40 m. In north-east prevailing wind irritation impacts could extend over a stretch of the Culgoora Road and Walgett Branch Railway Line. Users of the road and rail infrastructure would be travelling and only subject to very short exposure duration if they were passing through the area at the time of the event. In addition, this modelling does not consider deflection or containment of the vapours from the presence of the buildings south and east of the storage which would further mitigate any impacts. Our analysis of this scenario identified no unacceptable risks. We, therefore, did not compute a frequency for the subject accidents. The ALOHA model outputs are provided within **Appendix C,** and the impact zones are shown on Figure 6-2.

Figure 6-2 Toxic dispersion impacts from loss of hydrochloric acid from bulk storage tank



ID	Hazardous Substance
1	Sulphuric Acid
2	Diesel Fuel
3	LPG
4	Hydrogen Chloride (HCl) Liquid
5	Hydrogen Chloride (HCl)
6	Calcium Hydroxide
7	Fertilisers - Awaken ST
	Insecticides – Genero 600
	Fungicides - Dynasty
	Fungicides – Cruiser Extreme (Syngenta)
	Fungicide – Bion Plant Activator

Site ID	Sensitive Receptor	From LPG/HCl storages
1	Lot 2 DP 543273	1,400m W
2	Lot 47 DP 802158	1,100m SW
3	Lot 2 DP 510875	950m SSW
4	Lot 168 DP 757125	1500m ESE
5	Lot 2 DP 873839	2,000m ENE
6	Lot 154 DP 757125	1,500m NW
7	Culgoora Road	330m S
8	Walgett Branch Railway Line	410m S
9	Lot 154 DP757125	1,200m NW
11	Lot 1 DP1195186	1,400m WNW
10	Lot 1 & 2 DP1041461	1,500m SSW

N

0 200 400

Meters

Scale @ A4 1:14,000
Date: 07/07/16
Drawn: Marko D.

Legend

CLASS D
Serious Injury 100 ppm at 10 min
Footprint
Confidence
Irritation (5 ppm at 10 mins)
Footprint
Confidence

CLASS F
Serious Injury 100 ppm at 10 min
Footprint
Confidence
Irritation (5 ppm at 10 mins)
Footprint
Confidence

Sensitive receptor

Figure 6-2
Toxic dispersion impacts from loss of hydrochloric acid from bulk storage tank

DATA SOURCE
Cotton Seed Distributors Ltd.

CDM Smith

6.5 Scenario 2 – HCL Loss During Unloading

6.5.1 Overview

Scenario 2 - Toxic dispersion from release of HCl in loading area from a coupling failure on the tank fill point. Attended filling occurs and the spill is identified within five minutes and emergency shut off activated.

6.5.2 Assumptions and Calculations

The assumptions used in the modelling were based on common situations and typical industry specifications for similar equipment.

6.5.2.1 Release Sources

Failure on the coupling that attaches to the fill point on the tank.

6.5.2.2 Release Inventory and Duration

- The modelling adopted the largest bulk tanker expected to deliver to the site, being 38 tonne capacity being the input inventory;
- Assumption that no other alarm or method to detect the failure other than from the supervisor overseeing the spill; and
- For releases during unloading operation, release duration was set to five minutes, as it would be an attended operation and it is assumed that the operator would take this time to activate the emergency shut off to shut down filling operations.

6.5.2.3 Release Rate

Average road tanker pumping rates vary between 227 to 378 L per minute. The higher pumping rate being the release rate of 378 L per minute was assumed.

A five minute release at this rate would create a spill volume of 1890 L within a contained concrete bunded area of 30 m by 4 m (120 m^2).

6.5.2.4 Evaporation Rate

Pool area = $A = QS \; X \; DF$

where:

- A = Maximum area of pool (square metres) for depth of one centimetre
- QS = Quantity released (kilograms)
- DF = Density Factor (listed in Exhibit B-3, Appendix B) (0.42)

The calculation exceeded the bunded area, as such the bund is smaller than the unbunded pool area so the area of the bund was input into the model with the volume of the spill. The evaporation rate is calculated within the model.

6.5.2.5 Exposure Duration

The exposure duration is used in the calculation of toxicity effects. The maximum exposure duration was set to an hour as it was assumed that emergency response action would have already occurred, particularly for toxic chlorine gases with good odour warning properties. The toxicity effects rules in Section 6.2 were applied to create the threat zones.

6.5.3 Results

In this failure scenario of five minute spill contained within the bunded area, the spill would evaporate at a rate of 5.17 kg per minute at the air temperature of 24° C for the first six minutes then significantly reduce to around 2 kg per minute after 14 minutes. Over an hour period this would result in a release of 139 kg of total hazardous components.

Table 6-5 Consequence results for loss of HCl during unloading

AEGL Limits	Stability Class D		Stability Class F		Offsite Impacts	Offsite Population Impacted
	Length	Width	Length	Width		
Irritation (5 ppm)	< 431 m	< 50 – 60 m	< 1,200 m	< 100 m	Yes	2.4 (One homestead) 5 – all in vehicles
Serious Injury (100 ppm)	< 178 m	< 20 m	< 228 m	< 50 m	Yes	0
Fatality (2223 ppm)	< 10 m	Patchy	< 22 m	< 50 m	No	N/A

The results show there is no offsite risk of fatality and a minor area of serious injury 100 m beyond the northern boundary if the even occurred in a southerly wind.

Offsite irritation will occur under both weather conditions. Under Stability Class D conditions a minor area of irritation from the toxic cloud would extend 200 to 300 m beyond the boundary northern and southern boundaries if the winds were from the north or south, respectively, during the event. There are no residents within this potentially impacted zone. Under worst case, Stability Class F conditions there would be a wider area of offsite irritation.

There are three residences within a distance 1,200 m from the HCl storage area, these being Site ID 2 and 3 to the south south-west (requiring north north-east winds to carry impacts to this residents) and Site ID 9 to the north-west of the HCl storage area (which would require south-east winds to carry impacts to this resident). Given the 50 m width of the possible vapour plume and there only being three residents within a 360 degree impact area it would only be possible for one location to be affected during an event. In north-east prevailing wind irritation impacts could extend over a stretch of the Culgoora Road and Walgett Branch Railway Line. Users of the road and rail infrastructure would be travelling and only subject to very short exposure duration if they were passing through the area at the time of the event.

Impacts of vapour exposure at this concentration is likely to cause immediate irritation to persons within the area and symptoms may include sore throat, nasal discharge, cough, chest pain or wheezing, as well as fatigue, headache or dizziness. Impacts not likely to require treatment or have any long term impacts. This scenario has a greater impact due to the increased surface area of the spilled pool which significantly increases evaporation rates. An analysis of frequency for the subject accidents appears in Section 7.

The ALOHA model outputs are provided within **Appendix C**, and the impact zones are shown on Figure 6-3.

ID	Hazardous Substance
1	Sulphuric Acid
2	Diesel Fuel
3	LPG
4	Hydrogen Chloride (HCl) Liquid
5	Hydrogen Chloride (HCl)
6	Calcium Hydroxide
7	Fertilisers - Awaken ST
	Insecticides – Genero 600
	Fungicides - Dynasty
	Fungicides – Cruiser Extreme (Syngenta)
	Fungicide – Bion Plant Activator

Site ID	Sensitive Receptor	From LPG/HCl storages
1	Lot 2 DP 543273	1,400m W
2	Lot 47 DP 802158	1,100m SW
3	Lot 2 DP 510875	950m SSW
4	Lot 168 DP 757125	1500m ESE
5	Lot 2 DP 873839	2,000m ENE
6	Lot 154 DP 757125	1,500m NW
7	Culgoora Road	330m S
8	Walgett Branch Railway Line	410m S
9	Lot 154 DP757125	1,200m NW
11	Lot 1 DP1195186	1,400m WNW
10	Lot 1 & 2 DP1041461	1,500m SSW

N

0 250 500

Meters

Scale @ A4 1:17,500
Date: 07/07/16
Drawn: Marko D.

Legend

CLASS D
Serious Injury 100 ppm at 10 min
Footprint
Confidence
Irritation (5 ppm at 10 mins)
Footprint
Confidence

CLASS F
Serious Injury 100 ppm at 10 min
Footprint
Confidence
Irritation (5 ppm at 10 mins)
Footprint
Confidence

Sensitive receptor

Figure 6-3
Toxic impact zones from vapour cloud from unloading spill

DATA SOURCE
Cotton Seed Distributors Ltd.

CDM Smith

6.6 Scenario 3 – LPG Loss from Storage Tank

6.6.1 Overview

Scenario 3 - Release of gas from a hole in the LPG storage tank has occurred due a failure with a small tapping from a pressure gauge or a crack in a complex weld. Gas leaking and not burning (toxic effects, vapour cloud flash fire, overpressure (blast force)).

6.6.2 Assumptions and Calculations

The assumptions used in the modelling were based on common situations and typical industry specifications for similar equipment.

6.6.2.1 Tank Specification and Release Sources

- Tank specifications were provided and are likely to be a bullet tank of 30 m^3, being 10 m in length and 2 m in diameter; and
- The opening is 0.80 m from tank bottom.

6.6.2.2 Release Inventory and Duration

- The release inventory tank volume was assumed to be at 80% volume at the time of the event, based on a likely working inventory (equivalent to 24 m^3); and
- There is no mechanism to reduce the quantity released such as automatic shutoff values or emergency de-inventory and t the leak could not be stopped prior to the contents draining.

6.6.2.3 Release Rate

Continuous releases to atmosphere from vessel failures have been modelled using hole sizes corresponding with likely equipment storage specifications, including:

- 1.5 mm - pressure gauge connections protected by a tapping reduced internally to a bleed hole not larger than 1.5 mm diameter (World LP Gas Association 2013);
- 13 mm – significant weld fracture; and
- 32 mm – size of through hole on an ASA 300 flange.

6.6.2.4 Exposure Duration

The exposure duration is used in the calculation of toxicity effects. The maximum exposure duration was set to 60 mins for the 1.5 mm hole due to continuous sustained releases. Exposure duration for the 13 mm and 32 mm holes was set to 10 minutes as modelling showed a rapid decline in source strength after 8 minutes and propane quickly dissipates. Toxicity and flammability criteria outlined in sections 6.2 and 6.3 have been applied to create the threat zones.

6.6.3 Results

6.6.3.1 Small Release (1.5 mm hole)

No impacts resulted from a 1.5 mm size hole in the modelling results.

6.6.3.2 Medium Release (13 mm hole)

No offsite impacts from a toxic vapour cloud resulted from a 13 mm size hole in the modelling results, as shown in Table 6-6.

Table 6-6 Consequence results for 13mm hole in LPG tank not burning – toxic vapour cloud

AEGL Limits	Stability Class D		Stability Class F		Offsite Impacts	Offsite Population Impacted
	Length	Width	Length	Width		
Irritation (10,000 ppm)	< 45 m	patchy	< 101 m	< 130 m	No	N/A
Serious Injury (17,000 ppm)	< 32 m	patchy	< 79 m	< 120 m	No	N/A
Fatality (33,000 ppm)	< 21 m	patchy	< 57 m	< 100 m	No	N/A

The flammable area of the vapour cloud was predicted to be at 60% lower explosive limit (LEL), (12,600 ppm) capable of flame pockets at 39 m from the tank in patchy areas and at 10% LEL (2100 ppm) to 119 m downstream of the wind. The blast overpressure from the release did not exceed 7 kpW which is the force capable of shattering glass. This does not pose any offsite impacts.

6.6.3.3 Large Release (32 mm hole)

In this scenario under Stability Class D weather conditions the LPG would be released as a mixture of gas and aerosol in a two phase flow at a rate of 138 kg per minute, with a total release of 7,517 kg. Under Stability Class F weather conditions the release rate would be 124 kg per minute with a slightly less total release. The source strength would rapidly dissipate as shown in Figure 6-4 below, with the impacts modelled below only lasting about 8 minutes.

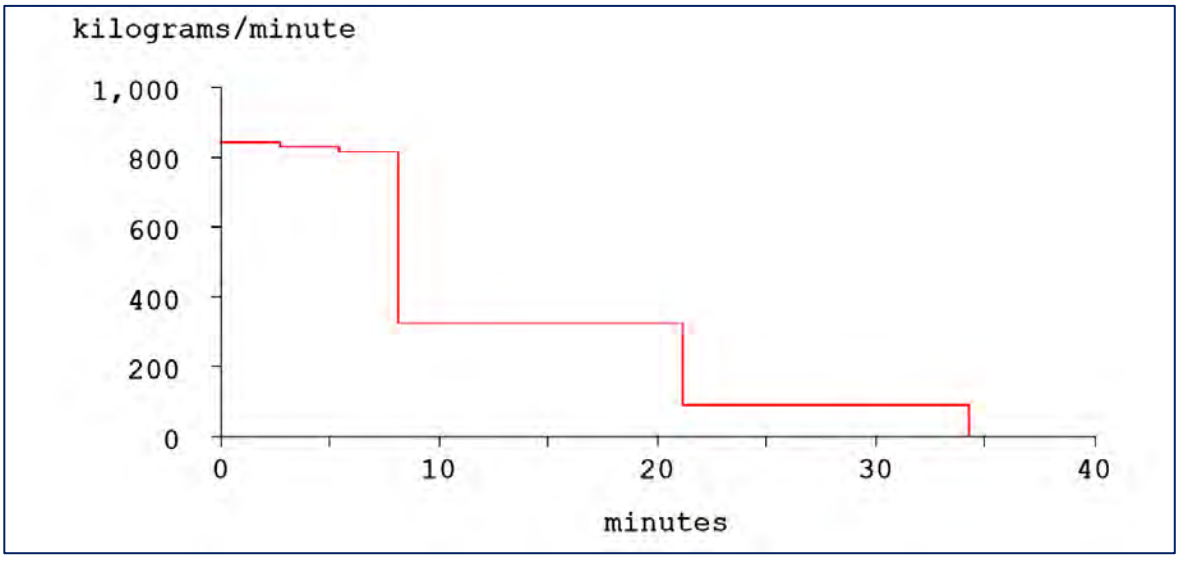


Figure 6-4 LPG release source strength over time

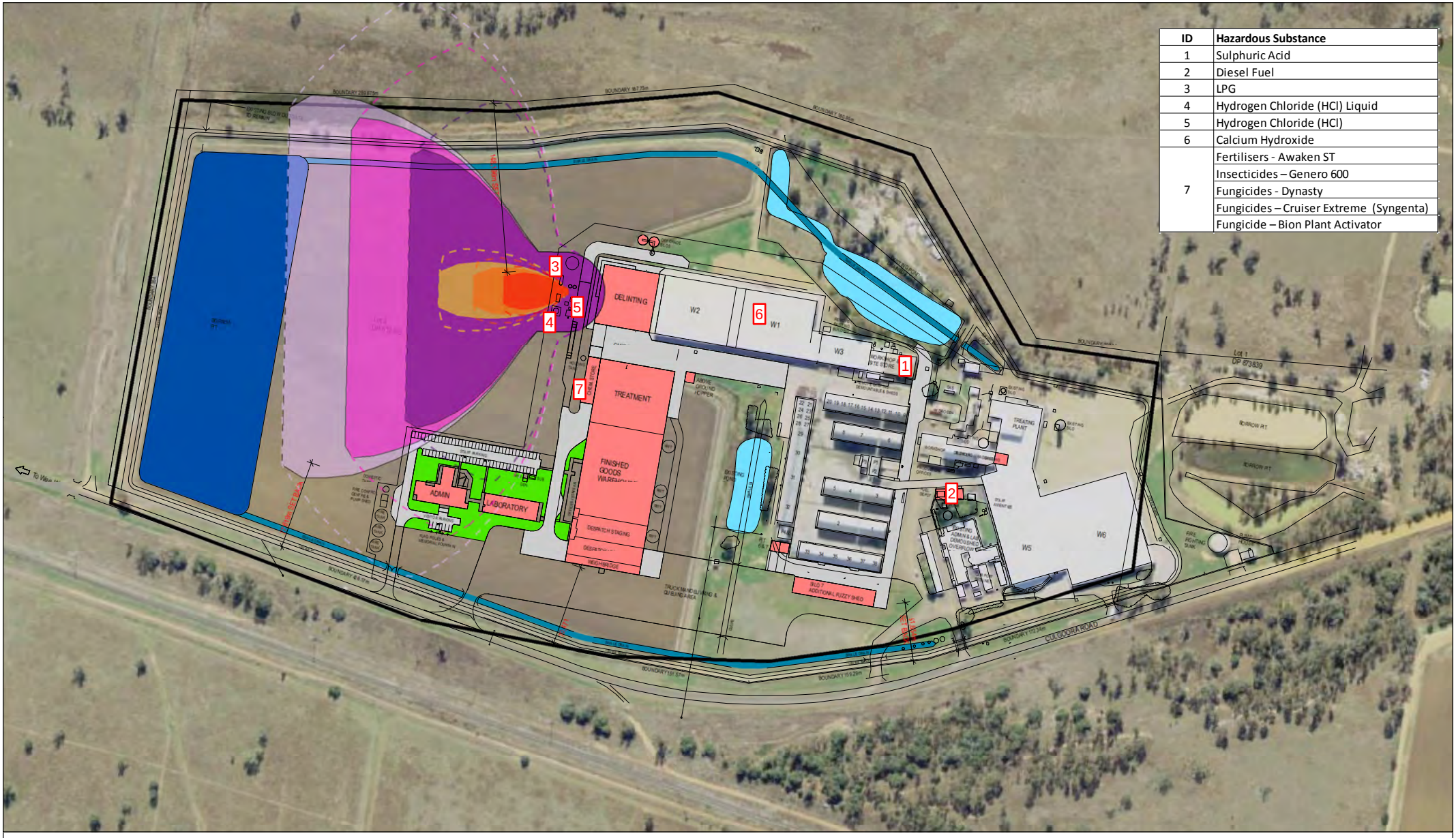
The impacts of the toxic vapour cloud from such a release are presented in Table 6-6 and shown in Figure 6-5. The symptoms of exposure are directly related to displacement of oxygen from air which can cause asphyxiation.

Table 6-7 Consequence results for 32 mm hole in LPG tank not burning – toxic vapour cloud

AEGL Limits	Stability Class D		Stability Class F		Offsite impacts	Offsite Population Impacted
	Length	Width	Length	Width		
Irritation (10,000 ppm)	< 109 m	< 50 m	< 243 m	< 300 m	Yes	0
Serious Injury (17,000 ppm)	< 75 m	< 40 m	< 188 m	< 220 m	Yes	0
Fatality (33,000 ppm)	< 53 m	50 – 60 m	< 136 m	< 200 m	Yes	0

Under all foreseen weather conditions there is no expectation of offsite impacts. Blast overpressure from explosion of the vapour cloud released did not the acceptable risk criterion of 7 kPa. The flammable area of the vapour cloud was predicted to be at 60% lower explosive limit (LEL), (12600 ppm) capable of flame pockets up to 218 m from the tank in patchy areas. Vapour could approach 10% LEL (2100 ppm) up to 515 metres downwind, which includes some offsite areas. HIPAP 4 does not indicate that concentrations this low constitute a hazard.

Our analysis of this scenario identified no unacceptable risks. We, therefore, did not compute a frequency for the subject accidents.



ID	Hazardous Substance
1	Sulphuric Acid
2	Diesel Fuel
3	LPG
4	Hydrogen Chloride (HCl) Liquid
5	Hydrogen Chloride (HCl)
6	Calcium Hydroxide
7	Fertilisers - Awaken ST
	Insecticides – Genero 600
	Fungicides - Dynasty
	Fungicides – Cruiser Extreme (Syngenta)
	Fungicide – Bion Plant Activator

N

0 50 100

Meters

Scale @ A4 1:4,500
Date: 07/07/16
Drawn: Marko D.

Legend

CLASS D

33000 ppm = AEGL-3 (10 min)
Footprint
Confidence

10000 ppm
Footprint
Confidence

17000 ppm = AEGL-2 (10 min)
Footprint
Confidence

CLASS F

33000 ppm = AEGL-3 (10 min)
Footprint
Confidence

10000 ppm
Footprint
Confidence

17000 ppm = AEGL-2 (10 min)
Footprint
Confidence

Figure 6-5
Consequence impacts from 32 mm leak in LPG tank not burning - toxic cloud

DATA SOURCE
Cotton Seed Distributors Ltd.

CDM Smith

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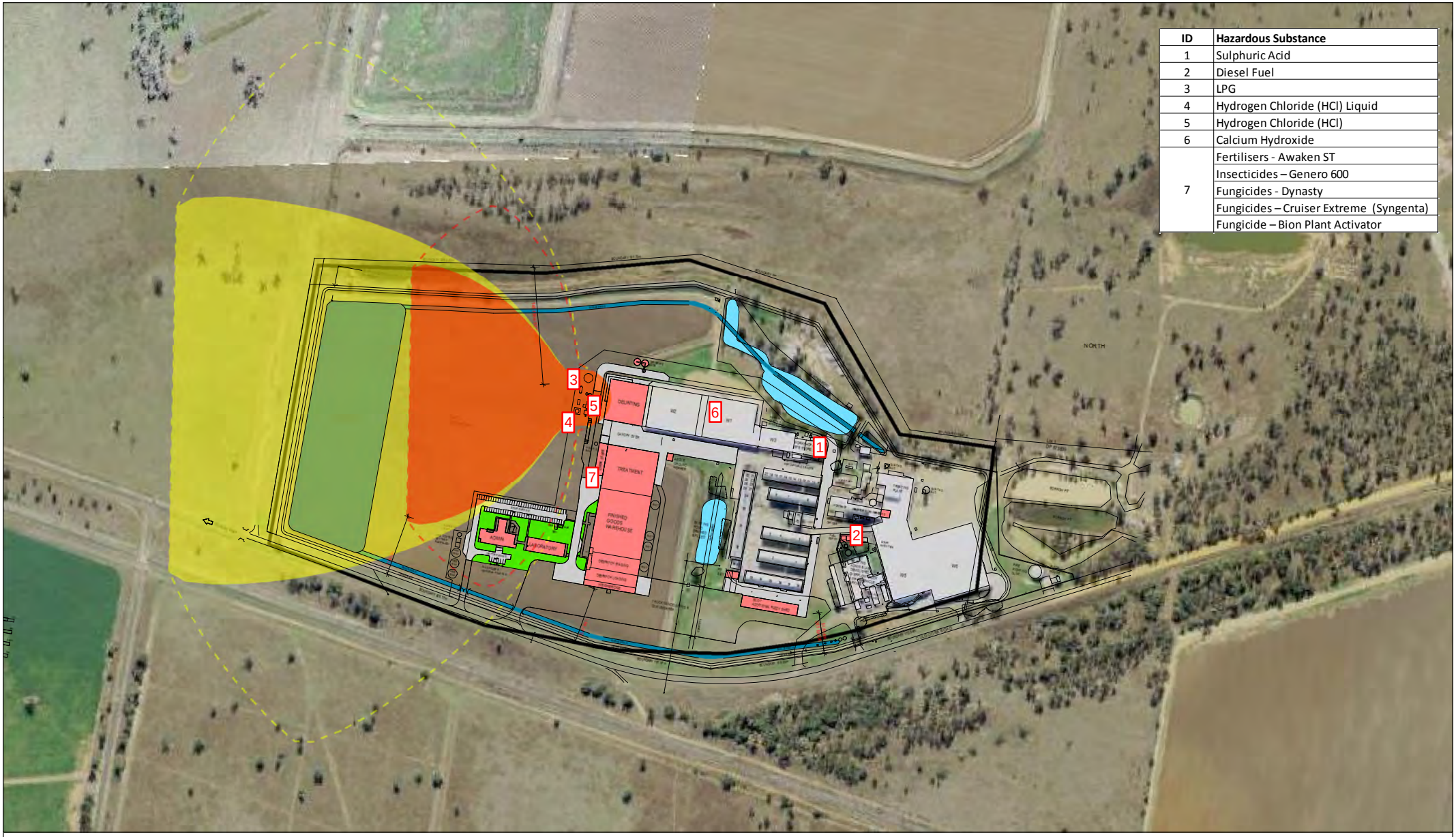

ID	Hazardous Substance
1	Sulphuric Acid
2	Diesel Fuel
3	LPG
4	Hydrogen Chloride (HCl) Liquid
5	Hydrogen Chloride (HCl)
6	Calcium Hydroxide
7	Fertilisers - Awaken ST
	Insecticides – Genero 600
	Fungicides - Dynasty
	Fungicides – Cruiser Extreme (Syngenta)
	Fungicide – Bion Plant Activator

N

0 75 150

Meters

Scale @ A4 1:6,500
Date: 07/07/16
Drawn: Marko D.

Legend

12600 ppm = 60% LEL = Flame Pockets

Footprint

Confidence

2100 ppm = 10% LEL

Footprint

Confidence

Figure 6-6

Flammability area from 32 mm hole in LPG tank - flammable vapour cloud

DATA SOURCE
Cotton Seed Distributors Ltd.

CDM Smith

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6.7 Scenario 4 – LPG Jet Fire Escape

6.7.1 Overview

Scenario 4 - Release from LPG storage tank with chemical burning (thermal radiation, explosion if heat causes the tank to fail and downwind toxic effects of fire by-products).

6.7.2 Assumptions and Calculations

The same assumptions and calculations used in Scenario 3 and outlined in Section 6.6.2 above have been applied for Scenario 4.

6.7.3 Results

6.7.3.1 Small Release (1.5 mm hole)

No impacts resulted from a 1.5 mm size hole in the modelling results for thermal radiation. Unlikely to cause a thermal radiation of 23 kW/m^2 to also cause failure of a pressure vessel if not relieved and thus tank explosion.

6.7.3.2 Medium Release (13 mm hole)

The results for gas leaking from a 13 mm hole ignited and burning are presented in Table 6-7 and the modelling outputs in **Appendix F.** The maximum burn rate would be 139 kg per minute producing an 8 m flame length with a total of 7,517 kg burnt. The thermal radiation impacts from the jet fire are presented in Table 6-8.

Table 6-8 Consequence results for 13mm hole in LPG tank burning – thermal radiation

AEGL Limits	Stability Class D		Offsite impacts	Offsite Population Impacted
	Length	Width		
Irritation (2.1 kW/m^2)	< 28 m	patchy	No	N/A
Serious Injury (4.7 kW/m^2)	< 19 m	patchy	No	N/A
Fatality (23 kW/m^2)	< 10 m	patchy	No	N/A

All thermal radiation impacts from this scenario would be contained onsite. We, therefore, did not compute a frequency for the subject accidents.

6.7.3.3 Large Release (32 mm hole)

The maximum burn rate would be 844 kg per minute producing a 19 m flame length for the first 10 minutes then it would reduce with a rapid decrease in the gas burn rate. A total of 12,005 kg would be burnt. The results for gas leaking from a 32 mm hole ignited and burning are presented in Table 6-8 and the consequences are displayed in Figure 6-7.

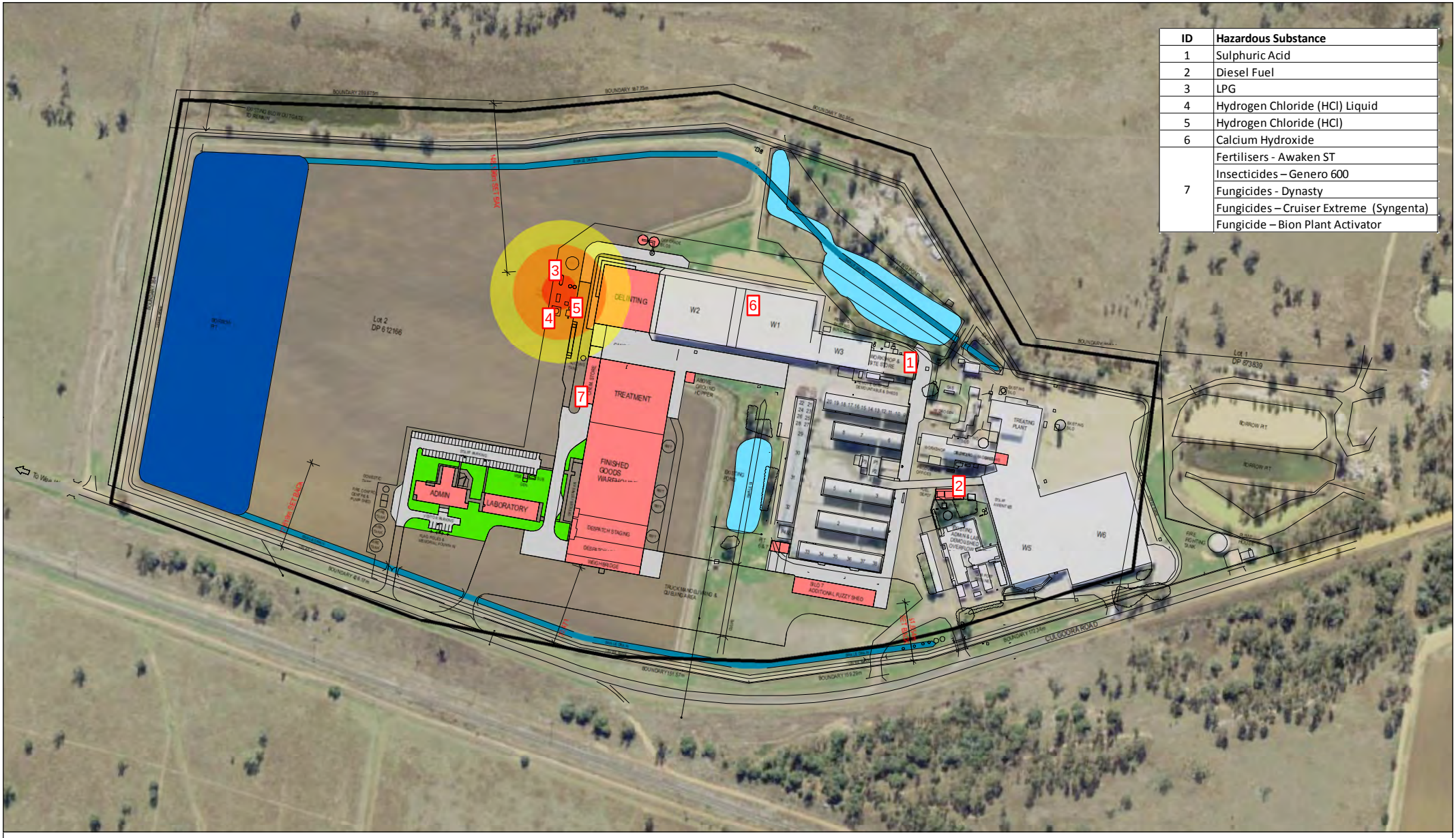
Modelling outputs are provided in **Appendix F.**

Table 6-9 Consequence results for 32 mm hole in LPG tank burning – thermal radiation

AEGL Limits	Stability Class D		Offsite impacts	Number of residents potentially impacted
	Length	Width		
Irritation (2.1 kW/m^2)	< 65 m	Patchy	No	N/A
Serious Injury (4.7 kW/m^2)	< 45 m	Patchy	No	N/A
Fatality (23 kW/m^2)	< 20 m	Patchy	No	N/A

All thermal radiation impacts from this scenario would be contained onsite. We, therefore, did not compute a frequency for the subject accidents. The potential for flame and heat radiation to cause tank failure scenario is presented in Scenario 5.

Burning of propane rarely causes acrid smoke or irritating fumes. The fertilizers (Loveland Products Inc 2011), fungicides (Syngenta Australia Pty Ltd 2013a and b), and insecticides onsite can produce hazardous products if subject to fire, combustion or explosion and will produce irritating and toxic gases may be generated by thermal decomposition or combustion of the products. The chemical storage area for the seed treatment chemicals including fungicides, pesticides are located 68 m from the LPG tank and are protected in a light weight single storage building. Our models show no ability for a fire involving the LPG tank to pose a risk to this storage.



N

0 50 100

Meters

Scale @ A4 1:4,500
Date: 07/07/16
Drawn: Marko D.

Legend

23 kW/(sq m)
Footprint

4.7 kW/(sq m)
Footprint

2.1 kW/(sq m)
Footprint

Figure 6-7
Consequence results for 32 mm hole in LPG tank burning - jet fire

DATA SOURCE
Cotton Seed Distributors Ltd.

CDM Smith

DRAGANICM B:\BES160264_Cotton_Seed\GIS\DATA\MXD\FINAL\008-R1-LPG_Burning.mxd 7/07/2016

6.8 Scenario 5 – Catastrophic Explosion

6.8.1 Overview

Scenario 5 - Tank explodes and chemical burns in a fire ball (BLEVE). BLEVEs occur when a tank is heated by an external fire. The fire causes the tank to heat and pressure to increase until the tank shell bursts. The gas boils and burns very quickly producing thermal radiation and risks from hazardous fragments and blast force from explosion and downwind toxic effects of fire by-products. This is a worst case outcome and has a very low frequency of occurrence.

6.8.2 Assumptions and Calculations

The assumptions used in the modelling were based on common situations and typical industry specifications for similar equipment.

6.8.2.1 Tank Specification and Release Sources

- Tank specifications were provided and are likely to be a bullet tank of 30 m^3, being 10 m in length and 2 m in diameter; and
- No heat or fire proof tank installed.

6.8.2.2 Release Inventory and Duration

- The release inventory tank volume was assumed to be at 80% volume at the time of the event, based on normal working inventory, equivalent to 24 m^3.

6.8.3 Results

A complete explosion of the LPG tank would burn in 10 seconds and create a 135 metre diameter fire ball. This explosion would create thermal radiation and overpressure from the blast impacts. Potential impacts from thermal radiation are predicted in Table 6-10.

Table 6-10 Consequence results for 32 mm hole in LPG tank burning – thermal radiation

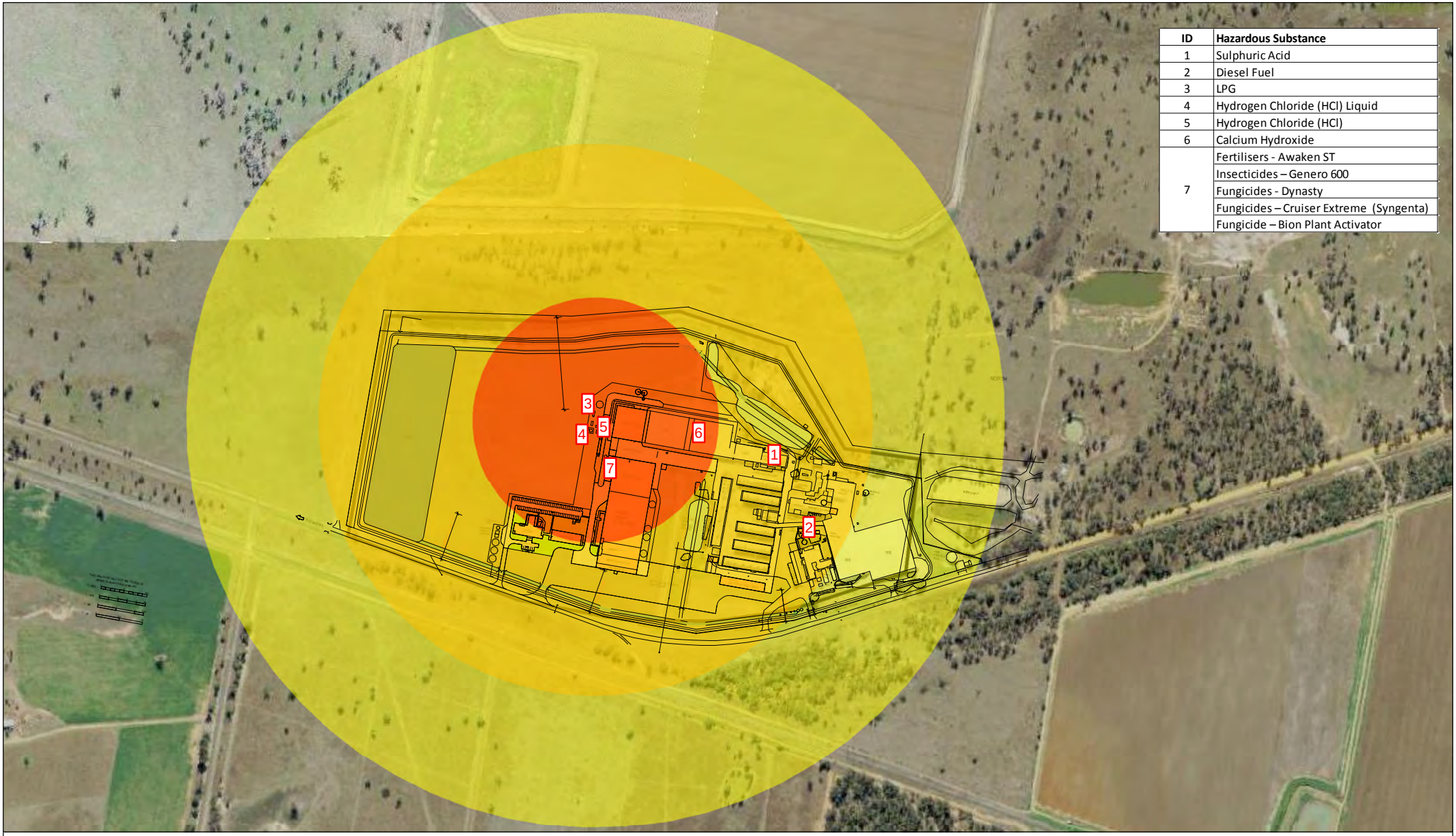
AEGL Limits	Stability Class D	Offsite impacts	Number of residents potentially impacted
	Length		
Irritation (2.1 kW/m^2)	< 652 m	Yes	0
Serious Injury (4.7 kW/m^2)	< 441 m	Yes	0
Fatality (23 kW/m^2)	< 196 m	No	N/A

Our analysis of this scenario identified an unacceptable risk. A calculation for frequency of the subject accidents appears in Section 7.

