

Final Hazard Analysis

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Upper South Creek – Advanced Water Recycling Centre





Final Hazard Analysis

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Executive Summary

Sydney Water is developing a modern, sustainable, and highly automated Advanced Water Recycling Centre (AWRC) and circular economy hub in Kemps Creek in Western Sydney. Located at the junction of Kemps Creek and South Creek, the AWRC will produce advanced quality recycled water suitable for release to the Nepean River in line with the Hawkesbury-Nepean nutrient removal framework.

The AWRC Foundation Plant will treat wastewater and produce high-quality water (close to drinking water standard) with flexibility to supply recycled water to future local customers, including residential, commercial and agriculture users in the Western Sydney Aerotropolis Growth Area (WSAGA) and South-West Growth Area (SWGA). The Jacobs and GHD Design Joint Venture (DJV) are designing the Upper South Creek AWRC.

The SSI-8609189 Minister's Conditions of Approval (CoA), condition E135(a) for the facility requires that a Final Hazard Analysis (FHA) is undertaken for the development and submitted to the NSW Department of Planning, Housing and Infrastructure (DPHE) prior to the commencement of operations.

The purpose of this report is to provide a final hazard analysis for the AWRC facility to address the requirements of *Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning* (HIPAP 4) and *Hazardous Industry Planning Advisory Paper No 6 – Hazard Analysis* (HIPAP 6). The hazard analysis aims at assessing the adequacy of such a system to meet the requirements of the associated individual fatality criteria for developments.

The hazard identification process identified that a Vapour Cloud Explosion (VCE) and flash fire from the digester gas holders, and a jet fire from the digester gas flare were possible.

The fatality and property damage consequence distances of explosion overpressure and radiated heat contours for these scenarios do not extend beyond the boundary and there is no off-site fatality impact. The scenarios have the potential to affect the on-site worker population in the immediate area. Potential property damage is confined to the AWRC site.

The hazard analysis study demonstrates that the AWRC facility could be designed, constructed and operated in a manner that will meet relevant regulations, standards and policies.

The assessment showed that there was no off-site fatality impact and that the risk complies to HIPAP 4 risk criteria. The risk of a fatality from an on-site VCE is low (one fatality approximately every 83 million years), and the probability of a jet fire from the gas flare is negligible. All risks identified can be managed to tolerable levels provided the recommendations identified are enacted.

As well as the implementation of the existing safeguards identified in the hazard identification process, it is recommended to:

- Implement ongoing maintenance of all equipment associated with the AWRC facility
- The implementation of an exclusion zone of 7 m around the digester gas flare whilst it is flaring
- Ensure and maintain appropriate separation distances between dangerous goods as per Table 7

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.3 and the assumptions and qualifications contained throughout the report.

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List of Abbreviations

Acronym	Full name/ Description
ADGC	Australian Code for the Transport of Dangerous Goods by Road & Rail
AWRC	Upper South Creek Advanced Water Recycling Centre
AWTP	Advanced Water Treatment Plant
CH ₄	Methane
CO ₂	Carbon dioxide
DG	Dangerous Goods
DJV	Design Joint Venture
DPHI	Department of Planning, Housing and Infrastructure
DNV	Det Norske Veritas
EIS	Environmental Impact Statement
FeCl ₃	Ferric Chloride
FHA	Final Hazard Analysis
HAZID	Hazard Identification study
HAZOP	Hazard and Operability study
HIPAP	Hazardous Industry Planning Advisory Paper
H ₂ SO ₄	Sulphuric acid
LOC	Loss of Containment
LPG	Liquefied Petroleum Gas
MBR	Membrane Bioreactor
MLRA	Multi-level Risk Assessment
NaHSO ₃	Sodium Bisulphite
NaOCl	Sodium hypochlorite
NaOH	Sodium hydroxide
PFD	Process Flow Diagram
PHA	Preliminary Hazard Analysis
PHAST	Process Hazard Analysis Software Tool
ROSA	Reverse Osmosis System Analysis
RO	Reverse Osmosis
ROP	RO Permeate
SBS	Sodium Bisulphite
SDS	Safety Data Sheet
SEAR	Secretary's Environmental Assessment Requirement
SEPP	State Environmental Protection Policy
SFAIRP	So Far As Is Reasonably Practicable
STEL	Short-term Exposure Limit
UN	United Nations
VCE	Vapour Cloud Explosion
WAS	Waste Activated Sludge
WHS	Work Health and Safety
WSAGA	Western Sydney Aerotropolis Growth Area

1. Introduction

Sydney Water is developing a modern, sustainable, and highly automated Advanced Water Recycling Centre (AWRC) and circular economy hub in Kemps Creek in Western Sydney. Located at the junction of Kemps Creek and South Creek, the AWRC will produce advanced quality recycled water suitable for release to the Nepean River in line with the Hawkesbury-Nepean nutrient removal framework.

The AWRC Foundation Plant will treat wastewater and produce high-quality water (close to drinking water standard) with flexibility to supply recycled water to future local customers, including residential, commercial and agriculture users in the Western Sydney Aerotropolis Growth Area (WSAGA) and South-West Growth Area (SWGA). The Jacobs and GHD Design Joint Venture (DJV) are designing the Upper South Creek AWRC.

The SSI-8609189 Minister's Conditions of Approval (CoA), condition E135(a) for the facility requires that a Final Hazard Analysis (FHA) is undertaken for the development and submitted to the NSW DPIE prior to the commencement of operations.

1.1 Purpose of this report

The purpose of this report is to provide a Final Hazard Analysis (FHA) of the AWRC development in accordance with the requirements of SSI-8609189 CoA E135(a), as quoted below:

'E135(a) - a Final Hazard Analysis of the AWRC development, prepared generally consistent with the Department's Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis' and Multi-Level Risk Assessment. The Final Hazard Analysis must:

- Include a final site layout including dangerous goods storage locations;
- Provide verification to Australian Standards for the storage and handling of the dangerous goods stored on the AWRC site including, but not limited to:
 - Flammable dangerous goods (Class 3); and
 - Corrosive liquids (Class 8).

The verification should be focused on key elements such as separation distances described in the relevant standard and critical controls.'

This report accounts for any design changes made since the concept design and Preliminary Hazard Analysis (PHA) study review prepared as part of the Environmental Impact Statement (EIS).

1.2 Scope

The purpose of this report is to provide a FHA for the AWRC facility, in order to satisfy the conditions of approval (application number SSI 8609189) under Section 5.19 of the Environmental Planning & Assessment Act 1979.

The scope of the FHA review will include:

- A review the 2021 PHA completed by Aurecon, and the current basis of design study to identify any changes made to the design. These changes may include changes to the site layout and dangerous good locations or quantities. These need to be assessed as part of the FHA.
- A final site layout including dangerous goods storage locations
- Provide verification to Australian Standards for the storage and handling of the dangerous goods stored on the AWRC site including, but not limited to Flammable dangerous goods (Class 3); and Corrosive liquids (Class 8)
- Hazard Identification (HAZID), analysis and assessment of process & environmental hazards, and
- Summary of land use safety implications

The FHA is undertaken in accordance with the Department's HIPAP 4 and HIPAP 6.

1.3 Assumptions

The following assumptions have been made in the preparation of this report:

- Dangerous good type and quantities have been provided by the DJV and are listed in Table 2 and are true and correct at the time of the screening
- The chemical data (UN number, dangerous goods classification) was based on available Safety Data Sheets (SDS) and are referenced and included in Appendix A
- All plant and equipment are installed and operated in accordance with appropriate Australian Standards, codes, and guidelines
- Dangerous goods are stored in accordance with the Australian Dangerous Goods Code (ADG Code), relevant standards and guidelines, even if not a licensable quantity
- All equipment and systems are designed to be inherently safe
- All equipment is maintained and operated as designed
- Any changes to the assumptions used in this report should result in a review of the screening process and update as required.

2. Site description

The site is a greenfield development located at the junction of Kemps Creek and South Creek, approximately 50km west of Sydney and will be known as the Upper South Creek Advanced Water Recycling Centre (AWRC). Refer Figure 1.

This facility will have an ultimate water treatment capacity of up to 70 ML/d and a Stage 1 capacity of 35 ML/d.



Figure 1 Location Map

The AWRC site is approximately 78 hectares in size and is bordered by South Creek to the west, Kemps Creek to the northeast, and the proposed M12 Motorway to the south. The site design is shown in Figure 2.

The key project components in the operational area include:

- The AWRC itself, including associated buildings, infrastructure, and equipment.
- Ancillary infrastructure, including pumping stations, administration building, carparking, internal roads, renewable energy generation, onsite detention basins, chemical storage, and switch rooms.

It will operate 24 hours a day and seven days a week.

During future stages, the AWRC development site is proposed to have a green space area, along the north and west of the site, adjacent to the waterways.

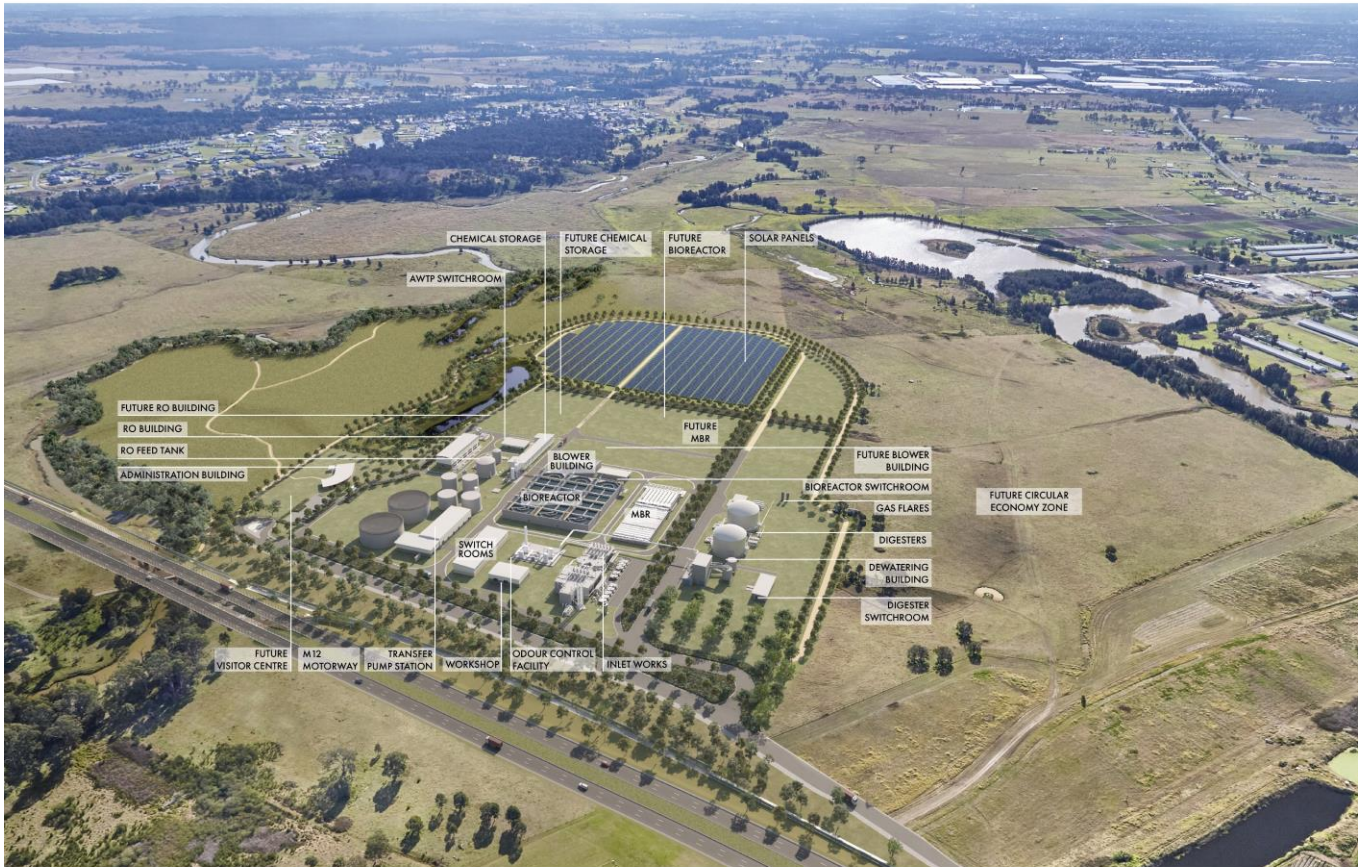


Figure 2 Regional Plan

2.1 Site Layout

AWRC Plant and equipment will include:

- Inlet works
- Five Stage Bardenpho Bioreactor
- Membrane Bioreactor (MBR)
- Waste Activated Sludge (WAS) Thickening
- Anaerobic digesters
- Biogas Pipework, energy recovery and hot water systems, including gas flare.
- Dewatering centrifuges
- Biosolids (Dewatered Sludge) conveyors
- Digesters and Dewatered Sludge Silo
- Biosolids truck out loading building.
- Advanced Water Treatment (Reverse Osmosis Membranes)
- Treated water and brine tanks and pumpstation, connected to a 24km brine pipeline to Malabar system
- Chemical dosing and storage.

These plant areas are depicted in Figure 3 below.

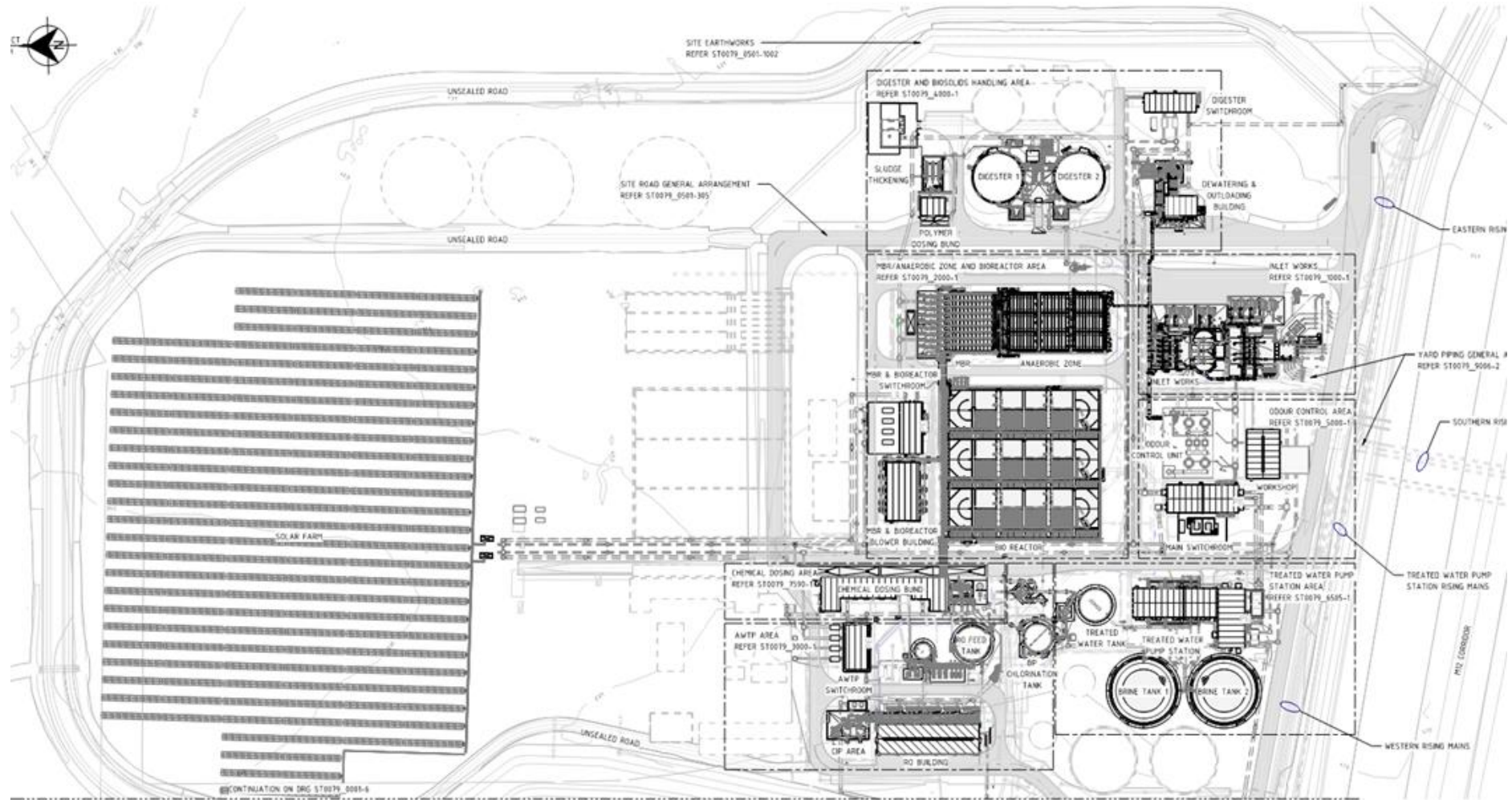


Figure 3 Site layout

2.2 Surrounding Land Uses

The AWRC site is surrounded by the rural and environmental recreation zones, Kemps Creek and Wianamatta-South Creek, respectively. According to the Western Sydney Aerotropolis Plan (2020) [Ref. 4], neither of these areas are planned for immediate rezoning. Thus, it may be several years before rezoning occurs. Figure 4 shows the current zoning around the future AWRC site.

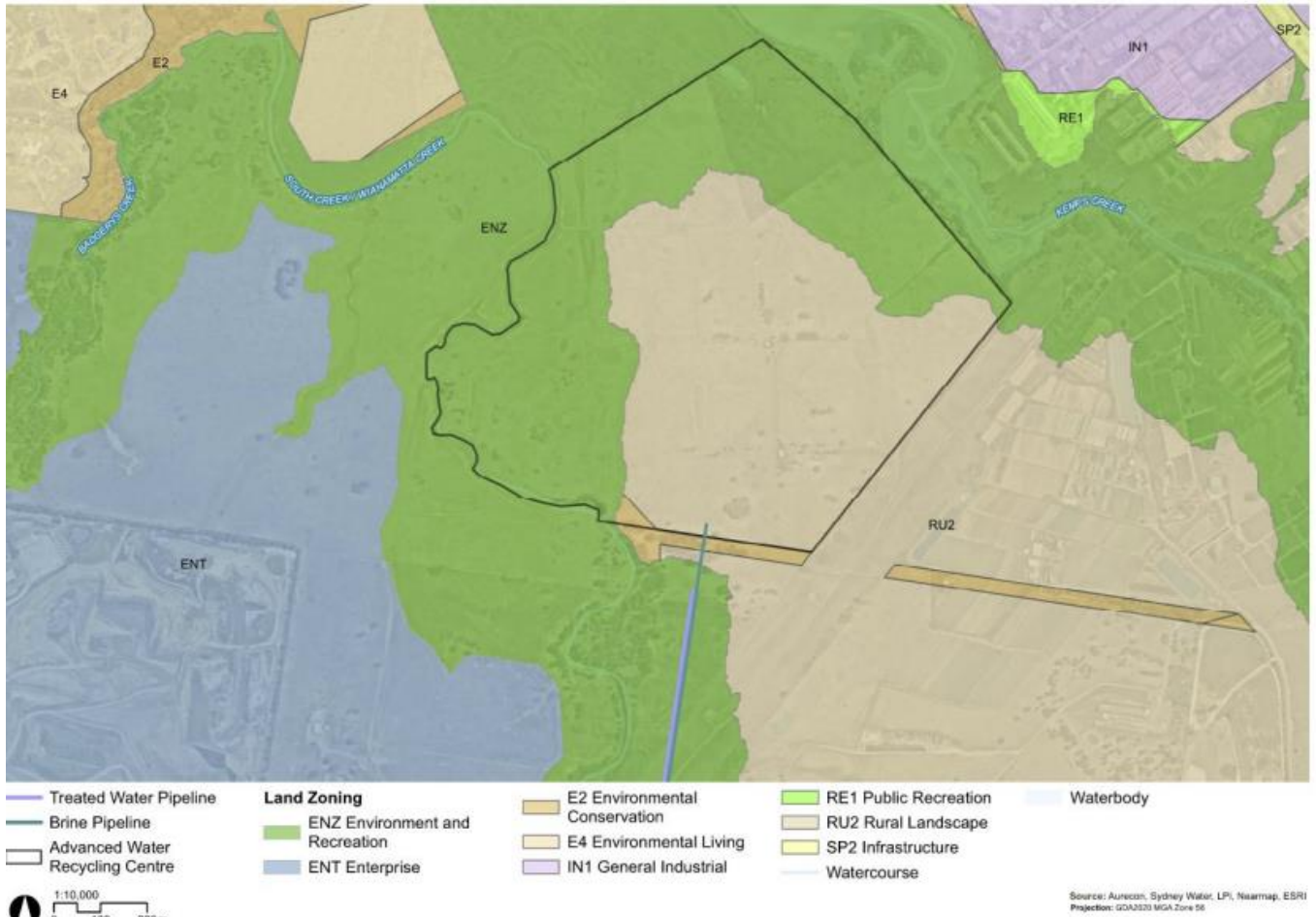


Figure 4 Zoning Map [Ref. 3]

As shown in Figure 2, the AWRC site is adjacent to the proposed M12 motorway. It is also adjacent to the Western Metro area within 500 meters of recreational parkland, rural and regional residential properties, and agricultural land. However, most residential areas are over one kilometre away.

The site is located approximately two kilometres from the future Western Sydney Airport and potentially beneath future flightpaths.

A summary of nearby sensitive receptors is located in Table 1.

Table 1 Summary of nearby sensitive receptors and risk criteria [Ref. 5]

Land use	Suggested criteria (risk in a million per year)	Comments
Hospitals, schools, childcare facilities, old age housing	0.5	The closest school is Mamre Anglican School over 2.5 km from the AWRC site, and the nearest childcare is over 8.0 km away The nearest hospitals are Blacktown Hospital and Liverpool Hospital, each over 15 km away. Catholic Healthcare Emmaus Retirement Village is the nearest retirement home, located over 3.0 km from the site.

Land use	Suggested criteria (risk in a million per year)	Comments
Residential, hotels, motels, tourist resorts	1.0	The nearest residential properties are over 1.0 km from the site and are in the Sydney suburb of Kemps Creek. The closest surrounding residential areas are located along Mamre Road and Clifton Avenue to the south and east of the site which are consist of rural residential and agricultural land.
Commercial developments including retail centres, offices and entertainment centres	5	There are several commercial offices within 2.0 km of the site, including the Seymour Whyte Office.
Sporting complexes and active open space, roads	10	The AWRC is adjacent to the proposed M12 motorway (immediately adjacent to the southern boundary of the AWRC site) and West Metro (approximately 1 km west of the AWRC site).
Industrial	50	The SUEZ Kemps Creek Resource Recovery Park is about 500 m to the south-west of the AWRC site.

On weekdays, there are expected to be ten to twelve people onsite at any given time, in addition to contractors and drivers. On weekends, this figure decreases to one person unless there is an event that requires additional assistance.

2.3 Process Description

2.3.1 Operational Process Summary

The AWRC will have the capacity to treat up to 35 ML/d of influent for Stage 1 and an ultimate capacity of 70 ML/d. The design Process Flow Diagram (PFD) is shown in Figure 5, and includes the following process areas:

- Inlet works for preliminary treatment, including coarse and fine screens, and grit removal
- Secondary and tertiary wastewater treatment via an activated sludge MBR process (this will be implemented via the staged installation of the cassettes)
- The AWTP via Reverse Osmosis (RO)
- Biogas production
- Biosolids handling facilities
- Infrastructure to South Creek for releases during wet weather
- Effluent discharge to the Nepean River, and the brine to the Malabar wastewater system.

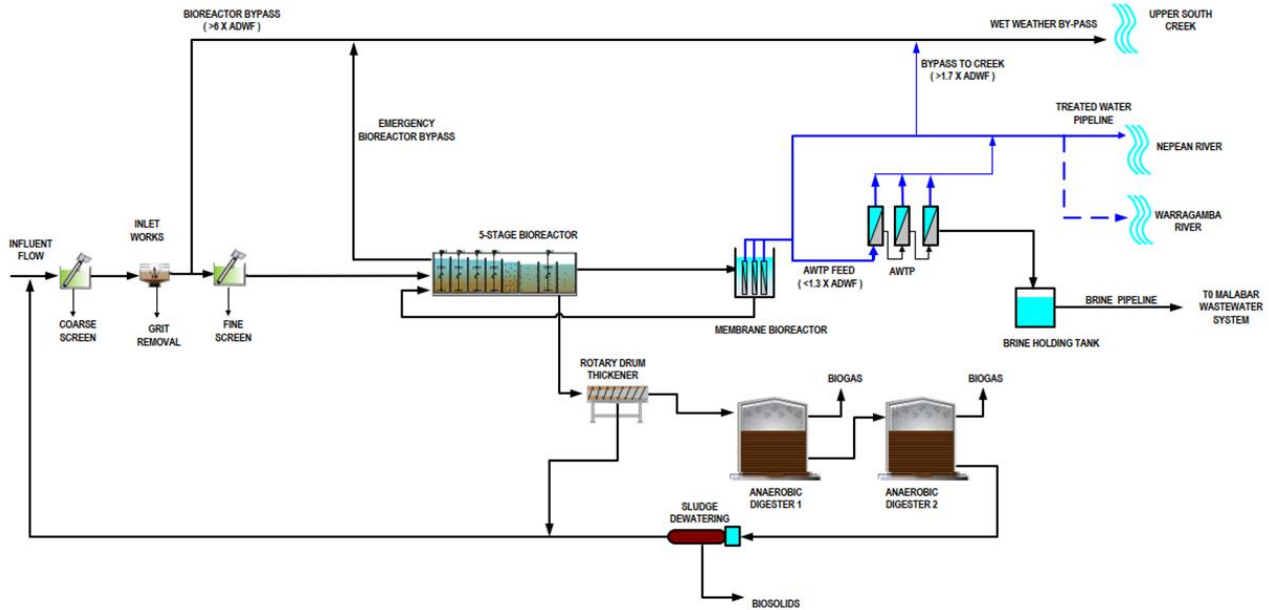


Figure 5 Process Flow Diagram

At Stage 1 of the design, the incoming mains and flow receive chamber were sized to treat 35 ML/day average dry weather flow. This was to allow for the future implementation of Stage 2 which will increase the influent flow from 35 ML/day to 70 ML/day. Otherwise, as per the PHA [Ref. 3], only Stage 1 of the design has been assessed.