ALOHA estimates the thermal radiation hazard from a fireball and/or a pool fire. Other potential BLEVE hazards include overpressure, hazardous fragments, smoke, and toxic by-products from the fire. ALOHA does not model these because, in most BLEVEs, thermal radiation impacts a greater area than the overpressure and is the more significant threat.

Carbon oxides (CO, CO2) fumes may be produced should burning occur (i.e. causing a deficiency of oxygen). The chemical storage area for the seed treatment chemicals including fungicides, pesticides

are located 68 m from the LPG tank and are protected in a light weight single storage building. The impacts from an explosion of the LPG tank does pose a low risk to this storage, and there is a possibility it could cause fire within this storage area. Thermal radiation at this heat causes spontaneous ignition of wood after long exposure. However, the BLEVE is expected to end in ten seconds and such a fire is unlikely. If stored agricultural products were to catch fire, the burning of these chemicals would increase the toxic hazards of the fire by products as well create environmental risks for the non-burning pure substance which spreads to the surroundings.



ID	Hazardous Substance
1	Sulphuric Acid
2	Diesel Fuel
3	LPG
4	Hydrogen Chloride (HCl) Liquid
5	Hydrogen Chloride (HCl)
6	Calcium Hydroxide
7	Fertilisers - Awaken ST
	Insecticides – Genero 600
	Fungicides - Dynasty
	Fungicides – Cruiser Extreme (Syngenta)
	Fungicide – Bion Plant Activator

N

0 125 250

Meters

Scale @ A4 1:8,250
Date: 07/07/16
Drawn: Marko D.

Legend

23 kW/(sq m)
Footprint

4.7 kW/(sq m)
Footprint

2.1 kW/(sq m)
Footprint

Figure 6-8
Thermal radiation impacts from explosion of LPG tank

DATA SOURCE
Cotton Seed Distributors Ltd.

CDM Smith

6.9 Cumulative Impacts

There are very minor and no offsite fatality risk, however, the possibility of domino effects or cumulative impacts should be considered. The distance between LPG and HCI Liquid (ID4) is approximately 19 m and HCI (ID5) is 21 m. Two potential circumstances have been identified and considered, these include hydrochloric acid leak which could cause corrosion of LPG piping and the explosion of the LPG tank causing a hole or rupture of the HCl tank.

6.9.1 Acid Leak Cause Corrosion of LPG Piping

Hydrochloric acid (corrosive) is not compatible with LPG storage as the acid is likely to interact with the metal pressure vessel or piping such that it is weakened or damaged to the extent that risk increases.

This risk exists in areas where LPG piping is located in areas where the HCl acid leak is possible. However, as leaking LPG from pipes or HCl are not considered to impose offsite risks this has not been considered further. The AS 3780-2008 – The storage and handling of corrosive substances requires material likely to come into contact with a corrosive substance to be immune from attack. It is recommended that in areas where a HCl leak could occur and impact LPG piping that CSD install LPG piping protection or material type resistant to corrosion from acid.

The other circumstance would be corrosive vapours from a large spill during filling. Modelling shows that the concentration from a Scenario 1 event in Stability Class F conditions would have an 1800 ppm concentration of vapours at the LPG storage tank, as shown in Figure 6-9 below.

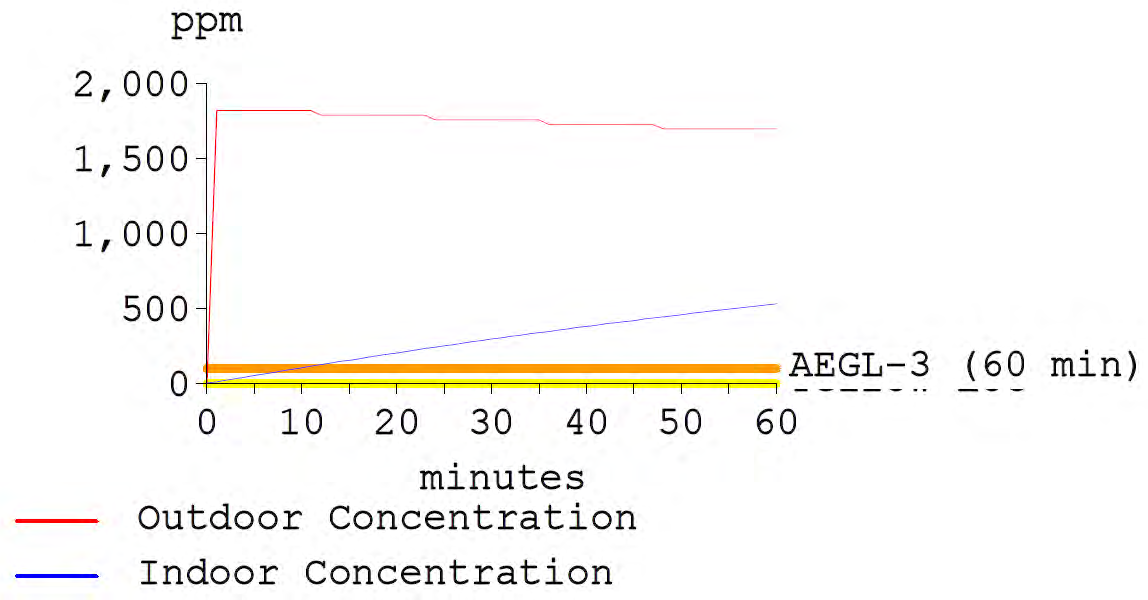


Figure 6-9 HCl vapour concentration at the LPG tank in a large spill from tank

The following recommendations are provided to minimise cumulative impacts of such a scenario:

- Implement a system to auto detect if there is a leak in the HCl system and set of alarm or notifications; and
- Consider the use of water sprays that could suppress vapour releases from the bund.

6.9.2 Explosion of LPG Causing a Rupture of the Acid Tank

The HCl tank is within the fireball area caused by an explosion of the propane tank. This would subject the hydrochloric acid tank to thermal radiation of up to 40 kW/m^2 which is likely to damage steel, increase pressure within side the tank requiring significant pressure release and likely cause a tank failure. To minimise this cumulative consequence risk if such an event occurred, a thermal screen could be constructed between the LPG storage and HCl tank to prevent such impacts during the fireball which only lasts around 10 seconds.

Under AS 1596 – 2002 Storage and handling of LP Gas a thermal screen if installed must met the following requirements:

- The thermal screen shall be constructed of non-combustible materials and be firmly supported so as to be capable of withstanding short duration LP Gas flash fires (flash fires rarely exceed 20 s duration).
- The thermal screen shall be of sufficient dimensions to ensure that any connections and associated pipework to the vessel or any other operable fittings are not in line of sight from the protected area. For vertical tanks the thermal screen need not be higher than 0.5 m above the highest point of potential or actual release of LP Gas in normal operation.
- The safety valves, bleed valves and drain valves are not considered as release points.
- The thermal screen shall be at least 1.8 m high.
- The thermal screen shall permit free access around and cross-ventilation for the tank.

Other more likely scenarios modelled, such as overpressure from a vapour cloud explosion caused from a 32 mm hole does not exceed pressures which would shatter glass and thus would not pose a risk to the acid storage tank.

Section 7 Frequency Assessment

The failure frequency data and source applied for this assessment is outlined in Table 7-1.

Table 7-1 Failure rates of equipment

Type of Failure	Failure Rate	Exposure Factor Discussion	Failure Rate Applied ($x10^{-6}$ per yr)
Road tanker unloading HCl (Scenario 2)			
Continuous large connection release	5×10^{-7} per year G2 - Continuous release from a hole the size of the largest connection - If the tank is (partly) filled with liquid, the release is modelled from the liquid phase out of the largest liquid connection.	Unit risk per year (TNO Purple Book)	0.5×10^{-6}/yr.
Hose failure	4×10^{-6} / operating hour Full bore rupture of the loading/unloading hose, the outflow is from both sides of the full bore rupture.	52 tanks per year * 20 minutes /tank (TNO Purple Book) Plume width at 330 m: 2 @ 20 m of 2,073 m circumference = 1.93×10^{-2}	1.3×10^{-6}/yr.
BLEVE of LPG Tank (Scenario 5)			
BLEVE Frequency	4.7 × 10-5 / year – For tanks worldwide	**Report No. 434 – 3 (Storage incident frequencies** International Association of Oil & Gas Producers, March 2010)	47×10^{-6}/yr.

The likelihood of an incident occurring in an area used for the storage and handling of corrosive substances and LPG can be minimized by good design and layout, sound engineering, good operating practices, and proper instruction and training of personnel in the performance of their duties.

Section 8 Risk Assessment

8.1 Consequence and Frequency Assessment

Only loss of containment events that contribute to the individual and or societal risk should be included in the quantitative risk assessment. Of the scenarios modelled in Section 6, only scenarios 3 and 5 have potential for offsite injury, the consequence and frequency are provided in Table 8-1.

Table 8-1 Consequence and frequency assessment

ID	Scenario	Event	Offsite impact	Potential residents impacted	Risk Criteria Limit (HIPAP No 4)	Frequency occurrence
1	Scenario 1	Loss from HCL storage tank - stability class F and D	Toxic Irritation	0	50×10^{-6}	N/A
2	Scenario 1	Loss from HCL storage tank - stability class F	Toxic Injury (exposure)	0	10×10^{-6}	N/A
3	Scenario 2	Loss from HCl unloading	Toxic Irritation	5	50×10^{-6}	1.8×10^{-6}
4	Scenario 2	Loss from HCl unloading	Toxic Injury (exposure)	0	10×10^{-6}	N/A
5	Scenario 3	32 mm leak in LPG not burning	Fatality	0	50×10^{-6}	N/A
6	Scenario 3	32 mm leak in LPG not burning	Toxic Injury	0	10×10^{-6}	N/A
7	Scenario 3	32 mm leak in LPG not burning	Toxic Irritation	0	50×10^{-6}	N/A
8	Scenario 3	32 mm leak in LPG not burning	Flammability	0		N/A
9	Scenario 5	LPG tank explosion	Thermal Injury	0	50×10^{-6}	47×10^{-6}
10	Scenario 5	LPG tank explosion	Thermal irritation	0	50×10^{-6}	47×10^{-6}

8.1.1 Individual Fatality Risk

The present situation and any approved future residential plans are considered. There is no residents, surrounding industry, recreational areas with population impacted by fatality risks from the potential occurrence of hazardous events from the Project. The risk of fatality at the nearest populated area (residential and industrial) is well below the criterion for new installations of on chance in a million per year (1×10^{-6}) and (50×10^{-6}) respectively.

8.1.2 Toxic Injury/Irritation

The present situation and any approved future residential plans are considered. There is no residents, surrounding industry, recreational areas with population impacted by injury risks from the potential occurrence of hazardous events from the Project. The population potentially impacted by irritation are those users at the time on the rail and road to the south of the Project site and one of three homesteads within 1,200m of the site. The risk of toxic irritation at the nearest populated area (residential and industrial) is well below the criterion.

8.1.3 Societal Risk

Due to the absence of occupation in the area of exposure offsite and the low potential or absence for fatalities an indicative societal risk criteria was not applicable and the project imposes negligible societal risk.

8.2 Risk to Biophysical Environment

There are no environmentally sensitive areas in the surrounding area and the landscape is predominantly cleared agricultural lands. Due to the bunding there are minor impacts posed to the environment from either a loss of HCl tank contents or spill during the unloading from bulk tankers. The only impacts to the surrounding environment would be the irritation and possible injury to nasal and respitory systems of animals present in the potential impact areas. This could include any cattle grazing in the surrounding paddocks to the site.

8.3 Controls

8.3.1 General

The proposed development has a number of controls proposed to increase the safety and reduce the consequence risks and frequencies of these events occurring. These measures include:

- Ventilation to internal areas designed in accordance with AS 1668;
- Site security system which is likely to include:
    - Closed circuit television (CCTV) at nominated external areas
    - Remote control monitoring of nominated external doors during after hours
    - Allow for future expansion and control of nominated doors using card swipe/proximity fobs and electric door latches
- Fire system including detection, hydrant coverage and sprinkler system
    - The fire hydrant system would be designed to be compliant with the Building Code of Australia, AS/NZS 3500.1.2 Australian Standard for Water Supply, AS 2419.1 Australian Standard for Fire Hydrant Design, Installation and Commissioning and The New South Wales Code of Practice for Plumbing and Drainage.
    - Fire hydrants would be double pillar type located not closer than 10 m to the building where possible. If located adjacent the building a fire rated wall 90/90/90 will be constructed.
    - The Fire Sprinkler System installation would be designed to be compliant with the Building Code of Australia, AS/NZS 3500.1.2 – Australian Standard for Water Supply, The New South Wales Code of Practice for Plumbing and Drainage and AS 2118.1 – Fire Sprinkler System.
    - Sprinklers are required to be installed in accordance with the requirements of the Building Code of Australia.

8.3.2 LPG

- LPG Storage has minimum separation distances imposed under AS/NZS1596 -2008 which requires 20 m minimum from the property boundary
- The entire installation would be designed to be compliant with AS 5601-2000/AG 601-2000 – Australian Standard for Gas Installations
- isolation valves on branch lines to the proposed buildings
- PLC and SCADA automation control systems

8.3.3 Hydrochloric Acid and HCl Gas

- Concrete bund with impervious liner in place (8 m x 8 m x 1 m equals capacity of 50 t tank plus 10%)
- High and low level indicators with remote telemetry to supplier
- Safety shower
- Site security with CCTV and remote control monitoring of external doors (Section 8.6)
- PLC and SCADA automation control systems
- Ventilation system which meets AS1668.2
- Site spill procedures to contain leaks
- Concrete bund with impervious liner 5 m x 5 m x 1 m under the stripping and evaporator towers and heat exchanger plant
- Site Emergency Response Plan
- Causemag storage onsite for neutralisation

Section 9 Conclusions and Recommendations

9.1 Conclusion

It is concluded that a range of emergency events which could occur with the proposed dangerous goods stored and used on site would not pose any fatality or serious injury risks to the offsite population. There is potential for offsite irritation from low concentrations of HCl vapour fumes on a small number of population, but the frequency of such an event occurring is below the acceptable risk criteria imposed within HIPAP No 4. As such the development is considered acceptable within the proposed location.

The modelling and assumptions were highly conservative and only considered minor controls which included bunding and attended operations. The frequency and the consequence of such scenario events is likely to be further mitigated in the design stage through the implementation of minimum requirements within the applicable Australian Standards (AS) and throughout operations with good practice controls. Such minimum AS requirements and other additional recommended controls are provided in the following.

9.2 Recommendations

The following recommendations and industry best practice should be applied and implemented at the site to ensure the risks are reduces to ALARP levels.

9.2.1 General

9.2.1.1 Emergency Response

- An Emergency Response Plan should be developed in consultation with the emergency services and relevant regulatory authorities. This should be reviewed regularly and plant personnel shall be familiar with the contents of the emergency plan.
- Adequate emergency response materials and equipment such as clean-up equipment, chemicals for neutralizing or decontaminating spills and absorbent materials shall be readily available. Regular inspection and maintenance of emergency response inventory is required.

9.2.2 Hydrochloric Acid Storage

To further reduce risk and consequences of the potential hazards the following recommendations are provided for the FRP acid storage tank:

9.2.2.1 Australian Standards and Best Practice

It is recommended that the following standards are implemented as minimum acceptable safety requirements for storage facilities, operating procedures, emergency planning and fire protection.

- Australian Standard (AS) 3780-2008 – The storage and handling of corrosive substances (Section 5);
- AS4452 – The Storage and handling of toxic substances; and
- AS 2430.3.7–2004 – Classification of hazardous areas.

9.2.2.2 Bund Design

The AS 3780 requirements are minimum standards:

- The minimum distance between the top inside perimeter of the bund and any protected place or boundary shall be 3 m and between a tank and the bund is 1 m, if tank under pressure this should be increased.
- The construction materials of the bund shall be substantially immune to attack by any corrosive substance that they may be required to contain, sufficiently impervious to retain and enable spillage recovery and designed to withstand the hydrostatic pressure expected to be exerted on them when they are full.
- The point at which any pipe passes through the wall of a bund shall be sealed to prevent leakage from the compound.
- Provision shall be made such that entry and exit by personnel into and out of the compound, under both normal conditions and emergency conditions, shall be ergonomically safe.

9.2.2.3 Tank Design

The AS 3780 requirements are minimum standards:

- The minimum separation distances for bulk containers from protected places and the boundaries of the premises shall be 8 m.
- All bulk containers, including their bases, shall be designed and constructed in such a manner as to be resistant to all likely sources of corrosion. Particular attention shall be paid to areas where accidental spillage is likely to affect the external surface of the container (e.g. around vents or surfaces adjacent to filling points).
- Every bulk container shall be installed on supports or a properly prepared plinth and constructed of non-combustible, corrosion resistant materials or be suitably protected by coatings. The supporting structure shall be designed in accordance with the Australian Standard appropriate to the type of construction (e.g. AS 4100 for steel, AS 3600 for concrete) and any welded-on support, bracket or other fitting shall be welded in such a manner as to prevent penetration of water that is likely to cause corrosion of the tank (e.g. weep holes shall be at the lowest point of mounting pads).
- All tanks shall be fitted with vents of design and capacity such that blockage by corrosive residues or deposits is avoided; and the pressure or vacuum resulting from filling, emptying or atmospheric changes cannot cause the maximum allowable operating stresses of the tank to be exceeded.
- Where a bulk container will be pressurized for the purpose of product transfer, the fittings and the pipework shall be designed for the maximum pressures that might develop.
- All liquid lines connected at or below the liquid level of the bulk container shall be fitted with a shut-off valve at the nozzle through which liquid is transferred into or out of the container. Where the capacity of the container exceeds 100 m3, all liquid outlet shut-off valves shall also be fitted with a remote means of activation. In all cases, the open and closed positions for the valves shall be clearly marked.

- Provision shall be made to enable the complete and safe draining of transfer hoses and filling lines prior to decoupling them.
- Where the fill tube is to extend below the surface of the liquid, it shall be provided with a siphon breaker (a splash plate may also be fitted).
- Filling through the top of the tank should be used wherever possible.
- Any transfer point (the point where the pipework from a bulk container terminates) be suitably anchored and provided with a quick-action shut-off valve (self-closing type) if the transfer point is positioned at or below the highest level of liquid in the container or pipework.
- All pipes shall be colour coded in conformity with AS 1345 and be well supported, and protected from potential damage by traffic. Flexible hoses shall not be used, except at transfer points.
- Valves, pumps, flow metres, other accessories and lubricants shall be suitable for use with the corrosive substance to be handled.
- The use of screw fittings should be avoided wherever possible.
- Where the corrosive substance is capable of forming a hazardous zone (see AS/NZS 2430.3 series), electrical equipment installed in such a zone shall comply with the requirements of those Standards.
- Electrical equipment shall be suitably protected against corrosion. Where such equipment is attached to a fixed tank, it shall be protected from exposure by use of a suitable enclosure (see AS 60529).
- Every fixed tank shall be fitted with an appropriate means of indicating the level of its contents. The safe fill level of a tank shall be clearly marked on the level-indicating device. Where the indication of the liquid level is not continuously available to the person filling the tank, the tank shall be fitted with a high-level alarm and an extra-high-level cut-off device capable of stopping the filling operation immediately.
- Every fixed tank shall have an overflow line installed which meets the AS3780 requirements.

Other recommended considerations:

- Fiberglass tanks are not always designed to withstand pressure or vacuum so proper venting is critical, especially if the product is to be loaded into the tank with air pressure. The tank manufacturer should be consulted for a recommendation on proper vent openings and pressure/vacuum relief systems.
- Fiberglass storage tanks should also be equipped with two 24-inch manways, 3-inch flanged nozzles and 3-inch flanged product inlet line. The tank manufacturer should be consulted for a recommendation on proper vent openings and pressure/vacuum relief systems.
- A pressure/vacuum relief device should be in place in addition to the tank vent.
- A fume scrubber to eliminate the release of irritating and corrosive vapours. The scrubber back-pressure can make a large difference in the pressure in the storage tank during and immediately after unloading. A typical packed column scrubber or re-circulating scrubber exerts very little back pressure; however, venting into the bottom of a vessel below a liquid head may exert a back-pressure above the tank design in routine venting operations.

9.2.2.4 Construction

- To the extent feasible, all fittings and pipes associated with the acid system should be in the bund, or protected from moving plant equipment by barriers or bollards.

9.2.2.5 Filling of Tank

To further reduce risk and consequences of the potential hazards the following recommendations are provided for the unloading of hydrochloric acid from road tankers into the storage tank:

- Develop a SOP which requires attended operation at all time and implements the requirements of AS 3780:2008 – Storage and handling of corrosive substances.
- A safety shower complying with AS 4775 (or a plunge bath) and eye-wash facilities (also complying with AS 4775) shall be located within 7 m of, but not closer than 2 m to, any product transfer point.
- The fire sprinkler system should include a water spray that can be used for suppressing vapour releases. To the extent feasible, all fittings and pipes associated with the acid system should be in the bund, or protected from moving plant equipment by barriers or bollards.
- Product transfer shall not be commenced until all essential gauges, valves, fittings and connections are illuminated to a level of at least 50 lux.

9.2.2.6 Operations

- The operations should comply with AS3780 requirements for controlled entry, clear access, lighting, ventilation, safety information, safety checks, handling precautions, signage and work permit for work and maintenance in these areas.
- The tank and all its appurtenances should be subject to a management of change system and periodic monitoring for mechanical integrity.
- Frequently inspect scrubber systems for evidence of obstructions and proper operation to minimize back pressure build-ups.
- Maintenance of the bunded area to ensure no collection of rainfall which would reduce the capacity.

9.2.3 LPG Storage

Reducing the risks associated with operating an LP Gas facility to As Low As Reasonably Practicable (ALARP) can be achieved with suitable design and engineering standards, safe operations, and comprehensive and rigorous maintenance programmes combined with effective staff training programmes. As the 30,000 L LPG tank is greater than 125 m from the public road it is considered to be a Class A site under the AS1596. It is recognised that the bullet vessel will be owned and supplied by Elgas or a third party gas supplier, as such, obligations on the design and the maintenance and testing will remain with the owner of the pressure vessel.

9.2.3.1 Australian Standards and Good Practice

- AS1940 – The storage and handling of flammable and combustible liquids;
- AS1596 – The storage and handling of LP Gas; and
- AS1210 – Pressure vessels
- World LP Gas Association's, Guide to Good Industry Practices for Bulk LP Gas Installations: http://www.wlpga.org/wp-content/uploads/2015/09/gbp-guide-to-good-industry-practices-for-bulk-lp-gas-installations.pdf

9.2.3.2 LPG Safety Recommendations

Fire deluge system - sprinkler or fire hydrant in vicinity of LPG storage to enable cooling of the tank in the event of a fire nearby or from jet fire from leak in tank to reduce risk of explosion.

Pressure testing – leakage testing of the pipework to be undertaken in accordance with the AS1596 minimum requirements.

Impact protection - vessel and pipework need to be protected from physical impact – bollards would need to be installed around the bullet to ensure no impact from vehicles or moving plant.

Separation distances – appropriate separation distances to protected places, doors, ignition sources.

Ignition sources - control of ignition sources around the storage and pipework areas. Ignition sources shall not fall within a hazardous area as defined in AS 2430.1 and AS/NZS 2430.3 series.

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

Vapour barrier or fire wall or thermal screen – consider a between the LPG tank and the hydrochloric storage and bund areas to minimise any chance of cumulative impacts.

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Appendix A - Safety Data Sheets

CDM Smith

cdmsmith.com

Sulphuric Acid SDS

Coogee Chemicals Sulphuric Acid

Coogee Chemicals

Chemwatch Hazard Alert Code: 4

Chemwatch: **48-4494**
Version No: **2.1.1.1**
Safety Data Sheet according to WHS and ADG requirements

Issue Date: **02/04/2015**
Print Date: **30/07/2015**
Initial Date: **Not Available**
S.GHS.AUS.EN

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

Product Identifier

Product name	Coogee Chemicals Sulphuric Acid
Proper shipping name	SULPHURIC ACID with more than 51% acid
Other means of identification	Not Available

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Battery Acid, Explosive Manufacture, Fertilizer.

Details of the manufacturer/importer

Registered company name	Coogee Chemicals
Address	Cnr of Patterson and Kwinana Beach Roads Kwinana WA Australia
Telephone	+61 8 9439 8200
Fax	+61 8 9439 8300
Website	www.coogee.com.au
Email	businessrelations@coogee.com.au

Emergency telephone number

Association / Organisation	Coogee Chemicals
Emergency telephone numbers	1800 800 655
Other emergency telephone numbers	Not Available

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

HAZARDOUS CHEMICAL. DANGEROUS GOODS. According to the Model WHS Regulations and the ADG Code.

CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability	0	
Toxicity	0	
Body Contact	4	
Reactivity	2	
Chronic	0	

0 = Minimum
1 = Low
2 = Moderate
3 = High
4 = Extreme

Poisons Schedule	S6
GHS Classification [1]	Metal Corrosion Category 1, Skin Corrosion/Irritation Category 1A, Serious Eye Damage Category 1
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HSIS ; 3. Classification drawn from EC Directive 1272/2008 - Annex VI*

Label elements

GHS label elements	
SIGNAL WORD	**DANGER**

Hazard statement(s)

H290	May be corrosive to metals
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage

Supplementary statement(s)

Continued...

Not Applicable

Precautionary statement(s) Prevention

P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P280	Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statement(s) Response

P301+P330+P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

Precautionary statement(s) Storage

P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container to authorised chemical landfill or if organic to high temperature incineration

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
7664-93-9	98	sulfuric acid
7732-18-5	2	water

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: ▸ Immediately hold eyelids apart and flush the eye continuously with running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. ▸ Transport to hospital or doctor without delay. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ▸ Immediately flush body and clothes with large amounts of water, using safety shower if available. ▸ Quickly remove all contaminated clothing, including footwear. ▸ Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre. ▸ Transport to hospital, or doctor.
Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor. ▸ Inhalation of vapours or aerosols (mists, fumes) may cause lung oedema. ▸ Corrosive substances may cause lung damage (e.g. lung oedema, fluid in the lungs). ▸ As this reaction may be delayed up to 24 hours after exposure, affected individuals need complete rest (preferably in semi-recumbent posture) and must be kept under medical observation even if no symptoms are (yet) manifested. ▸ Before any such manifestation, the administration of a spray containing a dexamethasone derivative or beclomethasone derivative may be considered. **This must definitely be left to a doctor or person authorised by him/her.** (ICSC13719)
Ingestion	▸ For advice, contact a Poisons Information Centre or a doctor at once. ▸ Urgent hospital treatment is likely to be needed. ▸ If swallowed do **NOT** induce vomiting. ▸ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ▸ Observe the patient carefully. ▸ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. ▸ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ▸ Transport to hospital or doctor without delay.

Indication of any immediate medical attention and special treatment needed

For acute or short term repeated exposures to strong acids:

- Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
- Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling
- Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
- Strong acids produce a coagulation necrosis characterised by formation of a coagulum (eschar) as a result of the dessicating action of the acid on proteins in specific tissues.

INGESTION:

- Immediate dilution (milk or water) within 30 minutes post ingestion is recommended.
- **DO NOT** attempt to neutralise the acid since exothermic reaction may extend the corrosive injury.
- Be careful to avoid further vomit since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
- Charcoal has no place in acid management.

Continued...

- Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:
- Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
- Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:
- Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjuctival cul-de-sacs. Irrigation should last at least 20-30 minutes. **DO NOT** use neutralising agents or any other additives. Several litres of saline are required.
- Cycloplegic drops, (1% cyclopentolate for short-term use or 5% homatropine for longer term use) antibiotic drops, vasoconstrictive agents or artificial tears may be indicated dependent on the severity of the injury.
- Steroid eye drops should only be administered with the approval of a consulting ophthalmologist).

[Ellenhorn and Barceloux: Medical Toxicology]

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

	▸ Water spray or fog. ▸ Foam.

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.

Advice for firefighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ May be violently or explosively reactive.
Fire/Explosion Hazard	▸ Non combustible. ▸ Not considered to be a significant fire risk.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Minor Spills	▸ Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material. ▸ Check regularly for spills and leaks.
Major Spills	▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard.
	Personal Protective Equipment advice is contained in Section 8 of the MSDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs.
Other information	▸ Store in original containers. ▸ Keep containers securely sealed.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ **DO NOT** use aluminium or galvanised containers ▸ Lined metal can, lined metal pail/ can. ▸ Plastic pail.
Storage incompatibility	▸ Reacts with mild steel, galvanised steel / zinc producing hydrogen gas which may form an explosive mixture with air. ▸ Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous

+	X	+	X	O	+

X — Must not be stored together
0 — May be stored together with specific preventions
+ — May be stored together

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	sulfuric acid	Sulphuric acid	1 mg/m3	3 mg/m3	Not Available	Not Available

EMERGENCY LIMITS

Continued...

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
sulfuric acid	Sulfuric acid	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
sulfuric acid	80 mg/m3	15 mg/m3
water	Not Available	Not Available

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
Personal protection	
Eye and face protection	▸ Safety glasses with unperforated side shields may be used where continuous eye protection is desirable, as in laboratories; spectacles are not sufficient where complete eye protection is needed such as when handling bulk-quantities, where there is a danger of splashing, or if the material may be under pressure. ▸ Chemical goggles.whenever there is a danger of the material coming in contact with the eyes; goggles must be properly fitted.
Skin protection	See Hand protection below
Hands/feet protection	▸ Elbow length PVC gloves ▸ When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.
Body protection	See Other protection below
Other protection	▸ Overalls. ▸ PVC Apron.
Thermal hazards	Not Available

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".
The effect(s) of the following substance(s) are taken into account in the ***computer-generated*** selection:
Coogee Chemicals Sulphuric Acid

Material	CPI
NEOPRENE	A
BUTYL	C
NATURAL RUBBER	C
NATURAL+NEOPRENE	C
NEOPRENE/NATURAL	C
NITRILE	C
PE	C
PVA	C
PVC	C
SARANEX-23	C
VITON	C

* CPI - Chemwatch Performance Index
A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion
NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -
* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

Respiratory protection

Type E-P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Where the concentration of gas/particulates in the breathing zone, approaches or exceeds the "Exposure Standard" (or ES), respiratory protection is required.
Degree of protection varies with both face-piece and Class of filter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 10 x ES	E-AUS P2	-	E-PAPR-AUS / Class 1 P2
up to 50 x ES	-	E-AUS / Class 1 P2	-
up to 100 x ES	-	E-2 P2	E-PAPR-2 P2 ^

^ - Full-face
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Clear brown colour acidic liquid with strong odour; miscible with water.

Physical state	Liquid	**Relative density (Water = 1)**	1.8
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Available

Continued...

pH (as supplied)	Not Available	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	10	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	335	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	Not Available	**Explosive properties**	Not Available
Flammability	Not Applicable	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Applicable	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	Not Applicable	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	<0.001	**Gas group**	Not Available
Solubility in water (g/L)	Miscible	**pH as a solution (1%)**	Not Available
Vapour density (Air = 1)	Not Available	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	▸ Contact with alkaline material liberates heat
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness.
Ingestion	Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and oesophagus. Immediate pain and difficulties in swallowing and speaking may also be evident.
Skin Contact	Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects.
Eye	If applied to the eyes, this material causes severe eye damage. Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns.
Chronic	Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and/or ulceration of mouth lining. Irritation of airways to lung, with cough, and inflammation of lung tissue often occurs.

Coogee Chemicals Sulphuric Acid	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
sulfuric acid	**TOXICITY**	**IRRITATION**
	Inhalation (guinea pig) LC50: 0.018 mg/L/8H[2]	Eye (rabbit): 1.38 mg SEVERE
	Inhalation (mouse) LC50: 0.32 mg/L/2H[2]	Eye (rabbit): 5 mg/30sec SEVERE
	Inhalation (rat) LC50: 0.51 mg/L/2hE[2]	
	Oral (rat) LD50: 2140 mg/kgE[2]	
water	**TOXICITY**	**IRRITATION**
	Oral (rat) LD50: >90000 mg/kg[2]	Not Available
Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's msds. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*	

SULFURIC ACID	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Occupational exposures to strong inorganic acid mists of sulfuric acid:
WATER	No significant acute toxicological data identified in literature search.

Acute Toxicity	⊘	**Carcinogenicity**	⊘
Skin Irritation/Corrosion	✔	**Reproductivity**	⊘

Continued...

Serious Eye Damage/Irritation	✔	**STOT - Single Exposure**	⊘
Respiratory or Skin sensitisation	⊘	**STOT - Repeated Exposure**	⊘
Mutagenicity	⊘	**Aspiration Hazard**	⊘

Legend: ✔ *– Data required to make classification available*
✘ *– Data available but does not fill the criteria for classification*
⊘ *– Data Not Available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

Prevent, by any means available, spillage from entering drains or water courses.
DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
water	LOW	LOW

Bioaccumulative potential

Ingredient	Bioaccumulation
water	LOW (LogKOW = -1.38)

Mobility in soil

Ingredient	Mobility
water	LOW (KOC = 14.3)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	▸ Recycle wherever possible. ▸ Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.

SECTION 14 TRANSPORT INFORMATION

Labels Required

	
Marine Pollutant	NO
HAZCHEM	2P

Land transport (ADG)

UN number	1830
Packing group	II
UN proper shipping name	SULPHURIC ACID with more than 51% acid
Environmental hazard	No relevant data
Transport hazard class(es)	Class: 8 Subrisk: Not Applicable
Special precautions for user	Special provisions: Not Applicable Limited quantity: 1 L

Air transport (ICAO-IATA / DGR)

UN number	1830
Packing group	II
UN proper shipping name	Sulphuric acid with more than 51% acid
Environmental hazard	No relevant data
Transport hazard class(es)	ICAO/IATA Class: 8 ICAO / IATA Subrisk: Not Applicable ERG Code: 8L

Continued...