The AWRC Facility will use MBR filtrate treated with monochloramine (created by mixing sodium hypochlorite and aqueous ammonia with RO permeate) before the RO Feed flow splitter to prevent biological growth. RO Permeate (ROP) is then stabilized with lime and carbon dioxide and treated in a chlorination tank with sodium hypochlorite to remove nitrogen from residual ammonia and chloramine. Afterward, ROP is dechlorinated with sodium bisulphite. When plant flow exceeds a certain rate, RO Permeate is mixed with MBR filtrate before being sent offsite.

This process means that liquified chlorine is not required on site for the chlorination of treated water.

Since the PHA was completed, the only significant change to the design is the removal of the methanol plant and storage and its replacement with liquid sugar and associated storage. This removes a significant source of risk identified and assessed in the original PHA [Ref. 3].

2.3.2 Hazardous materials

The updated list of Dangerous Goods (DGs) and hazardous materials stored and handled at the AWRC Facility is described in this section.

The following products in Table 2 have been identified as being present in the design of the AWRC. The SDS's associated with the materials are in Appendix A.

The site wide layout and relevant hazardous material storage area are in Appendix B. The layout provided and designs by chemical storage equipment vendors comply with the chemical segregation distances and storage requirements in AS 3780: The storage and handling of corrosive substances.

The Conditions of Approval required verification to Australian Standards for the storage and handling of the dangerous goods stored on the AWRC site. Based on Table 2, no Class 3 dangerous good will be stored at the AWRC Facility hence AS 1940:2017 The storage and handling of flammable and combustible liquids was not included. Appendix C details a response to AS 3780:2023 The storage and handling of corrosive substances requirements. This section does not constitute an audit of the site.

It should be noted that the SEPP 33 Threshold Quantity considers the combined quantity of chemicals in each DG class and packing group (PG), not the individual chemicals.

Table 2 Screening for the storage of Dangerous Goods used at the facility [Ref. 3]

Product Name	UN No.	Class	PG	Anticipated Storage Quantity	Combined Storage Quantity per DG class and PG	Feed Material Form	Storage Type	SEPP 33 Threshold Quantity	Threshold exceeded	Separation distances from protected place and boundaries required as per AS 3780	Location	Description
Liquefied Petroleum Gas (LPG)	1075	2.1	N/A	90 kg	90 kg	Gas	Bottles (2 45 kg bottles)	10 t	No	N/A	Digester Area (Cylinders will be stored on a concrete slab with minimum 3500mm distance from potential sources of ignition and in accordance with AS 4332 requirements)	LPG storage is provided as a backup gas supply for the hot water heater, especially during the plant commissioning period when biogas production from the digesters may not be sufficient to continuously operate the gas heater using biogas alone.
Methane / (Biogas)	1971	2.1	N/A	3,800 m ³	3,800 m ³	Gas	Process vessel	100 kg	Yes	N/A	Biogas holder, gas flare and pipework	Produced by the digesters and used for digester heating
Carbon Dioxide	1013	2.2	N/A	14 t	14t	Liquid	Tank	N/A	N/A	N/A	Chemical Delivery and Storage area (ST0079-7590-5)	Used as pH correction / alkalinity addition
Sodium Hydroxide	1824	8	II	70 t	91 t	Liquid	Tank	25 t	Yes	8 m	Chemical Delivery and Storage area (ST0079-7590-5)	Used for alkalinity correction and reverse osmosis cleaning in place
Sulphuric Acid	1830	8	II	19 t		Liquid	Tank				5 m	Chemical Delivery and Storage area (ST0079-7590-5)

BIOMATE MBC 781	3265	8	II	2 t		Liquid	IBC			5 m	RO CIP area (ST0079- M3067-2)	Biocide Typically stored in IBCs
Ferric Chloride	2582	8	III	130 t	222 t	Liquid	Tank	50 t	Yes	8 m	Chemical Delivery and Storage area (ST0079-7590- 5)	Used for chemical phosphorous removal and biogas odour control
Sodium Hypochlorite	1791	8	III	71 t		Liquid	Tank			5 m	Chemical Delivery and Storage area (ST0079-7590- 5)	Various including reverse osmosis system biofouling control, MBR membrane cleaning, advanced treated water breakpoint chlorination and disinfection of emergency overflows.
Sodium Bisulphite	2693	8	III	14 t		Liquid	Tank			5 m	Chemical Delivery and Storage area (ST0079-7590- 5)	Used for de-chlorination
Ammonium hydroxide	2672	8	III	7 t		Liquid	Tank			5 m	Chemical Delivery and Storage area (ST0079-7590- 5)	Used for forming chloramine for RO biofouling control

The revised SEPP 33 screening results show that threshold quantities are exceeded for Class 2.1 flammable gas and Class 8 corrosives storage on-site.

More detail regarding the DGs transported to the site is provided below as well as the SEPP thresholds.

Table 3 Screening for the transportation of dangerous goods [Ref. 3]

Dangerous Goods Class	Chemicals	Expected Weekly Loads (kL or t)	Expected Annual Movements	Threshold of Annual Movements	Threshold Exceeded
2.2	Carbon Dioxide	7	52	N/A	N/A
8	Ferric Chloride Sodium Hydroxide Sodium Hypochlorite Sodium Bisulphite Sulphuric Acid	58	375*	>500	No

* Based on B-double deliveries for Ferric Chloride.

Note that Class 2.1 goods have not been considered for transport screening as they will be produced onsite.

2.3.2.1 Carbon dioxide

Carbon dioxide (CO₂) is a colourless, odourless, and non-flammable gas. It is toxic and dangerous to life and health at concentrations of 170,000 ppm (17% v/v CO₂ in air) resulting in “loss of controlled and purposeful activity, unconsciousness, convulsions, coma, death within 1 minute exposure” [Ref. 2].

Whilst CO₂ is considered an asphyxiant, the main hazardous exposure route is through toxic consequences, with asphyxiant consequences being secondary as it requires a higher concentration in air compared to toxic impacts.

Refer to Table 4 for details on CO₂ health effects at various concentrations.

Table 4 Carbon dioxide health impacts

CO ₂ Concentration in Air (% v/v)	CO ₂ Concentration in Air (% v/v)	CO ₂ Concentration in Air (% v/v)
17 – 30	Within 1 minute	Loss of controlled and purposeful activity, unconsciousness, convulsions, coma, death
> 10 – 15	1 minute to several minutes	Dizziness, drowsiness, severe muscle twitching, unconsciousness
7 – 10	Few minutes 1.5 minutes to 1 hour	Unconsciousness, near consciousness Headache, increased heart rate, shortness of breath, dizziness, sweating, rapid breathing
6	1 – 2 minutes ≤ 16 minutes Several hours	Hearing and visual disturbances Headache, difficult breathing (dyspnea) Tremors
4 – 5	Within a few minutes	Headache, dizziness, increased blood pressure, uncomfortable breathing
3	1 hour	Mild headache, sweating, and difficult breathing at rest
2	Several hours	Headache, difficult breathing upon mild exertion

2.3.2.2 Methane (Biogas)

Methane (CH₄) is an extremely flammable, often compressed, gas commonly used as a fuel source for producing heat. It is odourless, colourless and less dense than air.

It should be kept away from heat, sparks, open flames, and hot surfaces. This is due to methane’s highly explosive nature as it can form an explosive mixture with air and may react violently with oxidants. The Lower Explosion Limit (LEL) is the lowest concentration of gas in the air required to ignite, burn or explode in the presence of an ignition source and for methane this is a 5% volume in air.

Methane is unlikely to cause damage to ground or water due to its high volatility. However, it is a greenhouse gas with a global warming potential ($\text{CO}_2 = 1$) of 25.

2.3.2.3 Liquefied Petroleum Gas (LPG)

LPG is an extremely flammable, mixture of hydrocarbon gases, primarily propane and butane used as a fuel source.

Similar to methane, it should be kept away from heat, sparks, open flames, and hot surfaces. LPG is highly flammable and can ignite easily. Leaks from the storage bottles can lead to gas accumulation, which poses a significant explosion risk if exposed to an ignition source.

2.3.2.4 Ferric Chloride

Ferric chloride (FeCl_3) solution is a corrosive reddish or yellow liquid with a pH of approximately 1.5. It is either odourless or produces a faint hydrogen chloride odour.

Once combusted, it may produce toxic fumes such as hydrogen chloride and iron oxides.

Due to its corrosive nature, ferric chloride is harmful to humans if ingested, inhaled, or touched.

2.3.2.5 Sodium Hydroxide

Sodium hydroxide (NaOH) solution is a water-white to slightly opaque liquid with a melting point of 12°C and a boiling point of 140°C . It has a pH of 14 and is stable under normal conditions.

Sodium hydroxide is corrosive to aluminium, zinc and tin, reacts violently with acids and salts, and absorbs carbon dioxide from the air.

Ingestion may result in nausea, vomiting, diarrhoea, abdominal pain, swelling of the larynx and subsequent suffocating, perforation of the gastrointestinal tract, cardiovascular collapse, and coma. It is corrosive to the eyes and skin.

2.3.2.6 Sodium Hypochlorite

Sodium hypochlorite (NaOCl), commonly used as bleach, is a clear, pale yellow, or greenish liquid with a characteristic pungent, chlorine-like odour. It is slightly explosive in the presence of heat and react with many organic solvents.

Sodium hypochlorite forms corrosive mixtures with water and is highly toxic to aquatic organisms, causing a pH shift in water.

It is extremely dangerous to humans if consumed as even 30 mL of a solution with 15% available chlorine may be lethal. It is also extremely dangerous if inhaled or brought into contact with the skin or eyes.

2.3.2.7 Sodium Bisulphite

Sodium Bisulphite (NaHSO_3) solution, typically between 25% and 50% v/v, is a corrosive acid solution of pH 3.5 – 5.0, the solution is irritating to eyes, nose, and throat and can irritate skin.

2.3.2.8 Sulphuric Acid

Sulphuric acid (H_2SO_4) is a strong acid with a pH of approximately 0.9. It may be corrosive to metals, is non-combustible, and a strong oxidiser. Heating may cause expansion or decomposition leading to the violent rupture of containers.

If inhaled, sulphuric acid may be fatal and if touched, it causes severe skin burns and eye damage, and is a known carcinogen.

2.3.2.9 Ammonium Hydroxide

Ammonium hydroxide (NH_4OH , Ammonia 25% AR Solution) is a colourless liquid, with a sharp, pungent odour. It is incompatible with acids as it reacts violently, and it is corrosive to metals including copper, nickel, tin, zinc, and aluminium.

Contact with ammonium hydroxide can cause sever skin burns and eye damage, and it may cause respiratory irritation if inhaled. It is very harmful if swallowed. Additionally, it is very toxic to aquatic life.

2.3.2.10 Summary of hazardous material compatibilities

The analysis considered the storage and handling of all dangerous goods and hazardous materials, and their compatibilities with other materials in Table 5. Where chemicals are incompatible, they cannot be stored in the same bund and it means that hazardous reactivity issues are expected and likely to occur. Where caution is identified, it means that hazardous reactivity issues could occur under certain conditions. Note that methane and BIOMATE MBC 781 are not included in this table as they are stored in different locations and are not expected to interact with any other chemicals.

Table 5 Compatibility of chemicals stored on site

Chemicals stored in the chemical delivery and storage area	Carbon dioxide					
Sodium hydroxide solution	Incompatible	Sodium hydroxide solution				
Sulphuric acid	Incompatible	Incompatible	Sulphuric acid			
Ferric chloride solution	Caution	Incompatible	Incompatible	Ferric chloride solution		
Sodium hypochlorite	Incompatible	Incompatible	Incompatible	Incompatible	Sodium hypochlorite	
Sodium bisulphite solution	Incompatible	Caution	Incompatible	Incompatible	Incompatible	Sodium bisulphite solution
Ammonium hydroxide	Caution	Caution	Incompatible	Incompatible	Incompatible	Caution

2.3.3 Changes since the PHA

The design has progressed since the PHA was completed in 2021 [Ref. 3]. Changes relevant to this FHA include methanol no longer being used as a supplemental carbon source as it has been replaced with a sugar solution. This has removed methanol as a DG and reduced the number of scenarios being modelled. Additionally, ammonium hydroxide has been added, and is a DG. No updates to the modelling were required due to this change.

3. Hazard identification

3.1 HAZID assessment

A Hazard and Operability study (HAZOP) was conducted by Sydney Water on 5 May 2020 and 6 May 2020 and updated and revised by GHD and Jacobs for this FHA. This information was updated as a Hazard Identification study (HAZID) as shown in Table 6.

Following the HAZID, all scenarios identified as potentially causing an offsite impact were further assessed in the consequence analysis in Section 4.

Table 6 Hazard identification summary

Hazard scenario	Causes	Consequence	Potential for offsite impact	Identified safeguards
Methane (biogas) release	Tank, pipework or flange leak. Tear in digester membrane gas holder.	Explosion in digester tank / gas holder	Yes	<ul style="list-style-type: none"> – Pressure and vacuum relief valves – Leak detection – Electrical equipment selected in accordance with the hazardous area classification – Comprehensive emergency plan and procedures provided for the site – SDSs held for all materials – PPE provided – Annual fire and evacuation training to be conducted – Excess gas is flared when necessary (duty + standby waste gas burners / flares) – Both digesters are connected to a common pipe and gas can be transferred between them. Total storage volume is effectively 2 time the volume of what one digester can store.
LPG release from the storage bottles	Faulty connections Physical damage or impact	Fire Explosion	No (due to low storage quantity this is not considered a credible risk of impacting off-site)	<ul style="list-style-type: none"> – Storage complies with AS 4332 The storage and handling of gases in cylinders, including: <ul style="list-style-type: none"> • Correct storage including solid and upright and restrained to prevent falling or damage • Ventilated storage • 3500 mm away from any ignition sources
Gas flare flame out and ignition leading to an explosion	On-demand failure of the duty and standby gas flares, methane / biogas may be released into the air	Fire	Yes	<ul style="list-style-type: none"> – Annual fire and evacuation training to be conducted – Comprehensive emergency plan and procedures provided for the site
Explosive gas-air mixture forms beneath the odour covers at inlet works (zone 2 hazardous area)	Methane gas from organic content of sewerage, and flammable liquid contaminants mixed with incoming sewerage accumulating	Explosion at odour covers of inlet works	No	<ul style="list-style-type: none"> – The area under the odour covers is constantly ventilated to try and stay below LEL – Electrical equipment selected in accordance with Zone 2 hazardous area

Hazard scenario	Causes	Consequence	Potential for offsite impact	Identified safeguards
				<ul style="list-style-type: none"> – Comprehensive emergency plan and procedures provided for the site – SDSs held for all materials – PPE provided – Annual fire and evacuation training to be conducted
Explosive gas-air mixture forms in the inlet works foul air ducts, fans, filters, and exhaust stacks	Accumulation of flammable gas	Explosion	No	<ul style="list-style-type: none"> – Electrical equipment selected in accordance with Zone 2 hazardous area – Comprehensive emergency plan and procedures provided for the site – SDSs held for all materials – PPE provided – Annual fire and evacuation training to be conducted
Explosive gas-air mixture may form in the rotary drum thickeners (inside flocculation tank, machine housing and thickened sludge hopper)	Waste activated sludge coming from an aerated process with a high sludge retention time has a low risk of methane generation. However, this machine does not have any ventilation, thus gas could accumulate in the housing of the machine.	Explosion	No	<ul style="list-style-type: none"> – Comprehensive emergency plan and procedures provided for the site – SDSs held for all materials – PPE provided – Annual fire and evacuation training to be conducted – Waste activated sludge coming from an aerated process with a high sludge retention time has a low risk of methane generation. Automated duty rotation of RDT's minimises time for sludge to remain static inside equipment. Minor natural ventilation is available through sludge hopper and RDT vents. Therefore, this are is classified as non-hazardous [Ref. 14]
Explosive gas-air mixture forms in the digested sludge centrifuge	With dewatering operations being near to continuous (20 hours or more), gas can realistically accumulate in the bowl of the machine. (inside bowl) Despite odour extraction on centrate and solids chute, gas can realistically accumulate in the housing	Explosion	No	<ul style="list-style-type: none"> – Electrical equipment selected in accordance with Zone 2 hazardous area – Comprehensive emergency plan and procedures provided for the site – SDSs held for all materials – PPE provided – Annual fire and evacuation training to be conducted

Hazard scenario	Causes	Consequence	Potential for offsite impact	Identified safeguards
	of the machine. (inside machine outer housing)			
Explosive gas-air mixture forms in the dewatered sludge belt and screw conveyors	<p>Although sludge is stabilised, it is not uncommon for conveyors to be stopped without being cleared and for sludge to sit in position for 24hrs or more.</p> <p>Despite all screw and belt conveyors being fitted with odour extraction, gas can realistically accumulate in the housing of the machine.</p>	Explosion	No	<ul style="list-style-type: none"> – Electrical equipment selected in accordance with Zone 2 hazardous area – The area under the odour covers is constantly ventilated to try and stay below LEL – Comprehensive emergency plan and procedures provided for the site – SDSs held for all materials – PPE provided – Annual fire and evacuation training to be conducted
Explosive gas-air mixture forms in the dewatered sludge silo	<p>Although sludge is stabilised, it is sitting for a significant period with minimal ventilation. Some amount of methane that is produced may accumulate. Small amounts of hydrogen sulphide (being heavier than air) could accumulate over time in the lower section of the silo away from extraction openings.</p>	Explosion	No	<ul style="list-style-type: none"> – Electrical equipment selected in accordance with Zone 2 hazardous area – The area under the odour covers is constantly ventilated to try and stay below LEL – Ventilation in the silo – Comprehensive emergency plan and procedures provided for the site – SDSs held for all materials – PPE provided – Annual fire and evacuation training to be conducted
Explosive gas-air mixture forms in the odour control facility	<p>The odour control facility extracts odourous and hazardous gases from the process throughout the plant.</p> <p>The facility involves the extraction of Volatile Organic Compounds (VOC) to the odour control facility.</p>	Explosion	No	<ul style="list-style-type: none"> – Electrical equipment selected in accordance with Zone 2 hazardous area – Comprehensive emergency plan and procedures provided for the site – SDSs held for all materials – PPE provided – Annual fire and evacuation training to be conducted

Hazard scenario	Causes	Consequence	Potential for offsite impact	Identified safeguards
Radiant heat or embers from a bushfire affecting infrastructure on site	Radiant heat or embers from a bushfire impacting fire sensitive areas i.e Digesters, Gas Flares, Bioreactor Switchroom, Administration building, Solar Farm	Explosion (at digester) or fire at other areas	Yes	<ul style="list-style-type: none"> – Asset Protection Zone (APZ) – of at least 10 m around the AWRC facility (including the solar farm), to provide a maximum bushfire attack level (BAL) 29 rating. – The APZ may be maintained along the outside of the perimeter fence and include the perimeter access road. – Electricity services will all be underground. – Essential equipment housed in structures with a Fire Resistance Level of -/30/- . Vulnerable control equipment is to be suitably protected or enclosed in non-combustible ducts or sheathing – Administration buildings should be provided with compliant ember protection as stated in AS3959 (i.e. mesh screens applied to all vents, weep holes and access doors). Under the current layout, if the area between the administration and visitor centre and the outer edge of the fire trail is maintained as an APZ, the BAL is reduced to 12.5. – Solar farm is to be on mown or dwarf grass substrates, maintained in a low fuel condition
Release of corrosive material (e.g. sodium hydroxide)	Tank, Pipework or flange leak	Potential for injury or environmental release	No	<ul style="list-style-type: none"> – Pallet bunds used for IBC Storage – Pallet bunds used for pail and drum storage – Pallet bunds used for diesel storage – Comprehensive emergency plan and procedures provided for handling corrosives – SDSs held for all materials – Emergency spill kits provided
Release of sulphuric acid / 400kg or litres in 200 litre drums	Tank, Pipework or flange leak	Potential for injury or environmental release	No	<ul style="list-style-type: none"> – Bulk storage provided in accordance with Dangerous Goods Storage requirements – Comprehensive emergency plan and procedures provided for handling corrosives – All chemical storage tanks bunded – SDSs held for all materials – Emergency spill kits provided

Hazard scenario	Causes	Consequence	Potential for offsite impact	Identified safeguards
Interaction of incompatible dangerous goods stored together	Inadequate storage Corrosion and leaks from the storage tanks	Fire, toxic gas or potential for environmental release	Yes	<ul style="list-style-type: none"> – Segregated in accordance with the relevant Australian Standards, AS 3780 – SDSs held for all materials – Emergency spill kits & PPE provided
Production of hazardous materials from the interaction of chemicals (e.g., chlorine gas produced from interaction of citric acid and sodium hypochlorite)	Inadequate storage Corrosion and leaks from the storage tanks	Fire, toxic gas or potential for environmental release	Yes	<ul style="list-style-type: none"> – Segregated in accordance with the relevant Australian Standards, AS 3780 – SDSs held for all materials – Emergency spill kits & PPE provided – Interlocks to prevent dosing incompatible chemicals simultaneously – Alarming of leak detection in common pipework dosing locations
Release of firewater into the environment	Firewater encounters the incoming waste stream or processing areas and is contaminated	Potential for environmental release	Yes	<ul style="list-style-type: none"> – The stormwater system is designed to allow for sufficient capacity to contain the firewater in the event of a fire and retain it until testing confirms it is safe for release
Release of brine into the environment	Tank, Pipework or flange leak	Potential for environmental release	Yes	<ul style="list-style-type: none"> – Design and operational measures in place to reduce the likelihood of a pipeline failure or leak – Systems to detect pipeline failure or leak
Fire at the solar farm	Solar farm is indicatively located on the northern side of the site	Fire Personal injury/fatality Asset Damage Plant shut down	Yes	<ul style="list-style-type: none"> – Location of the solar PV panels is outside the hazardous area classifications – Correct installation and maintenance procedure

3.2 Hazard analysis scenarios

The revised HAZID and hazardous material screening in section 2.3.2 identified the following hazards for the AWRC facility with a potential for offsite impact:

1. Fire/explosion in the digester gas holder
2. Gas flare flame out and ignition leading to an explosion
3. Bushfire impacting the AWRC (fire/explosion in the digester gas holder)
4. Interaction of incompatible dangerous goods stored together
5. Production of hazardous materials from the interaction of chemicals
6. Release of firewater into the environment
7. Release of brine into the environment
8. Solar farm

Potential events such as the fire/explosion in the gas holder, or gas flare flame out and explosion may lead to off-site consequences.

However, the nearest sensitive receptors are located 300-400m away (refer to Section 2.2). It is considered that there is a potential for harm from such events, and that such events may have an impact on surrounding land uses, but will unlikely affect sensitive receptors, therefore a Level 2 semi-quantitative PHA approach has been adopted for this analysis.

3.2.1 Biogas holder

Figure 6 shows the biogas holders which contain the biogas produced as part of the digestion process. The biogas will consist primarily of methane (i.e. 60% methane/40% carbon dioxide).