Special precautions for user	Special provisions	Not Applicable
	Cargo Only Packing Instructions	855
	Cargo Only Maximum Qty / Pack	30 L
	Passenger and Cargo Packing Instructions	851
	Passenger and Cargo Maximum Qty / Pack	1 L
	Passenger and Cargo Limited Quantity Packing Instructions	Y840
	Passenger and Cargo Limited Maximum Qty / Pack	0.5 L

Sea transport (IMDG-Code / GGVSee)

UN number	1830	
Packing group	II	
UN proper shipping name	SULPHURIC ACID with more than 51% acid	
Environmental hazard	Not Applicable	
Transport hazard class(es)	IMDG Class	8
	IMDG Subrisk	Not Applicable
Special precautions for user	EMS Number	F-A , S-B
	Special provisions	Not Applicable
	Limited Quantities	1 L

Transport in bulk according to Annex II of MARPOL 73 / 78 and the IBC code

Source	Ingredient	Pollution Category
IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk	sulfuric acid	Y

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

SULFURIC ACID(7664-93-9) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Exposure Standards
Australia Hazardous Substances Information System - Consolidated Lists
Australia Inventory of Chemical Substances (AICS)
International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs
International Air Transport Association (IATA) Dangerous Goods Regulations - Prohibited List Passenger and Cargo Aircraft

WATER(7732-18-5) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Inventory of Chemical Substances (AICS)

National Inventory	Status
Australia - AICS	Y
Canada - DSL	Y
Canada - NDSL	N (water; sulfuric acid)
China - IECSC	Y
Europe - EINEC / ELINCS / NLP	Y
Japan - ENCS	N (water)
Korea - KECI	Y
New Zealand - NZIoC	Y
Philippines - PICCS	Y
USA - TSCA	Y
Legend:	*Y = All ingredients are on the inventory N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net

The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Continued...

end of SDS

Diesal Fuel SDS

Material Safety Data Sheet

CS: 1.6.13

Infosafe No™ LQ10L | Issue Date : May 2012 | ISSUED by UNITEDPE

Product Name : **DIESEL**

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name	DIESEL
Company Name	UNITED PETROLEUM PTY LTD
Address	200 Hoddle Street Abbotsford Vic 3067 Australia
Emergency Tel.	1300 131 001
Telephone/Fax Number	Tel: (03)9413 1400 Fax: (03)9413 1401
Recommended Use	Fuel for on-road diesel-powered engines.

Other Names

Name	Product Code
DIST.	
HI FLOW DIESEL	
ADO	
AUTOMOTIVE GAS	

2. HAZARDS IDENTIFICATION

Hazard Classification	HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. Hazard classification according to the criteria of NOHSC. Dangerous goods classification according to the Australia Dangerous Goods Code.
Risk Phrase(s)	R40 Limited evidence of a carcinogenic effect. R51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. R65 Harmful: may cause lung damage if swallowed. R66 Repeated exposure may cause skin dryness and cracking.
Safety Phrase(s)	S2 Keep out of reach of children. S36/37 Wear suitable protective clothing and gloves. S61 Avoid release to the environment. Refer to special instructions/safety data sheet. S62 If swallowed, do not induce vomiting; seek medical advice immediately and show this container or label.
Signs and Symptoms of Exposure	If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance.
Safety Hazards	May ignite on surfaces at temperatures above auto-ignition temperature. Vapour in the headspace of tanks and containers may ignite and explode at temperatures exceeding autoignition temperature, where vapour concentrations are within the flammability range. Not classified as flammable but will burn. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire.
Environmental Hazards	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Other Information	This product is intended for use in closed systems only.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients

Name	CAS	Proportion
Fuels, diesel, no.2	68476-34-6	100 %

Preparation Description

Complex mixture of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons with carbon numbers predominantly in the C9 to C25 range. May also contain several additives at <0.1% v/v each. May contain cetane improver (Ethyl Hexyl Nitrate) at <0.2% v/v.
May contain catalytically cracked oils in which polycyclic aromatic compounds, mainly 3-ring but some 4- to 6-ring species are present.

4. FIRST AID MEASURES

Inhalation	Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.
Ingestion	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (37° C), shortness of breath, chest congestion or continued coughing or wheezing.
Skin	Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
First Aid Facilities	Eye wash and normal washroom facilities.
Advice to Doctor	Treat symptomatically.
Other Information	For advice in an emergency, contact a Poisons Information Centre (Phone Australia 13 1126) or a doctor at once.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Hazards from Combustion Products	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Oxides of sulphur. Unidentified organic and inorganic compounds. Carbon monoxide may be evolved if incomplete combustion occurs.
Specific Hazards	Combustible liquid. Will burn under fire conditions. Will float and can be reignited on surface water. Flammable vapours may be present even at temperatures below the flash point.
Properties on Heating & in case of Fire	Fire fighters should wear Self-Contained Breathing Apparatus (SCBA) operated in positive pressure mode and full protective clothing to prevent exposure to vapours or fumes. Water spray may be used to cool down heat-exposed containers. Fight fire from safe location. This product should be prevented from entering drains and watercourses.
Unsuitable Extinguishing Media	Do not use water in a jet.

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures	Wear appropriate personal protective equipment and clothing to prevent exposure. Extinguish or remove all sources of ignition and stop leak if safe to do so. Increase ventilation. Evacuate all unprotected personnel. If possible contain the spill. Place inert absorbent, non-combustible material onto spillage. Use clean non-sparking tools to collect the material and place into suitable labelled containers for subsequent recycling or disposal. Dispose of waste according to the applicable local and national regulations. If contamination of sewers or waterways occurs inform the local water and waste management authorities in accordance with local regulations.

7. HANDLING AND STORAGE

Handling and Storage	General Precautions: Avoid breathing vapours or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 (Exposure controls/personal protection) of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material. Air-dry contaminated clothing in a well-ventilated area before laundering. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Prevent spillages. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Never siphon by mouth. Contaminated leather articles including shoes cannot be decontaminated and should be destroyed to prevent reuse. For comprehensive advice on handling,

	product transfer, storage and tank cleaning refer to the product supplier. Maintenance and Fuelling Activities - Avoid inhalation of vapours and contact with skin.
Precautions for Safe Handling	Avoid inhaling vapour and/or mists. Avoid prolonged or repeated contact with skin. When using do not eat or drink. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Earth all equipment. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire. The vapour is heavier than air, spreads along the ground and distant ignition is possible.
Conditions for Safe Storage	Drum and small container storage: Drums should be stacked to a maximum of 3 high. Use properly labelled and closeable containers. Tank storage: Tanks must be specifically designed for use with this product. Bulk storage tanks should be diked (bunded). Locate tanks away from heat and other sources of ignition. Must be stored in a diked (bunded) well-ventilated area, away from sunlight, ignition sources and other sources of heat. Vapours from tanks should not be released to atmosphere. Breathing losses during storage should be controlled by a suitable vapour treatment system. The vapour is heavier than air. Beware of accumulation in pits and confined spaces. Keep in a bunded area with a sealed (low permeability) floor, to provide containment against spillage. Prevent ingress of water. For information on the design of the storeroom, reference should be made to Australian Standard AS1940 - The storage and handling of flammable and combustible liquids and AS/NZS 4452:1997 The storage and handling of toxic substances. Reference should also be made to all applicable local and national regulations.
Storage Regulations	Classified as a C1 (COMBUSTIBLE LIQUID) for the purpose of storage and handling, in accordance with the requirements of AS 1940. Refer to State Regulations for storage and transport requirements. AS 1940:2004 The storage and handling of flammable and combustible liquids.
Product Transfer	Avoid splash filling. Wait 2 minutes after tank filling (for tanks such as those on road tanker vehicles) before opening hatches or manholes. Wait 30 minutes after tank filling (for large storage tanks) before opening hatches or manholes. Keep containers closed when not in use. Do not use compressed air for filling, discharging or handling. Contamination resulting from product transfer may give rise to light hydrocarbon vapour in the headspace of tanks that have previously contained gasoline. This vapour may explode if there is a source of ignition. Partly filled containers present a greater hazard than those that are full, therefore handling, transfer and sampling activities need special care.
Recommended Materials	For containers, or container linings use mild steel, stainless steel. Aluminium may also be used for applications where it does not present an unnecessary fire hazard. Examples of suitable materials are: high density polyethylene (HDPE) and Viton (FKM), which have been specifically tested for compatibility with this product. For container linings, use amine-adduct cured epoxy paint. For seals and gaskets use: graphite, PTFE, Viton A, Viton B.
Unsuitable Materials	Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), nitrile rubber (NBR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyvinyl chloride (PVC), polyisobutylene.; However, some may be suitable for glove materials.
Other Information	Ensure that all local regulations regarding handling and storage facilities are followed.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

National Exposure Standards

National Occupational Health And Safety Commission (NOHSC), Australia Exposure Standards:

Substance	TWA		STEL		NOTICES
	ppm	mg/m³	ppm	mg/m³	
Naphthalene	10	52	15	79	-
Oil mist, mineral	-	5 (mist)	-	-	-

TWA (Time Weighted Average): The average airborne concentration of a

	particular substance when calculated over a normal eight-hour working day, for a five-day week. STEL (Short Term Exposure Limit): The average airborne concentration over a 15 minute period which should not be exceeded at any time during a normal eight-hour workday. Additional Information: In the absence of a national exposure limit, the American Conference of Governmental Industrial Hygienists (ACGIH) recommends the following values for Diesel Fuel: TWA - 100 mg/m³ Critical effects based on Skin and Irritation.
Biological Limit Values	No biological limit available.
Engineering Controls	Provide sufficient ventilation to keep airborne levels below the exposure limits. Where vapours or mists are generated, particularly in enclosed areas, and natural ventilation is inadequate, a flameproof exhaust ventilation system is required. Refer to AS 1940 - The storage and handling of flammable and combustible liquids and AS/NZS 60079.10.1:2009 Explosive atmospheres - Classification of areas - Explosive gas atmospheres, for further information concerning ventilation requirements.
Respiratory Protection	If engineering controls are not effective in controlling airborne exposure then an approved respirator with a replaceable organic vapour filter should be used. Reference should be made to Australian/New Zealand Standards AS/NZS 1715, Selection, Use and Maintenance of Respiratory Protective Devices; and AS/NZS 1716, Respiratory Protective Devices, in order to make any necessary changes for individual circumstances.
Eye Protection	Safety glasses with side shields or chemical goggles should be worn. Final choice of appropriate eye/face protection will vary according to individual circumstances. Eye protection devices should conform with Australian/New Zealand Standard AS/NZS 1337 - Eye Protectors for Industrial Applications.
Hand Protection	Wear gloves of impervious material such as nitrile. Final choice of appropriate gloves will vary according to individual circumstances i.e. methods of handling or according to risk assessments undertaken. Reference should be made to AS/NZS 2161.1: Occupational protective gloves - Selection, use and maintenance.
Body Protection	Suitable protective work wear, e.g. cotton overalls buttoned at neck and wrist is recommended. Chemical resistant apron is recommended where large quantities are handled.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Yellow. Pale straw. Colourless. Liquid.
Odour	May contain a reodorant
Melting Point	Not available
Freezing Point	Not available
Boiling Point	170 - 390 °C
Solubility in Water	Not available
pH Value	Not available
Vapour Pressure	< 1 hPa at 20 °C
Vapour Density (Air=1)	Not available
Octanol/Water Partition Coefficient	3 - 6
Density	Typical 0.84 g/cm³ at 15 °C
Flash Point	63 °C (estimated)
Flammability	Combustible liquid
Auto-Ignition Temperature	> 220 °C

Flammable Limits - Lower	1 %(V)
Flammable Limits - Upper	6 %(V)
Kinematic Viscosity	2 - 4.5 mm²/s at 40 °C

10. STABILITY AND REACTIVITY

Chemical Stability	Stable under normal conditions of storage and handling.
Conditions to Avoid	Avoid heat, sparks, open flames and other ignition sources.
Incompatible Materials	Strong oxidising agents.
Hazardous Decomposition Products	Hazardous decomposition products are not expected to form during normal storage. Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases, including carbon monoxide, carbon dioxide and other organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.
Hazardous Polymerization	Will not occur.

11. TOXICOLOGICAL INFORMATION

Toxicology Information	Information given is based on product data, a knowledge of the components and the toxicology of similar products: LD50 (Oral, Rat): >2,000 mg/kg LD50 (Dermal, Rabbit): >2,000 mg/kg LC50 (Inhalation, Rat): >5 mg/L/4h
Inhalation	High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.
Ingestion	Harmful-may cause lung damage if swallowed. Small amounts of liquid aspirated into the respiratory system during ingestion or from vomiting may cause severe pulmonary injury that may lead to death. May cause irritation to the mouth, throat, esophagus and stomach with symptoms of nausea, abdominal discomfort, vomiting and diarrhoea.
Skin	May cause moderate skin irritation. Prolonged/repeated contact may cause defatting of the skin which can lead to dermatitis.
Eye	May be irritating to eyes. The symptoms may include redness, itching and tearing.
Mutagenicity	In-vitro mutagenicity studies show that mutagenic activity is related to 4-6 ring polycyclic aromatic content.
Carcinogenicity	Limited evidence of carcinogenic effect. Repeated skin contact has resulted in irritation and skin cancer in animals. This substance is classified as a Category 3 Carcinogen according to National Occupational Health and Safety Commission (NOHSC). That is, there is some evidence from appropriate animal studies that human exposure to this substance may result in the development of cancer, but this evidence is insufficient to place the substance in Category 2. Category 3 Carcinogens are substances that cause concern for humans owing to possible carcinogenic effects.

12. ECOLOGICAL INFORMATION

Ecological Information	Information given is based on a knowledge of the components and the ecotoxicology of similar products. Fuels are typically made from blending several refinery streams. Ecotoxicological studies have been carried out on a variety of hydrocarbon blends and streams but not those containing additives. Acute Toxicity: Toxic:LL/EL/IL50 1-10 mg/l(to aquatic organisms)(LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract).
Ecotoxicity	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Persistence / Degradability	Major constituents are inherently biodegradable. The volatile constituents will oxidize rapidly by photochemical reactions in air.

Mobility	Floats on water. Partly evaporates from water or soil surfaces, but a significant proportion will remain after one day. Large volumes may penetrate soil and could contaminate groundwater. Contains volatile constituents.
Bioaccumulative Potential	Contains constituents with the potential to bioaccumulate.
Other Adverse Effects	Films formed on water may affect oxygen transfer and damage organisms.

13. DISPOSAL CONSIDERATIONS

Disposal Considerations	The disposal of the spilled or waste material must be done in accordance with applicable local and national regulations.
Product Disposal	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses. Do not dispose of tank water bottoms by allowing them to drain into the ground. This will result in soil and groundwater contamination. Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Container Disposal	Send to drum recoverer or metal reclaimer. Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard if heated above the flash point. Do not puncture, cut or weld uncleaned drums. Do not pollute the soil, water or environment with the waste container. Comply with any local recovery or waste disposal regulations.
Local Legislation	Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements and must be complied with.

14. TRANSPORT INFORMATION

Transport Information	Not classified as Dangerous Goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail. (7th edition) Note: Not classified under ADG 07 regulations as special provision AU 02 applies. IMDG: Identification number: UN 3082 Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. Technical name: (Gas oil - unspecified) Class / Division: 9 Packing group: III IATA (Country variations may apply): UN No.: 3082 Proper shipping name: Environmentally hazardous substance, liquid, n.o.s. Technical name: (Gas oil - unspecified) Class / Division: 9 Packing group: III
IMDG Marine Pollutant (MP)	Yes

15. REGULATORY INFORMATION

Regulatory Information	Classified as Hazardous according to criteria of National Occupational Health & Safety Commission (NOHSC), Australia. Not classified as a Scheduled Poison according to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).
Poisons Schedule	Not Scheduled
Hazard Category	Harmful,Dangerous for the environment
AICS (Australia)	All components are listed or exempt.

16. OTHER INFORMATION

Infosafe No™ LQ10L	Issue Date :May 2012	ISSUED by UNITEDPE

Product Name :**DIESEL**

Date of preparation or last revision of MSDS MSDS Created: May 2012

...End Of MSDS...

LPG SDS

SAFETY DATA SHEET
FOR
Liquefied Petroleum Gas (LPGas)

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Supplier Name	Elgas Ltd, A.C.N. 002 749 260
Address	10 Julius Avenue, North Ryde NSW 2113 PO Box 1336, Chatswood NSW 2067 AUSTRALIA
Telephone	(02) 8094 3200
Fax	(02) 9018 0146
Emergency	1800 819 783 (24 hours)
Other Names	Propane, butane, propene or a combination of these products
Uses	As an energy source in the residential, commercial and automotive markets. A feedstock for the petrochemical industry and as refrigerant.

2. HAZARDS IDENTIFICATION

NOT CLASSIFIED AS HAZARDOUS ACCORDING TO ASCC (NOHSC) CRITERIA.
CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE.

3. COMPOSITION / INFORMATION ON INGREDIENTS

			CAS Number
	LP Gas	Composition in accordance with the appropriate LPG Australia specifications and state regulations	68476 – 85 – 7
Main Components	Propane		0074 – 98 – 6
	Propene		115 – 07 – 1
	n-Butane		106 – 97 – 8
	Iso-Butane		75 – 28 – 5
Minor Components	Ethane		74 – 84 – 0
	1,3-Butadiene	<0.1%	106 – 99 – 0
Odourant:	Ethyl Mercaptan	Approx 25ppm	75 – 08 – 1

4. FIRST AID MEASURES

In all cases seek medical attention and see the Elgas Super Cold Contact Injuries Hospital Information Sheet for further information and procedures.

Eye	Treatment for cold burns: Immediately flush with tepid water or with sterile saline solution. Hold eyelids apart and irrigate for 15 minutes. Seek medical attention.
Inhalation	Remove from area of exposure immediately. Be aware of possible explosive atmospheres. If victim is not breathing apply artificial respiration and seek urgent medical attention. Give oxygen if available. Keep warm and rested.
Skin	Cold burns: Remove contaminated clothing and gently flush affected areas with warm water (30 C) for 15 minutes. Apply non-adhesive sterile dressing and treat as for a thermal burn. For large burns, immerse in warm water for 15 minutes. DO NOT apply any form of direct heat. Seek immediate medical attention.
Ingestion	For advice, contact a Poisons Information Centre on 13 11 26 (Australia Wide) or a doctor. Ingestion is considered unlikely due to product form.
Advice to Doctor	Treat symptomatically. Severe inhalation over exposure may sensitise the heart to catecholamine induced arrhythmias. Do not administer catecholamines to an overexposed person.

5. FIRE FIGHTING MEASURES

Flammability	Highly flammable. Heating to decomposition produces acrid smoke and irritating fumes. Product will add fuel to a fire. Eliminate all ignition sources including cigarettes, open flames, spark producing switches / tools, heaters, naked lights, pilot lights, mobile phones etc. when handling.
Fire and Explosion	Highly flammable. Temperatures in a fire may cause cylinders or pressure vessels to rupture and pressure relief devices to be activated (venting). Call Fire Brigade. This product will add fuel to a fire. Cool cylinders and vessels exposed to fire by applying water from a protected location and with water spray directing spray primarily onto the upper surface. Do not approach any LPGas container suspected of being hot.
Extinguishing	Stop flow of gas if safe to do so, such as by closing valves or by activating Emergency Shutdown Systems. If the gas source cannot be isolated, do not extinguish the flame, since re-ignition and explosion could occur. Await arrival of emergency services. Drench and cool cylinders or vessels with water spray from protected area at a safe distance. If it is absolutely necessary to extinguish the flame, use only a dry chemical powder extinguisher. Do not move cylinders for at least 24 hours. Avoid shock and bumps to cylinders. Evacuate the area of persons not fighting the fire. Carbon oxides (CO, CO_2) fumes may be produced should burning occur especially within an enclosed space (ie causing a deficiency of oxygen). Fire fighters should wear full protective clothing and be aware of the risk of possible explosion (especially in a confined space). Flashback may occur along vapour trail. Where possible, remove cool cylinders from the path of the fire. Do not re-use a fire-exposed vessel or cylinder – seek advice of supplier.
Hazchem Code	2YE (as defined in ADG7 published in 2007) 2WE (as defined in ADG6 published in 1998)

6. ACCIDENTAL RELEASE MEASURES

Spillage	As this product has a very low flash point any spillage or leak is a fire and / or explosion hazard. If a leak has not ignited, stop gas flow, isolate sources of ignition and evacuate personnel. Ensure good ventilation. Liquid leaks generate large volumes of heavier than air flammable vapour which may travel to remote sources of ignition (eg along drainage systems). Where appropriate, use water spray to disperse the gas or vapour and to protect personnel attempting to stop leakage. Vapour may collect in any confined space.
Gas Cylinders	If the cylinder is leaking, eliminate all potential ignition sources and evacuate area of personnel. Inform manufacturer / supplier of leak. If safe to enter the area, wear appropriate PPE and carefully move the cylinder to a well ventilated remote area, then allow to discharge. Do not attempt to repair leaking valve or cylinder fusible plugs. For vessels operate the Emergency Shutdown System (where fitted) and proceed as above.

7. HANDLING AND STORAGE

Precautions for Safe Handling	Avoid inhalation of vapour. Avoid contact with liquid and cold storage containers. When handling cylinders wear protective footwear and suitable gloves. Always ensure that cylinders are within test date, are fit for use and are leak checked prior to use. Do not fill dented, gouged or rusty containers (refer AS2337.1). Only fill cylinders to 80% fill level (ullage tube via decanting or mass via mechanical filling). The maximum fill level for vessels is dependent upon their size and location as detailed in AS / NZS 1596. Avoid contact with eyes. Class 2.1 Flammable Gas products may only be loaded in the same vehicle or packed in the same freight container with the classes of products as permitted in the ADG Code (see references). Cylinders shall only be transported in an upright, secure position in accordance with the National Road Transport Commission Load Restraint Guide and shall not be dropped.
Conditions for Safe Storage	Store and use only in equipment / containers designed for use with this product. Store and dispense only in well ventilated areas away from heat and sources of ignition. Do not enter storage vessels. If entry to a vessel is necessary, contact the supplier. Cylinders and vessels must be properly labelled. Do not remove warning labels. LPGas cylinders shall be stored in accordance with the requirements of the ADG Code, AS 4332 and AS/NZS1596. Do not store in pits and basements where vapour may collect. Store cylinders securely in an upright position. Note: forklift cylinders may be stored horizontally. Store away from incompatible materials particularly oxidising agents. Check vessels and cylinders are clearly labelled. Do not contaminate cylinders or vessels with other products.
Other Information	Product spilt on clothing may give rise to delayed evaporation and subsequent fire hazard. Check for leaks by sound and smell and by locating with soapy water or with approved detection devices. Use only equipment and pipework designed and approved (where applicable) for LPGas applications. Ensure that cylinders cannot be struck by forklift vehicles or by dropped or rolled objects, etc. Refer to Australian state and territory Dangerous Goods regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Ventilation

Maintain adequate ventilation.

Confined areas (eg tanks) should be adequately ventilated and gas tested and must NEVER be entered unless under supervision via a Permit Procedure.

Exposure Standards

Ingredient Name	Occupational Exposure Limits
LP Gas	**NOHSC** TWA: 1000 ppm 8 hour(s)
Butane	**NOHSC** TWA: 1900 mg/m^3 8 hour(s) TWA: 800 ppm 8 hour(s)
Propane	**ACGIH TLV** TWA: 1000 ppm 8 hour(s)
Propylene	**ACGIH TLV** TWA: 500 ppm 8 hour(s)

PPE

Wear suitable gloves and overalls to prevent cold burns and frostbite.
In filling operations wear protective clothing including impervious gloves, safety goggles or face shield.

All clothing should be of the anti-static, low flame spread type.
When handling cylinders wear protective footwear.

9. PHYSICAL AND CHEMICAL PROPERTIES

PROPERTY	PROPANE		BUTANE	
Appearance **Odour** **Chemical Formula**	**Colourless Gas** **Characteristic Odour** **C_3H_8**		**Colourless Gas** **Characteristic Odour** **C_4H_{10}**	
Molecular Weight	**44.1**		**58.1**	
Boiling Point	**-42^{0}C**		**-0.5^{0}C**	
	Liquid at 15^{0}C	Gas at 101 kPa & 15^{0}C	Liquid at 15^{0}C	Gas at 101 kPa & 15^{0}C
Density (kg/m^3)	510	1.86	568	2.47
Relative Density: water = 1.0 air = 1.0	 0.510	 1.53	 0.568	 2.00
Litres/tonne m^3/tonne m^3/m^3 of liquid	1961 1.961 1.000	536000 536 274	1760 1.760 1.000	405000 405 235
Specific heat of liquid (kJ/kg/^{0}C)	2.512		2.386	
Latent heat of vapourisation (MJ/m^3) (MJ/kg = GJ/t)	 232 0.358		 239 0.372	
Heat combustion (MJ/m^3) (MJ/kg = GJ/t)	 25000 50.1	 93.3 50.1	 28800 49.47	 121.9 49.47
Volume of air (m^3) needed to burn 1m^3 of gas		23.7		31.0
Flash point Ignition temp.		-104^{0}C 493-549^{0}C		-60^{0}C 482-538^{0}C
Max. flame temp.		1970^{0}C		1990^{0}C
Limits of flammability in air (% by vol): upper % lower %	 	 9.6 2.4	 	 8.6 1.9

Other Properties:		Solubility (water): 0.07cm^3 / cm^3
Other name/numbers:	**LPGas**	UN 1075
	Propane	UN 1978
	Butane	UN 1011
	IsoButane	UN 1969

10. STABILITY AND REACTIVITY

Reactivity	Incompatible with oxidising agents, acids, heat and ignition sources. Do not use natural rubber flexible hoses. Also incompatible (potentially violently) with oxygen, halogens and metal halides.
Decomposition Products	Heating to decomposition produces acrid smoke and irritating fumes.

11. TOXICOLOGICAL INFORMATION

Health Hazard Summary	Asphyxiant gas. Symptoms of exposure are directly related to displacement of oxygen from air.
Eye	Non irritating. However, direct contact with evaporating liquid may result in severe cold burns with possible permanent damage.
Inhalation	Non irritating – Asphyxiant. Effects are proportional to oxygen displacement. Low vapour concentrations may cause nausea, dizziness, headaches and drowsiness. May have a narcotic effect if high concentrations of vapour are inhaled. High vapour concentrations may produce symptoms of oxygen deficiency which, coupled with central nervous system depression, may lead to rapid loss of consciousness.
Abuse	Under normal conditions of use the product is non hazardous, however abuse involving deliberate inhalation of very high concentrations of vapour can produce unconsciousness and / or result in a sudden fatality or brain damage.
Skin	Non irritating. Contact with evaporating liquid or supercold vessels or pipes may result in frost-bite with severe tissue damage.
Ingestion	Due to product form, ingestion is considered highly unlikely.
Toxicity Data	PROPANE (74-98-6) LC50 (Inhalation) : 50,000 ppm ISOBUTANE (75-28-5) LC50 (Inhalation): 57pph/15 min (rat)

12. ECOLOGICAL INFORMATION

Eco Toxicity	Not toxic to flora, fauna or soil organisms. Will not cause long term adverse effects in the environment and is not dangerous to the ozone layer.
Mobility	Spillages are unlikely to penetrate the soil. The product is likely to volatise rapidly into the air.
Persistence / Degradability	Unlikely to cause long term adverse effects in the environment.
Bio-accumulative Potential	This material is not expected to bio-accumulate.
Other Ecological Information	Unlikely to cause long term effects in the aquatic environment.

13. DISPOSAL CONSIDERATIONS

Waste Disposal	Cylinders should be returned to the manufacturer or supplier for disposal. Empty cylinders or vessels may contain some remaining product. Hazard warning labels are a guide to the safe handling of empty packaging and should not be removed. LPGas cylinders or vessels should NEVER be inadvertently disposed of in any land fill facility without being rendered visually and physically unusable before disposal. 'EMPTY' container warning: 'empty' containers can sometimes retain residue (liquid and / or vapour) and can be dangerous. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS AND OTHER SOURCES OF IGNITION THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to clean.
Legislation	Dispose of in accordance with relevant legislation.

14. TRANSPORT INFORMATION

Transport	Transport of LPGas is controlled in accordance with the requirements of the ADG Code and the Load Restraint Guide.
UN Number	1075
Shipping Name	PETROLEUM GASES, LIQUEFIED
DG Class	2.1
Subsidiary Risk(s)	None Allocated
Packing Group	None Allocated
Hazchem Code	See Section 5

15. REGULATORY INFORMATION

AICS	All chemicals listed on the Australian Inventory of Chemical Substances (AICS).
Poison Schedule	A poison schedule number has not been allocated to this product using the criteria in the Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP).

16. OTHER INFORMATION

Principal Retail Centres

NSW Blacktown
22 Holbeche Road
Blacktown NSW 2148
Phone: (02) 9672 0777
Fax: (02) 9672 1481

QLD Brisbane
Tanker Street
Lytton QLD 4178
Phone: (07) 3396 2769
Fax: (07) 3893 1495

ACT Canberra
3-5 Geelong Street
Fyshwick ACT 2609
Phone: (02) 6280 6355
Fax: (02) 6280 4217

WA Perth
2 Uppsala Place
Canning Vale WA 6155
Phone: (08) 6465 8561
Fax: (08) 6254 2893

NT Darwin
1227 Winnellie Road
Winnellie NT 0821
Phone: (08) 8947 4256

VIC Mulgrave
331-347 Police Road
Mulgrave VIC 3170
Phone: (03) 9767 7222
Fax: (03) 9767 7372

SA Adelaide
1 Newfield Road
Para Hills West SA 5096
Phone: (08) 8368 4700
Fax: (08) 8349 4624

Swap 'n' Go
Contact the principal retail centre in your state or territory

Stargas
Contact the principal retail centre in your state or territory

References

ALPGA (now Gas Energy Australia) Specification for Liquefied Petroleum Gas for Automotive use 2004.

ALPGA (now Gas Energy Australia) Specification for Liquefied Petroleum Gas for Heating use 2004.

ACGIH = American Conference of Governmental Industrial Hygienists

CAS Number = Chemical Abstracts Service Registry Number

HAZCHEM Code = Emergency action code of numbers and letters which gives information to emergency services

ICAO = International Civil Aviation Organisation

IATA = International Air Transport Association

IMDG = International Maritime Organisation Rules

NOHSC = National Occupational Health & Safety Commission, Australia

TWA = Time weighted average

STEL = Short term exposure limit

UN Number = United Nations Number, a four digit number assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods
Petroleum and Gas Legislation / Queensland: 2004

Australian Standards as detailed within this document

The Australian Code for the Transport of Dangerous Goods by Road and Rail (commonly known as the ADG Code)

The Load Restraint Guide as prepared by the National Transport Commission

Hydrogen Chloride (Liquid) SDS

Safety Data Sheet

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name: **POOL SHOP HCL 33%**

Recommended use of the chemical and restrictions on use: Precursor for generation of chlorine dioxide gas used in water treatment.

Supplier: Ixom Operations Pty Ltd
ABN: 51 600 546 512
Street Address: Level 8, 1 Nicholson Street
Melbourne 3000
Australia

Telephone Number: +61 3 9665 7111
Facsimile: +61 3 9665 7937
Emergency Telephone: **1 800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

2. HAZARDS IDENTIFICATION

Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail; DANGEROUS GOODS.

This material is hazardous according to Safe Work Australia; HAZARDOUS SUBSTANCE.

Classification of the substance or mixture:
Corrosive to Metals - Category 1
Skin Corrosion - Sub-category 1B
Eye Damage - Category 1
Specific target organ toxicity (single exposure) - Category 3

SIGNAL WORD: DANGER

Hazard Statement(s):
H290 May be corrosive to metals.
H314 Causes severe skin burns and eye damage.
H335 May cause respiratory irritation.

Precautionary Statement(s):

Prevention:
P234 Keep only in original container.
P260 Do not breathe mist / vapours / spray.
P264 Wash hands thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves / protective clothing / eye protection / face protection.

Response:
P301+P330+P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P363 Wash contaminated clothing before re-use.
P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312 Call a POISON CENTER or doctor/physician if you feel unwell.
P321 Specific treatment (see First Aid Measures on Safety Data Sheet).
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 Immediately call a POISON CENTER or doctor/physician.
P390 Absorb spillage to prevent material damage.

Storage:
P403+P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.
P406 Store in corrosive resistant container with a resistant inner liner.

Disposal:
P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

Poisons Schedule (SUSMP): S6 Poison.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Proportion	Hazard Codes
Hydrochloric acid	-	>=20%	H314 H335
Water	7732-18-5	to 100%	-

4. FIRST AID MEASURES

For advice, contact a Poisons Information Centre (e.g. phone Australia 131 126; New Zealand 0800 764 766) or a doctor.

Inhalation:
Remove victim from area of exposure - avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. If patient finds breathing difficult and develops a bluish discolouration of the skin (which suggests a lack of oxygen in the blood - cyanosis), ensure airways are clear of any obstruction and have a qualified person give oxygen through a face mask. Apply artificial respiration if patient is not breathing. Seek immediate medical advice.

Skin Contact:
If spilt on large areas of skin or hair, immediately drench with running water and remove clothing. Continue to wash skin and hair with plenty of water (and soap if material is insoluble) until advised to stop by the Poisons Information Centre or a doctor.

Eye Contact:
If in eyes, hold eyelids apart and flush the eye continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre or a doctor, or for at least 15 minutes. Continue to wash with large amounts of water until medical help is available.

Ingestion:
Immediately rinse mouth with water. If swallowed, do NOT induce vomiting. Give a glass of water. Seek immediate medical assistance.

Indication of immediate medical attention and special treatment needed:
Treat symptomatically. Can cause corneal burns.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media:
Not combustible, however, if material is involved in a fire use: Fine water spray, normal foam, dry agent (carbon dioxide, dry chemical powder).

Hazchem or Emergency Action Code: 2R

Specific hazards arising from the substance or mixture:
Non-combustible material.

Special protective equipment and precautions for fire-fighters:
Decomposes on heating emitting toxic fumes. Fire fighters to wear self-contained breathing apparatus and suitable protective clothing if risk of exposure to products of decomposition. Heating can cause expansion or decomposition of the material, which can lead to the containers exploding. If safe to do so, remove containers from the path of fire.

6. ACCIDENTAL RELEASE MEASURES

Emergency procedures/Environmental precautions:
Clear area of all unprotected personnel. If contamination of sewers or waterways has occurred advise local emergency services.

Personal precautions/Protective equipment/Methods and materials for containment and cleaning up:
Slippery when spilt. Avoid accidents, clean up immediately. Wear protective equipment to prevent skin and eye contact and breathing in vapours. Work up wind or increase ventilation. Contain - prevent run off into drains and waterways. Use absorbent (soil, sand or other inert material). Neutralise with lime or soda ash. Collect and seal in properly labelled containers or drums for disposal. Wash area down with excess water.

7. HANDLING AND STORAGE

This material is a Scheduled Poison S6 and must be stored, maintained and used in accordance with the relevant regulations.

Precautions for safe handling:
Avoid skin and eye contact and breathing in vapour, mists and aerosols. Keep out of reach of children. Always add the acid to water, never the reverse.

Conditions for safe storage, including any incompatibilities:
Store in cool place and out of direct sunlight. Store away from incompatible materials described in Section 10. Store away from foodstuffs. Do not store in aluminium containers. Do not store in galvanised containers. Keep containers closed when not in use - check regularly for leaks.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters: No value assigned for this specific material by Safe Work Australia. However, Workplace Exposure Standard(s) for constituent(s):

Hydrogen chloride: Peak Limitation = 7.5 mg/m^3 (5 ppm)

As published by Safe Work Australia Workplace Exposure Standards for Airborne Contaminants.

Peak Limitation - a maximum or peak airborne concentration of a particular substance determined over the shortest analytically practicable period of time which does not exceed 15 minutes.

These Workplace Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These workplace exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Appropriate engineering controls:
Ensure ventilation is adequate and that air concentrations of components are controlled below quoted Workplace Exposure Standards. If inhalation risk exists: Use with local exhaust ventilation or while wearing suitable mist respirator. Keep containers closed when not in use.