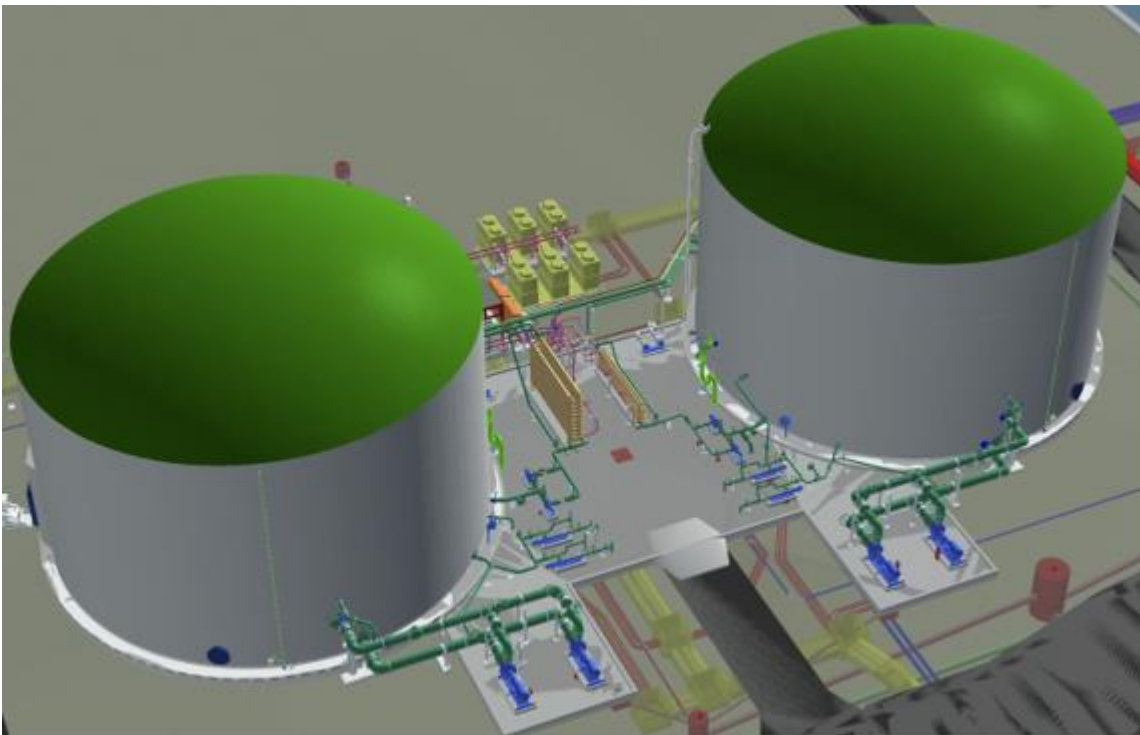


Figure 6 *Biogas holders*

Loss of containment of biogas holders is most likely to be a result of a leak from the gas holders or associated pipework. A possible consequence of this release includes a fire or Vapour Cloud Explosion (VCE) due to a release of methane. Due to the potential for offsite impact, this scenario was assessed in Section 4.

3.2.2 Gas flares

In the event of an on-demand failure of the duty and standby gas flares, methane / biogas may be released into the air. This will form a vapour cloud and in the event of an ignition source being present, a jet fire may result.

Due to the potential for offsite impact, this scenario was assessed in Section 4.

3.2.3 Bushfire

AWRC site is located in a ‘bushfire prone’ area and therefore must comply with the NSW Rural Fire Services document Planning for Bush Fire Protection [Ref. 12].

The Bushfire Constraints and Opportunities Assessment completed for the facility states that the AWRC meets the requirements of the Planning for Bush Fire Protection and is therefore bushfire compliant. Therefore, this event is not carried forward for detailed analysis.

Further information regarding fire safety is located in the Fire Safety Study.

If a bushfire impacts the AWRC, the consequences of a fire/explosion in the digester gas holder is address as noted in section 3.2.1

3.2.4 Incompatible and reactive chemicals

The PHA for the AWRC [Ref. 3] states that the most credible causes of failure leading to the interaction of incompatible DGs include corrosion and leaks from the storage tanks. These interactions may lead to new substances which are corrosive, flammable, or explosive. Hence the tanks are to be segregated in accordance with the relevant Australian Standards, namely AS 3780 – *The Storage & handling of corrosive substances* [Ref. 9]. AS 3780 also requires separate bunding and containment, and drainage systems for all DGs.

The spacing and segregation of the tanks is covered by Clause 6.3.3 and requires tanks storing incompatible chemicals to be separated by a distance of 5m.

The separation distances to protected works and the site boundary, is summarised in Table 7. Subject to the implementation of these control measures the residual risk of this hazard is considered low SFAIRP.

Table 7 Required DG separation distances [Ref. 9]

Tank capacity (kL)	Separation distance (m)		
	PG I		PGs II and III
-	≤ 3	3	3
> 3	≤ 50	8	5
> 50	-	15	8

3.2.5 Goods not classified as dangerous goods

Some of the chemicals stored onsite are not classified as DGs but may produce them if they come into contact with other DGs. An example of this is citric acid. As specified in the PHA [Ref. 3], citric acid may react with sodium bisulphite to produce the toxic gas, sulphur dioxide. Citric acid also reacts with sodium hypochlorite and produces chlorine gas. Hence, all acids onsite should be stored at least five meters away from the sodium bisulphite storage and the sodium hypochlorite storage or be stored in a separate bunded area.

The CIP bund area is not used for storage purposes except for specialty chemicals (mainly detergents that are not categorised as dangerous good). Acid/base that are used for CIP purposes are generally made up to low concentrations and immediately dosed right after. Therefore, the CIP bund area is not classified as a dangerous goods storage area. This approach has been confirmed by Sydney Water (c.f. RFI 15742).

3.2.6 Firewater containment

The current stormwater system design incorporates a first flush water diverter for Stage 1, which is estimated to have a capacity of 130 kL. The first flush system captures the first 7-8 mm of rainfall runoff of all hardstand areas onsite and returns it to the head of the works.

Due to the potential for fire water to enter the environment uncontrollably, a stormwater system has been designed with sufficient capacity to contain the firewater in the event of a fire and retain it until testing confirms it is safe for release.

The design of the firefighting water containment system is required to accommodate the total firefighting water volume supplied to the site, that is 288,000 L, considering the potential rainfall events for the sites geographic location. The stormwater catchment system capable of containing up to 489 kL of water, providing sufficient capacity to capture all contaminated fire-water run-off produced by the fire hydrants

3.2.7 Brine pipeline release

Another hazard analysis scenario involves a leak in the brine transfer pipeline between the AWRC and the Malabar wastewater network. This may result in damage to the environment or human injury. The projections identified the worst and average brine quality. The results of this analysis are shown in Table 8 below.

Table 8 Brine quality results

Analyte Name		Units	Concentration	
			Average	Worst
Ammonia	NH4+ + NH3	mg/L	1.53	1.60
Potassium	K	mg/L	129.34	130.49
Sodium	Na	mg/L	984.69	1525.72
Magnesium	Mg	mg/L	107.26	107.98
Calcium	Ca	mg/L	157.56	250.25
Strontium	Sr	mg/L	0.57	10.71
Carbonate (part of alkalinity measure)	CO3	mg/L	1.31	1.62
Bi-carbonate (part of alkalinity measure)	HCO3	mg/L	730.42	1261.24
Nitrate	NO3	mg/L	30.63	30.88
Chlorine	Cl	mg/L	1407.08	1742.47
Fluoride	F	mg/L	4.87	14.04
Sulphate	SO4	mg/L	497.23	922.47
Silicon dioxide	SiO2	mg/L	105.09	106.03
Boron	B	mg/L	0.17	0.19
Carbon dioxide	CO2	mg/L	41.88	100.18
Total dissolved solids	TDS	mg/L	4164.19	6171.99
"Power of hydrogen"	pH	pH units	7.34	7.21

The composition of the brine shows that a release from the pipeline is very unlikely to create toxic, fire or explosion risks. As such it is considered unlikely that a release of brine into the environment would have any impact on humans.

There are design and operational measures in place to reduce the likelihood of a pipeline failure or leak. In the event of an incident, there are systems in place to detect the failure. These controls are discussed in further detail in the EIS report [Ref 10].

Due to the low predicted impact of this scenario, it was not discussed further.

3.2.8 Solar Farm

The solar farm is indicatively located on the northern side of the site. However, with regards to the FHA, no hazards relevant to the AWRC were identified.

The solar farm does not include a battery energy storage system.

3.3 Status of PHA recommendations

Several recommendations were made in the 2021 PHA [Ref. 6] as shown in Table 9.

Table 9 PHA recommendation status

Potential impact	Mitigation measure	Impact significance following mitigation	Updates (November 2023)
Release of methanol near sensitive receptor	If methanol is chosen as the final supplemental carbon source: A route evaluation study for the transport of methanol should be completed in accordance with HIPAP 11 – <i>Route Selection</i> [6]; and The likelihood of both a pool fire and dispersion of a toxic cloud should be quantified.	Medium	No longer relevant as methanol has been removed from the design.
Interaction between incompatible dangerous goods	Class 8 substances will be stored in accordance with AS 3780-2008, and in accordance with obligations under section 5 of chapter 7 of the Work Health and Safety Regulations 2011 [5]. Citric acid (nor any other acid) will not be stored in the same bunded area as sodium bisulphite or sodium hypochlorite	Low	Citric acid and sodium bisulphite bunds were reallocated so that bisulphite is separated from acid and alkaline storages by neutral (e.g., sucrose and antiscalant) chemicals on each side. This change was reflected in the 80% design submission
Compliance with Work Health and Safety Regulations	A manifest of the hazardous chemicals exceeding manifest quantities is to be prepared in accordance with Regulation 347 and Schedule 12 of the WHS Regulations. The regulator must be notified of hazardous chemicals exceeding manifest quantities in accordance with Regulation 348 of the WHS Regulations. An emergency plan is to be prepared for the site and provided to the NSW Fire and Rescue as per the requirements of Regulation 361 of the WHS Regulations. The school should be notified as part of the emergency response plan in the event of an emergency involving a methanol tanker near the school. Outer warning placards regarding quantities of hazardous chemicals should be displayed at any entrance where emergency services may enter the workplace in accordance with Regulation 349 and Schedule 13 of the WHS Regulations. Placards should be displayed on or near the storage of hazardous chemicals in accordance with Regulation 350 and Schedule 13 of the WHS Regulations.	Low	Trility to note for operational procedures/documentation Safety signage register to be developed

Potential impact	Mitigation measure	Impact significance following mitigation	Updates (November 2023)
Release of firewater into the environment	The stormwater system should be designed with sufficient capacity to contain the firewater in the event of a fire and retain it until testing confirms it is safe for release.	Low	<p>Being a wastewater treatment facility, it is highly likely for firewater that comes into contact with the incoming waste stream or processing areas to be contaminated.</p> <p>Due to the potential for contaminated fire water to enter the environment, the stormwater system is required to allow for sufficient capacity to contain the firewater in the event of a fire and retain it until testing confirms it is safe for release.</p> <p>The stormwater system considers rainfall events in the area and has been designed to contain a 1 in 20-year rainfall event within the drainage systems, pipes, pits and swales.</p> <p>The stormwater catchment system capable of containing up to 489 kL of water, providing sufficient capacity to capture all contaminated fire-water run-off produced by the fire hydrants (288,000 L)</p>

4. Consequence analysis

The following scenarios have been carried forward from the hazard identification phase of the study for consequence analysis, likelihood analysis and risk assessment:

- **Digester gas holders:** a Vapour Cloud Explosion (VCE) after a loss of containment of the biogas
- **Gas flare:** flame out and delayed ignition and fire/VCE event.

These scenarios were performed using PHAST (Process Hazard Analysis Software Tool) version 8.23.73.0, a commercial software package from Det Norske Veritas (DNV).

A night and day weather category have been used in the consequence modelling to understand the difference in results based on changes to wind speed and conditions.

It should be noted that consequence modelling is not the same as risk modelling. Consequence modelling only represents the impact zone that would be affected if a release should occur. It does not consider the following important risk considerations:

- Likelihood of a release, i.e. a leak frequency
- Probability of a wind direction towards a particular location

Methane was used as a representation for biogas to determine the consequences of the scenarios listed above.

The general inputs required for PHAST are shown in Table 10.

Table 10 Modelling assumptions

Parameter	Assumption
Software	PHAST Version 8.23.73.0
Hazardous material	The representative material for biogas used in this study is methane
Release location	Outside releases
Calculation height of interest	Consequences based on impacts at 1.5 m (average height for a person, either standing or crouching)
Release format	Jet fire
Atmospheric temperature	24 degrees Celsius (mean annual maximum temperature from BoM Horsley Park Equestrian Centre AWS)
Surface temperature	24 degrees Celsius (mean annual maximum temperature from BoM Horsley Park Equestrian Centre AWS)
Weather category 1	F1.5 – wind speed 1.5 m/s and stable conditions (night with moderate clouds and light winds)
Weather category 2	D5 – wind speed 5 m/s and neutral conditions (day with little sun and high winds)

4.1 Relevant Risk Criteria

This section outlines the relevant criteria used to understand the impact of the model.

4.1.1 Heat Radiation Criteria

The effects of various heat radiation levels used in this assessment are summarised in Table 11 as per the NSW HIPAP No. 4 [Ref. 5].

Table 11 Heat radiation criteria [Ref. 5]

Heat radiation (kW/m ²)	Effect
4.7	– Will cause pain in 15-20 seconds and injury after 30 seconds of exposure (at least second-degree burns will occur)

Heat radiation (kW/m ²)	Effect
12.6	<ul style="list-style-type: none"> – Significant chance of fatality for extended exposure. High chance of injury – Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure – Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
23	<ul style="list-style-type: none"> – Likely fatality for extended exposure and chance of fatality for instantaneous exposure – Spontaneous ignition of wood after long exposure – Unprotected steel will reach thermal stress temperatures which can cause failure – Pressure vessel needs to be relieved, or failure would occur
35	<ul style="list-style-type: none"> – Cellulosic material will pilot ignite within one minute's exposure – Significant chance of fatality for people exposed instantaneously

4.1.2 Explosion Overpressure Criteria

The effects of various explosion overpressures used in this assessment are summarised in Table 12 as per the NSW HIPAP No. 4 [Ref. 5].

Table 12 Effects of explosion overpressure [Ref. 5]

Explosion overpressure (kPa)	Effect
7	<ul style="list-style-type: none"> – Damage to internal partitions and joinery but can be repaired – Probability of injury is 10% – No fatality
14	<ul style="list-style-type: none"> – House uninhabitable and badly cracked
21	<ul style="list-style-type: none"> – Reinforced structures distort – Storage tanks fail – 20% chance of fatality to a person in a building
35	<ul style="list-style-type: none"> – House uninhabitable – Wagons and plants items overturned – Threshold of eardrum damage – 50% chance of fatality for a person in a building and 15% chance of fatality for a person in the open

4.2 Consequence Modelling Results

The model inputs and outputs from the consequence modelling for each of the following scenarios is presented below.

1. **Digester gas holders:** a VCE after a loss of containment of the biogas
2. **Digester gas holders:** a fireball after a loss of containment of the biogas
3. **Gas flare:** flame out and delayed ignition and fire event.

4.2.1 Digester Gas Holder

The VCE scenario involving a loss of containment of methane from the digester gas holder was based is a cloud of methane and air in the optimal stoichiometric ratio for combustion forming in the digester gas holder annular area.

A cloud of this nature could credibly form as the result of a catastrophic failure of the gas holder.

The total volume beneath the gas holder when it is fully inflated with digester gas at maximum holding capacity is 1900 m³, which is inclusive of the headspace above the liquid level up to the top of the concrete side wall. The gas holder is depicted in the diagram shown in Figure 7.

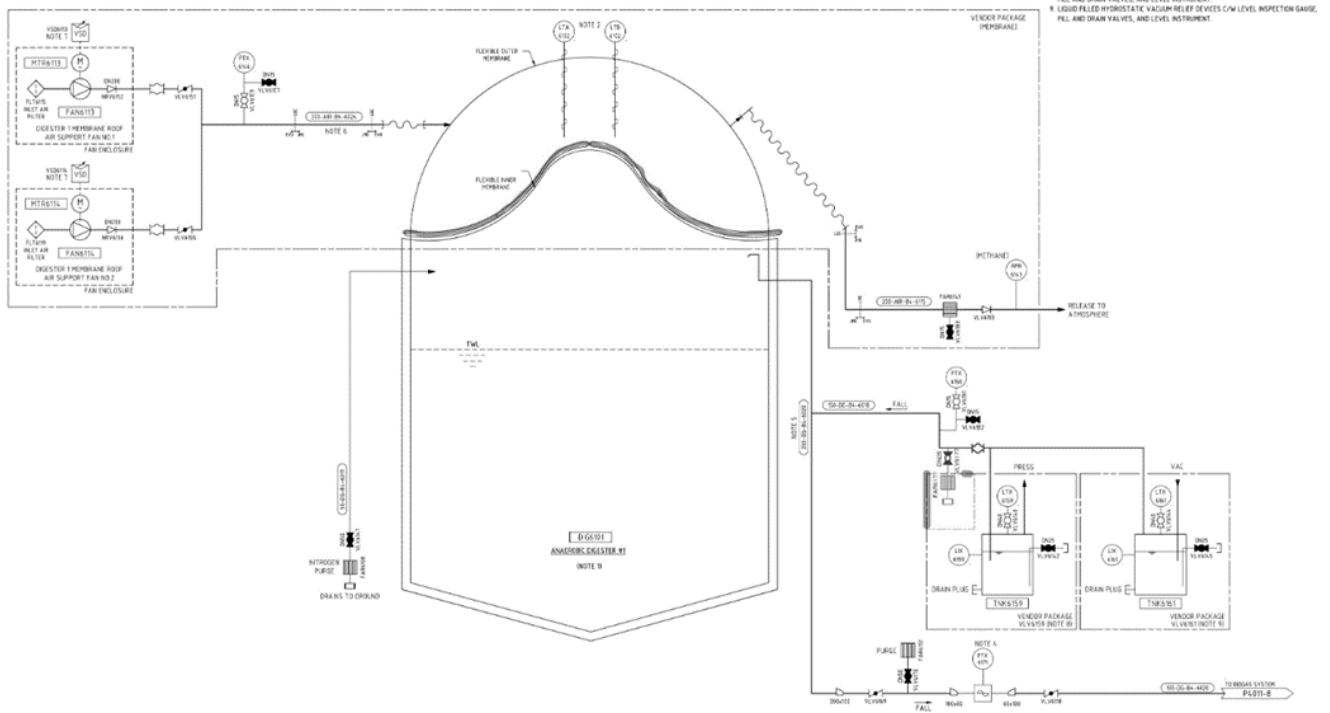
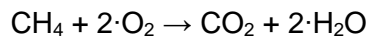


Figure 7 Digester gas holder diagram (indicative of final design)

A 1,900 m³ cloud containing a methane-air mixture in the optimal stoichiometric ratio for combustion was defined in PHAST. This ratio is an output from PHAST and defines the case for what the highest explosion overpressures will be, in the event of a deflagration.

The optimal stoichiometric ratio is given by the combustion equation for methane.



The stoichiometric ratio of methane to air is 1:10.5. Therefore, a 1,900 m³ cloud in its optimal stoichiometric ratio with air contains 48 m³ of methane at process conditions of 25 °C and 2.4 kPa.

Inputs used for the model are shown in Table 13.

Table 13 Input parameters for gas holder VCE

Parameter	Value
Material	Methane ¹
Elevation	14.5 m
Temperature	41 °C
Pressure	0.025 barg
Volume inventory	1,900 m ³
Concentration of interest	22,000 ppm

Details of release are included in Appendix B. These were produced as an output by PHAST.

4.2.1.1 Digester Gas Holder – Vapour Cloud Explosion (VCE)

The results of the consequence modelling for the VCE are presented in Figure 8. These results are represented by impact zone contours (dotted lines) showing the maximum distance in any direction and the actual impact contours (solid lines) showing the actual shape in one specific wind direction on the site layout in Figure 9.

¹ Note that the digester gas is actually a nominal blend of 60% methane, 39% CO₂ and 1% 'other'. It is not pure methane. For this model, however, 100% methane was used.

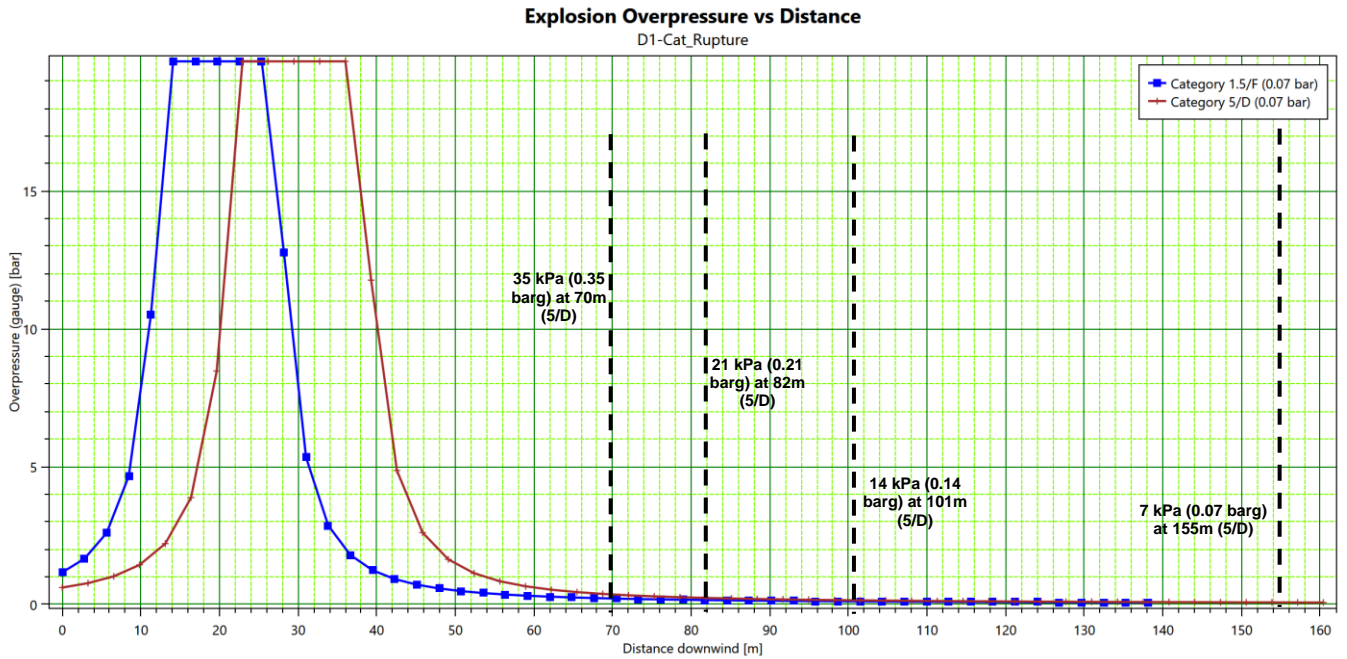


Figure 8 Gas holder VCE overpressure vs. distance

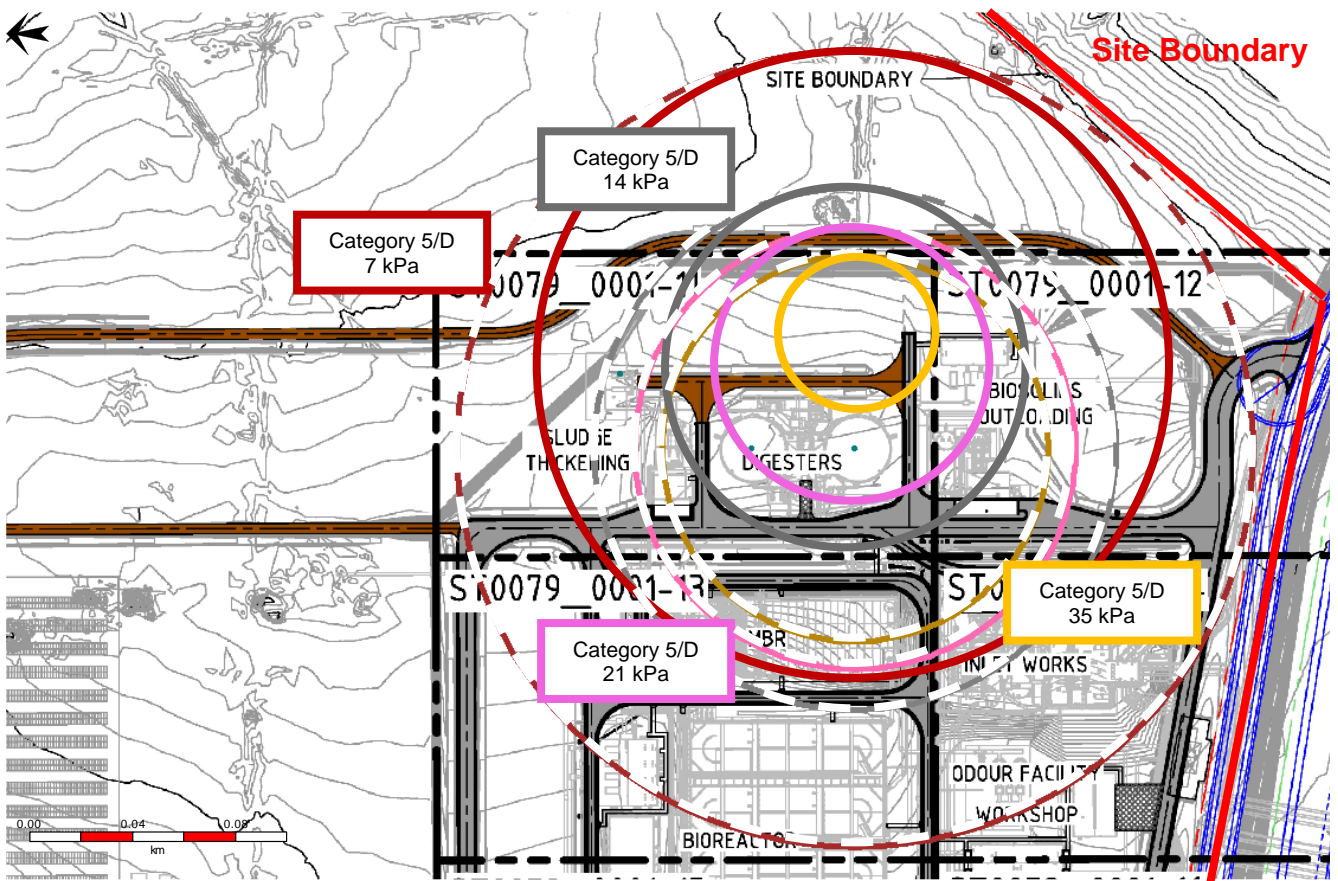


Figure 9 Gas holder VCE impact zone contours

The site layout as at the time of writing shows the digester gas holders are approximately 150 m from the eastern site boundary and approximately 145 m from the southern site boundary. At these distances, the overpressure is approximately 0.7 kPa. According to Table 12, this may result in:

- Damage to internal partitions and joinery but can be repaired
- Probability of injury is 10%
- No fatality

None of the contours shown in Figure 9 reach beyond the site boundary. Hence, no offsite impact is expected.