Individual protection measures, such as Personal Protective Equipment (PPE):
The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, CHEMICAL GOGGLES, RUBBER BOOTS, AIR MASK , GLOVES (Long), APRON.
* Not required if wearing air supplied mask.

Wear overalls, chemical goggles, full face shield, elbow-length impervious gloves, splash apron or equivalent chemical impervious outer garment, and rubber boots. Use with adequate ventilation. If determined by a risk assessment an inhalation risk exists, wear an air-supplied mask meeting the requirements of AS/NZS 1715 and AS/NZS 1716. Always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state:	Clear Liquid
Colour:	Colourless to Slightly Yellow
Odour:	Pungent
Solubility:	Miscible with water.
Specific Gravity:	1.0536 (for 20% concentration)
Relative Vapour Density (air=1):	Not available
Vapour Pressure (20 °C):	Not available
Flash Point (°C):	Not applicable
Flammability Limits (%):	Not applicable
Autoignition Temperature (°C):	Not applicable
Boiling Point/Range (°C):	98 (for 28% concentration)
pH:	<1

10. STABILITY AND REACTIVITY

Reactivity: Reacts with alkalis.

Chemical stability:	Corrosive to many metals with the liberation of extremely flammable hydrogen gas.
Possibility of hazardous reactions:	Reacts with oxidising agents and sodium hypochlorite liberating toxic chlorine gas.
Conditions to avoid:	Avoid contact with foodstuffs.
Incompatible materials:	Incompatible with alkalis , oxidising agents , sodium hypochlorite , cyanides , and many metals .
Hazardous decomposition products:	Hydrogen chloride.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms or effects that may arise if the product is mishandled and overexposure occurs are:

Ingestion:	Swallowing can result in nausea, vomiting, diarrhoea, abdominal pain and chemical burns to the gastrointestinal tract.
Eye contact:	A severe eye irritant. Corrosive to eyes; contact can cause corneal burns. Contamination of eyes can result in permanent injury.
Skin contact:	Contact with skin will result in severe irritation. Corrosive to skin - may cause skin burns.
Inhalation:	Breathing in mists or aerosols will produce respiratory irritation.

Acute toxicity: No LD50 data available for the product. However, for constituent(s) HYDROGEN CHLORIDE:
Oral LD50 (rabbit): 900 mg/kg
Inhalation LC50 (rat): 3124 ppm/1h.

Chronic effects: Repeated exposure to low levels of hydrochloric acid may produce discolouration and erosion of teeth and ulceration of the nasal passages.

12. ECOLOGICAL INFORMATION

Ecotoxicity Avoid contaminating waterways.

13. DISPOSAL CONSIDERATIONS

Disposal methods:
Refer to Waste Management Authority. Dispose of material through a licensed waste contractor. Decontamination and destruction of containers should be considered.

14. TRANSPORT INFORMATION

Road and Rail Transport
Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail; DANGEROUS GOODS.

UN No:	1789
Transport Hazard Class:	8 Corrosive
Packing Group:	II
Proper Shipping Name or Technical Name:	HYDROCHLORIC ACID
Hazchem or Emergency Action Code:	2R

Marine Transport
Classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; DANGEROUS GOODS.

UN No:	1789
Transport Hazard Class:	8 Corrosive
Packing Group:	II
Proper Shipping Name or Technical Name:	HYDROCHLORIC ACID
IMDG EMS Fire:	F-A
IMDG EMS Spill:	S-B

Air Transport
Classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; DANGEROUS GOODS.

UN No:	1789
Transport Hazard Class:	8 Corrosive
Packing Group:	II
Proper Shipping Name or Technical Name:	HYDROCHLORIC ACID

15. REGULATORY INFORMATION

Classification:
This material is hazardous according to Safe Work Australia; HAZARDOUS SUBSTANCE.

Classification of the substance or mixture:
Corrosive to Metals - Category 1
Skin Corrosion - Sub-category 1B
Eye Damage - Category 1
Specific target organ toxicity (single exposure) - Category 3

Hazard Statement(s):
H290 May be corrosive to metals.
H314 Causes severe skin burns and eye damage.
H335 May cause respiratory irritation.

Poisons Schedule (SUSMP): S6 Poison.

All the constituents of this material are listed on the Australian Inventory of Chemical Substances (AICS).

16. OTHER INFORMATION

`Registry of Toxic Effects of Chemical Substances'. Ed. D. Sweet, US Dept. of Health & Human Services: Cincinatti, 2012.

This safety data sheet has been prepared by Ixom Operations Pty Ltd Toxicology & SDS Services.

Reason(s) for Issue:
5 Yearly Revised Primary SDS

This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since Ixom Operations Pty Ltd cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Ixom representative or Ixom Operations Pty Ltd at the contact details on page 1.

Ixom Operations Pty Ltd's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

Hydrogen Chloride (Gas) SDS

HYDROCHLORIC ACID 32%

Coogee Chemicals

Chemwatch Hazard Alert Code: **3**

Chemwatch: **48-4484**
Version No: **3.1.1.1**
Safety Data Sheet according to WHS and ADG requirements

Issue Date: **17/07/2015**
Print Date: **30/07/2015**
Initial Date: **Not Available**
S.GHS.AUS.EN

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

Product Identifier

Product name	HYDROCHLORIC ACID 32%
Proper shipping name	HYDROCHLORIC ACID
Other means of identification	Not Available

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Acidifier, Chemical intermediate, Laboratory reagent, Pickling and anodising metals, scale remover.

Details of the manufacturer/importer

Registered company name	Coogee Chemicals
Address	Cnr of Patterson and Kwinana Beach Roads Kwinana WA Australia
Telephone	+61 8 9439 8200
Fax	+61 8 9439 8300
Website	www.coogee.com.au
Email	businessrelations@coogee.com.au

Emergency telephone number

Association / Organisation	Coogee Chemicals
Emergency telephone numbers	1800 800 655
Other emergency telephone numbers	Not Available

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

HAZARDOUS CHEMICAL. DANGEROUS GOODS. According to the Model WHS Regulations and the ADG Code.

CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability	0	
Toxicity	3	
Body Contact	3	
Reactivity	1	
Chronic	1	

0 = Minimum
1 = Low
2 = Moderate
3 = High
4 = Extreme

Poisons Schedule	S6
GHS Classification [1]	Metal Corrosion Category 1, Acute Toxicity (Oral) Category 4, Acute Toxicity (Inhalation) Category 2, Skin Corrosion/Irritation Category 1A, Serious Eye Damage Category 1
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HSIS ; 3. Classification drawn from EC Directive 1272/2008 - Annex VI*

Label elements

GHS label elements

SIGNAL WORD	**DANGER**

Hazard statement(s)

H290	May be corrosive to metals
H302	Harmful if swallowed
H330	Fatal if inhaled
H314	Causes severe skin burns and eye damage

Continued...

H318	Causes serious eye damage

Supplementary statement(s)

Not Applicable

Precautionary statement(s) Prevention

P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P271	Use only outdoors or in a well-ventilated area.

Precautionary statement(s) Response

P301+P330+P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

Precautionary statement(s) Storage

P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container to authorised chemical landfill or if organic to high temperature incineration

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
7647-01-0	32	hydrochloric acid
7732-18-5	balance	water

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: ▸ Immediately hold eyelids apart and flush the eye continuously with running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. ▸ Transport to hospital or doctor without delay. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ▸ Immediately flush body and clothes with large amounts of water, using safety shower if available. ▸ Quickly remove all contaminated clothing, including footwear. ▸ Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre. ▸ Transport to hospital, or doctor.
Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor, without delay.
Ingestion	▸ For advice, contact a Poisons Information Centre or a doctor at once. ▸ Urgent hospital treatment is likely to be needed. ▸ If swallowed do **NOT** induce vomiting. ▸ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ▸ Observe the patient carefully. ▸ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. ▸ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ▸ Transport to hospital or doctor without delay.

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.
For acute or short term repeated exposures to strong acids:

- Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
- Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling
- Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
- Strong acids produce a coagulation necrosis characterised by formation of a coagulum (eschar) as a result of the dessicating action of the acid on proteins in specific tissues.

INGESTION:

- Immediate dilution (milk or water) within 30 minutes post ingestion is recommended.
- **DO NOT** attempt to neutralise the acid since exothermic reaction may extend the corrosive injury.
- Be careful to avoid further vomit since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
- Charcoal has no place in acid management.
- Some authors suggest the use of lavage within 1 hour of ingestion.

Continued...

SKIN:
- Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
- Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:
- Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjuctival cul-de-sacs. Irrigation should last at least 20-30 minutes. **DO NOT** use neutralising agents or any other additives. Several litres of saline are required.
- Cycloplegic drops, (1% cyclopentolate for short-term use or 5% homatropine for longer term use) antibiotic drops, vasoconstrictive agents or artificial tears may be indicated dependent on the severity of the injury.
- Steroid eye drops should only be administered with the approval of a consulting ophthalmologist).

[Ellenhorn and Barceloux: Medical Toxicology]

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

	▸ Water spray or fog. ▸ Foam.

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.

Advice for firefighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear full body protective clothing with breathing apparatus. |HCl can liberate highly flammable hydrogen gas when in contact with certain metals.
Fire/Explosion Hazard	▸ Non combustible. ▸ Not considered to be a significant fire risk.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Minor Spills	▸ Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material. ▸ Check regularly for spills and leaks.
Major Spills	▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard.
	Personal Protective Equipment advice is contained in Section 8 of the MSDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs.
Other information	▸ Store in original containers. ▸ Keep containers securely sealed.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ **DO NOT** use aluminium or galvanised containers ▸ Lined metal can, lined metal pail/ can. ▸ Plastic pail.
Storage incompatibility	▸ Inorganic acids are generally soluble in water with the release of hydrogen ions. The resulting solutions have pH's of less than 7.0. |Incompatible with oxidizing agents eg. hypochlorites, alkalis, most metals etc, alcohols and amines.

X X + X X +

X — Must not be stored together
0 — May be stored together with specific preventions
+ — May be stored together

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	hydrochloric acid	Hydrogen chloride	Not Available	Not Available	7.5 mg/m3 / 5 ppm	Not Available

EMERGENCY LIMITS

Continued...

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
hydrochloric acid	Hydrogen chloride; (Hydrochloric acid)	Not Available	Not Available	Not Available
hydrochloric acid	Deuterochloric acid; (Deuterium chloride)	1.8 ppm	22 ppm	100 ppm

Ingredient	Original IDLH	Revised IDLH
hydrochloric acid	100 ppm	50 ppm
water	Not Available	Not Available

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
Personal protection	
Eye and face protection	▸ Chemical goggles. ▸ Full face shield may be required for supplementary but never for primary protection of eyes.
Skin protection	See Hand protection below
Hands/feet protection	▸ Wear chemical protective gloves, e.g. PVC. ▸ Wear safety footwear or safety gumboots, e.g. Rubber ▸ When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.
Body protection	See Other protection below
Other protection	▸ Overalls. ▸ PVC Apron.
Thermal hazards	Not Available

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".
The effect(s) of the following substance(s) are taken into account in the ***computer-generated*** selection:
HYDROCHLORIC ACID 32%

Material	CPI
BUTYL	A
NEOPRENE	A
BUTYL/NEOPRENE	C
HYPALON	C
NAT+NEOPR+NITRILE	C
NATURAL RUBBER	C
NATURAL+NEOPRENE	C
NEOPRENE/NATURAL	C
NITRILE	C
NITRILE+PVC	C
PE/EVAL/PE	C
PVA	C
PVC	C
SARANEX-23	C
VITON	C
VITON/NEOPRENE	C

* CPI - Chemwatch Performance Index
A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion
NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -
* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

Respiratory protection

Type B-P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Where the concentration of gas/particulates in the breathing zone, approaches or exceeds the "Exposure Standard" (or ES), respiratory protection is required.
Degree of protection varies with both face-piece and Class of filter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 10 x ES	B-AUS P2	-	B-PAPR-AUS / Class 1 P2
up to 50 x ES	-	B-AUS / Class 1 P2	-
up to 100 x ES	-	B-2 P2	B-PAPR-2 P2 ^

^ - Full-face
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Colourless to slightly yellow corrosive liquid with pungent acidic odour; miscible with water.

Continued...

Physical state	Liquid	**Relative density (Water = 1)**	1.161
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Available
pH (as supplied)	<1	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	<-20	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	109	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	as for water	**Explosive properties**	Not Available
Flammability	Not Applicable	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Applicable	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	Not Applicable	**Volatile Component (%vol)**	100
Vapour pressure (kPa)	2	**Gas group**	Not Available
Solubility in water (g/L)	Miscible	**pH as a solution (1%)**	Not Available
Vapour density (Air = 1)	1.3	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	▸ Contact with alkaline material liberates heat
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness.
Ingestion	Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and oesophagus. Immediate pain and difficulties in swallowing and speaking may also be evident.
Skin Contact	The material can produce chemical burns following direct contact with the skin. Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue.
Eye	The material can produce chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating.
Chronic	Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure. Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and/or ulceration of mouth lining.

HYDROCHLORIC ACID 32%	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
hydrochloric acid	**TOXICITY**	**IRRITATION**
	Inhalation (rat) LC50: 3124 ppm/1h[2]	Eye (rabbit): 5mg/30s - mild
	Oral (rat) LD50: 900 mg/kg[2]	
water	**TOXICITY**	**IRRITATION**
	Oral (rat) LD50: >90000 mg/kg[2]	Not Available
Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's msds. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*	

HYDROCHLORIC ACID 32%	Inhalation (Rat) LC50: 4.2-4.7 mg/l/1h
HYDROCHLORIC ACID	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound.
WATER	No significant acute toxicological data identified in literature search.

Continued...

Acute Toxicity	✔	**Carcinogenicity**	⊘
Skin Irritation/Corrosion	✔	**Reproductivity**	⊘
Serious Eye Damage/Irritation	✔	**STOT - Single Exposure**	⊘
Respiratory or Skin sensitisation	⊘	**STOT - Repeated Exposure**	⊘
Mutagenicity	⊘	**Aspiration Hazard**	⊘

Legend: ✔ *– Data required to make classification available*
✘ *– Data available but does not fill the criteria for classification*
⊘ *– Data Not Available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

Prevent, by any means available, spillage from entering drains or water courses.
DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
hydrochloric acid	LOW	LOW
water	LOW	LOW

Bioaccumulative potential

Ingredient	Bioaccumulation
hydrochloric acid	LOW (LogKOW = 0.5392)
water	LOW (LogKOW = -1.38)

Mobility in soil

Ingredient	Mobility
hydrochloric acid	LOW (KOC = 14.3)
water	LOW (KOC = 14.3)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	▸ Containers may still present a chemical hazard/ danger when empty. ▸ Return to supplier for reuse/ recycling if possible.

SECTION 14 TRANSPORT INFORMATION

Labels Required

	
Marine Pollutant	NO
HAZCHEM	2R

Land transport (ADG)

UN number	1789
Packing group	II
UN proper shipping name	HYDROCHLORIC ACID
Environmental hazard	No relevant data
Transport hazard class(es)	Class: 8 Subrisk: Not Applicable
Special precautions for user	Special provisions: Not Applicable Limited quantity: 1 L

Air transport (ICAO-IATA / DGR)

UN number	1789
Packing group	II
UN proper shipping name	Hydrochloric acid

Continued...

Environmental hazard	No relevant data
Transport hazard class(es)	ICAO/IATA Class: 8 ICAO / IATA Subrisk: Not Applicable ERG Code: 8L
Special precautions for user	Special provisions: A3A803 Cargo Only Packing Instructions: 855 Cargo Only Maximum Qty / Pack: 30 L Passenger and Cargo Packing Instructions: 851 Passenger and Cargo Maximum Qty / Pack: 1 L Passenger and Cargo Limited Quantity Packing Instructions: Y840 Passenger and Cargo Limited Maximum Qty / Pack: 0.5 L

Sea transport (IMDG-Code / GGVSee)

UN number	1789
Packing group	II
UN proper shipping name	HYDROCHLORIC ACID
Environmental hazard	Not Applicable
Transport hazard class(es)	IMDG Class: 8 IMDG Subrisk: Not Applicable
Special precautions for user	EMS Number: F-A , S-B Special provisions: Not Applicable Limited Quantities: 1 L

Transport in bulk according to Annex II of MARPOL 73 / 78 and the IBC code

Source	Ingredient	Pollution Category
IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk	hydrochloric acid	Z

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

HYDROCHLORIC ACID(7647-01-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Exposure Standards
Australia Hazardous Substances Information System - Consolidated Lists
Australia Inventory of Chemical Substances (AICS)
International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs

WATER(7732-18-5) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Inventory of Chemical Substances (AICS)

National Inventory	Status
Australia - AICS	Y
Canada - DSL	Y
Canada - NDSL	N (hydrochloric acid; water)
China - IECSC	Y
Europe - EINEC / ELINCS / NLP	Y
Japan - ENCS	N (water)
Korea - KECI	Y
New Zealand - NZIoC	Y
Philippines - PICCS	Y
USA - TSCA	Y
Legend:	*Y = All ingredients are on the inventory N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net

Continued...

The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

end of SDS

Calcium Hydroxide SDS

1. IDENTIFICATION

Product Name	**Calcium Hydroxide**
Other Names	CALCIUM HYDROXIDE (Ca(OH)2); Hydrated Lime; Slaked Lime
Uses	Mortar, plasters, cements, calcium salts, ammonia recovery in gas manufacture, disinfectant, water softening, food additive as buffer and neutralising agent.
Chemical Family	No Data Available
Chemical Formula	Ca(OH)2
Chemical Name	Calcium Hydroxide
Product Description	No Data Available

Contact Details of the Supplier of this Safety Data Sheet

Organisation	Location	Telephone
Redox Pty Ltd	2 Swettenham Road Minto NSW 2566 Australia	+61-2-97333000
Redox Pty Ltd	11 Mayo Road Wiri Auckland 2104 New Zealand	+64-9-2506222
Redox Inc.	2132A E. Dominguez Street Carson CA 90810 USA	+1-424-675-3200
Redox Chemicals Sdn Bhd	No. 8, Block G, Ground Floor, Taipan 2 Jalan PJU 1A/3 Ara Damansara 47301, Petaling Jaya, Selangor, Malaysia	+60-3-7843-6833

Emergency Contact Details

For emergencies only; DO NOT contact these companies for general product advice.

Organisation	Location	Telephone
Poisons Information Centre	Westmead NSW	1800-251525 131126
Chemcall	Australia	1800-127406 +64-4-9179888
Chemcall	Malaysia	+64-4-9179888
Chemcall	New Zealand	0800-243622 +64-4-9179888
National Poisons Centre	New Zealand	0800-764766
CHEMTREC	USA & Canada	1-800-424-9300 CN723420 +1-703-527-3887

2. HAZARD IDENTIFICATION

Poisons Schedule (Aust) No Data Available

Globally Harmonised System

Hazard Classification Hazardous according to the criteria of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS)

Hazard Categories			Specific Target Organ Toxicity (Single Exposure) - Category 3 Skin Corrosion/Irritation - Category 2 Serious Eye Damage/Irritation - Category 1
Pictograms			
Signal Word			Danger
Hazard Statements		**H315**	Causes skin irritation.
		H318	Causes serious eye damage.
		H335	May cause respiratory irritation.
Precautionary Statements	General	**P102**	Keep out of reach of children.
	Prevention	**P280**	Wear protective gloves/protective clothing/eye protection/face protection.
		P261	Avoid breathing dust/fume.
	Response	**P302 + P352**	IF ON SKIN: Wash with plenty of soap and water.
		P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
		P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
	Disposal	**P501**	Dispose of contents/container in accordance with local / regional / national / international regulations.

National Transport Commission (Australia)
Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code)

Dangerous Goods Classification	NOT Dangerous Goods according to the criteria of the Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code)

Environmental Protection Authority (New Zealand)
Hazardous Substances and New Organisms Act 1996

HSNO Classifications	Health Hazards	**8.2C**	Substances that are corrosive to dermal tissue UN PGIII
		8.3A	Substances that are corrosive to ocular tissue
	Environmental Hazards	**9.1D**	Substances that are slightly harmful to the aquatic environment or are otherwise designed for biocidal action

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients

Chemical Entity	Formula	CAS Number	Proportion
Calcium Hydroxide	No Data Available	1305-62-0	>=95.0 %

4. FIRST AID MEASURES

Description of necessary measures according to routes of exposure

Swallowed	Clean mouth with water and drink afterwards plenty of water. Do NOT induce vomiting. Obtain medical attention.
Eye	Immediately wash in and around the eye area with large amounts of water for at least 15 minutes. Eyelids to be held apart. Remove clothing if contaminated and wash skin. Urgently seek medical assistance. Transport to hospital or medical centre.
Skin	Carefully and gently brush the contaminated body surfaces in order to remove all traces of product. Wash affected area immediately with plenty of water. Remove contaminated clothing. If necessary seek medical advice.
Inhaled	Remove victim from area of exposure - avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. Seek medical advice if effects persist.
Advice to Doctor	Most important symptoms and effects, both acute and delayed : Calcium dihydroxide is not acutely toxic via the oral, dermal, or inhalation route. The substance is classified as irritating to skin and the respiratory tract, and entails a risk of serious damage to the eye. There is no concern for adverse systemic effects because local effects (pH-effect) are the major health hazard.
Medical Conditions Aggravated by Exposure	Persons with pre-existing skin problems or impaired respiratory function may be more susceptible to the effects of this substance.

5. FIRE FIGHTING MEASURES

General Measures	Clear fire area of all non-emergency personnel. Stay upwind. Keep out of low areas. Eliminate ignition sources. Move fire exposed containers from fire area if it can be done without risk.
Flammability Conditions	Product is a non-flammable solid. Non-combustible material.
Extinguishing Media	Not combustible, however, if material is involved in a fire use: Fine water spray, normal foam, dry agent (carbon dioxide, dry chemical powder). Do not use water.
Hazardous Products of Combustion	Caustics fumes of calcium oxide form when heated to decomposition (580 deg C).
Special Fire Fighting Instructions	Do NOT allow fire fighting water to reach waterways, drains or sewers. Store fire fighting water for treatment.
Personal Protective Equipment	Fire fighters to wear self-contained breathing apparatus and suitable protective clothing if risk of exposure to products of decomposition.
Flash Point	No Data Available
Lower Explosion Limit	No Data Available
Upper Explosion Limit	No Data Available
Auto Ignition Temperature	No Data Available
Hazchem Code	No Data Available

6. ACCIDENTAL RELEASE MEASURES

General Response Procedure	Avoid accidents, clean up immediately. Slippery when spilled. Eliminate all sources of ignition. Increase ventilation. Avoid generating dust. Stop leak if safe to do so. Isolate the danger area. Use clean, non-sparking tools and equipment.
Clean Up Procedures	Contain and sweep/shovel up spills with dust binding material or use an industrial vacuum cleaner. Transfer to a suitable, labelled container and dispose of promptly as hazardous waste.
Containment	Stop leak if safe to do so. Isolate the danger area.
Decontamination	Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal.
Environmental Precautionary Measures	Contain the spillage. Keep the material dry if possible. Cover area if possible to avoid unnecessary dust hazard. Avoid uncontrolled spills to watercourses and drains (pH increase). Any large spillage into watercourses must be alerted to the Environment Agency or other regulatory body.
Evacuation Criteria	Evacuate all unnecessary personnel.
Personal Precautionary Measures	Personnel involved in the clean up should wear full protective clothing as listed in section 8.

7. HANDLING AND STORAGE

Handling	Ensure an eye bath and safety shower are available and ready for use. Observe good personal hygiene practices and recommended procedures. Wash thoroughly after handling. Take precautionary measures against static discharges by bonding and grounding equipment. Avoid contact with eyes, skin and clothing. Do not inhale product dust/fumes.
Storage	Store in a cool, dry, well-ventilated area. The substance should be stored under dry conditions. Any contact with air and moisture should be avoided. Do not use aluminium for transport or storage if there is a risk of contact with water. Keep containers tightly closed when not in use. Inspect regularly for deficiencies such as damage or leaks. Protect against physical damage. Store away from incompatible materials as listed in section 10. Keep out of direct sunlight. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. This product is not classified dangerous for transport according to The Australian Code for the Transport of Dangerous Goods By Road and Rail.
Container	Container type/packaging must comply with all applicable local legislation. Store in original packaging as approved by manufacturer.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

General	The following exposure standard has been established by The Australian Safety and Compensation Council (ASCC); Calcium Hydroxide CAS 1305-62-0: TWA = 5mg/m3 NOTE: The exposure value at the TWA is the average airborne concentration of a particular substance when calculated over a normal 8 hour working day for a 5 day working week. These exposure standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.
Exposure Limits	No Data Available
Biological Limits	PNEC aqua = 490 µg/l PNEC soil/groundwater = 1080 mg/l
Engineering Measures	A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area.
Personal Protection Equipment	RESPIRATOR: If dust exists, wear dust mask/respirator (AS1715/1716). EYES: Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area (AS1336/1337). HANDS: Wear rubber or PVC gloves (AS2161). CLOTHING: Long-sleeved impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact (AS3765/2210).
Work Hygienic Practices	Avoid inhalation or ingestion and contact with skin and eyes. General occupational hygiene measures are required to ensure safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no drinking, eating and smoking at the workplace. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Solid
Appearance	Powder
Odour	Odourless
Colour	White or off white (beige)
pH	12.45 1.0% in watering solution to 20 deg C
Vapour Pressure	No Data Available
Relative Vapour Density	No Data Available
Boiling Point	2850 °C
Melting Point	>450 °C
Freezing Point	No Data Available

Solubility	1844.9 mg/L 20°C
Specific Gravity	2.24
Flash Point	No Data Available
Auto Ignition Temp	No Data Available
Evaporation Rate	No Data Available
Bulk Density	No Data Available
Corrosion Rate	No Data Available
Decomposition Temperature	No Data Available
Density	No Data Available
Specific Heat	No Data Available
Molecular Weight	74.10 g/mol
Net Propellant Weight	No Data Available
Octanol Water Coefficient	No Data Available
Particle Size	No Data Available
Partition Coefficient	No Data Available
Saturated Vapour Concentration	No Data Available
Vapour Temperature	No Data Available
Viscosity	No Data Available
Volatile Percent	No Data Available
VOC Volume	No Data Available
Additional Characteristics	100% solubility in NH2Cl4
Potential for Dust Explosion	No Data Available
Fast or Intensely Burning Characteristics	No Data Available
Flame Propagation or Burning Rate of Solid Materials	No Data Available
Non-Flammables That Could Contribute Unusual Hazards to a Fire	No Data Available
Properties That May Initiate or Contribute to Fire Intensity	No Data Available
Reactions That Release Gases or Vapours	No Data Available
Release of Invisible Flammable Vapours and Gases	No Data Available

10. STABILITY AND REACTIVITY

General Information	No oxidising properties (Based on the chemical structure, the substance does not contain a surplus of oxygen or any structural groups known to be correlated with a tendency to react exothermally with combustible material)
Chemical Stability	Under normal conditions of use and storage, calcium dihydroxide is stable. Reactivity : In aqueous media Ca(OH)2 dissociates resulting in the formation of calcium cations and hydroxyl anions (when below the limit of water solubility).
Conditions to Avoid	Minimise exposure to air and moisture to avoid degradation.
Materials to Avoid	Calcium dihydroxide reacts exothermically with acids. When heated above 580 °C, calcium dihydroxide decomposes to produce calcium oxide (CaO) and water (H2O): Ca(OH)2 CaO + H2O. Calcium oxide reacts with water and generates heat. This may cause risk to flammable material. Calcium dihydroxide reacts exothermically with acids to form salts. Calcium dihydroxide reacts with aluminium and brass in the presence of moisture leading to the production of hydrogen. Ca(OH)2 + 2 Al + 6 H2O Ca[Al(OH)4]2 + 3 H2
Hazardous Decomposition Products	When heated above 580 °C, calcium dihydroxide decomposes to produce calcium oxide (CaO) and water (H2O)
Hazardous Polymerisation	Hazardous Polymerization Will not occur.

11. TOXICOLOGICAL INFORMATION

General Information	Oral: LD50 > 2000 mg/kg bw (OECD 425, rat) Dermal: LD50 > 2500 mg/kg bw (OECD 402, rabbit) Bacterial reverse mutation assay (Ames test, OECD 471): Negative Mammalian chromosome aberration test: Negative Calcium (administered as Ca-lactate) is not carcinogenic (experimental result, rat). Calcium dihydroxide is not acutely toxic. Classification for acute toxicity is not warranted.
EyeIrritant	Corrosive. May produce severe irritation and pain. May induce ulcerations of the corneal epithelium. Can cause blindness. Calcium dihydroxide entails a risk of serious damage to the eye (eye irritation studies (in vivo, rabbit).
Ingestion	Gastric irritant. Ingestion may be followed by severe pain, vomiting, diarrhoea, and collapse. If death does not occur in 24 hours, oesophageal perforation may occur, as evidenced by fall in blood pressure and severe pain. A narrowing of the oesophagus may occur weeks, months, or years after ingestion, making swallowing difficult.
Inhalation	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Can cause chemical bronchitis.
SkinIrritant	Corrosive. May cause severe burns and blistering, depending on duration of contact. Prolonged or repeated skin contact may produce severe irritation or dermatitis. Calcium dihydroxide is irritating to skin (in vivo, rabbit).
Carcinogen Category	No Data Available

12. ECOLOGICAL INFORMATION

Ecotoxicity	LC50 (96h) for freshwater fish: 50.6 mg/l LC50 (96h) for marine water fish: 457 mg/l EC50 (48h) for freshwater invertebrates: 49.1 mg/l LC50 (96h) for marine water invertebrates: 158 mg/l EC50 (72h) for freshwater algae: 184.57 mg/l NOEC (72h) for freshwater algae: 48 mg/l NOEC (14d) for marine water invertebrates: 32 mg/l
Persistence/Degradability	Not relevant for inorganic substances.
Mobility	Calcium dihydroxide, which is sparingly soluble, presents a low mobility in most soils
Environmental Fate	EC10/LC10 or NOEC for soil macroorganisms: 2000 mg/kg soil dw EC10/LC10 or NOEC for soil microorganisms: 12000 mg/kg soil dw NOEC (21d) for terrestrial plants: 1080 mg/kg Acute pH-effect. Although this product is useful to correct water acidity, an excess of more than 1 g/l may be harmful to aquatic life. pH-value of > 12 will rapidly decrease as result of dilution and carbonation.
Bioaccumulation Potential	Not relevant for inorganic substances.
Environmental Impact	No Data Available

13. DISPOSAL CONSIDERATIONS

General Information	Dispose of in accordance with all local, state and federal regulations. All empty packaging should be disposed of in accordance with Local, State, and Federal Regulations or recycled/reconditioned at an approved facility.
Special Precautions for Land Fill	Contact a specialist disposal company or the local waste regulator for advice. Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. TRANSPORT INFORMATION

Land Transport (Australia)
ADG

Proper Shipping Name	CALCIUM HYDROXIDE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

Land Transport (New Zealand)
NZS5433

Proper Shipping Name	CALCIUM HYDROXIDE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

Land Transport (United States of America)
US DOT

Proper Shipping Name	CALCIUM HYDROXIDE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

Sea Transport
IMDG

Proper Shipping Name	CALCIUM HYDROXIDE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available
EMS	No Data Available
Marine Pollutant	No

Air Transport
IATA

Proper Shipping Name	CALCIUM HYDROXIDE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

National Transport Commission (Australia)
Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code)

Dangerous Goods Classification	NOT Dangerous Goods according to the criteria of the Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code)

15. REGULATORY INFORMATION

General Information	No Data Available
Poisons Schedule (Aust)	No Data Available

Environmental Protection Authority (New Zealand)
Hazardous Substances and New Organisms Act 1996

Approval Code	HSR002925

National/Regional Inventories

Australia (AICS)	Listed
Canada (DSL)	Not Determined
Canada (NDSL)	Not Determined
China (IECSC)	Not Determined
Europe (EINECS)	215-137-3
Europe (REACh)	Registered
Japan (ENCS/METI)	Not Determined
Korea (KECI)	Not Determined
Malaysia (EHS Register)	Not Determined
New Zealand (NZIoC)	Listed
Phillipines (PICCS)	Not Determined
Switzerland (Giftliste 1)	Not Determined

Switzerland (Inventory of Notified Substances)	Not Determined
Taiwan (NCSR)	Not Determined
USA (TSCA)	Not Determined

16. OTHER INFORMATION

Related Product Codes	CAHYDR1000, CAHYDR1001, CAHYDR1002, CAHYDR2000, CAHYDR2200, CAHYDR3000, CAHYDR3001, CAHYDR4000, CAHYDR5000, CAHYDR6000, CAHYDR6100, CAHYDR7000, CAHYDR7100, CAHYDR7500, CAHYDR8000, CAHYDR8100, CAHYDR4500, CAHYDR8200, CAHYDR8101, CAHYDR8102, CAHYDR8103, CAHYDR7501, CAHYDR8104, CAHYDR7520, CAHYDR8113
Revision	3
Revision Date	01 Feb 2015
Key/Legend	**<** Less Than **>** Greater Than **AICS** Australian Inventory of Chemical Substances **atm** Atmosphere **CAS** Chemical Abstracts Service (Registry Number) **cm²** Square Centimetres **CO2** Carbon Dioxide **COD** Chemical Oxygen Demand **deg C (°C)** Degrees Celcius **EPA (New Zealand)** Environmental Protection Authority of New Zealand **deg F (°F)** Degrees Farenheit **g** Grams **g/cm³** Grams per Cubic Centimetre **g/l** Grams per Litre **HSNO** Hazardous Substance and New Organism **IDLH** Immediately Dangerous to Life and Health **immiscible** Liquids are insoluable in each other. **inHg** Inch of Mercury **inH2O** Inch of Water **K** Kelvin **kg** Kilogram **kg/m³** Kilograms per Cubic Metre **lb** Pound **LC50** LC stands for lethal concentration. LC50 is the concentration of a material in air which causes the death of 50% (one half) of a group of test animals. The material is inhaled over a set period of time, usually 1 or 4 hours. **LD50** LD stands for Lethal Dose. LD50 is the amount of a material, given all at once, which causes the death of 50% (one half) of a group of test animals. **ltr** or **L** Litre **m³** Cubic Metre **mbar** Millibar **mg** Milligram **mg/24H** Milligrams per 24 Hours **mg/kg** Milligrams per Kilogram **mg/m³** Milligrams per Cubic Metre **Misc** or **Miscible** Liquids form one homogeneous liquid phase regardless of the amount of either component present. **mm** Millimetre **mmH2O** Millimetres of Water **mPa.s** Millipascals per Second **N/A** Not Applicable **NIOSH** National Institute for Occupational Safety and Health **NOHSC** National Occupational Heath and Safety Commission **OECD** Organisation for Economic Co-operation and Development **Oz** Ounce **PEL** Permissible Exposure Limit **Pa** Pascal **ppb** Parts per Billion **ppm** Parts per Million **ppm/2h** Parts per Million per 2 Hours **ppm/6h** Parts per Million per 6 Hours **psi** Pounds per Square Inch **R** Rankine **RCP** Reciprocal Calculation Procedure **STEL** Short Term Exposure Limit **TLV** Threshold Limit Value

tne Tonne
TWA Time Weighted Average
ug/24H Micrograms per 24 Hours
UN United Nations
wt Weight

Fertilisers Awaken SDS

MATERIAL SAFETY DATA SHEET

AWAKEN® ST

FOR CHEMICAL EMERGENCY, SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT, CALL CHEMTREC - DAY OR NIGHT 1-800-424-9300

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MANUFACTURED FOR:

LOVELAND PRODUCTS, INC.
P.O. Box 1286 • Greeley, CO 80632-1286

24-Hour Emergency Phone: 1-800-424-9300
Medical Emergencies: 1-866-944-8565
U.S. Coast Guard National Response Center: 1-800-424-8802

PRODUCT NAME: AWAKEN® ST
CHEMICAL NAME: Zinc Ammonium Acetate
CHEMICAL FAMILY: Seed Treatment
EPA REG. NO.: not applicable
MSDS Number: 7102608-11-LPI **MSDS Revisions:** Sections 2 and 3 **Date of Issue:** 10/11/11 **Supersedes:** 07/27/10

2. HAZARDS IDENTIFICATION SUMMARY

KEEP OUT OF REACH OF CHILDREN – CAUTION - May be harmful if swallowed, inhaled or absorbed through skin. May cause eye and skin irritation. Avoid contact with eyes, skin and clothing. Avoid contact with open cuts or sores. Avoid breathing vapors. Use with adequate ventilation. Eye protection and gloves are suggested when handling undiluted product. Wash thoroughly after handling and using this product. In case of contact, flush with water. Get medical attention for eyes. This blended liquid seed treatment is derived from Anhydrous Ammonia, Acetic Acid, Potassium Nitrate, Urea Ammonium Nitrate Solution, Sodium Borate, Copper Sulfate, Ferrous Sulfate, Manganese Sulfate, Sodium Molybdate, Zinc Oxide, Zinc Sulfate, Citric Acid (chelation agent and pH adjustment), and water (diluent). Nausea and vomiting could be expected upon large dose ingestion. The acute ingestive effects are described as nausea, chills, and diarrhea. Eye or skin contact with these products could cause irritation (particularly in sensitive persons), and respiratory irritation could be expected from the unprotected inhalation of fertilizer mists. Product users should avoid prolonged or repeated skin contact by wearing impervious gloves, long sleeve shirt, long pants, socks and rubber boots. Goggles for eye protection are recommended.

This product is a clear dark green-colored liquid with slightly sweet non-offensive odor.

3. COMPOSITION, INFORMATION ON INGREDIENTS

Chemical Ingredients:	Percentage by Weight:	CAS No.	TLV (Units)
Total Nitrogen (N)	6.00	Mixture	none established
Soluble Potash (K_2O)	1.00	Mixture	none established
Zinc (Zn)	5.05	Mixture	none established
Micro ingredients: B, Cu, Fe, Mn, Mo	0.781	Mixture	none established
Fertilizer salts and inert ingredients, including	87.219		
Citric Acid (chelation agent, pH adjustment)		77-92-9	not listed
Water (diluent)		7789-20-0	not listed

4. FIRST AID MEASURES

If in eyes: Immediately flush eyes with plenty of water. Continue flushing for at least 15 minutes and call a physician if irritation persists.
If on skin: Flush affected skin with water. Remove all contaminated clothing. Launder clothing before reuse.
If inhaled: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician if indicated.
If swallowed: Drink plenty of water if conscious. Call a physician or poison control center immediately for advice on inducing vomiting. Do not induce vomiting or give anything by mouth to an unconscious person.

FOR A MEDICAL EMERGENCY INVOLVING THIS PRODUCT CALL: 1-866-944-8565.

5. FIRE FIGHTING MEASURES

FLASH POINT (°F/Test Method): Does not flash.
FLAMMABLE LIMITS (LFL & UFL): Not established
EXTINGUISHING MEDIA: Considered non-combustible, use medium appropriate to surrounding fire. Dry chemical, carbon dioxide (CO_2), foam, water spray or fog.
HAZARDOUS COMBUSTION PRODUCTS: May include but are not limited to oxides of carbon and oxides of sulfur, ammonia, and oxides of nitrogen.
SPECIAL FIRE FIGHTING PROCEDURES: Use water spray to cool containers exposed to fire. Remain upwind. Avoid breathing smoke. Wear self-contained breathing apparatus and full protective gear.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Containers may burst due to pressure build-up of aqua ammonia.

6. ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
Ventilate area. Contain spill, absorb liquid with clay or other absorbent material. Sweep up material and place in container for possible land application according to label use or for proper disposal. Check local, state and federal regulations for proper disposal.
CAUTION: Keep spills and cleaning runoff out of municipal sewers and open bodies of water.

7. HANDLING AND STORAGE

HANDLING: Open the container carefully. Contents may be under pressure and has a distinct odor of ammonia. Eye protection and gloves are suggested when handling undiluted product. Use with adequate ventilation.

STORAGE: Keep container tightly closed when not in use. A poorly sealed container may adversely affect product quality. Store in original container only. Store in a dry place above 40°F. Avoid freezing. If product freezes, allow it to warm and then mix thoroughly before use. Do not use food or drink containers for mixing or storage. Do not contaminate water, food, or feed by storage or disposal.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Not normally required. If ammonia odor is too strong use local or mechanical ventilation.
RESPIRATORY PROTECTION: Not normally required, if ammonia vapors are too strong wear a NIOSH approved respirator for anhydrous ammonia.
EYE PROTECTION: Chemical goggles or shielded safety glasses.
SKIN PROTECTION: Wear protective clothing: long-sleeved shirts and pants, shoes plus socks. Wear rubber or chemical-resistant gloves.

	OSHA PEL 8 hr TWA	ACGIH TLV-TWA
Ammonia	35 mg/m^3	17 mg/m^3

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR: Clear dark green-colored liquid with slightly sweet non-offensive odor
SPECIFIC GRAVITY (Water = 1): 1.187g/ml
BULK DENSITY: 9.91 lbs/gal.
SOLUBILITY: Soluble
pH: 6.0 – 6.5 (neat)
VAPOR PRESSURE: Not established
BOILING POINT: 212°F/100°C
PERCENT VOLATILE (by volume): Not established
EVAPORATION RATE: Not established
Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

10. STABILITY AND REACTIVITY

STABILITY: Stable
CONDITIONS TO AVOID: Excessive heat. Keep containers tightly closed.
INCOMPATIBILITY: Strong oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS: May include but are not limited to oxides of carbon and oxides of sulfur, ammonia, and oxides of nitrogen.
HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

Acute Oral LD_{50} (rat): Ammonia: 350 mg/kg
Acute Dermal LD_{50} (rabbit): not established
Eye Irritation (rabbit): Causes mild irritation
Skin Irritation (rabbit): Causes mild irritation
Inhalation LC_{50} (rat): 2000 ppm (4 hr).
Skin Sensitization (guinea pig): not established
Carcinogenic Potential: None listed in OSHA, NTP, IARC or ACGIH

12. ECOLOGICAL INFORMATION

Material is toxic to fish and other aquatic organisms.
Do not contaminate water supplies.

13. DISPOSAL CONSIDERATIONS

Wastes may be disposed of on site or at an approved waste disposal facility. Triple rinse (or equivalent), adding rinse water to spray tank. Offer container for recycling or dispose of in a sanitary landfill or by other procedures approved by appropriate authorities. Recycling decontaminated containers is the best option of container disposal. The Agricultural Container Recycling Council (ACRC) operates the national recycling program. To contact your state and local ACRC recycler visit the ACRC web page at http://www.acrecycle.org/. Do not contaminate water, food or feed by storage or disposal.

14. TRANSPORT INFORMATION

TDG/DOT Shipping Description: NOT REGULATED
Freight Classification: FERTILIZNG COMPOUNDS (MANUFACTURED FERTILIZERS), NOI, LIQUID (NMFC 68140, SUB 6; CLASS 70)
Consult appropriate ICAO/IATA and IMDG regulations for shipment requirements in the Air and Maritime shipping modes

15. REGULATORY INFORMATION

NFPA & HMIS Hazard Ratings:

NFPA		HMIS	
1	Health	1	Health
0	Flammability	0	Flammability
1	Instability	1	Reactivity
		H	PPE

0 Least, 1 Slight, 2 Moderate, 3 High, 4 Severe

SARA Hazard Notification/Reporting
SARA Title III Hazard Category:

Immediate	Y	Fire	N	Sudden Release of Pressure	N
Delayed	N	Reactive	N		

Reportable Quantity (RQ) under U.S. CERCLA: Ammonia (CAS: 7664-41-7) 100 pounds
SARA, Title III, Section 313: Ammonia (CAS: 7664-41-7)
RCRA Waste Code: Not listed
CA Proposition 65: Not listed

16. OTHER INFORMATION

MSDS STATUS: Sections 2 and 3 revised

PREPARED BY: Registrations and Regulatory Affairs

REVIEWED BY: Environmental/ Regulatory Services

Information regarding the contents and levels of metals in this product is available on the Internet at http://www.regulatory-info-lpi.com

MATERIAL SAFETY DATA SHEET

eChem (Australia) Pty Ltd
Level 4, Lantos Place
80 Stamford Road, Indooroopilly QLD 4068
Ph: 1300 781 649 Fax: 1300 781 650
A.C.N. 089 133 095

Issued: April 2013

Emergency Contact: 1800 033 111

SECTION 1 IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name: **Genero 600**
Flowable Seed Dressing Insecticide

Full Product Name:	Genero 600 Flowable Seed Dressing Insecticide.
Other Names:	Imidacloprid.
Use:	Liquid seed dressing insecticide for use on cotton, canola, pasture, lupin cereals and some summer crop seeds.
Company:	*e*Chem (Australia) Pty Ltd
Address:	Level 4, Lantos Place 80 Stamford Road, Indooroopilly QLD 4068
ACN/ABN:	089 133 095
Telephone Number:	02 6750 8019 **Fax Number:** 02 6752 3123
Emergency Contact:	1800 033 111

SECTION 2 HAZARDS IDENTIFICATION

Classified as hazardous according to criteria of Safe Work Australia.
Not classified as a Dangerous Good according to the ADG Code.

Risk phrases:	R22	Harmful if swallowed.
	R43	May cause sensitisation by skin contact.
Safety Phrases:	S2	Keep out of reach of children.
	S13	Keep away from food, drink and animal feedstuffs.
	S23	Do not breathe vapour or spray.
	S24/25	Avoid contact with skin and eyes.
	S36/37	Wear suitable protective clothing and gloves.

SECTION 3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients:

CHEMICAL	*CAS NUMBER*	*PROPORTION*	*RISK*
Imidacloprid	138261-41-3	600 g/L	R22
Hexahydro-1,3.5-tris (2-hydroxy-ethyl)-sym-triazine	4719-04-4	< 1%	R43
Hexahydro-1,3.5-tris (2-hydroxy-ethyl)-sym-triazine	4719-04-4	< 1%	R43
Other ingredients (including water) determined not to be hazardous		to 100%	

Trace quantities of impurities are possible.

SECTION 4 FIRST AID MEASURES

FIRST AID

Ingestion: If poisoning occurs, contact a Doctor or Poisons Information Centre. Phone 13 1126. Give water to drink.

SECTION 4 FIRST AID MEASURES (Continued)

Eye contact: If in eyes, immediately flush with running water for at least 15 minutes. If irritation occurs and persists, obtain medical attention.

Skin contact: Remove contaminated clothing. Wash skin thoroughly with soap and water. If skin irritation persists, seek medical advice.

Inhalation: Remove to fresh air and observe until recovered. If irritation or symptoms persist, seek medical advice.

Advice to Doctor: Treat symptomatically. No specific antidote is available. The active ingredient, imidacloprid, belongs to the chloronicotinyl or neonicotinoid chemical group. Local symptoms are not expected. Systemic symptoms may include apathy, depressed muscular tone, respiratory disturbances and trembling muscular cramps in severe cases of poisoning.

Treatment for systemic (nicotine-like) effects: Check pulse and blood pressure frequently, as bradycardia and hypotonia are possible. Provide supportive measures for respiratory function and cardiac action. Additional therapeutic measures involve accelerated elimination of the substance from the body (gastrolavage, saline laxatives).

Contraindications: Absorption agents such as alcohol and milk. Oils and fats are not particularly effective as imidacloprid has low liposolubility.

SECTION 5 FIRE FIGHTING MEASURES

Specific Hazard: Generally considered a low risk due to the water content, but once the water has evaporated the product is combustible.

Extinguishing media: Extinguish fire using media suited to burning material. If containers are ruptured contain all runoff.

Hazards from combustion products: Product is likely to decompose after heating to dryness and continued strong heating and will emit toxic and noxious vapours (eg. Hydrogen chloride, carbon monoxide and nitrogen oxides) when burnt. Will not polymerise.

Precautions for fire-fighters and special protective equipment: Isolate fire area. Evacuate downwind residents. Wear full protective clothing and self contained breathing apparatus. Do not breathe smoke or vapours generated. Contain all runoff.

SECTION 6 ACCIDENTIAL RELEASE MEASURES

Emergence procedures / Material and methods for containment and cleanup procedures: Wear wear elbow-length PVC gloves to prevent skin contamination. In the case of spillage, stop leak if safe to do so, and contain spill. Absorb spilled material with absorbent material such as sand, clay or cat litter. Vacuum, shovel or pump spilled material into an approved container and dispose of of waste as indicated in section 13 or according to the Australian Standard 2507 - Storage and Handling of Pesticides. Keep out animals and unprotected persons.

SECTION 7 HANDLING AND STORAGE

Precautions for safe Handling: No smoking, eating or drinking should be allowed where material is used or stored. Harmful if swallowed. Will irritate the eyes and skin. Repeated exposure may cause allergic disorders. Avoid contact with eyes and skin. When opening the container and using the product, wear elbow-length PVC gloves. Wash hands after use. After each day's use, wash gloves.

Conditions for safe Storage: Genero 600 is not classified as Dangerous Goods under the Australian Code for the Transport of Dangerous Goods by Road and Rail. This product is a Schedule 6 Poison (S6) and must be stored in accordance with the relevant Health Department regulations.

Store product in the closed, original container in a cool, well ventilated area away from children, animals, food, feedstuffs, seed and fertilisers. Do not store for prolonged periods in direct sunlight. Empty containers and product should not be burnt. Do not re-use container for any purpose.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines:
No exposure limits have been assigned by Safe Work Australia for this product.

Biological Limit Values:
No biological limit allocated.

Engineering controls:
Use in well ventilated areas. Keep containers closed when not in use. No special engineering controls are required.

Personal Protective equipment (PPE):
General: When opening the container and using the product, wear elbow-length PVC gloves. Wash hands after use. After each day's use, wash gloves.

Personal Hygiene: Clean water should be available for washing in case of eye or skin contamination. Wash skin before eating, drinking or smoking. Shower at the end of the workday.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Light brown to off white coloured liquid.
Odour:	Slight characteristic odour.
Boiling point:	Not known.
Freezing point:	Not known.
Specific Gravity:	1.2 ± 0.1.
Solubility in Water:	suspends in water. Not soluble.
pH:	4-7.
Flammability:	Not combustible.
Corrosive hazard:	Not corrosive.
Flashpoint (°C):	Not applicable - not flammable.
Flammability Limits (%):	Not combustible.
Poisons Schedule:	This product is a schedule 6 (S6) poison.

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: Product stable for at least 2 years under normal conditions of use.

Conditions to avoid: Avoid heat sources.

Incompatible materials: Avoid strong oxidising agents.

Hazardous Decomposition Products: None under normal conditions. In a fire toxic and noxious gases may be released.

Hazardous Polymerization: Material is not known to polymerize.

SECTION 11 TOXICOLOGICAL INFORMATION

No specific data is available for this product as no toxicity tests have been conducted on this product. Information presented is our best judgement based on similar products and/or individual components. As with all products for which limited data is available, caution must be exercised through the use of protective equipment and handling procedures to minimise exposure. Irritating to the eyes and skin.

Potential Health Effects:

ACUTE EFFECTS

Swallowed: This product maybe harmful if swallowed. Symptoms of poisoning include apathetic state, depressed muscular tone, respiratory disturbances and trembling. Muscular cramps are also possible in severe cases of poisoning. The estimated Acute Oral LD_{50} (rat) = 750 mg/kg.

Eye: This product is irritating to the eyes.

Skin: This product is irritating to the skin. Repeated or prolonged exposure may cause allergic disorders. The estimated LD_{50} > 4000 mg/kg.

SECTION 11 TOXICOLOGICAL INFORMATION (Continued)

Inhaled: Inhalation of mists or sprays may produce respiratory irritation. The estimated LC_{50} is greater than 1.86 mg/L/4 hours, (this was the highest concentration able to be produced).

Long Term Exposure: In animal studies, imidacloprid has shown no evidence of oncogenic effects, no carcinogenic effect no teratogenic potential and is not mutagenic. Imidacloprid is quickly and almost completely absorbed from the gastrointestinal tract and eliminated in urine (70-80%) and faeces (20-30%).

SECTION 12 ECOLOGICAL INFORMATION

Environmental Toxicology: No information is available for the product. The following information refers to the active ingredient, imidacloprid. Toxic to upland game birds (Bobwhite quail LD_{50} 152 mg/kg; Japanese quail LD_{50} = 31 mg/kg). Toxic to fish and aquatic species - rainbow trout LD_{50} = 211 mg/L and golden orfe LD_{50} = 237 mg/L. Toxic to *Daphnia magna* LC_{50} (48 hour) = 85 mg/L. Toxic to bees when used as a spray, but when used as a seed treatment it has been shown to be safe to bees. DO NOT contaminate streams, rivers or water courses.

Environmental Fate: No information is available for the product. The following information refers to the active ingredient, imidacloprid. Imidacloprid has medium absorption to soil with a half life of 48-190 days. It is not expected to leach.

SECTION 13 DISPOSAL CONSIDERATIONS

Spills and Disposal:
Empty container disposal: Triple or preferably pressure rinse containers before disposal. Add rinsings to spray tank. DO NOT dispose of undiluted chemicals on site. If recycling, replace cap and return clean containers to recycler or designated collection point. If not recycling, break, crush or puncture and bury empty containers in a local authority landfill. If no landfill is available, bury the containers below 500mm in a disposal pit specifically marked and set up for this purpose clear of water ways desirable vegetation and tree roots. Empty containers and product should not be burnt. Do not cut, weld or saw empty containers, as there is the possibility that fumes inside the container maybe ignited and cause the container to explode.

After spill or accident: Clear area of all unprotected personnel. Wear full protective clothing and equipment including chemical resistant (PVC) gloves. Prevent spill from spreading or entering waterways, sewers or underground drains. Absorb spill with absorbent material such as sand clay or cat litter. Place material into an approved drum. To decontaminate spill area, tools and equipment wash with a suitable solution (eg organic solvent, detergent, bleach or caustic) and add the solution to the drums of waste already collected. Dispose of drummed waste and decontamination solution in accordance with the requirements of Local Authorities or State Waste Management Authorities. If there is a need to dispose of the product, approach local authorities who hold periodic collections of unwanted chemicals (ChemClear®).

SECTION 14 TRANSPORT INFORMATION

Transport: Genero 600 is not classified as Dangerous Goods under the Australian Code for the Transport of Dangerous Goods by Road and Rail. This product is a Schedule 6 Poison (S6) and must be stored in accordance with the relevant Health Department regulations.

SECTION 15 REGULATORY INFORMATION

Under the Standard for Uniform Scheduling of Drugs and Poisons (SUSDP), this product is a schedule 6 poison.
This product is registered under the Agricultural and Veterinary Chemicals Code Act 1994. Product Registration No. 62019.
This product is classified as a Hazardous Substance under the criteria of Safe Work Australia. (Xn: Harmful, Xi: Irritant).

SECTION 15 REGULATORY INFORMATION (Continued)

Genero 600 is not classified as Dangerous Goods under the Australian Code for the Transport of Dangerous Goods by Road and Rail.

Requirements concerning special training:
Check State or Territory regulations that require people who use pesticides in their job or business to have training in the application of the materials.

SECTION 16 OTHER INFORMATION

Issue Date: 29 April 2013. Valid for 5 years. (revised address details).

Key to abbreviations and acronyms used in this MSDS:

ADG Code:	Australian Dangerous Goods Code (for the transport of dangerous goods by Road and Rail).
ASCC:	Australian Safety & Compensation Council (formally known as the National Occupational Health & Safety Commission (NOHSC)).
Bradycardia:	Is a resting heart rate of under 60 beats per minute (adults).
Carcinogen:	An agent which is responsible for the formation of a cancer.
Genotoxic:	Capable of causing damage to genetic material, such as DNA.
Hypotonia:	A condition of abnormally low muscle tone.
Mutagenic:	Able to produce a mutation (a change in the genetic material of cells).
Neurotoxicity:	An adverse change in the structure or function of the nervous system.
PPE:	Personal protective equipment.
Teratogen:	An agent capable of causing abnormalities in a developing foetus.
TWA:	The Time Weighted Average airborne concentration over an eight-hour working day, for a five day working week over an entire working life.
Oedema:	Accumulation of fluid in tissues.
PPE:	Personal protective equipment.
Teratogen:	An agent capable of causing abnormalities in a developing foetus, that is causing birth defects.
STEL:	Short Term Exposure Limits
TWA:	The Time Weighted Average airborne concentration over an eight-hour working day, for a five day working week over an entire working life.

References

1. "Search Hazardous Substances". Work Safe Australia HSIS website. (2013).
2. "Approved Criteria for Classifying Hazardous Substances" 3rd Ed. NOHSC Australia. [NOHSC:1008 (2004)]. October 2004.
3. Exotoxnet. Imidacloprid. 2007

This MSDS summarises our best knowledge of the health and safety hazard information of the product and how to safely handle and use the product in the workplace. Each user should read this MSDS and consider the information in the context of how the product will be handled and used in the workplace including in conjunction with other products.

If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact this company.

End MSDS

SAFETY DATA SHEET

Section 1: IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name:	**DYNASTY® Fungicide Seed Treatment**
Other Names:	**Proper shipping name:** Environmentally Hazardous Substance, Liquid, N.O.S. (azoxystrobin) **Applicable only for marine and air transport** **Product code:** A13012B
Recommended Use:	Fungicide seed treatment for the control of seedling damping-off caused by *Pythium* spp. and *Rhizoctonia solani* in Cotton.
Company Details:	**Syngenta Australia Pty Ltd** ABN 33 002 933 717
Address:	**Level 1, 2-4 Lyonpark Road** **MACQUARIE PARK NSW 2113** **AUSTRALIA**
Telephone Number:	**(02) 8876 8444**
Emergency Telephone Number:	**24 hours - 1800 033 111**

Section 2: HAZARDS IDENTIFICATION

Hazard Classification:	Classified as a hazardous chemical according to the Australian criteria for the classification of chemicals
Risk Phrases:	R43 May cause sensitization by skin contact.
Safety Phrases:	–

Section 3: COMPOSITION / INFORMATION ON INGREDIENTS

SUBSTANCE			
Chemical Identity of Pure Substance:	Azoxystrobin	Metalaxyl-M	Fludioxonil
Synonym:	ICI5504	CGA329351	CGA173506
CAS Number:	131860-33-8	70630-17-0	131341-86-1

MIXTURE		
Chemical Identity of Ingredients	**CAS No**	**Proportion (%w/v)**
Azoxystrobin	131860-33-8	7.5
Metalaxyl-M	70630-17-0	3.75
Fludioxonil	131341-86-1	1.25
1,2-propanediol		5 – 10
Other ingredients determined not to be hazardous	-	to 100

Section 4: FIRST AID MEASURES

Description of Necessary First Aid Measures:	In case of poisoning by any exposure route contact a doctor or Poisons Information Centre on 131 126. Have the product label or SDS with you when calling or going for treatment.	
	Ingestion:	If swallowed, seek medical advice immediately and show the container or label. Do NOT induce vomiting.
	Eye contact:	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses. Immediate medical attention is required.
	Skin contact:	Take off all contaminated clothing immediately. Wash off immediately with plenty of water. If skin irritation persists, call a physician. Wash contaminated clothing before re-use.
	Inhalation:	Move the victim to fresh air. If breathing is irregular or stopped, administer artificial respiration. Keep patient warm and at rest. Call a doctor or Poisons Information Centre immediately.
Poisoning Symptoms:	Poisoning symptoms in laboratory animals were non-specific	
Medical Advice:	Treat symptomatically.	

Section 5: FIRE FIGHTING MEASURES

Suitable Extinguishing Media:	*Extinguishing media - small fires* Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. *Extinguishing media - large fires* Alcohol-resistant foam or water spray.
Hazards from Combustion Products:	As the product contains combustible organic components, fire will produce dense black smoke containing hazardous products of combustion (see section 10). Exposure to decomposition products may be a hazard to health.
Special Protective Precautions and Equipment for Fire Fighters:	Wear full protective clothing and self-contained breathing apparatus. Do not allow run-off from fire fighting to enter drains or water courses. Cool closed containers exposed to fire with water spray.
Hazchem Code:	2X

Section 6: ACCIDENTAL RELEASE MEASURES

Emergency Procedures:	In case of spillage it is important to take all steps necessary to • Avoid eye and skin contact • Avoid contamination of waterways
Methods and Materials for Containment and Clean Up:	**Procedure for spill** (1) Keep all bystanders away (2) Wear full length clothing and PVC gloves

	(3) Reposition any leaking containers so as to minimise further leakage (4) Dam and absorb spill with an absorbent material (eg sand or soil) (5) Shovel the absorbed spill into drums (6) Disposal of the absorbed material will depend upon the extent of the spill • For quantities up to 50 L of product bury in a secure landfill site • For quantities greater than 50 L seek advice from the manufacturer (use emergency contact number below) before attempting disposal. Contain in a secure location until disposal method is established (7) Decontaminate spill area with detergent and water and rinse with the smallest volume of water practicable

Section 7: HANDLING AND STORAGE

Precautions for Safe Handling:	Will irritate the eyes. Avoid contact with eyes. Repeated exposure may cause allergic disorders. Wash hands after use. When preparing the slurry, wear: • cotton overalls buttoned to the neck and wrist • a washable hat • elbow-length PVC gloves • face shield. When using the prepared slurry, wear: • cotton overalls buttoned to the neck and wrist • a washable hat • elbow-length PVC gloves. After each day's use, wash gloves, face shield and contaminated clothing.
Conditions for Safe Storage:	Store in the closed, original container in a cool, well-ventilated area. DO NOT store for prolonged periods in direct sunlight.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

ALWAYS READ AND FOLLOW THE LABEL INSTRUCTIONS AND WARNINGS

	Component	*Exposure limit*	*Value type*
National Exposure Standards:	1,2-propanediol	10 mg/m^3 Particulates 150 ppm 474 mg/m^3 Total (vapour & particulates)	8h TWA
Syngenta Exposure Standards:	azoxystrobin	2 mg/m^3	8h TWA
	fludioxonil	10 mg/m^3	8h TWA
	metalaxyl-M	10 mg/m^3	8h TWA
Biological Limit Values:	No biological limits allocated		
Engineering Controls:	Containment and/or segregation is the most reliable technical protection measure if exposure cannot be eliminated. The extent of these protection measures depends on the actual risks in use. If airborne mists or vapours are generated, use local exhaust ventilation controls. Assess exposure and use any additional measures to keep airborne levels below any relevant exposure limit. Where necessary, seek additional occupational hygiene advice.		

Personal Protective Equipment:	The use of technical measures should always have priority over the use of personal protective equipment. When selecting personal protective equipment, seek appropriate professional advice. Personal protective equipment should be certified to appropriate standards. When preparing the slurry, wear: • cotton overalls buttoned to the neck and wrist • a washable hat • elbow-length PVC gloves • face shield. When using the prepared slurry, wear: • cotton overalls buttoned to the neck and wrist • a washable hat • elbow-length PVC gloves.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Cream to beige liquid	**Vapour Density:**	Not known
Odour:	Sweetish, slightly pungent	**Boiling Point/Range:**	>95°C at 1013.25 hPa
pH:	5 - 9 at 1 % w/v	**Solubility:**	4.1 g/L at 25°C in water
Vapour Pressure:	Not available	**Specific Gravity or Density:**	1.10 - 1.14 g/cm^3

Flash Point:	> 100°C	**Explosive Properties:**	Not explosive
Upper and Lower Flammable (Explosive) Limits in Air:	Not known	**Oxidising Properties:**	Not oxidising
		Combustibility:	Not a combustible liquid
Ignition Temperature:	585°C (auto-ignition)	**Corrosiveness:**	Not corrosive

Section 10: STABILITY AND REACTIVITY

Chemical Stability:	Stable under normal conditions.
Conditions to Avoid:	None known.
Incompatible Materials:	None known.
Hazardous Decomposition Products:	Combustion or thermal decomposition will evolve toxic and irritant vapours.
Hazardous Reactions:	None known. Hazardous polymerisation does not occur.

Section 11: TOXICOLOGICAL INFORMATION

Health Effects from Likely Routes of Exposure:		
Acute:	**Oral toxicity:**	**LOW TOXICITY** Tests on rats indicate this product has a low toxicity following single doses of undiluted product. (LD_{50} >5000 mg/kg)
	Dermal toxicity:	**LOW TOXICITY** Tests on rats indicate this product has a low toxicity following skin contact with undiluted product. (LD_{50} >5000 mg/kg)
	Inhalation:	**LOW TOXICITY** Tests on rats indicate this product is not harmful due to inhalation of undiluted product. (LC_{50} (4h) >5.34 mg/L air)
	Skin irritation:	**SLIGHT IRRITANT (rabbit)**
	Eye irritation:	**SLIGHT IRRITANT (rabbit)**
	Sensitisation:	**SKIN SENSITISER (Guinea pigs)**
Chronic:	**Azoxystrobin technical** has been extensively tested on laboratory mammals and in test-tube systems. No evidence of mutagenic, neurotoxic, carcinogenic, teratogenic or reproductive effects was obtained. **Fludioxonil technical** has been extensively tested on laboratory mammals and in test-tube systems. No evidence of mutagenic, carcinogenic, teratogenic or reproductive effects was obtained. **Metalaxyl-M**, either as technical grade metalaxyl-M or as a 50% component of technical grade metalaxyl, has been extensively tested on laboratory mammals and in test-tube systems. No evidence of mutagenic, teratogenic or reproductive effects was obtained.	

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity	*Toxicity to fish:*	**Moderately toxic to fish** *Oncorhynchus mykiss* (rainbow trout): LC_{50} = 6.8 mg/L, 96 h
	Toxicity to daphnia and other aquatic invertebrates:	**Moderately toxic to Daphnia** *Daphnia magna* (Water flea): EC_{50} = 2.4 mg/L, 48 h
	Toxicity to algae:	**Moderately toxic to algae** *Pseudokirchneriella subcapitata* (green algae): E_bC_{50} =1.9 mg/L, 72 h; E_rC_{50} = 13 mg/L, 72 h
Persistence and Degradability:	*Azoystrobin:*	*Water* Degradation half life: >12 d Azoxystrobin is stable in water *Soil* Degradation half life : 59.5 d Azoxystrobin is not persistent in soil.
	Metalaxyl-M:	*Water* Degradation half life: 22.4 - 47.5 d Metalaxyl-M is not persistent in water. *Soil* Degradation half life : < 50 d Metalaxyl-M is not persistent in soil.
	Fludioxonil:	*Water* Degradation half life: >8 d Fludioxonil is stable in water

		Soil Degradation half life : 6 - 25 d Fludioxonil is not persistent in soil.
Mobility	*Azoxystrobin:*	Azoxystrobin has low to very high mobility in soil.
	Metalaxyl-M:	Metalaxyl-M has a range from low to very high mobility in soil depending on soil type.
	Fludioxonil:	Fludioxonil has low to very high mobility in soil.
Environmental Fate (Exposure):	*Azoxystrobin:*	Incorporated into organic molecules.
	Metalaxyl-M:	Incorporated into organic molecules.
	Fludioxonil:	Incorporated into organic molecules.
Bioaccumulative Potential:	*Azoxystrobin:*	Azoxystrobin has medium potential to bioaccumulate.
	Metalaxyl-M:	Metalaxyl-M has a low potential for bioaccumulation.
	Fludioxonil:	Fludioxonil does not bioaccumulate.

Section 13: DISPOSAL CONSIDERATIONS

Disposal Methods and Containers:	*Non-returnable containers* Triple or preferably pressure rinse containers before disposal. Add rinsings to spray tank. DO NOT dispose of undiluted chemicals on site. If recycling, replace cap and return clean containers to recycler or designated collection point. If not recycling, break, crush or puncture and bury empty containers in a local authority landfill. If no landfill is available, bury the containers below 500 mm in a disposal pit specifically marked and set up for this purpose clear of waterways, desirable vegetation and tree roots. Empty containers and product should not be burnt. *Returnable containers* Empty contents fully into application equipment. Close all valves and return to point of sale for refill or storage.
Special Precautions for Landfill or Incineration:	Not applicable

Section 14: TRANSPORT INFORMATION

LAND TRANSPORT ADG			
UN Number:	3082	**Packing Group:**	III
UN Proper Shipping Name:	Environmentally Hazardous Substance, Liquid, N.O.S. (azoxystrobin)	**Special Precautions for User:**	None allocated
Class:	9	**Hazchem Code:**	2X
Subsidiary Risk:	None allocated		

SEA TRANSPORT IMDG			
UN Number:	3082	**Subsidiary Risk:**	None allocated
UN Proper Shipping Name:	Environmentally Hazardous Substance, Liquid, N.O.S. (azoxystrobin)	**Packing Group:**	III
Class:	9	**Marine Pollutant:**	Marine pollutant

AIR TRANSPORT IATA - DGR			
UN Number:	3082	**Subsidiary Risk:**	None allocated
UN Proper Shipping Name:	Environmentally Hazardous Substance, Liquid, N.O.S. (azoxystrobin)	**Packing Group:**	III
Class:	9		

Section 15: REGULATORY INFORMATION

APVMA Product Number:	58355
Poisons Schedule (SUSDP):	5

Section 16: OTHER INFORMATION

Date of preparation or last revision: March 2013

Source of Data: The information provided in this SDS is sourced from Syngenta internal studies which have been conducted according to Regulatory requirements including OECD and CIPAC Guidelines and EC Directives. A comprehensive package of toxicological and environmental data for the active ingredients of this product has been submitted to the government health and environment authorities and has been evaluated by expert toxicologists and environmental scientists.

Note: This product is a registered agricultural chemical and must, therefore, be used in accordance with the container label directions

CONTACT POINT: Regulatory Manager, Syngenta Australia Pty Ltd
(02) 8876 8444
24 HOURS EMERGENCY CONTACT: 1800 033 111

This Material Safety Data Sheet summarises our best knowledge of the health and safety hazard information of the product and how to safely handle and use the product in the workplace. Each user should read this SDS and consider the information in the context of how the product will be handled and used in the workplace including in conjunction with other products.
If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact this company.

DISCLAIMER
This product complies with the specifications in its statutory registration. Implied terms and warranties are excluded. Syngenta's liability for breach of the express or any non-excludable implied warranty is limited to product replacement or purchase price refund. The purchaser must determine suitability for intended purpose and take all proper precautions in the handling, storage and use of the product including those on the label and/or safety data sheet failing which Syngenta shall have no liability.

MATERIAL SAFETY DATA SHEET

Syngenta Crop Protection, Inc.
Post Office Box 18300
Greensboro, NC 27419

In Case of Emergency, Call
1-800-888-8372

1. PRODUCT IDENTIFICATION

Product Name: **CRUISER EXTREME** Product No.: A14115A

EPA Signal Word: Caution

Active Ingredient(%): Azoxystrobin (0.50%) CAS No.: 131860-33-8
Chemical Name: Methyl (E)-2-{2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl}-3-methoxyacrylate
Chemical Class: A beta-methyoxyacrylate fungicide

Active Ingredient(%): Fludioxonil (1.25%) CAS No.: 131341-86-1
Chemical Name: 4-(2,2-difluoro-1,3-benzodioxol-4-yl)-1H-pyrrole-3-carbonitrile
Chemical Class: Substituted Benzodioxalcarbonitrile Fungicide

Active Ingredient(%): Mefenoxam (1.00%) CAS No.: 70630-17-0 & 69516-34-3
Chemical Name: (R,S)-2-[(2,6-dimethylphenyl)-methoxyacetylamino]-propionic acid methyl ester
Chemical Class: Phenylamide Fungicide

Active Ingredient(%): Thiamethoxam (25.00%) CAS No.: 153719-23-4
Chemical Name: 4H-1,3,5-Oxadiazin-4-imine,3-[(2-chloro-5-thiazolyl) methyl]tetrahydro-5-methyl-N-nitro-
Chemical Class: Neonicotinoid Insecticide

EPA Registration Number(s): 100-1208 **Section(s) Revised: 2, 8**

2. HAZARDS IDENTIFICATION

Health and Environmental

Causes mild eye and skin irritation.