A summary of the overpressure distances from the digesters is shown in Table 14. The table also provides a summary of the consequence effects at overpressures of interest. It is important to note, however, that the release elevation is 14.5 m above the ground. This is above the height of interest as the height of interest is between 1.5 m and 3.0 m.

Table 14 Summary of gas holder VCE contour distances [Ref. 5]

Level of overpressure exposure (kPa)	Distance from digester (Category 5/D weather conditions) (m)	Consequences
7	154	<ul style="list-style-type: none"> – Damage to internal partitions and joinery but can be repaired – Probability of injury is 10% – No fatality
14	97	<ul style="list-style-type: none"> – House uninhabitable and badly cracked
21	78	<ul style="list-style-type: none"> – Reinforced structures distort – Storage tanks fail – 20% chance of fatality to a person in a building
35	62	<ul style="list-style-type: none"> – House uninhabitable – Wagons and plants items overturned – Threshold of eardrum damage – 50% chance of fatality for a person in a building and 15% chance of fatality for a person in the open

4.2.1.2 Digester Gas Holder – flash fire

Figure 10 shows the intensity radii contours for a flash fire from the gas digesters. Weather data for Category 5/D and Category 1.5/F showed the same effect zone results. Hence, only Category 5/D is shown.

As shown, there is no offsite impact expected from any of the heat radiation levels. However, there is still the probability of an onsite fatality as personnel within 43 m of the digesters may be exposed to up to 37.5 kW/m² of heat radiation. Exposure to this level of radiation leads to a “significant chance of fatality for people exposed instantaneously” [Ref. 5].

Individuals within 81 m of the digesters may experience 12.5 kW/m² of heat radiation, and those within 145 m may experience 4 kW/m². The consequences of these levels of heat radiation exposure are shown in Table 11.

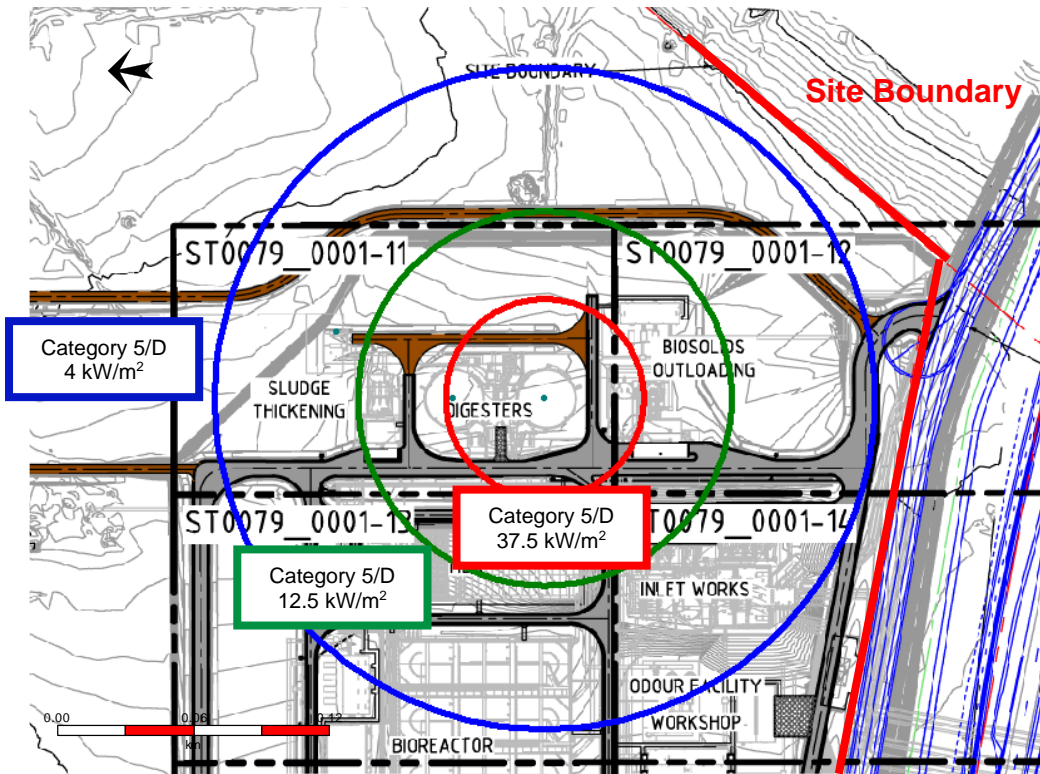


Figure 10 Gas holder intensity radii for flash fire effect contours

4.2.2 Digester Gas Flare – jet fire

The maximum process flow to the flare from both digesters is 120 m³ / hr under process conditions.

Should a flame out occur, the biogas will entrain over time triggering a 15-minute site shutdown. In this time, a gas cloud of 0.1 m diameter may form.

Figure 11 shows a graph depicting an aerial view of the jet fires with different intensity radii. The sizes of these jet fires are reflected in the contours on the map in Figure 12.

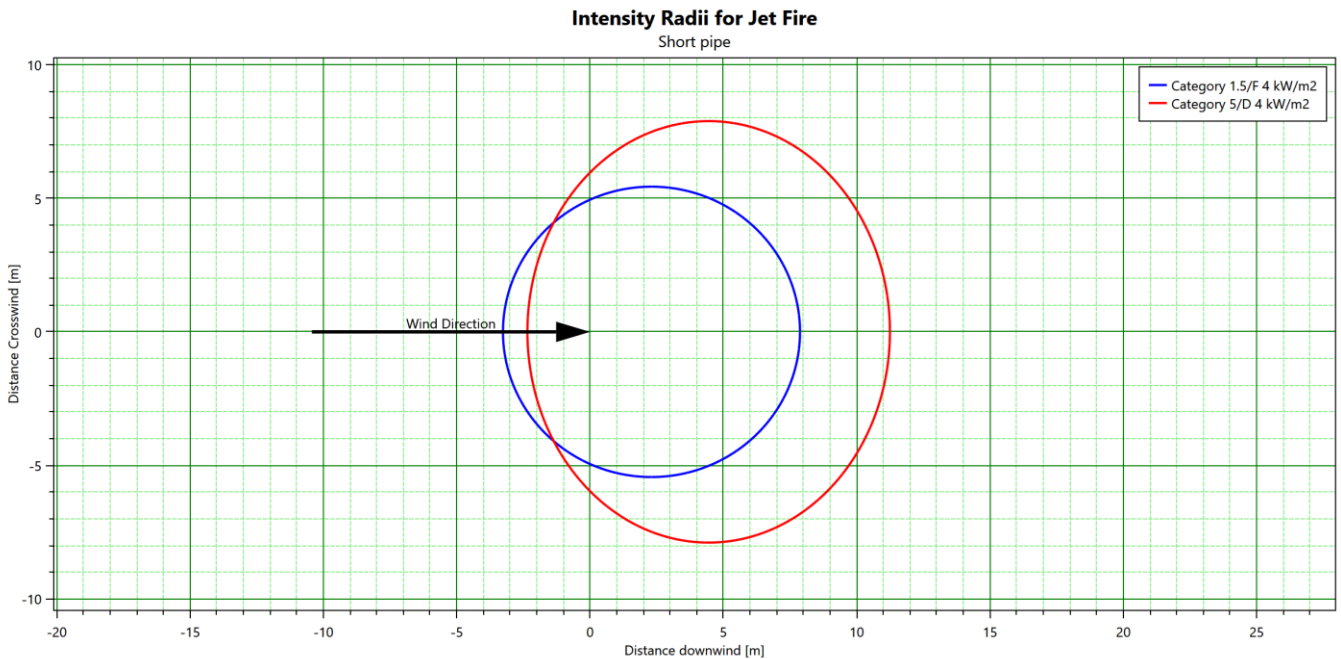


Figure 11 Gas flare jet fire intensity radii

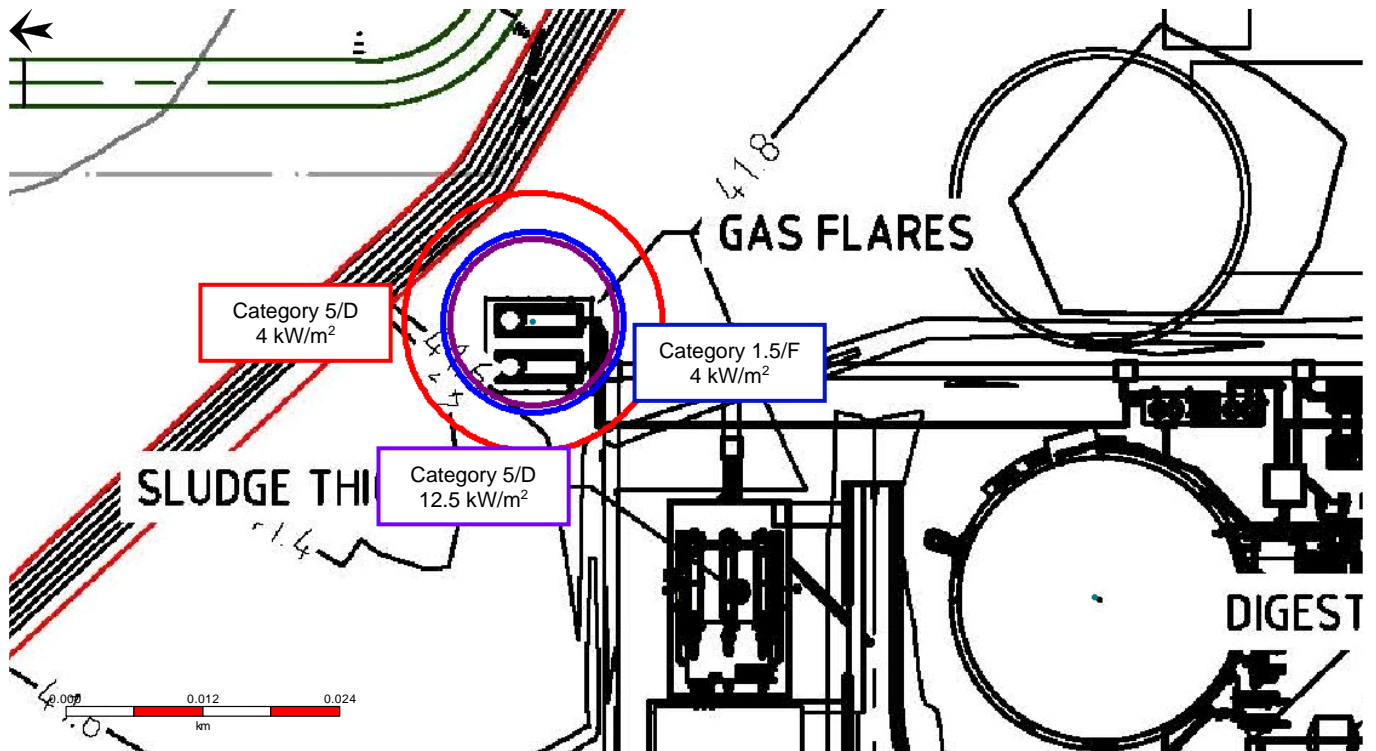


Figure 12 Gas flare intensity radii for jet fire contours

Figure 12 shows no offsite impact and an onsite heat radiation effect of 4 kW/m².

According to Table 11, this scenario has a high chance of injury, and a possible fatality for extended exposure, for individuals within 7 m of the gas flare when the fire occurs (i.e., within the 12.5 kW/m² contour).