Hazardous Decomposition Products

None known.

Physical Properties

Appearance: Beige liquid

Odor: Aromatic

Unusual Fire, Explosion and Reactivity Hazards

During a fire, irritating and possibly toxic gases may be generated by thermal decomposition or combustion.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Material	OSHA PEL	ACGIH TLV	Other	NTP/IARC/OSHA Carcinogen
Talc	20 mppcf (containing <1% quartz) TWA	2 mg/m³ (respirable; <1% crystalline silica) TWA	2 mg/m³ (respirable; <1% quartz) TWA **	IARC Group 3

Glycerin	15 mg/m³ TWA (total); 5 mg/m³ TWA (respirable)	10 mg/m³ TWA (total)	Not Established	No
Azoxystrobin (0.50%)	Not Established	Not Established	2 mg/m³ TWA ***	No
Mefenoxam (1.00%)	Not Established	Not Established	10 mg/m³ TWA ***	No
Fludioxonil (1.25%)	Not Established	Not Established	10 mg/m³ TWA ***	No
Thiamethoxam (25.00%)	Not Established	Not Established	3 mg/m³ TWA ***	No

** recommended by NIOSH

*** Syngenta Occupational Exposure Limit (OEL)

Ingredients not precisely identified are proprietary or non-hazardous. Values are not product specifications.
Syngenta Hazard Category: B

4. FIRST AID MEASURES

Have the product container, label or Material Safety Data Sheet with you when calling Syngenta (800-888-8372), a poison contol center or doctor, or going for treatment.

Ingestion: If swallowed: Call Syngenta (800-888-8372), a poison control center or doctor immediately for treatment advice. Have the person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so after calling 800-888-8372 or by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

Eye Contact: If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after 5 minutes, then continue rinsing eye. Call Syngenta (800-888-8372), a poison control center or doctor for treatment advice.

Skin Contact: If on skin or clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call Syngenta (800-888-8372), a poison control center or doctor for treatment advice.

Inhalation: If inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call Syngenta (800-888-8372), a poison control center or doctor for further treatment advice.

Notes to Physician

There is no specific antidote if this product is ingested.

Treat symptomatically.

Medical Condition Likely to be Aggravated by Exposure

None known.

5. FIRE FIGHTING MEASURES

Fire and Explosion

Flash Point (Test Method):	> 212°F	
Flammable Limits (% in Air):	Lower: Not Applicable	Upper: Not Applicable
Autoignition Temperature:	815°F	
Flammability:	Not Applicable	

Unusual Fire, Explosion and Reactivity Hazards

During a fire, irritating and possibly toxic gases may be generated by thermal decomposition or combustion.

In Case of Fire

Use dry chemical, foam or CO2 extinguishing media. Wear full protective clothing and self-contained breathing apparatus. Evacuate nonessential personnel from the area to prevent human exposure to fire, smoke, fumes or products of combustion. Prevent use of contaminated buildings, area, and equipment until decontaminated. Water runoff can cause environmental damage. If water is used to fight fire, dike and collect runoff.

6. ACCIDENTAL RELEASE MEASURES

In Case of Spill or Leak

Control the spill at its source. Contain the spill to prevent from spreading or contaminating soil or from entering sewage and drainage systems or any body of water. Clean up spills immediately, observing precautions outlined in Section 8. Cover entire spill with absorbing material and place into compatible disposal container. Scrub area with hard water detergent (e.g. commercial products such as Tide, Joy, Spic and Span). Pick up wash liquid with additional absorbent and place into compatible disposal container. Once all material is cleaned up and placed in a disposal container, seal container and arrange for disposition.

7. HANDLING AND STORAGE

Store the material in a well-ventilated, secure area out of reach of children and domestic animals. Do not store food, beverages or tobacco products in the storage area. Prevent eating, drinking, tobacco use, and cosmetic application in areas where there is a potential for exposure to the material. Wash thoroughly with soap and water after handling.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

THE FOLLOWING RECOMMENDATIONS FOR EXPOSURE CONTROLS/PERSONAL PROTECTION ARE INTENDED FOR THE MANUFACTURE, FORMULATION AND PACKAGING OF THIS PRODUCT.

FOR COMMERCIAL APPLICATIONS AND/OR ON-FARM APPLICATIONS CONSULT THE PRODUCT LABEL.

Ingestion:	Prevent eating, drinking, tobacco usage and cosmetic application in areas where there is a potential for exposure to the material. Wash thoroughly with soap and water after handling.
Eye Contact:	Where eye contact is likely, use chemical splash goggles.
Skin Contact:	Where contact is likely, wear chemical-resistant gloves (such as barrier laminate, butyl rubber, nitrile rubber, neoprene rubber, polyvinyl chloride [PVC] or Viton), coveralls, socks and chemical-resistant footwear.
Inhalation:	A respirator is not normally required when handling this substance. Use effective engineering controls to comply with occupational exposure limits. In case of emergency spills, use a NIOSH approved respirator with any N, R, P or HE filter.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Beige liquid
Odor:	Aromatic
Melting Point:	Not Applicable
Boiling Point:	Not Available
Specific Gravity/Density:	1.23 g/ml
pH:	7.4 @ 77°F (25°C)

Solubility in H2O

Azoxystrobin :	6 mg/l in water @ 68°F (20°C)
Fludioxonil:	1.8mg/l @ 77°F (25°C)
Mefenoxam:	26g/l @ 77°F (25°C)
Thiamethoxam:	4.1g/l @ 77°F (25°C)

Vapor Pressure

Azoxystrobin :	8.25 x 10(-13) mmHg @ 68°F (20°C)
Fludioxonil:	2.9 x 10(-9) mmHg @ 77°F (25°C)
Mefenoxam:	2.5 x 10(-5) mmHg @ 77°F (25°C)
Thiamethoxam:	2 x 10(-11) mmHg @ 68°F (20°C)

10. STABILITY AND REACTIVITY

Stability:	Stable under normal use and storage conditions.
Hazardous Polymerization:	Will not occur.
Conditions to Avoid:	None known.

Materials to Avoid: None known.

Hazardous Decomposition Products: None known.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity/Irritation Studies (Finished Product)

Ingestion:

Oral (LD50 Rabbit) : > 5000 mg/kg body weight

Dermal:

Dermal (LD50 Rabbit) : > 5050 mg/kg body weight

Inhalation:

Inhalation (LC50 Rat) : Not Available

Eye Contact: Minimally Irritating (Rabbit)

Skin Contact: Practically Non-Irritating (Rabbit)

Skin Sensitization: Not Available

Reproductive/Developmental Effects

Azoxystrobin : Shows weak chromosomal damage in mammalian cells at cytotoxic levels. Negative in whole animal assays for chromosomal and DNA damage at high dosages (> or = 2000 mg/kg).
In rabbits, no effect was observed up to the highest dose level (500 mg/kg/day). In rats, developmental effects were seen only at maternally toxic doses (100 mg/kg/day).

Fludioxonil: Delayed development at doses causing maternal toxicity.

Mefenoxam: None observed.

Thiamethoxam: Developmental: Not teratogenic in rats or rabbits.
Reproductive: No effects on reproduction. Minor increase in a common testis effect in rats at high doses, which did not affect reproduction. When used in accordance with label directions and recommendations in this MSDS, no effects would be expected in humans.

Chronic/Subchronic Toxicity Studies

Azoxystrobin : In a rat 90-day feeding study, liver toxicity was observed at 2000 ppm. This was manifest as gross distension of the bile duct, increased numbers of lining cells and inflammation of the duct. No toxicologically significant effects were seen in repeat dose dog studies.
Data reviews do not indicate any potential for endocrine disruption.
There is no evidence of neurotoxicity in any of the studies conducted with azoxystrobin.

Fludioxonil: Liver and kidney toxicity at high dose levels.

Mefenoxam: Liver effects at high dose animal tests.

Thiamethoxam: Subchronic: Liver effects occurred in rodents only at high dose levels. Not neurotoxic after high acute and subchronic exposure in rats.

Carcinogenicity

Azoxystrobin : No carcinogenic effects observed in rats or mice at doses up to the maximum tolerated dose.

Fludioxonil: Marginal increase (7%) of liver tumors (female, rats: 3,000 ppm); Within historical control range (1 to 10%).

Mefenoxam: None observed.

Thiamethoxam: Classified as "not likely to be carcinogenic in humans" based on lifetime studies in mice and rats.

Other Toxicity Information

None

Toxicity of Other Components

Glycerin

Test results reported in Section 11 for the final product take into account any acute hazards related to the glycerin in the formulation.

Talc

Limited potential for respiratory disease.

Target Organs

Active Ingredients

Azoxystrobin : Liver

Fludioxonil: Liver, kidney

Mefenoxam: Liver

Thiamethoxam: Liver

Inert Ingredients

Glycerin: Not Applicable

Talc: Respiratory tract

12. ECOLOGICAL INFORMATION

Ecotoxicity Effects

Azoxystrobin :

Fish (Rainbow Trout) 96-hour LC50 470 ppb

Green Algae 5-day EC50 106 ppb

Invertebrate (Water Flea) 48-hour EC50 259 ppb

Bird (Mallard Duck) 14-day LD50 > 250 mg/kg

Mefenoxam:

Fish (Rainbow Trout) 96-hour LC50 > 121 ppm

Invertebrate (Water Flea) Daphnia Magna 48-hour EC50 > 113 ppm

Bird (Bobwhite Quail) 14-day LD50 981 mg/kg

Fludioxonil:

Fish (Rainbow Trout) 96-hour LC50 0.47 ppm

Green Algae 5-day EC50 0.087 ppm

Invertebrate (Water Flea) Daphnia Magna 48-hour EC50 0.9 ppm

Bird (Bobwhite Quail) 14-day LD50 > 2000 mg/kg

Thiamethoxam:

Fish (Rainbow Trout) 96-hour LC50 > 100 ppm

Bird (Mallard Duck) LD50 Oral 576 mg/kg

Invertebrate (Daphnia Magna) 48-hour EC50 > 106 ppm

Green Algae 4-day EC50 > 97 ppm

Environmental Fate

Azoxystrobin :

The information presented here is for the active ingredient, azoxystrobin.
Low bioaccumulation potential. Not persistent in soil. Stable in water. Moderate mobility in soil. Sinks in water (after 24 h).

Fludioxonil:

The information presented here is for the active ingredient, fludioxonil.
Does not bioaccumulate. Persistent in soil. Stable in water. Low mobility in soil. Sinks in water (after 24 h).

Mefenoxam:

The information presented here is for the active ingredient, mefenoxam.
Does not bioaccumulate. Not persistent in soil or water. Moderate mobility in soil. Mixes/sinks (after 24 h).

Thiamethoxam:

The information presented here is for the active ingredient, thiamethoxam.
Not persistent in soil. Stable in water. Moderate mobility in soil. Floats in water (after 24 h).

13. DISPOSAL CONSIDERATIONS

Disposal

Do not reuse product containers. Dispose of product containers, waste containers, and residues according to local, state, and federal health and environmental regulations.

Characteristic Waste: Not Applicable

Listed Waste: Not Applicable

14. TRANSPORT INFORMATION

DOT Classification

Ground Transport - NAFTA
Not regulated.

Air Transport - NAFTA
Not regulated.

B/L Freight Classification

Insecticide/Fungicide, NOI, Not Regulated

Comments

Water Transport - International
Proper Shipping Name: Environmentally Hazardous Substance, Liquid, N.O.S. (1H-Pyrrole-3-Carbonitrile, 4-(2,2-Difluoro-1,3-Benzodioxol-4-yl)-, Marine Pollutant
Hazard Class or Division: Class 9
Identification Number: UN 3082
Packing Group: PG III

Air Transport - International
Proper Shipping Name: Environmentally Hazardous Substance, Liquid, N.O.S. (1H-Pyrrole-3-Carbonitrile, 4-(2,2-Difluoro-1,3-Benzodioxol-4-yl)-
Hazard Class or Division: Class 9
Identification Number: UN 3082
Packing Group: PG III
Packing Instructions: 914
Packaging Limitations: Inner packages over 5 liters and single packages over 450 liters cannot be shipped by aircraft.

15. REGULATORY INFORMATION

EPCRA SARA Title III Classification

Section 311/312 Hazard Classes: Acute Health Hazard

Section 313 Toxic Chemicals: Not Applicable

California Proposition 65

Not Applicable

CERCLA/SARA 302 Reportable Quantity (RQ)

None

RCRA Hazardous Waste Classification (40 CFR 261)

Not Applicable

TSCA Status

Exempt from TSCA, subject to FIFRA

16. OTHER INFORMATION

NFPA Hazard Ratings		HMIS Hazard Ratings	
Health:	1	Health:	1
Flammability:	1	Flammability:	1
Instability:	0	Reactivity:	0

0	Minimal
1	Slight
2	Moderate
3	Serious
4	Extreme

For non-emergency questions about this product call:

1-800-334-9481

Original Issued Date: 10/12/2004
Revision Date: 12/7/2009 Replaces: 5/6/2005

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.

End of MSDS

SAFETY DATA SHEET

Section 1: IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name:	**BION® Plant Activator Seed Treatment**
Other Names:	**Proper shipping name:** Environmentally Hazardous Substance, Liquid, N.O.S. (acibenzolar-S-methyl) **Applicable only for marine and air transport** **Product code:** A9625B
Recommended Use:	Applied to cotton as a seed treatment to activate the plant's natural defence mechanisms
Company Details:	**Syngenta Australia Pty Ltd** ABN 33 002 933 717
Address:	**Level 1, 2-4 Lyonpark Road** **MACQUARIE PARK NSW 2113** **AUSTRALIA**
Telephone Number:	**(02) 8876 8444**
Emergency Telephone Number:	**24 hours - 1800 033 111**

Section 2: HAZARDS IDENTIFICATION

Hazard Classification:	Not classified as a hazardous chemical according to the Australian criteria for the classification of chemicals
Risk Phrases:	–
Safety Phrases:	–

Section 3: COMPOSITION / INFORMATION ON INGREDIENTS

SUBSTANCE	
Chemical Identity of Pure Substance:	acibenzolar-S-methyl
Synonym:	CGA245704
CAS Number:	135158-54-2

MIXTURE

Chemical Identity of Ingredients	**CAS No**	**Proportion (%w/v)**
acibenzolar-S-methyl	135158-54-2	50
1,2-propanediol	57-55-6	5 - 10
styrylphenol polyethoxyester phosphate	90093-37-1	2 - 10
other ingredients determined not to be hazardous	-	to 100

Section 4: FIRST AID MEASURES

Description of Necessary First Aid Measures:	In case of poisoning by any exposure route contact a doctor or Poisons Information Centre on 131 126. Have the product label or SDS with you when calling or going for treatment. **Ingestion:** If swallowed, seek medical advice immediately and show the container or label. Do NOT induce vomiting. **Eye contact:** Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses. Immediate medical attention is required. **Skin contact:** Take off all contaminated clothing immediately. Wash off immediately with plenty of water. If skin irritation persists, call a physician. Wash contaminated clothing before re-use. **Inhalation:** Move the victim to fresh air. If breathing is irregular or stopped, administer artificial respiration. Keep patient warm and at rest. Call a doctor or Poisons Information Centre immediately.
Poisoning Symptoms:	Poisoning symptoms in laboratory animals were non-specific
Medical Advice:	Treat symptomatically.

Section 5: FIRE FIGHTING MEASURES

Suitable Extinguishing Media:	*Extinguishing media - small fires* Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. *Extinguishing media - large fires* Alcohol-resistant foam or water spray.
Hazards from Combustion Products:	As the product contains combustible organic components, fire will produce dense black smoke containing hazardous products of combustion (see section 10). Exposure to decomposition products may be a hazard to health.
Special Protective Precautions and Equipment for Fire Fighters:	Wear full protective clothing and self-contained breathing apparatus. Do not allow run-off from fire fighting to enter drains or water courses. Cool closed containers exposed to fire with water spray.

Section 6: ACCIDENTAL RELEASE MEASURES

Emergency Procedures:	In case of spillage it is important to take all steps necessary to • Avoid eye and skin contact • Avoid contamination of waterways
Methods and Materials for Containment and Clean Up:	**Procedure for spill** (1) Keep all bystanders away (2) Wear full length clothing and PVC gloves (3) Reposition any leaking containers so as to minimise further leakage

	(4) Dam and absorb spill with an absorbent material (eg sand or soil) (5) Shovel the absorbed spill into drums (6) Disposal of the absorbed material will depend upon the extent of the spill • For quantities up to 50 L of product bury in a secure landfill site • For quantities greater than 50 L seek advice from the manufacturer (use emergency contact number below) before attempting disposal. Contain in a secure location until disposal method is established (7) Decontaminate spill area with detergent and water and rinse with the smallest volume of water practicable

Section 7: HANDLING AND STORAGE

Precautions for Safe Handling:	Will irritate the eyes. Avoid contact with eyes. Wash hands after use. When opening the container and preparing treatment solution wear: • cotton overalls buttoned to the neck and wrist (or equivalent clothing).
Conditions for Safe Storage:	Keep out of reach of children. Store in tightly sealed original containers in a dry secure place away from fertilisers, seed, feed and food. Store out of direct sunlight. Keep out of reach of children, unauthorised persons and animals.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

ALWAYS READ AND FOLLOW THE LABEL INSTRUCTIONS AND WARNINGS

	Component	*Exposure limit*	*Value type*
National Exposure Standards:	1,2-propanediol	10 mg/m^3 Particulates 150 ppm Total (vapour & 474 mg/m^3 particulates)	8h TWA
Syngenta Exposure Standards:	acibenzolar-S-methyl	10 mg/m^3	8h TWA
Biological Limit Values:	No biological limits allocated		
Engineering Controls:	Containment and/or segregation is the most reliable technical protection measure if exposure cannot be eliminated. The extent of these protection measures depends on the actual risks in use. If airborne mists or vapours are generated, use local exhaust ventilation controls. Assess exposure and use any additional measures to keep airborne levels below any relevant exposure limit. Where necessary, seek additional occupational hygiene advice.		
Personal Protective Equipment:	The use of technical measures should always have priority over the use of personal protective equipment. When selecting personal protective equipment, seek appropriate professional advice. Personal protective equipment should be certified to appropriate standards. When opening the container and preparing treatment solution wear: • cotton overalls buttoned to the neck and wrist (or equivalent clothing).		

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Yellow to yellow brown liquid	**Vapour Density:**	Not known
Odour:	Weak, chalky	**Boiling Point/Range:**	ca.100 °C at 1,013.25 hPa
pH:	5 - 9 at 1% w/v	**Solubility:**	Miscible in water
Vapour Pressure:	2.2 x 10^{-4} Pa at 20°C (acibenzolar-S-methyl)	**Specific Gravity or Density:**	1.18 – 1.22 g/mL at 20°C

Flash Point:	> 100 °C at 980 hPa	**Oxidising Properties:**	Not oxidising
Upper and Lower Flammable (Explosive) Limits in Air:	Not known	**Combustibility:**	Not combustible
Ignition Temperature:	295°C	**Corrosiveness:**	Not corrosive to stainless steel and HDPE; slightly corrosive to tin plate, galvanised sheet metal and iron steel.
Explosive Properties:	Not explosive		

Section 10: STABILITY AND REACTIVITY

Chemical Stability:	Stable under normal conditions.
Conditions to Avoid:	None known.
Incompatible Materials:	None known.
Hazardous Decomposition Products:	Combustion or thermal decomposition will evolve toxic and irritant vapours.
Hazardous Reactions:	None known. Hazardous polymerisation does not occur.

Section 11: TOXICOLOGICAL INFORMATION

Health Effects from Likely Routes of Exposure:

Acute:	**Oral toxicity:**	**LOW TOXICITY** Tests on rats indicate this product has a low toxicity following single doses of undiluted product. (LD_{50} >3000 mg/kg)
	Dermal toxicity:	**LOW TOXICITY** Tests on rats indicate this product has a low toxicity following skin contact with undiluted product. (LD_{50} >4000 mg/kg)
	Inhalation:	**LOW TOXICITY** Tests on rats indicate this product has a low toxicity due to inhalation of undiluted product. (LC_{50} (4h) >1.379 mg/L air)
	Skin irritation:	**NON IRRITANT (rabbit)**
	Eye irritation:	**SLIGHT IRRITANT (rabbit)**
	Sensitisation:	**NOT A SKIN SENSITISER (Guinea pigs)**
Chronic:	**Acibenzolar-S-methyl technical** has been extensively tested on laboratory mammals and in test-tube systems. No evidence was obtained of mutagenic, carcinogenic, teratogenic neurotoxic or reproductive effects.	

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity	*Toxicity to fish:*	**Moderately toxic to fish** *Lepomis macrochirus* (bluegill sunfish): LC_{50} = 2.6 mg/L, 96 h
	Toxicity to daphnia and other aquatic invertebrates:	**Highly toxic to Daphnia** *Daphnia magna* (Water flea): EC_{50} = 0.91 mg/L, 48 h
	Toxicity to algae:	**Slightly toxic to algae** *Pseudokirchneriella subcapitata* (green algae): E_rC_{50} = 28 mg/L, 72 h
Persistence and Degradability:	Acibenzolar-S-methyl is not persistent in water and soil.	
Mobility	Acibenzolar-S-methyl has low to slight mobility in soil.	
Environmental Fate (Exposure):	Incorporated into C, N, O and H containing organic molecules.	
Bioaccumulative Potential:	Acibenzolar-S-methyl does not bioaccumulate.	

Section 13: DISPOSAL CONSIDERATIONS

Disposal Methods and Containers:	Triple or preferably pressure rinse containers before disposal. Add rinsings to spray tank. DO NOT dispose of undiluted chemicals on site. If recycling, replace cap and return clean containers to recycler or designated collection point. If not recycling, break, crush or puncture and bury empty containers in a local authority landfill. If no landfill is available, bury the containers below 500 mm in a disposal pit specifically marked and set up for this purpose clear of waterways, desirable vegetation and tree roots. Empty containers and product should not be burnt..
Special Precautions for Landfill or Incineration:	Not applicable

Section 14: TRANSPORT INFORMATION

LAND TRANSPORT ADG	Not dangerous goods in Australia		
UN Number:	None allocated	**Packing Group:**	None allocated
UN Proper Shipping Name:	None allocated	**Special Precautions for User:**	None allocated
Class:	None allocated	**Hazchem Code:**	None allocated
Subsidiary Risk:	None allocated		

SEA TRANSPORT IMDG			
UN Number:	3082	**Subsidiary Risk:**	None allocated
UN Proper Shipping Name:	Environmentally Hazardous Substance, Liquid, N.O.S. (acibenzolar-S-methyl)	**Packing Group:**	III
Class:	9	**Marine Pollutant:**	Marine pollutant

AIR TRANSPORT IATA - DGR			
UN Number:	3082	**Subsidiary Risk:**	None allocated
UN Proper Shipping Name:	Environmentally Hazardous Substance, Liquid, N.O.S. (acibenzolar-S-methyl)	**Packing Group:**	III
Class:	9		

Section 15: REGULATORY INFORMATION

APVMA Product Number:	60556
Poisons Schedule (SUSDP):	7

Section 16: OTHER INFORMATION

Date of preparation or last revision: April 2013

Source of Data: The information provided in this SDS is sourced from Syngenta internal studies which have been conducted according to Regulatory requirements including OECD and CIPAC Guidelines and EC Directives. A comprehensive package of toxicological and environmental data for the active ingredients of this product has been submitted to the government health and environment authorities and has been evaluated by expert toxicologists and environmental scientists.

Note: This product is a registered agricultural chemical and must, therefore, be used in accordance with the container label directions

CONTACT POINT: Regulatory Manager, Syngenta Australia Pty Ltd
(02) 8876 8444
24 HOURS EMERGENCY CONTACT: 1800 033 111

This Material Safety Data Sheet summarises our best knowledge of the health and safety hazard information of the product and how to safely handle and use the product in the workplace. Each user should read this SDS and consider the information in the context of how the product will be handled and used in the workplace including in conjunction with other products.
If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact this company.

DISCLAIMER
This product complies with the specifications in its statutory registration. Implied terms and warranties are excluded. Syngenta's liability for breach of the express or any non-excludable implied warranty is limited to product replacement or purchase price refund. The purchaser must determine suitability for intended purpose and take all proper precautions in the handling, storage and use of the product including those on the label and/or safety data sheet failing which Syngenta shall have no liability.

Appendix B - Narrabri Weather Statistics

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Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual	No. Years	Start Year	End Year
Mean maximum temperature (Degrees C) for years 1962 to 2002	33.8	33.2	31.2	27.3	22.5	18.7	18	19.8	23.4	27.1	30.1	33	26.5	40	1962	2002
Highest temperature (Degrees C) for years 1962 to 2002	43.4	42.3	40.6	37.2	31.3	26.9	26.7	32.1	36.6	40.7	43	43.3	43.4	40	1962	2002
Lowest maximum temperature (Degrees C) for years 1962 to 2002	20.2	17.9	18.9	14	11.7	9.4	7.8	10.4	11.1	14.4	14.9	19.2	7.8	40	1962	2002
Decile 1 maximum temperature (Degrees C) for years 1962 to 2002	28.8	29	26.9	22.7	17.8	14.8	14.1	15.6	18.4	21.4	24.4	27.5		40	1962	2002
Decile 9 maximum temperature (Degrees C) for years 1962 to 2002	38.5	37.2	35.1	31.1	26.6	22.3	21.7	24	28.5	32.2	35.6	37.8		40	1962	2002
Mean number of days >= 30 Degrees C for years 1962 to 2002	26.4	24	21.8	5.8	0.1	0	0	0.1	1.7	8	15.8	24.3	128	40	1962	2002
Mean number of days >= 35 Degrees C for years 1962 to 2002	13.1	9.2	3.6	0.1	0	0	0	0	0.1	0.9	4.1	11.3	42.4	40	1962	2002
Mean number of days >= 40 Degrees C for years 1962 to 2002	1.3	0.4	0.1	0	0	0	0	0	0	0	0.3	0.7	2.8	40	1962	2002
Mean minimum temperature (Degrees C) for years 1962 to 2002	19.3	19.1	16.4	11.9	8.3	5.2	3.7	4.6	7.6	11.7	14.8	17.7	11.7	40	1962	2002
Lowest temperature (Degrees C) for years 1962 to 2002	10.6	7.8	5.6	0.7	-2.2	-5.6	-4.4	-3.9	-1.7	-0.6	3.9	6	-5.6	40	1962	2002
Highest minimum temperature (Degrees C) for years 1962 to 2002	28.3	27.4	24.7	21	19.8	15.2	16.4	17.6	21.1	24.7	26.9	28.3	28.3	40	1962	2002
Decile 1 minimum temperature (Degrees C) for years 1962 to 2002	15.4	15.6	12.2	7.2	2.8	0.5	-0.9	0.2	2.2	6.1	9.9	13.1		40	1962	2002

Decile 9 minimum temperature (Degrees C) for years 1962 to 2002	23.3	22.8	20.1	16.8	13.9	10.1	9.3	10.2	13.5	17.1	19.5	22.1		40	1962	2002
Mean number of days <= 2 Degrees C for years 1962 to 2002	0	0	0	0.1	2	6.2	11.7	8.1	2.6	0.1	0	0	30.8	40	1962	2002
Mean number of days <= 0 Degrees C for years 1962 to 2002	0	0	0	0	0.4	2.4	5.3	3	0.4	0	0	0	11.5	40	1962	2002
Mean rainfall (mm) for years 1891 to 2016	83.8	62.3	57.9	38.4	47	48.5	46.5	40.4	42.1	51.9	61.2	77.1	661.6	80	1891	2016
Highest rainfall (mm) for years 1891 to 2016	307	220	227.6	210.6	196.4	240.6	159.6	159.9	141.6	211.1	204.3	284.2	1012.1	87	1891	2016
Date of Highest rainfall for years 1891 to 2016	1984	1977	1894	1905	1991	1920	1984	1918	1998	1969	1961	2004	1969	N/A	1891	2016
Lowest rainfall (mm) for years 1891 to 2016	0	0	0	0	0	0.2	0	0	0	0	0	2.9	297.4	87	1891	2016
Date of Lowest rainfall for years 1891 to 2016	1960	1901	2016	2013	2008	1986	2011	1995	2007	2002	1897	1974	1994	N/A	1891	2016
Decile 1 monthly rainfall (mm) for years 1891 to 2016	10.1	8.7	2.7	0	1.2	12.8	6.2	3.3	2.8	9.6	8.5	17.6	464.1	86	1891	2016
Decile 5 (median) monthly rainfall (mm) for years 1891 to 2016	60.2	50.6	44.4	22.2	33	38.1	40.7	32.2	30.6	48.7	59.4	65.1	669.4	86	1891	2016
Decile 9 monthly rainfall (mm) for years 1891 to 2016	211.8	141.5	133.5	88.7	105.3	90.9	93.4	94.7	98.3	97.7	113	156	899.5	86	1891	2016
Highest daily rainfall (mm) for years 1891 to 2016	135.4	128.2	129	83	100.2	111.3	64	58.4	74.4	68.6	66.8	101.4	135.4	86	1891	2016
Mean number of days of rain for years 1800 to 3000	6	5.3	4.9	3.7	4.5	5.6	5.4	5.1	5	5.8	6.3	6.7	64.3	86	1891	2016
Mean number of days of rain >= 1 mm for years 1891 to 2016	3.7	3.1	2.8	2.2	2.6	3.3	3.1	2.9	3	3.5	3.9	4.1	38.2	86	1891	2016

Mean number of days of rain >= 10 mm for years 1891 to 2016	1.7	1.3	1.3	0.8	1.1	1.2	1.1	1	1	1.3	1.5	1.7	15	86	1891	2016
Mean number of days of rain >= 25 mm for years 1891 to 2016	0.8	0.5	0.5	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.5	0.5	4.7	86	1891	2016
Mean daily solar exposure (MJ/(m*m)) for years 1990 to 2016	26.7	24.1	21.1	16.6	12.9	10.6	11.7	15.1	19.3	22.9	25	26.8	19.4	26	1990	2016
Mean number of clear days for years 1962 to 2002	11.1	9.5	12.4	11.9	11.1	11.4	13.2	13.8	14.2	10.9	10.1	11	140.6	39	1962	2002
Mean number of cloudy days for years 1962 to 2002	8.7	7.7	7	7	10.1	9.5	9.2	7.6	7	8.6	8.6	8.1	99.1	39	1962	2002
Mean 9am temperature (Degrees C) for years 1962 to 2002	25.1	24	22.6	18.8	13.5	9.6	8.3	10.9	15.8	20.1	22	24.6	17.9	39	1962	2002
Mean 9am wet bulb temperature (Degrees C) for years 1962 to 2002	19.4	18.9	17.6	14.9	11.2	8.2	6.9	8.7	12.2	15	16.6	18.7	14	30	1962	2002
Mean 9am dew point temperature (Degrees C) for years 1962 to 2002	15.9	15.5	14.3	11.9	9.5	6.7	5.5	5.8	8.8	10.6	12.7	14.9	11	17	1962	2002
Mean 9am relative humidity (%) for years 1962 to 2002	61	65	64	66	78	84	82	73	65	57	59	59	68	17	1962	2002
Mean 9am cloud cover (okas) for years 1962 to 2002	3	3.2	2.7	2.7	3.5	3.4	3.2	2.7	2.6	3.1	3.2	3	3	39	1962	2002
Mean 9am wind speed (km/h) for years 1962 to 2002	17.1	17.6	17.1	14.7	12.9	12.6	11.7	13.1	16.3	18.5	18.3	18.8	15.7	38	1962	2002
Mean 3pm temperature (Degrees C) for years 1962 to 2002	32.7	32.2	30.3	26.4	21.4	17.9	17.1	19	22.6	26	29	31.9	25.5	39	1962	2002
Mean 3pm wet bulb temperature (Degrees C) for years 1962 to 2002	22	21.9	20.3	17.7	15	12.7	11.6	12.5	14.8	17.2	18.8	20.5	17.1	30	1962	2002

Mean 3pm dew point temperature (Degrees C) for years 1962 to 2002	15.5	15.5	13.8	11.3	9.6	7.4	6.2	5.3	7.7	9.1	11.7	13.6	10.6	17	1962	2002
Mean 3pm relative humidity (%) for years 1962 to 2002	38	40	39	42	49	52	50	42	39	37	39	37	42	17	1962	2002
Mean 3pm cloud cover (oktas) for years 1962 to 2002	4.3	4.4	4.1	4	4.3	4.1	3.8	3.7	3.6	4.3	4.5	4.3	4.1	39	1962	2002
Mean 3pm wind speed (km/h) for years 1962 to 2002	16.9	17.1	17.4	16.4	15.4	16.8	17.3	18.5	19.7	19.2	19.2	19	17.7	38	1962	2002

Appendix C - Scenario 1 Model Outputs

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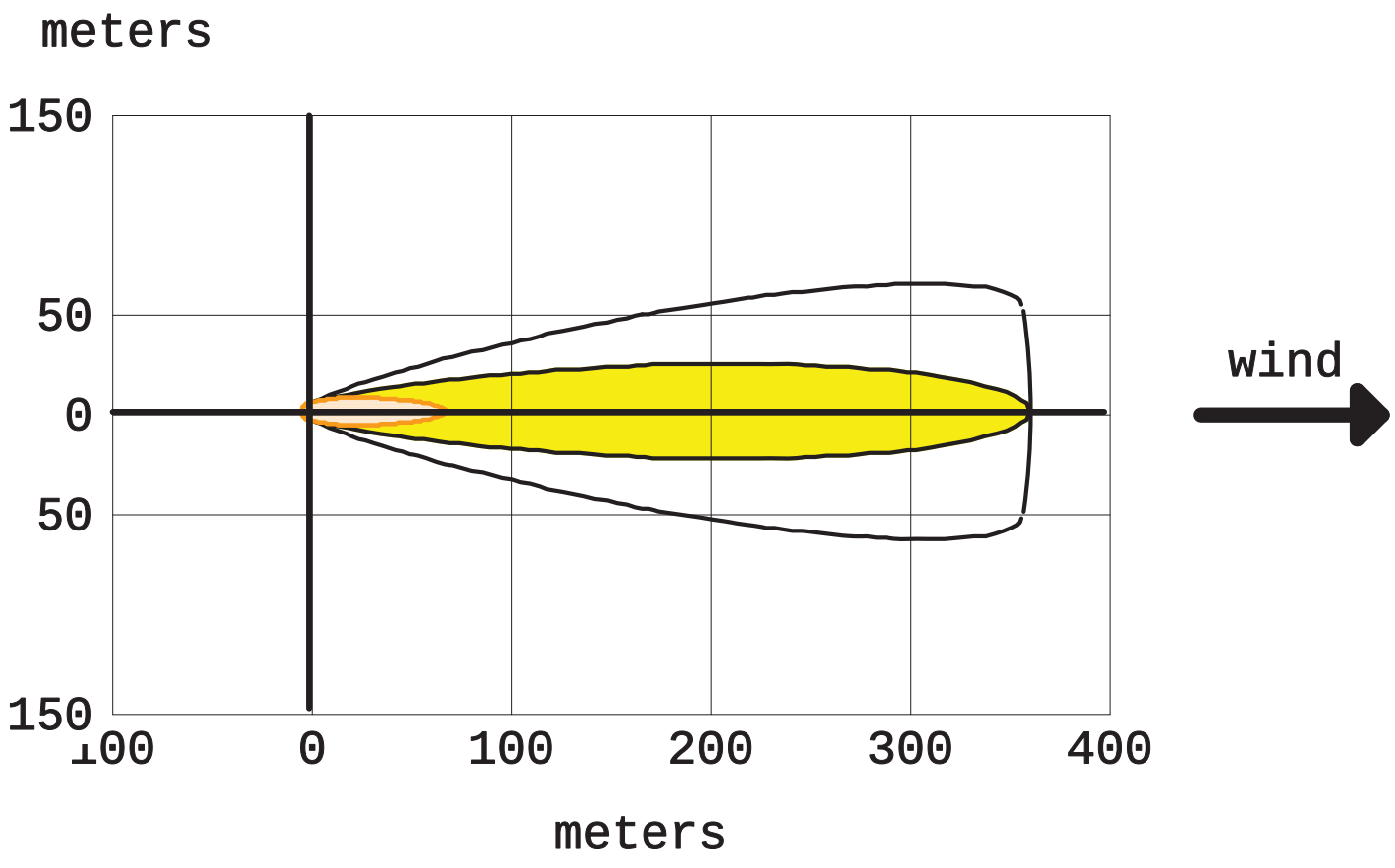
Scenario 1 - Toxic Vapour Cloud Stability Class D

Toxic Threat Zone

ALOHA® 5.4.5

```
Time: July 3, 2016  1656 hours ST (user specified)

Chemical Name: HYDROCHLORIC ACID
  Solution Strength: 33% (by weight)

  Hazardous Component: HYDROGEN CHLORIDE
Wind: 4.88 meters/second from E at 3 meters

THREAT ZONE:
  Model Run: Gaussian
  Red    : less than 10 meters(10.9 yards) --- (2223 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
  Orange: 68 meters --- (100 ppm = AEGL-3 [60 min])
  Yellow: 361 meters --- (5 ppm)
```



greater than 2223 ppm (not drawn)

greater than 100 ppm (AEGL-3 [60 min])

greater than 5 ppm

wind direction confidence lines

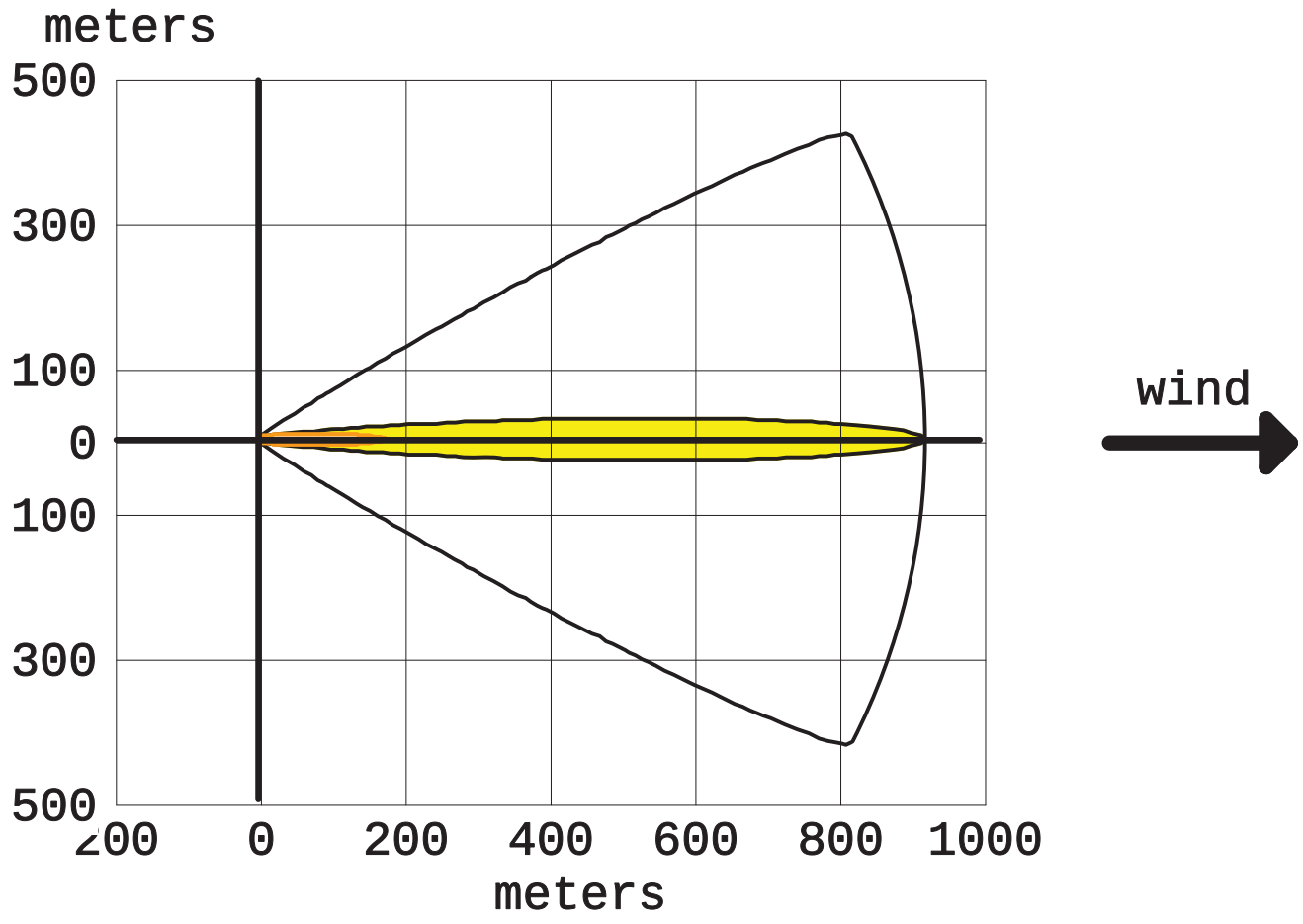
```
SITE DATA:
  Location: WEE WAA, NEW SOUTH WALES, AU
  Building Air Exchanges Per Hour: 1.04 (unsheltered single storied)
  Time: July 3, 2016  1656 hours ST (user specified)

CHEMICAL DATA:
  Chemical Name: HYDROCHLORIC ACID
  Solution Strength: 33% (by weight)
  Ambient Boiling Point: 74.0° C
  Partial Pressure at Ambient Temperature: 0.058 atm
  Ambient Saturation Concentration: 61,193 ppm or 6.12%
  Hazardous Component: HYDROGEN CHLORIDE
  Molecular Weight: 36.46 g/mol
  AEGL-1 (60 min): 1.8 ppm   AEGL-2 (60 min): 22 ppm   AEGL-3 (60 min): 100 ppm
  IDLH: 50 ppm

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 4.88 meters/second from E at 3 meters
  Ground Roughness: open country         Cloud Cover: 5 tenths
  Air Temperature: 24° C                 Stability Class: D
  No Inversion Height                    Relative Humidity: 65%

SOURCE STRENGTH:
  Evaporating Puddle
  Puddle Area: 64 square meters          Puddle Volume: 37500 liters
  Ground Type: Concrete                  Ground Temperature: 24° C
  Initial Puddle Temperature: Ground temperature
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 3.42 kilograms/min
     (averaged over a minute or more)
  Total Amount Hazardous Component Released: 183 kilograms

THREAT ZONE:
  Model Run: Gaussian
  Red   : less than 10 meters(10.9 yards) --- (2223 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
  Orange: 68 meters --- (100 ppm = AEGL-3 [60 min])
  Yellow: 361 meters --- (5 ppm)
```

Scenario 1 - Toxic Vapour Cloud Stability Class F

Toxic Threat Zone

ALOHA® 5.4.5

```
Time: July 3, 2016  1656 hours ST (user specified)

Chemical Name: HYDROCHLORIC ACID
  Solution Strength: 33% (by weight)

  Hazardous Component: HYDROGEN CHLORIDE
Wind: 1.3 meters/second from E at 2 meters

THREAT ZONE:
  Model Run: Gaussian
  Red    : 17 meters --- (2223 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
  Orange: 174 meters --- (100 ppm = AEGL-3 [60 min])
  Yellow: 917 meters --- (5 ppm)
```



greater than 2223 ppm (not drawn)

greater than 100 ppm (AEGL-3 [60 min])

greater than 5 ppm

wind direction confidence lines

```
SITE DATA:
  Location: WEE WAA, NEW SOUTH WALES, AU
  Building Air Exchanges Per Hour: 0.36 (unsheltered single storied)
  Time: July 3, 2016  1656 hours ST (user specified)

CHEMICAL DATA:
  Chemical Name: HYDROCHLORIC ACID
  Solution Strength: 33% (by weight)
  Ambient Boiling Point: 74.0° C
  Partial Pressure at Ambient Temperature: 0.035 atm
  Ambient Saturation Concentration: 36,657 ppm or 3.67%
  Hazardous Component: HYDROGEN CHLORIDE
  Molecular Weight: 36.46 g/mol
  AEGL-1 (60 min): 1.8 ppm   AEGL-2 (60 min): 22 ppm   AEGL-3 (60 min): 100 ppm
  IDLH: 50 ppm

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 1.3 meters/second from E at 2 meters
  Ground Roughness: open country         Cloud Cover: 3 tenths
  Air Temperature: 16° C                 Stability Class: F
  Inversion Height: 600 meters           Relative Humidity: 5%

SOURCE STRENGTH:
  Evaporating Puddle
  Puddle Area: 64 square meters          Puddle Volume: 37500 liters
  Ground Type: Concrete                  Ground Temperature: 16° C
  Initial Puddle Temperature: Ground temperature
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 878 grams/min
     (averaged over a minute or more)
  Total Amount Hazardous Component Released: 50.8 kilograms

THREAT ZONE:
  Model Run: Gaussian
  Red   : 17 meters --- (2223 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
  Orange: 174 meters --- (100 ppm = AEGL-3 [60 min])
  Yellow: 917 meters --- (5 ppm)
```

Appendix D - Scenario 2 Model Outputs

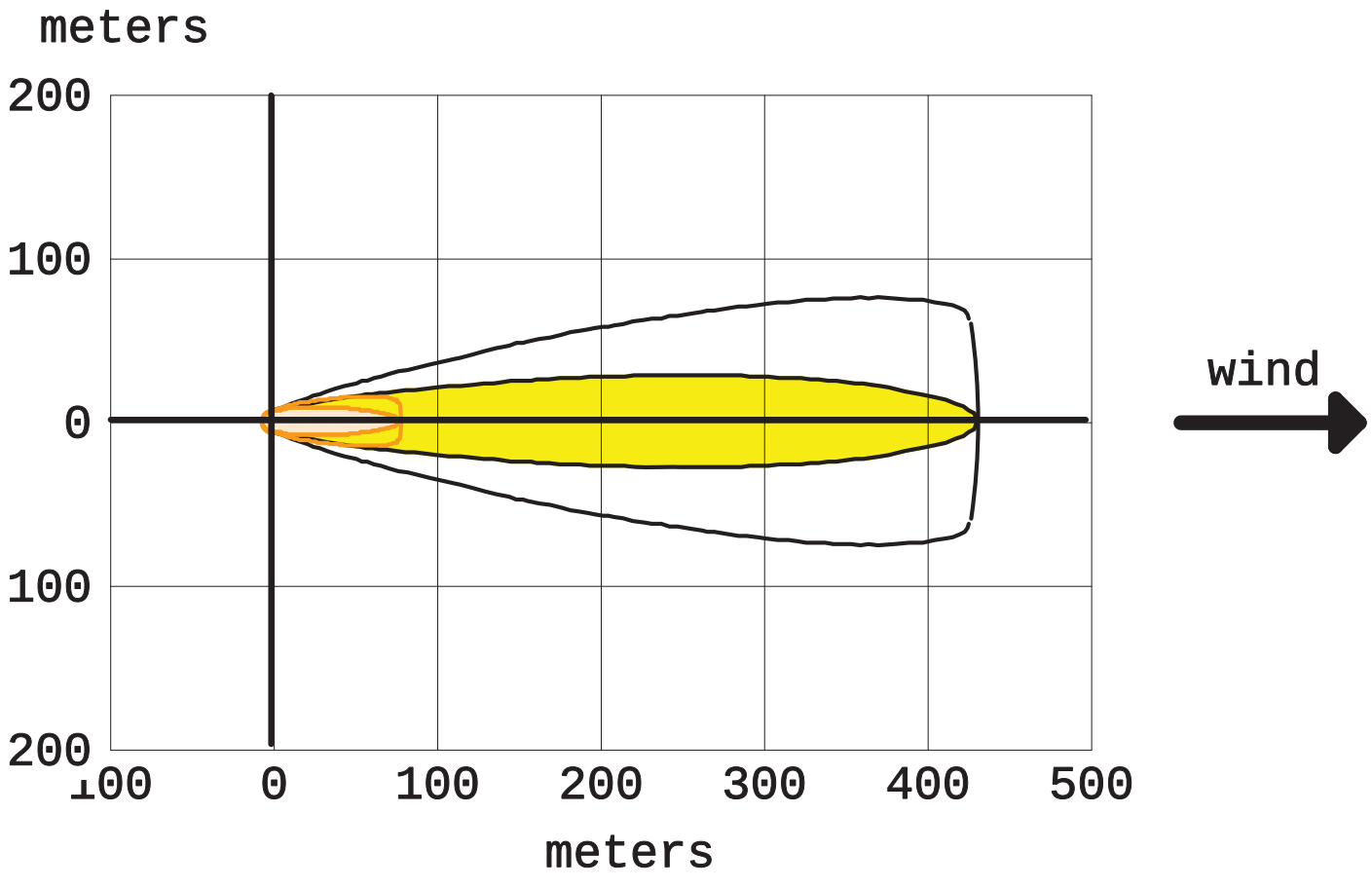
CDM Smith

cdmsmith.com

Scenario 2 - Toxic Vapour Cloud Class D

Toxic Threat Zone ALOHA® 5.4.5

```
Time: June 21, 2016  1215 hours ST (user specified)

Chemical Name: HYDROCHLORIC ACID
  Solution Strength: 33% (by weight)

  Hazardous Component: HYDROGEN CHLORIDE
Wind: 4.88 meters/second from E at 2 meters

THREAT ZONE:
  Model Run: Gaussian
  Red    : less than 10 meters(10.9 yards) --- (2223 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
  Orange: 78 meters --- (100 ppm = AEGL-3 [60 min])
  Yellow: 431 meters --- (5 ppm)
```



greater than 2223 ppm (not drawn)

greater than 100 ppm (AEGL-3 [60 min])

greater than 5 ppm

wind direction confidence lines

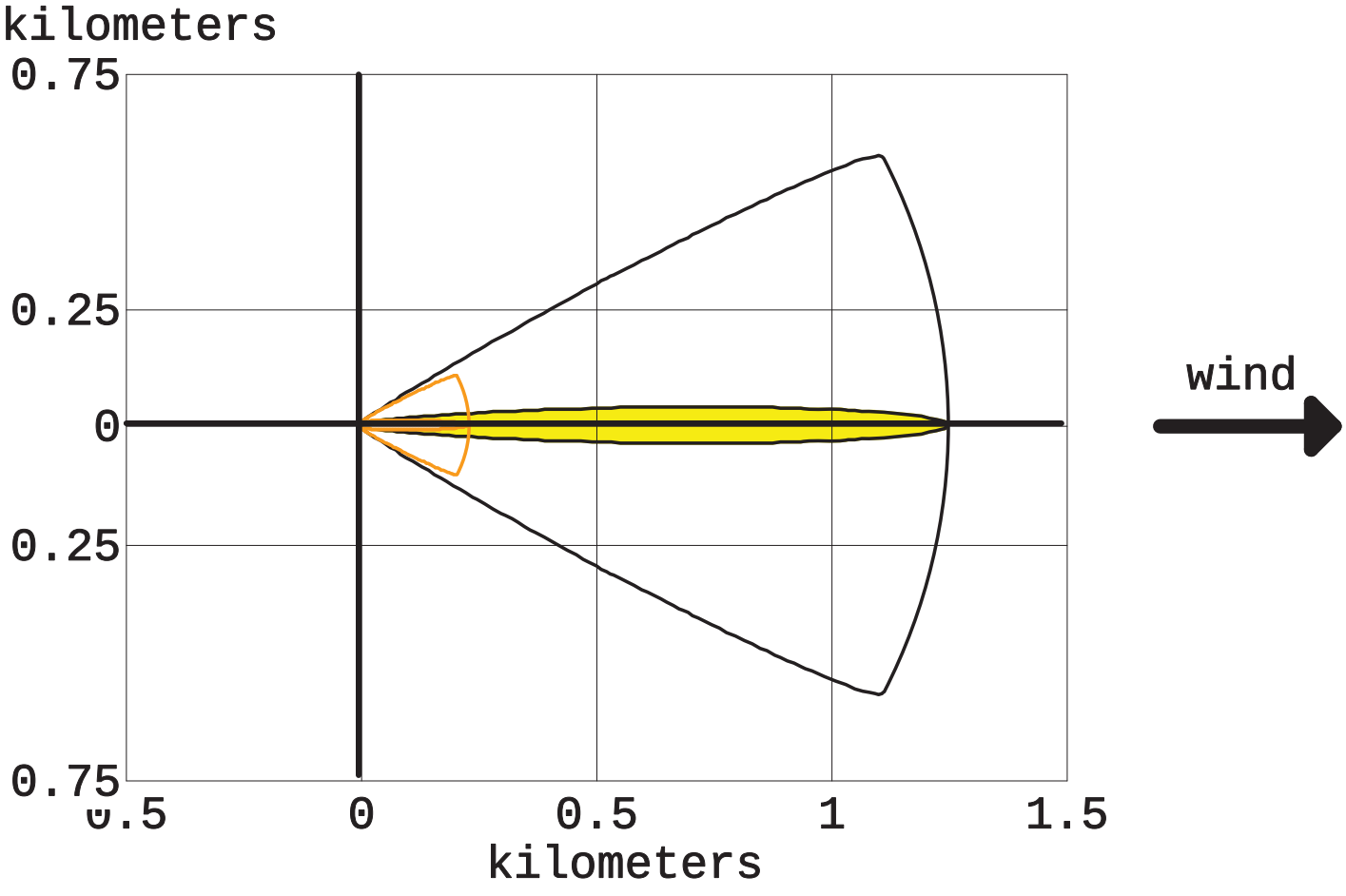
Stability Class F

Text Summary ALOHA® 5.4.5

```
SITE DATA:
  Location: WEE WAA, NSW, AUSTRALIA, AUSTRALIA
  Building Air Exchanges Per Hour: 0.67 (user specified)
  Time: June 21, 2016  1215 hours ST (user specified)

CHEMICAL DATA:
  Chemical Name: HYDROCHLORIC ACID
  Solution Strength: 33% (by weight)
  Ambient Boiling Point: 74.6° C
  Partial Pressure at Ambient Temperature: 0.058 atm
  Ambient Saturation Concentration: 59,686 ppm or 5.97%
  Hazardous Component: HYDROGEN CHLORIDE
  Molecular Weight: 36.46 g/mol
  AEGL-1 (60 min): 1.8 ppm   AEGL-2 (60 min): 22 ppm   AEGL-3 (60 min): 100 ppm
  IDLH: 50 ppm

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 4.88 meters/second from E at 2 meters
  Ground Roughness: open country          Cloud Cover: 3 tenths
  Air Temperature: 24° C                  Stability Class: D
  No Inversion Height                     Relative Humidity: 65%

SOURCE STRENGTH:
  Evaporating Puddle
  Puddle Area: 120 square meters          Puddle Volume: 1890 liters
  Ground Type: Concrete                   Ground Temperature: 24° C
  Initial Puddle Temperature: Air temperature
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 5.17 kilograms/min
     (averaged over a minute or more)
  Total Amount Hazardous Component Released: 139 kilograms

THREAT ZONE:
  Model Run: Gaussian
  Red    : less than 10 meters(10.9 yards) --- (2223 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
  Orange: 78 meters --- (100 ppm = AEGL-3 [60 min])
  Yellow: 431 meters --- (5 ppm)
```

Toxic Threat Zone ALOHA® 5.4.5

```
Time: June 21, 2016  1215 hours ST (user specified)

Chemical Name: HYDROCHLORIC ACID
  Solution Strength: 33% (by weight)

  Hazardous Component: HYDROGEN CHLORIDE
Wind: 1.3 meters/second from E at 2 meters

THREAT ZONE:
  Model Run: Gaussian
  Red    : 22 meters --- (2223 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
  Orange: 228 meters --- (100 ppm = AEGL-3 [60 min])
  Yellow: 1.2 kilometers --- (5 ppm)
```



greater than 2223 ppm (not drawn)

greater than 100 ppm (AEGL-3 [60 min])

greater than 5 ppm

wind direction confidence lines

```
SITE DATA:
  Location: WEE WAA, NSW, AUSTRALIA, AUSTRALIA
  Building Air Exchanges Per Hour: 0.67 (user specified)
  Time: June 21, 2016  1215 hours ST (user specified)

CHEMICAL DATA:
  Chemical Name: HYDROCHLORIC ACID
  Solution Strength: 33% (by weight)
  Ambient Boiling Point: 74.6° C
  Partial Pressure at Ambient Temperature: 0.035 atm
  Ambient Saturation Concentration: 35,755 ppm or 3.58%
  Hazardous Component: HYDROGEN CHLORIDE
  Molecular Weight: 36.46 g/mol
  AEGL-1 (60 min): 1.8 ppm   AEGL-2 (60 min): 22 ppm   AEGL-3 (60 min): 100 ppm
  IDLH: 50 ppm

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 1.3 meters/second from E at 2 meters
  Ground Roughness: open country         Cloud Cover: 3 tenths
  Air Temperature: 16° C
  Stability Class: F (user override)
  Inversion Height: 600 feet             Relative Humidity: 5%

SOURCE STRENGTH:
  Evaporating Puddle
  Puddle Area: 120 square meters         Puddle Volume: 1890 liters
  Ground Type: Concrete                  Ground Temperature: 16° C
  Initial Puddle Temperature: Air temperature
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 1.49 kilograms/min
     (averaged over a minute or more)
  Total Amount Hazardous Component Released: 67.1 kilograms

THREAT ZONE:
  Model Run: Gaussian
  Red   : 22 meters --- (2223 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
  Orange: 228 meters --- (100 ppm = AEGL-3 [60 min])
  Yellow: 1.2 kilometers --- (5 ppm)
```

Appendix E - Scenario 3 Model Outputs

CDM Smith

cdmsmith.com

Toxic Cloud Class D (13 mm hole)

Toxic Threat Zone

ALOHA® 5.4.5

```
Time: June 21, 2016  1501 hours ST (user specified)

Chemical Name: PROPANE

Wind: 4.88 meters/second from E at 3 meters

THREAT ZONE:
  Model Run: Heavy Gas
  Red    : 21 meters --- (33000 ppm = AEGL-3 [60 min])
  Note: Threat zone was not drawn because effects of near-field patchiness
    make dispersion predictions less reliable for short distances.
  Orange: 32 meters --- (17000 ppm = AEGL-2 [60 min])
  Note: Threat zone was not drawn because effects of near-field patchiness
    make dispersion predictions less reliable for short distances.
  Yellow: 45 meters --- (10000 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
    make dispersion predictions less reliable for short distances.
```

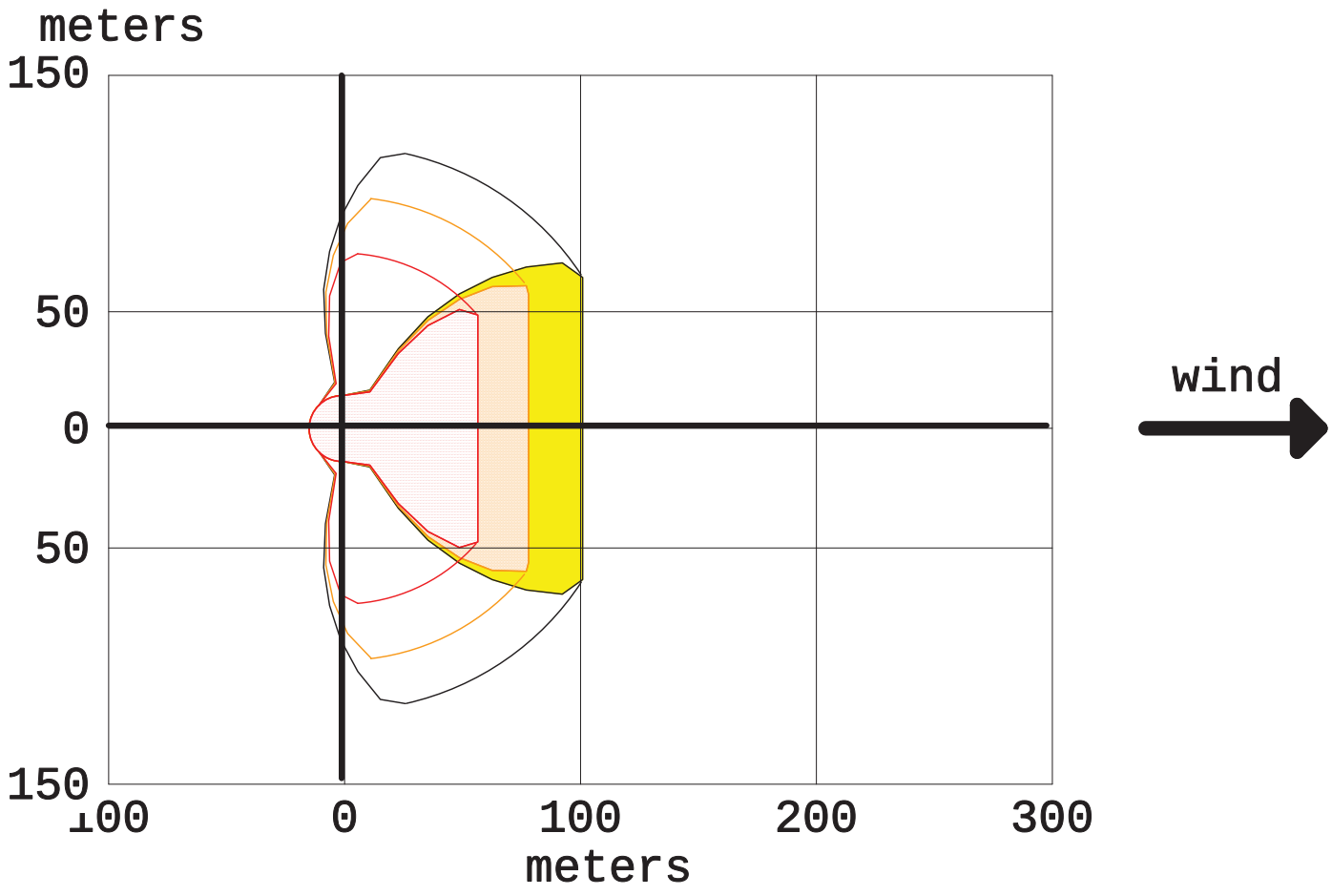
```
 SITE DATA:
   Location: WEE WAA, NSW, AUSTRALIA, AUSTRALIA
   Building Air Exchanges Per Hour: 1.04 (unsheltered single storied)
   Time: June 21, 2016  1501 hours ST (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE                  Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -42.6° C
   Vapor Pressure at Ambient Temperature: greater than 1 atm
   Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 4.88 meters/second from E at 3 meters
   Ground Roughness: open country          Cloud Cover: 3 tenths
   Air Temperature: 24° C                  Stability Class: D
   No Inversion Height                     Relative Humidity: 65%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical escaping from tank (not burning)
   Tank Diameter: 2 meters                 Tank Length: 10 meters
   Tank Volume: 31.4 cubic meters
   Tank contains liquid                    Internal Temperature: 24° C
   Chemical Mass in Tank: 12,505 kilograms
   Tank is 80% full
   Circular Opening Diameter: 1.3 centimeters
   Opening is 0.80 meters from tank bottom
   Release Duration: ALOHA limited the duration to 1 hour
   Max Average Sustained Release Rate: 138 kilograms/min
      (averaged over a minute or more)
   Total Amount Released: 7,517 kilograms
   Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

 THREAT ZONE:
   Model Run: Heavy Gas
   Red   : 21 meters --- (33000 ppm = AEGL-3 [60 min])
   Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
   Orange: 32 meters --- (17000 ppm = AEGL-2 [60 min])
   Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
   Yellow: 45 meters --- (10000 ppm)
   Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
```

Toxic Cloud Class F (13 mm hole)

Toxic Threat Zone

ALOHA® 5.4.5

```
Time: June 21, 2016  1501 hours ST (user specified)

Chemical Name: PROPANE

Wind: 1.3 meters/second from E at 3 meters

THREAT ZONE:
  Model Run: Heavy Gas
  Red    : 57 meters --- (33000 ppm = AEGL-3 [60 min])
  Orange: 79 meters --- (17000 ppm = AEGL-2 [60 min])
  Yellow: 101 meters --- (10000 ppm)
```



greater than 33000 ppm (AEGL-3 [60 min])

greater than 17000 ppm (AEGL-2 [60 min])

greater than 10000 ppm

wind direction confidence lines

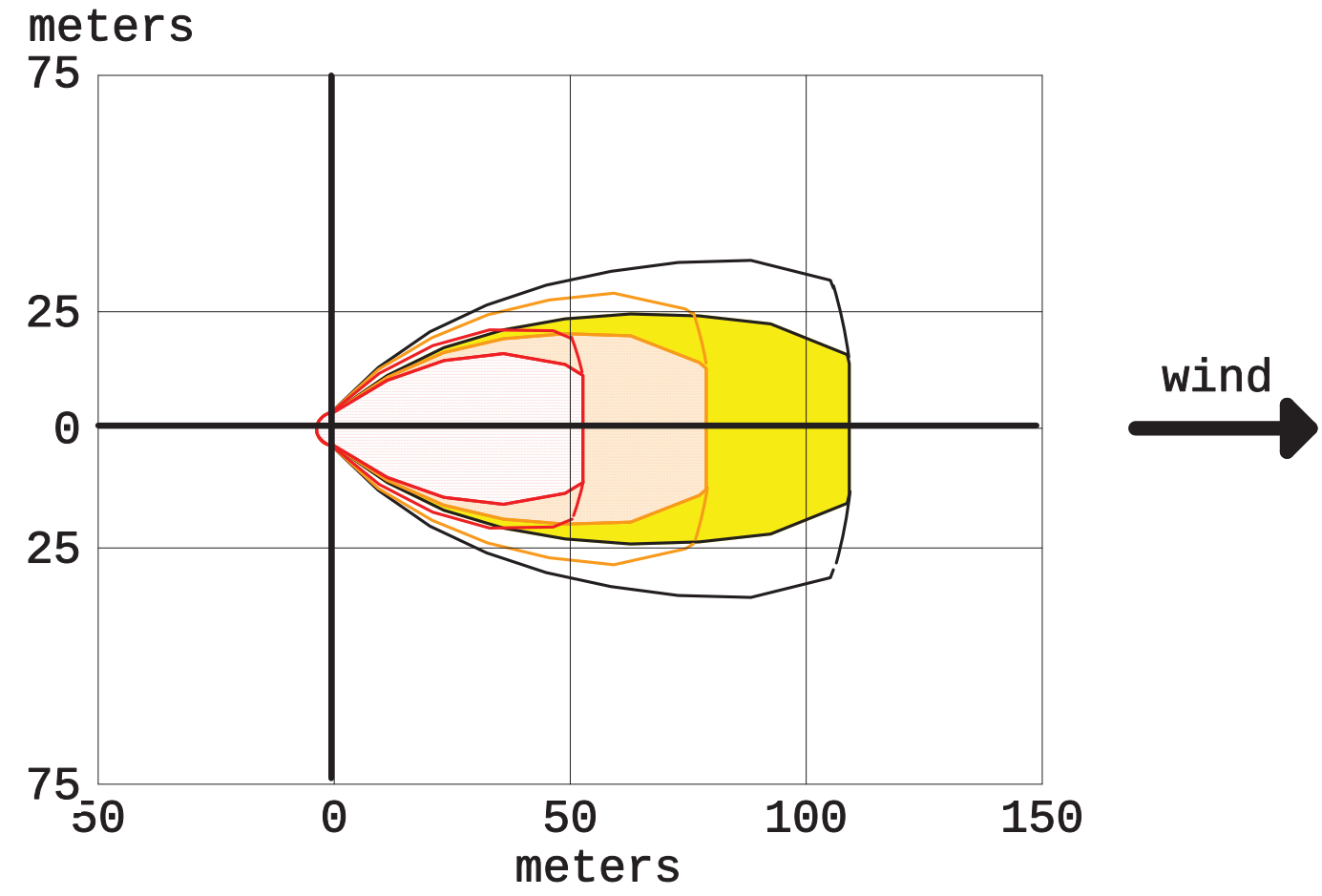
```
 SITE DATA:
   Location: WEE WAA, NSW, AUSTRALIA, AUSTRALIA
   Building Air Exchanges Per Hour: 0.34 (unsheltered single storied)
   Time: June 21, 2016  1501 hours ST (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE                  Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm       UEL: 95000 ppm
   Ambient Boiling Point: -42.6° C
   Vapor Pressure at Ambient Temperature: greater than 1 atm
   Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 1.3 meters/second from E at 3 meters
   Ground Roughness: open country          Cloud Cover: 3 tenths
   Air Temperature: 24° C
   Stability Class: F (user override)
   Inversion Height: 600 feet              Relative Humidity: 5%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical escaping from tank (not burning)
   Tank Diameter: 2 meters                 Tank Length: 10 meters
   Tank Volume: 31.4 cubic meters
   Tank contains liquid                    Internal Temperature: 24° C
   Chemical Mass in Tank: 12,505 kilograms
   Tank is 80% full
   Circular Opening Diameter: 1.3 centimeters
   Opening is 0.80 meters from tank bottom
   Release Duration: ALOHA limited the duration to 1 hour
   Max Average Sustained Release Rate: 138 kilograms/min
      (averaged over a minute or more)
   Total Amount Released: 7,517 kilograms
   Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

 THREAT ZONE:
   Model Run: Heavy Gas
   Red   : 57 meters --- (33000 ppm = AEGL-3 [60 min])
   Orange: 79 meters --- (17000 ppm = AEGL-2 [60 min])
   Yellow: 101 meters --- (10000 ppm)
```

Toxic Cloud Class D (32 mm hole)

Toxic Threat Zone

ALOHA® 5.4.5

```
Time: June 21, 2016  1501 hours ST (user specified)

Chemical Name: PROPANE

Wind: 4.88 meters/second from E at 3 meters

THREAT ZONE:
  Model Run: Heavy Gas
  Red    : 53 meters --- (33000 ppm = AEGL-3 [60 min])
  Orange: 79 meters --- (17000 ppm = AEGL-2 [60 min])
  Yellow: 109 meters --- (10000 ppm)
```



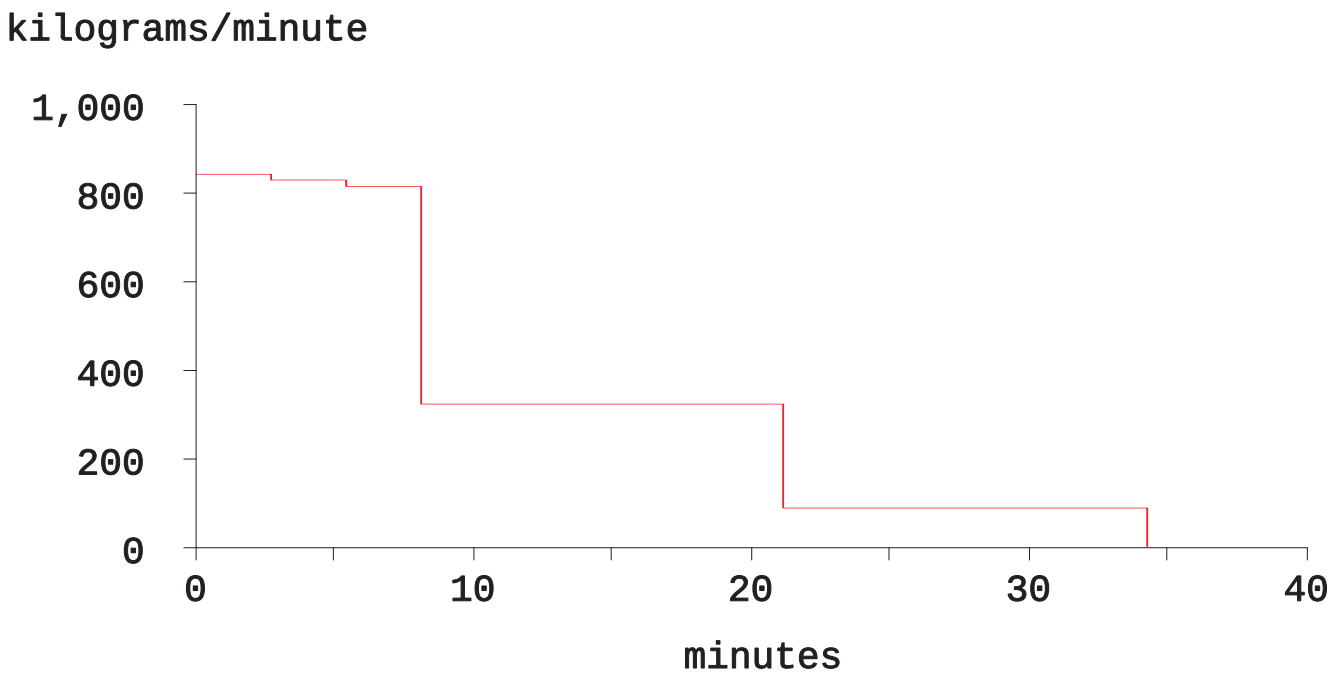
greater than 33000 ppm (AEGL-3 [60 min])

greater than 17000 ppm (AEGL-2 [60 min])

greater than 10000 ppm

wind direction confidence lines

```
Time: June 21, 2016  1501 hours ST (user specified)

Chemical Name: PROPANE

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 2 meters                Tank Length: 10 meters
  Tank Volume: 31.4 cubic meters
  Tank contains liquid                   Internal Temperature: 24° C
  Chemical Mass in Tank: 12,505 kilograms
  Tank is 80% full
  Circular Opening Diameter: 3.2 centimeters
  Opening is 0.80 meters from tank bottom
  Release Duration: 34 minutes
  Max Average Sustained Release Rate: 838 kilograms/min
     (averaged over a minute or more)
  Total Amount Released: 12,005 kilograms
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



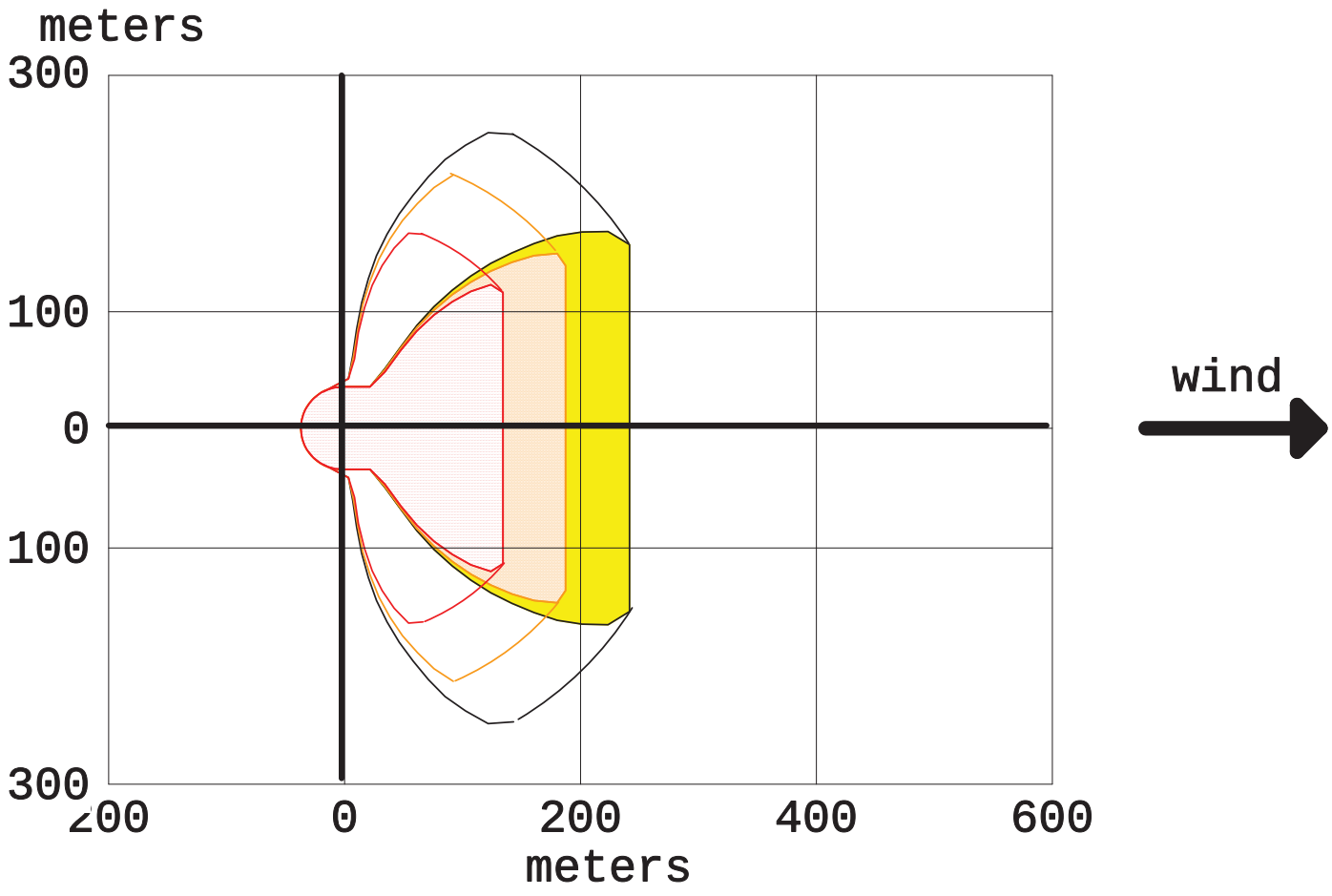
```
 SITE DATA:
   Location: WEE WAA, NSW, AUSTRALIA, AUSTRALIA
   Building Air Exchanges Per Hour: 1.04 (unsheltered single storied)
   Time: June 21, 2016  1501 hours ST (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE                  Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -42.6° C
   Vapor Pressure at Ambient Temperature: greater than 1 atm
   Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 4.88 meters/second from E at 3 meters
   Ground Roughness: open country          Cloud Cover: 3 tenths
   Air Temperature: 24° C                  Stability Class: D
   No Inversion Height                     Relative Humidity: 65%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical escaping from tank (not burning)
   Tank Diameter: 2 meters                 Tank Length: 10 meters
   Tank Volume: 31.4 cubic meters
   Tank contains liquid                    Internal Temperature: 24° C
   Chemical Mass in Tank: 12,505 kilograms
   Tank is 80% full
   Circular Opening Diameter: 3.2 centimeters
   Opening is 0.80 meters from tank bottom
   Release Duration: 34 minutes
   Max Average Sustained Release Rate: 838 kilograms/min
      (averaged over a minute or more)
   Total Amount Released: 12,005 kilograms
   Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

 THREAT ZONE:
   Model Run: Heavy Gas
   Red   : 53 meters --- (33000 ppm = AEGL-3 [60 min])
   Orange: 79 meters --- (17000 ppm = AEGL-2 [60 min])
   Yellow: 109 meters --- (10000 ppm)
```

Toxic Cloud Class F (32 mm hole)

Toxic Threat Zone

ALOHA® 5.4.5

```
Time: June 21, 2016  1501 hours ST (user specified)

Chemical Name: PROPANE

Wind: 1.3 meters/second from E at 2 meters

THREAT ZONE:
  Model Run: Heavy Gas
  Red    : 136 meters --- (33000 ppm = AEGL-3 [60 min])
  Orange: 188 meters --- (17000 ppm = AEGL-2 [60 min])
  Yellow: 243 meters --- (10000 ppm)
```



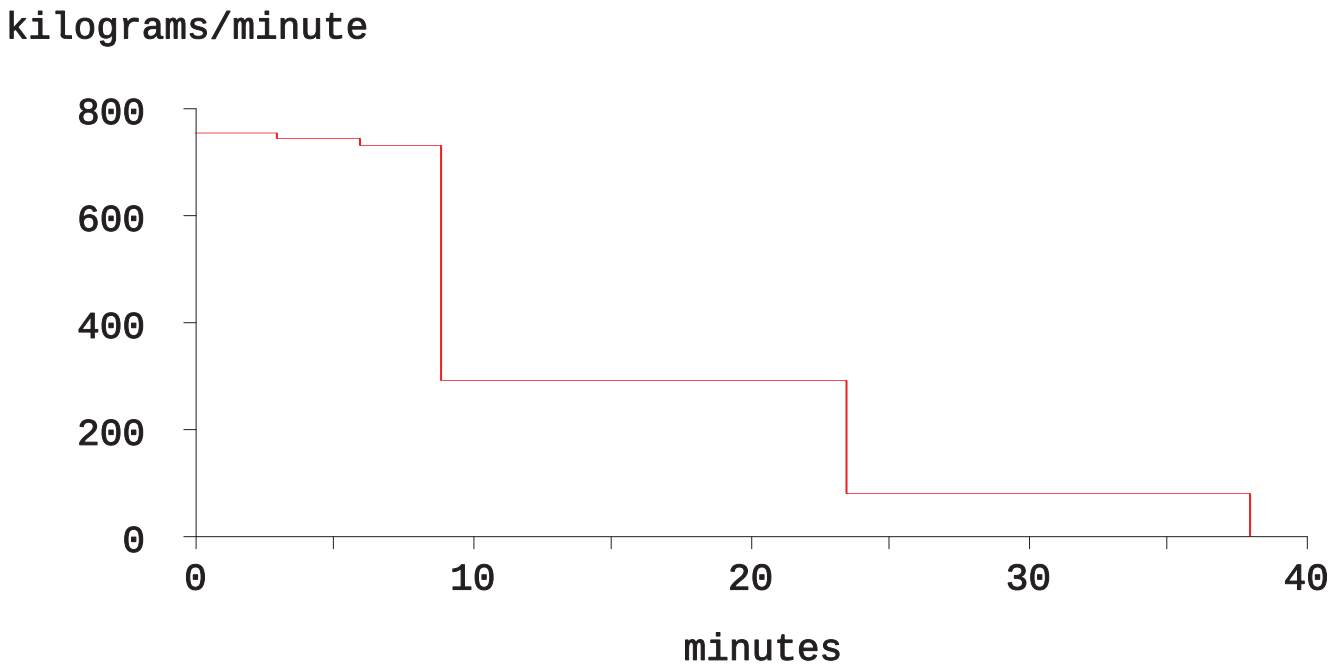
greater than 33000 ppm (AEGL-3 [60 min])

greater than 17000 ppm (AEGL-2 [60 min])

greater than 10000 ppm

wind direction confidence lines

```
Time: June 21, 2016  1501 hours ST (user specified)

Chemical Name: PROPANE

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 2 meters                 Tank Length: 10 meters
  Tank Volume: 31.4 cubic meters
  Tank contains liquid                    Internal Temperature: 16° C
  Chemical Mass in Tank: 12,505 kilograms
  Tank is 78% full
  Circular Opening Diameter: 3.2 centimeters
  Opening is 0.80 meters from tank bottom
  Release Duration: 38 minutes
  Max Average Sustained Release Rate: 754 kilograms/min
     (averaged over a minute or more)
  Total Amount Released: 12,005 kilograms
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
 SITE DATA:
   Location: WEE WAA, NSW, AUSTRALIA, AUSTRALIA
   Building Air Exchanges Per Hour: 0.36 (unsheltered single storied)
   Time: June 21, 2016  1501 hours ST (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE                  Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -42.6° C
   Vapor Pressure at Ambient Temperature: greater than 1 atm
   Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 1.3 meters/second from E at 2 meters
   Ground Roughness: open country          Cloud Cover: 3 tenths
   Air Temperature: 16° C
   Stability Class: F (user override)
   Inversion Height: 600 feet              Relative Humidity: 5%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical escaping from tank (not burning)
   Tank Diameter: 2 meters                 Tank Length: 10 meters
   Tank Volume: 31.4 cubic meters
   Tank contains liquid                    Internal Temperature: 16° C
   Chemical Mass in Tank: 12,505 kilograms
   Tank is 78% full
   Circular Opening Diameter: 3.2 centimeters
   Opening is 0.80 meters from tank bottom
   Release Duration: 38 minutes
   Max Average Sustained Release Rate: 754 kilograms/min
      (averaged over a minute or more)
   Total Amount Released: 12,005 kilograms
   Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

 THREAT ZONE:
   Model Run: Heavy Gas
   Red   : 136 meters --- (33000 ppm = AEGL-3 [60 min])
   Orange: 188 meters --- (17000 ppm = AEGL-2 [60 min])
   Yellow: 243 meters --- (10000 ppm)
```

Appendix F - Scenario 4 Model Outputs

CDM Smith

cdmsmith.com

Thermal Radiation (1.5 mm hole)

Thermal Radiation Threat Zone ALOHA® 5.4.5

```
 Time: June 21, 2016  1501 hours ST (user specified)

 Chemical Name: PROPANE

 Wind: 4.88 meters/second from E at 3 meters

 THREAT ZONE:
   Threat Modeled: Thermal radiation from jet fire
   Red    : less than 10 meters(10.9 yards) --- (23 kW/(sq m))
   Orange: less than 10 meters(10.9 yards) --- (10.0 kW/(sq m) = potentially
lethal within 60 sec)
   Yellow: less than 10 meters(10.9 yards) --- (4.7 kW/(sq m))
```


```
  Threat Modeled: Thermal radiation from jet fire
  Red    : less than 10 meters(10.9 yards) --- (23 kW
  Orange: less than 10 meters(10.9 yards) --- (10.0
  Yellow: less than 10 meters(10.9 yards) --- (4.7 k
```

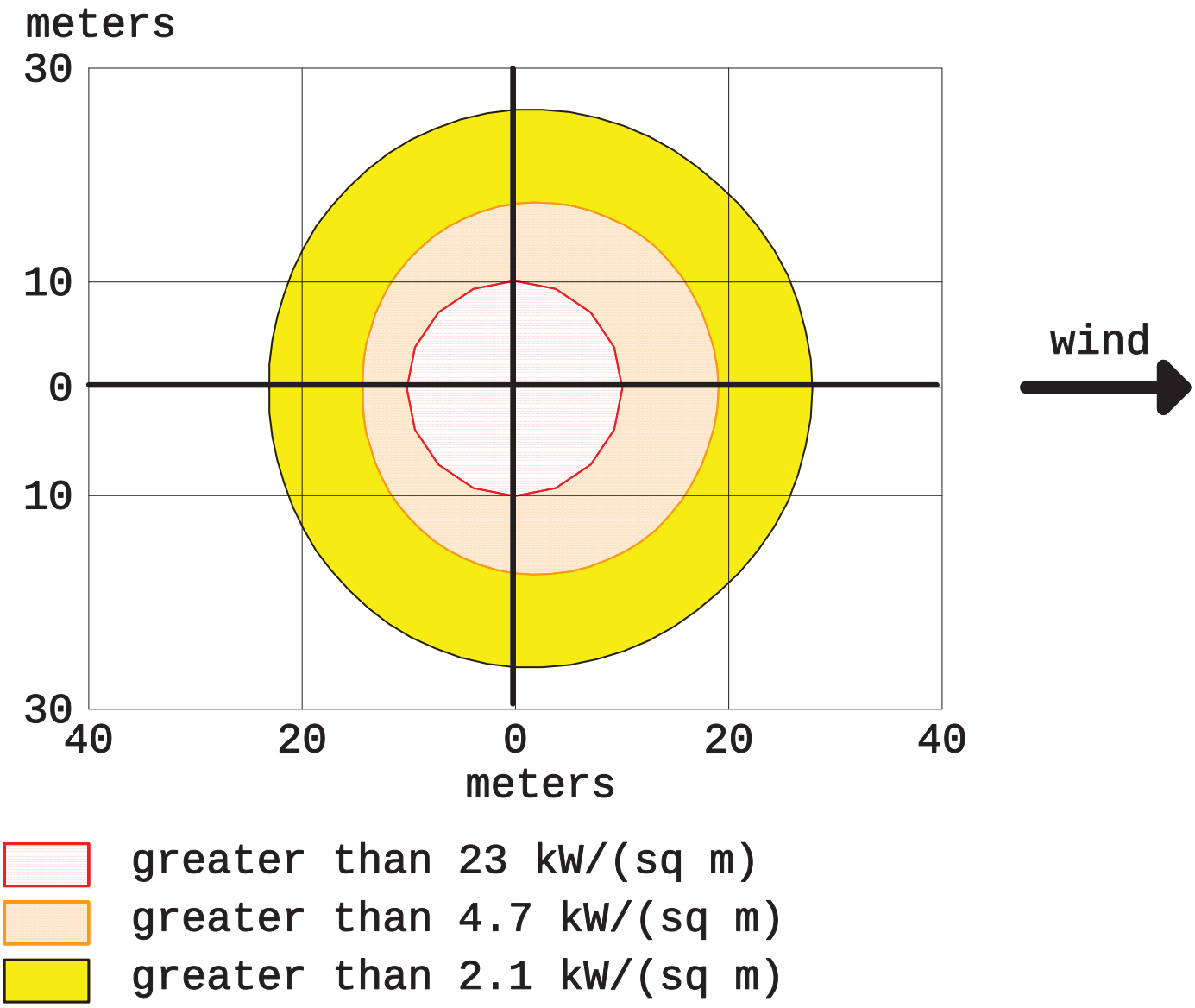
```
 SITE DATA:
   Location: WEE WAA, NSW, AUSTRALIA, AUSTRALIA
   Building Air Exchanges Per Hour: 1.04 (unsheltered single storied)
   Time: June 21, 2016  1501 hours ST (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE                  Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -42.6° C
   Vapor Pressure at Ambient Temperature: greater than 1 atm
   Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 4.88 meters/second from E at 3 meters
   Ground Roughness: open country          Cloud Cover: 3 tenths
   Air Temperature: 24° C                  Stability Class: D
   No Inversion Height                     Relative Humidity: 65%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical is burning as it escapes from tank
   Tank Diameter: 2 meters                 Tank Length: 10 meters
   Tank Volume: 31.4 cubic meters
   Tank contains liquid                    Internal Temperature: 24° C
   Chemical Mass in Tank: 12,505 kilograms
   Tank is 80% full
   Circular Opening Diameter: .15 centimeters
   Opening is 0.80 meters from tank bottom
   Max Flame Length: 1 meter
   Burn Duration: ALOHA limited the duration to 1 hour
   Max Burn Rate: 1.85 kilograms/min
   Total Amount Burned: 111 kilograms
   Note: The chemical escaped from the tank and burned as a jet fire.

 THREAT ZONE:
   Threat Modeled: Thermal radiation from jet fire
   Red    : less than 10 meters(10.9 yards) --- (23 kW/(sq m))
   Orange: less than 10 meters(10.9 yards) --- (10.0 kW/(sq m) = potentially
lethal within 60 sec)
   Yellow: less than 10 meters(10.9 yards) --- (4.7 kW/(sq m))
```

Thermal Radiation Class D (13 mm hole)

Thermal Radiation Threat Zone

ALOHA® 5.4.5

```
Time: February 21, 2016  2328 hours ST (user specified)

Chemical Name: PROPANE

Wind: 4.88 meters/second from E at 3 meters

THREAT ZONE:
  Threat Modeled: Thermal radiation from jet fire
  Red    : 10 meters --- (23 kW/(sq m))
  Orange: 19 meters --- (4.7 kW/(sq m))
  Yellow: 28 meters --- (2.1 kW/(sq m))
```



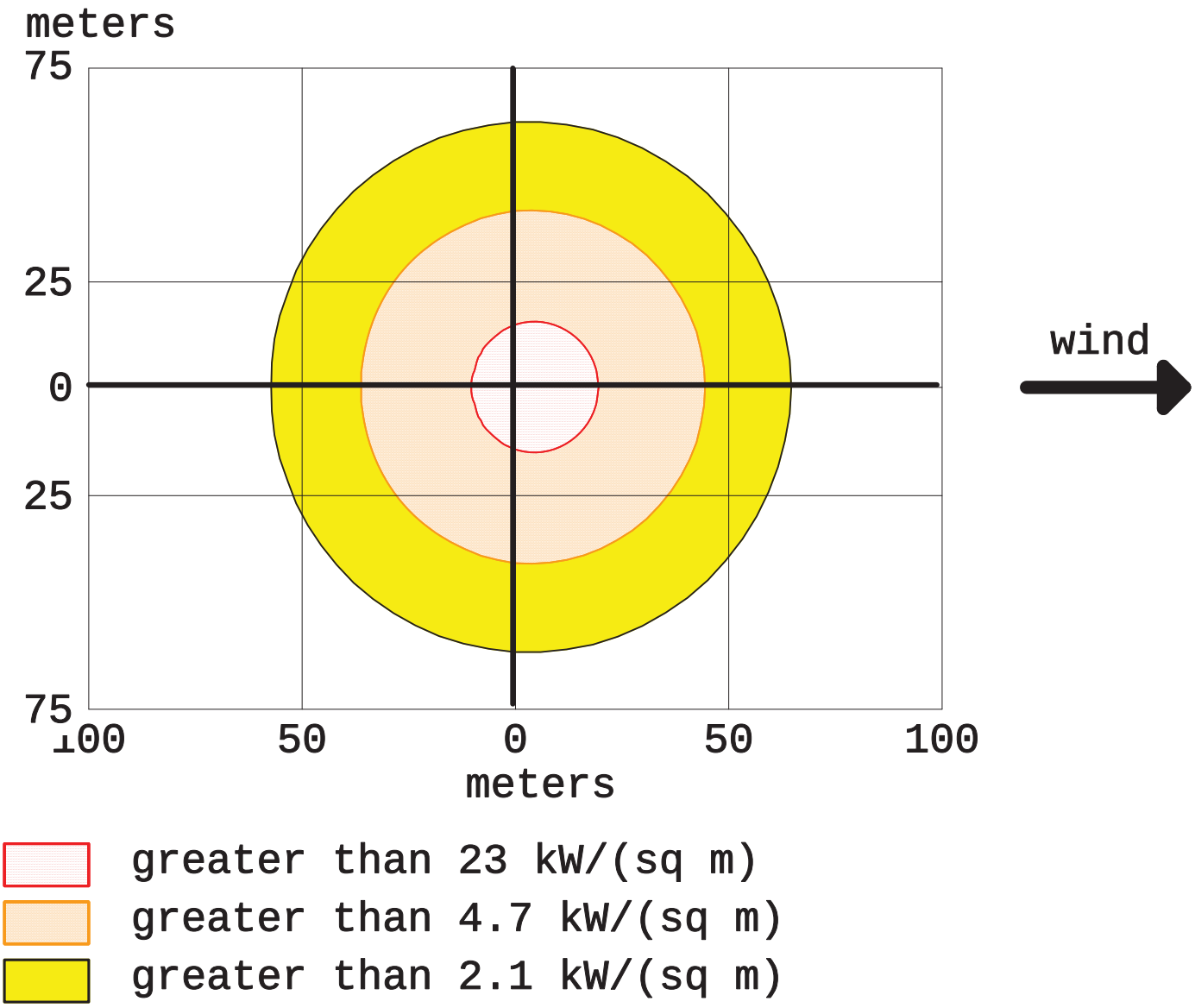
```
 SITE DATA:
   Location: WEE WAA, NSW, AUSTRALIA, AUSTRALIA
   Building Air Exchanges Per Hour: 1.04 (unsheltered single storied)
   Time: February 21, 2016  2328 hours ST (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE                  Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -42.6° C
   Vapor Pressure at Ambient Temperature: greater than 1 atm
   Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 4.88 meters/second from E at 3 meters
   Ground Roughness: open country          Cloud Cover: 3 tenths
   Air Temperature: 24° C                  Stability Class: D
   No Inversion Height                     Relative Humidity: 65%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical is burning as it escapes from tank
   Tank Diameter: 2 meters                 Tank Length: 10 meters
   Tank Volume: 31.4 cubic meters
   Tank contains liquid                    Internal Temperature: 24° C
   Chemical Mass in Tank: 12,505 kilograms
   Tank is 80% full
   Circular Opening Diameter: 1.3 centimeters
   Opening is 0.80 meters from tank bottom
   Max Flame Length: 8 meters
   Burn Duration: ALOHA limited the duration to 1 hour
   Max Burn Rate: 139 kilograms/min
   Total Amount Burned: 7,517 kilograms
   Note: The chemical escaped from the tank and burned as a jet fire.

 THREAT ZONE:
   Threat Modeled: Thermal radiation from jet fire
   Red   : 10 meters --- (23 kW/(sq m))
   Orange: 19 meters --- (4.7 kW/(sq m))
   Yellow: 28 meters --- (2.1 kW/(sq m))
```

Thermal Radiation Class D (32 mm hole)

Thermal Radiation Threat Zone

ALOHA® 5.4.5

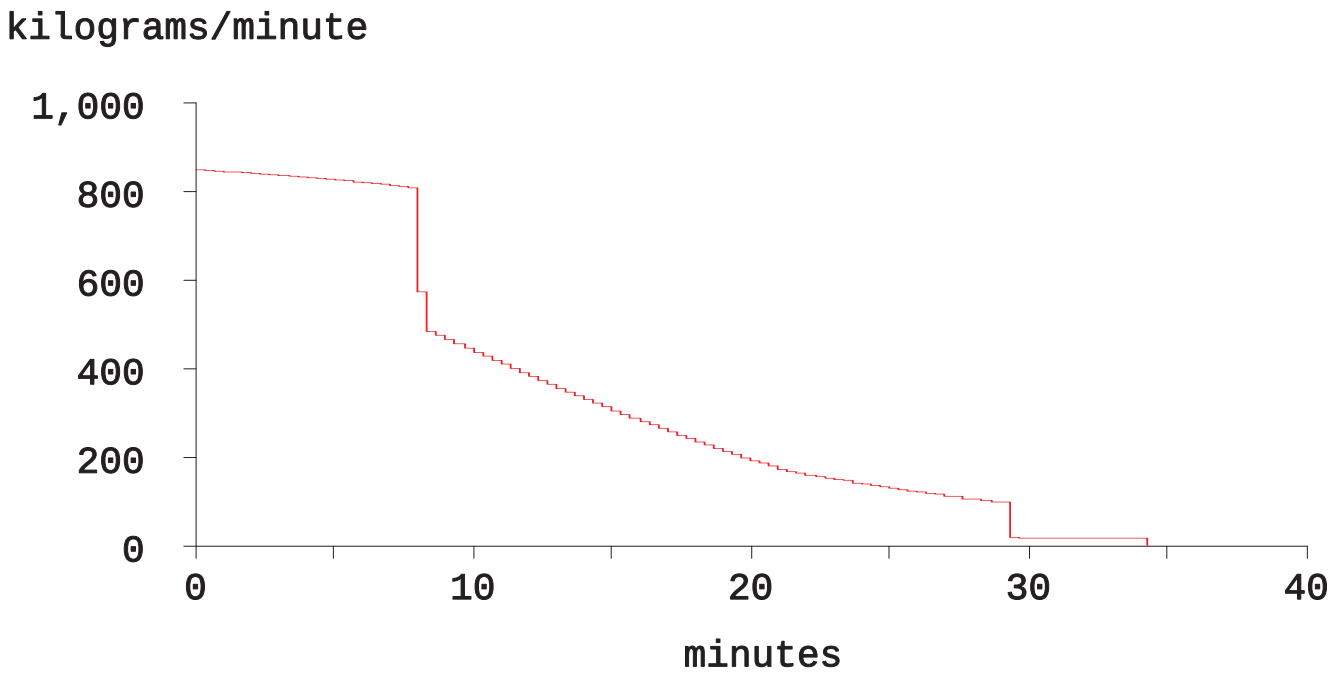
```
Time: February 21, 2016  2328 hours ST (user specified)

Chemical Name: PROPANE

Wind: 4.88 meters/second from E at 3 meters

THREAT ZONE:
  Threat Modeled: Thermal radiation from jet fire
  Red    : 20 meters --- (23 kW/(sq m))
  Orange: 45 meters --- (4.7 kW/(sq m))
  Yellow: 65 meters --- (2.1 kW/(sq m))
```



Time: February 21, 2016 2328 hours ST (user specified)

Chemical Name: PROPANE

SOURCE STRENGTH:
Leak from hole in horizontal cylindrical tank
Flammable chemical is burning as it escapes from tank
Tank Diameter: 2 meters Tank Length: 10 meters
Tank Volume: 31.4 cubic meters
Tank contains liquid Internal Temperature: 24° C
Chemical Mass in Tank: 12,505 kilograms
Tank is 80% full
Circular Opening Diameter: 3.2 centimeters
Opening is 0.80 meters from tank bottom
Max Flame Length: 19 meters Burn Duration: 34 minutes
Max Burn Rate: 844 kilograms/min
Total Amount Burned: 12,005 kilograms
Note: The chemical escaped from the tank and burned as a jet fire.



```
 SITE DATA:
   Location: WEE WAA, NSW, AUSTRALIA, AUSTRALIA
   Building Air Exchanges Per Hour: 1.04 (unsheltered single storied)
   Time: February 21, 2016  2328 hours ST (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE                  Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm       UEL: 95000 ppm
   Ambient Boiling Point: -42.6° C
   Vapor Pressure at Ambient Temperature: greater than 1 atm
   Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 4.88 meters/second from E at 3 meters
   Ground Roughness: open country          Cloud Cover: 3 tenths
   Air Temperature: 24° C                  Stability Class: D
   No Inversion Height                     Relative Humidity: 65%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical is burning as it escapes from tank
   Tank Diameter: 2 meters                 Tank Length: 10 meters
   Tank Volume: 31.4 cubic meters
   Tank contains liquid                    Internal Temperature: 24° C
   Chemical Mass in Tank: 12,505 kilograms
   Tank is 80% full
   Circular Opening Diameter: 3.2 centimeters
   Opening is 0.80 meters from tank bottom
   Max Flame Length: 19 meters             Burn Duration: 34 minutes
   Max Burn Rate: 844 kilograms/min
   Total Amount Burned: 12,005 kilograms
   Note: The chemical escaped from the tank and burned as a jet fire.

 THREAT ZONE:
   Threat Modeled: Thermal radiation from jet fire
   Red    : 20 meters --- (23 kW/(sq m))
   Orange: 45 meters --- (4.7 kW/(sq m))
   Yellow: 65 meters --- (2.1 kW/(sq m))
```

Appendix G - Scenario 5 Model Outputs

CDM Smith

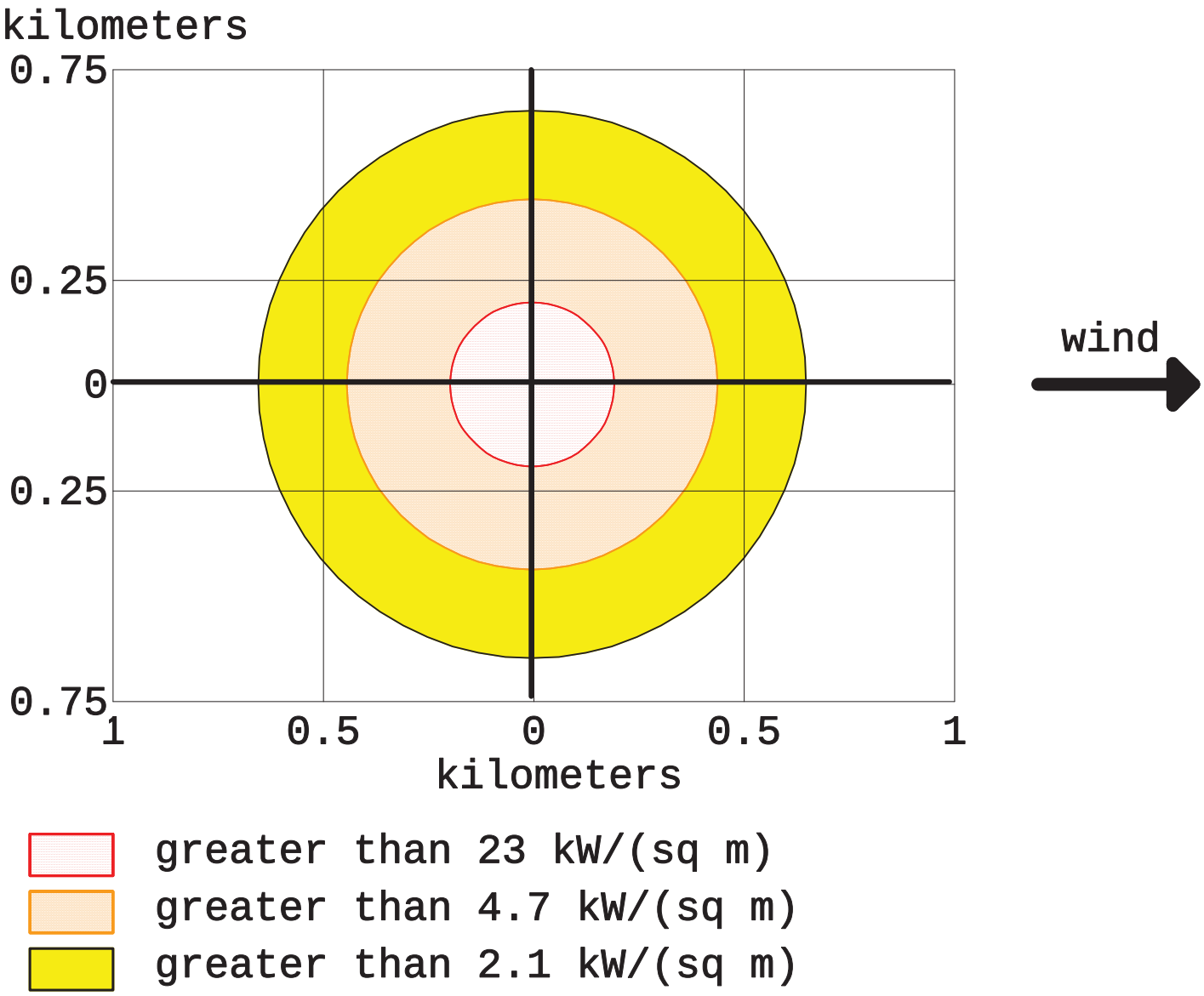
cdmsmith.com

Thermal Radiation Class D (32 mm hole)

Thermal Radiation Threat Zone

ALOHA® 5.4.5

```
Time: February 21, 2016  2328 hours ST (user specified)

Chemical Name: PROPANE

Wind: 4.88 meters/second from E at 3 meters

THREAT ZONE:
  Threat Modeled: Thermal radiation from fireball
  Red    : 196 meters --- (23 kW/(sq m))
  Orange: 441 meters --- (4.7 kW/(sq m))
  Yellow: 652 meters --- (2.1 kW/(sq m))
```



```
 SITE DATA:
   Location: WEE WAA, NSW, AUSTRALIA, AUSTRALIA
   Building Air Exchanges Per Hour: 1.04 (unsheltered single storied)
   Time: February 21, 2016  2328 hours ST (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE                  Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -42.6° C
   Vapor Pressure at Ambient Temperature: greater than 1 atm
   Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 4.88 meters/second from E at 3 meters
   Ground Roughness: open country          Cloud Cover: 3 tenths
   Air Temperature: 24° C                  Stability Class: D
   No Inversion Height                     Relative Humidity: 65%

 SOURCE STRENGTH:
   BLEVE of flammable liquid in horizontal cylindrical tank
   Tank Diameter: 2 meters                 Tank Length: 10 meters
   Tank Volume: 31.4 cubic meters
   Tank contains liquid
   Internal Storage Temperature: 24° C
   Chemical Mass in Tank: 12,505 kilograms
   Tank is 80% full
   Percentage of Tank Mass in Fireball: 100%
   Fireball Diameter: 135 meters           Burn Duration: 10 seconds

 THREAT ZONE:
   Threat Modeled: Thermal radiation from fireball
   Red    : 196 meters --- (23 kW/(sq m))
   Orange: 441 meters --- (4.7 kW/(sq m))
   Yellow: 652 meters --- (2.1 kW/(sq m))
```

Appendix H - Disclaimer and Limitations

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