Individuals within 11 m of the gas flare during a Category 5/D weather event may be exposed to 4 kW/m² of heat radiation. This is unlikely to result in a fatality.

Due to the small flammable mass produced from a gas flare flameout scenario (0.03 kg), it was determined that the consequence of a VCE from the gas flare would be insignificant. Hence, this scenario was not investigated further.

5. Likelihood analysis

The likelihood of the worst-case scenarios for onsite impacts resulting in a fatality or injury was calculated using an event tree. The assignment of the frequency and probability values has been made based on industry failure frequencies, specialist risk management judgement and the quantified consequences. The results of the likelihood analysis are shown in Table 15.

It is important to note that the determination of 'absolute values' for assigned probabilities is less important than consistently using 'comparative' or 'relative' values. The overall aim is to provide a ranking to compare with risk criteria.

Table 15 Onsite frequency results

	Event Tree	VCE	Reference
A	Frequency of pressure vessel release (per annum) (upper failure, conservative assumption)	6×10^{-6}	HSE UK failure rates (2017), page 18 [Ref. 13]
B	Probability of ignition	0.01	Conservative assumption for combustible gas
C	Frequency of VCE (per annum)	6×10^{-8}	Calculation (A x B)
D	Probability of person impacted/ present	1	Personnel present 24/7 as a conservative estimate
E	Probability impact results in fatality	0.2 (Onsite operators in immediate area impacted)	Based on consequence and relative location
F	Frequency of fatality (per annum)	1.2×10^{-8}	Calculation (C x D x E)

It was determined that the likelihood of a failure-on-demand of the gas flare resulting in a release of biogas will be incredibly low. Hence, no event tree was completed, although it is recommended that an exclusion zone be created within a 7 m radius of the gas flare (i.e. within the 12.5 kW/m² Category 5/D contour).

6. Risk assessment

Neither the gas holder VCE nor gas flare jet fire consequence effects contours extend beyond the site boundary. Therefore, offsite fatality risk for the AWRC facility is negligible, and deemed to be zero. Only onsite fatality risk is considered.

A summary of the compliance of all the events with the relevant risk criteria from HIPAP 4 is provided in Table 16. This assessment shows that the project will comply with the risk criteria. The risk of a fire or explosion event resulting in a fatality is remote.

Table 16 Risk criteria compliance

Event	Individual Fatality Risk	One Fatality every X Years	HIPAP Risk Criteria	Compliance
Explosion scenarios with fatality of offsite people	0.00	–	1.00×10^{-6}	Complies
Explosion scenarios with fatality of onsite personnel	1.2×10^{-8}	83,333,333	5.00×10^{-5}	Complies

7. Conclusions

The hazard analysis study demonstrates that the AWRC could be designed, constructed, and operated in a manner that will meet relevant regulations, standards, and policies.

Any changes to the assumption used in this report should result in a review of the hazard analysis and update as required.

7.1 Findings

The assessment showed that there was no off-site impact and that the risk complies to HIPAP 4 risk criteria. All risks identified can be managed to tolerable levels provided the recommendations identified are enacted (refer to Section 7.2).

7.2 Recommendations

As well as the implementation of the existing safeguards identified in the hazard identification process (Section 3.1), it is recommended to:

- Implement ongoing maintenance of all equipment associated with the AWRC facility
- An exclusion zone of 7 m around the digester gas flare whilst it is flaring has been added to design and noted in the drawings.
- Ensure and maintain appropriate separation distances between dangerous goods as per Table 7

8. References

1. NSW Government, *Upper South Creek Advanced Water Recycling Centre – Concept and Stage 1 Conditions of Approval*, Application no. SSI 8609189 (2022).
2. United States Environmental Protection Agency, *Carbon Dioxide as a Fire Suppressant: Examining the Risks* Report EPA430-R-00-002, Washington, DC: February 2000. Available at: <http://www.epa.gov/ozone/snap/fire/co2/co2report.html>.
3. Aurecon & ARUP, *Upper South Creek Advanced Water Recycling Centre Preliminary Hazard Analysis*. Issued June 2021.
4. NSW State Government, *Western Sydney Aerotropolis Plan*. September 2020. Available at: [https://shared-drupal-s3fs.s3-ap-southeast-2.amazonaws.com/master-test/fapub_pdf/00-Western+Sydney+Aerotropolis/00-Final+Planning+Package/Final+Documents/Western+Sydney+Aerotropolis+Plan+2020+\(Low+Res+Part+1+of+2\).pdf](https://shared-drupal-s3fs.s3-ap-southeast-2.amazonaws.com/master-test/fapub_pdf/00-Western+Sydney+Aerotropolis/00-Final+Planning+Package/Final+Documents/Western+Sydney+Aerotropolis+Plan+2020+(Low+Res+Part+1+of+2).pdf).
5. NSW Department of Planning, Industry and Environment (DPIE), *HIPAP No. 4 - Risk Criteria for Land Use Safety Planning*, 2011
6. NSW Department of Planning, Industry and Environment (DPIE), *HIPAP No. 6 - Guidelines for Hazard Analysis*, 2011.
7. NSW Department of Planning, Industry and Environment (DPIE), *Applying SEPP 33*, 2011.
8. NSW Department of Planning, Industry and Environment (DPIE), *Multi-level Risk Assessment*, 2011.
9. *AS 3780-2008: The storage and handling of corrosive substances*, 2008.
10. Sydney Water, *Upper South Creek Advanced Water Recycling Centre Environmental Impact Statement* (2021).
11. PHAST Version 8.3 – DNVGL
12. NSW Rural Fire Service, *Planning for Bush Fire Protection*, 2019.
13. HSE UK, *Failure rate and event data for use within risk assessments*, 2017
14. Johnston, C, *Hazardous Area Classification: Explosive atmospheres*. GHD and JACOBS DJV, 2023

Appendices

Appendix A

Safety data sheets

SULFURIC ACID

ChemWatch Review SDS

Chemwatch Hazard Alert Code: 4

Chemwatch: 1830

Version No: 15.1.1.1

Safety Data Sheet according to WHS and ADG requirements

Issue Date: 01/01/2013

Print Date: 14/02/2017

S.GHS.AUS.EN

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

Product Identifier

Product name	SULFURIC ACID
Chemical Name	sulfuric acid
Synonyms	Deltrex, H2SO4, Ikon Sulfuric Acid - 98%, 73%, 70%, 60%, Incitec substance 000304426401, Nordhausen acid, Pronalys BSPSL741, RIA00, Selby Sulphuric acid sp.gr. 1.84, Sulfuric Acid 52-98%, battery acid, black acid, dipping acid, electrolyte acid, hydrogen sulfate, hydrogen sulphate, oil of vitriol, smelter acid, sulphuric acid, vitriol brown oil
Proper shipping name	SULPHURIC ACID with more than 51% acid
Chemical formula	H2SO4
Other means of identification	Not Available
CAS number	7664-93-9

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

Relevant identified uses	The manufacture of superphosphate fertiliser, inorganic and petro-chemicals, explosives and pigments. Component of heavy duty metal cleaners, pickles. In manufacture of rayon, cellulose film. As battery electrolyte and also in electroplating processes.
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Details of the supplier of the safety data sheet

Registered company name	Wesfarmers (Wesfarmers CSBP)	Appendage 014	Incitec Pivot
Address	PO Box 345 Kwinana WA 6167 Australia	8 Abbott Road Seven Hills NSW 2147 Australia	70 Southbank Boulevard Melbourne VIC 3006 Australia
Telephone	+61 8 9411 8777	+61 02 9839 4000	+61 3 8695 4400
Fax	+61 8 9411 8289	+61 2 9674 6225	+61 3 8695 4419
Website	www.csbp.com.au	www.apschem.com.au	https://www.incitecpivot.com.au/MSDS.asp
Email	corporate@csbp.com.au	Not Available	jack.rohde@incitecpivot.com.au
Registered company name	Fisher Scientific (Biolab)	Appendage 004	Chemprod Nominees (TA Omega Chemicals) (Omega Chemicals)
Address	5 Caribbean Drive Scoresby VIC 3179 Australia	49-61 Stephen Road Botany NSW 2019 Australia	55 Fitzgerald Road Laverton North VIC 3026 Australia
Telephone	+61 3 9757 4300/1300 735 292	+61 2 9666 0331	+61 3 8368 8000
Fax	+61 3 9763 1169	+61 2 9700 1066	+61 3 8368 8020
Website	Not Available	https://www.nuplex.com.au	https://www.omegachem.com.au/product_list.php
Email	info@biolab.com.au	paulm@nuplex.com.au	info@omegachem.com.au
Registered company name	CA Group	Consolidated Chemical	See Sen Chemical Berhad
Address	32 Industrial Avenue Thomastown VIC 3074 Australia	52-62 Waterview Close Dandenong South VIC 3175 Australia	Lot PT 3940 Kaw. Perindustrian Teluk Kalong Kemaman 24000 Malaysia
Telephone	+61 3 9359 5811	+61 3 9799 7555	+603 986 32142/+603 986 3230
Fax	+61 3 9359 4076	+61 3 9799 7666	+603 986 32143
Website	www.cagroup.com.au	Not Available	Not Available
Email	jmarchese@cagroup.com.au	melb@conchem.com.au	Not Available
Registered company name	Sigma-Aldrich (Merck)		
Address	No 7, Jalan Pus 7/21, Bandar Sunway Pelaling Jaya Selangor D.E. 46150 Malaysia		
Telephone	+60 3 5635 3321		
Fax	+60 3 563 54116		
Website	www.sigma-aldrich.com		
Email	Not Available		

Emergency telephone number

Association / Organisation	Not Available	Not Available	Not Available
Emergency telephone numbers	Not Available	Not Available	Not Available

Other emergency telephone numbers	Not Available	Not Available	Not Available
Association / Organisation	Not Available	Not Available	Not Available
Emergency telephone numbers	Not Available	Not Available	Not Available
Other emergency telephone numbers	Not Available	Not Available	Not Available
Association / Organisation	(03) 8301 7100	Not Available	Not Available
Emergency telephone numbers	(03) 8301 7107 (Business hours 9am – 5pm)	1800 839 984	Not Available
Other emergency telephone numbers	0428 904 506 (After Hours)	Not Available	Not Available
Association / Organisation	Not Available		
Emergency telephone numbers	Not Available		
Other emergency telephone numbers	Not Available		

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

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


CHEMWATCH HAZARD RATINGS

	Min	Max	
Flammability	0		
Toxicity	3		
Body Contact	4		
Reactivity	2		
Chronic	4		

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

Poisons Schedule	S6 S3
Classification ^[1]	Metal Corrosion Category 1, Acute Toxicity (Inhalation) Category 2, Skin Corrosion/Irritation Category 1A, Serious Eye Damage Category 1, Carcinogenicity Category 1A
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	
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SIGNAL WORD	DANGER
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Hazard statement(s)

H290	May be corrosive to metals.
H330	Fatal if inhaled.
H314	Causes severe skin burns and eye damage.
H350	May cause cancer.

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P271	Use only outdoors or in a well-ventilated area.
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): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

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 in accordance with local regulations.
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SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

CAS No	%[weight]	Name
7664-93-9	>51	<u>sulfuric acid</u>
7732-18-5	remainder	<u>water</u>

Mixtures

See section above for composition of Substances

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact	<p>If this product comes in contact with the eyes:</p> <ul style="list-style-type: none"> ▶ 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	<p>If skin or hair contact occurs:</p> <ul style="list-style-type: none"> ▶ 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	<ul style="list-style-type: none"> ▶ 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. ▶ 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. <p>This must definitely be left to a doctor or person authorised by him/her. (ICSC13719)</p>
Ingestion	<ul style="list-style-type: none"> ▶ 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 desiccating 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.

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 conjunctival 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.
- ▶ Dry chemical powder.
- ▶ BCF (where regulations permit).

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.
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Advice for firefighters

Fire Fighting	<ul style="list-style-type: none"> ▶ Alert Fire Brigade and tell them location and nature of hazard. ▶ May be violently or explosively reactive. ▶ Wear full body protective clothing with breathing apparatus. ▶ Prevent, by any means available, spillage from entering drains or water courses.
Fire/Explosion Hazard	<ul style="list-style-type: none"> ▶ Non combustible. ▶ Not considered to be a significant fire risk. ▶ Acids may react with metals to produce hydrogen, a highly flammable and explosive gas. ▶ Heating may cause expansion or decomposition leading to violent rupture of containers. <p>Decomposition may produce toxic fumes of: , sulfur oxides (SOx)</p>
HAZCHEM	2P

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	<ul style="list-style-type: none"> ▶ 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. ▶ Clean up all spills immediately. ▶ Avoid breathing vapours and contact with skin and eyes. ▶ Control personal contact with the substance, by using protective equipment. ▶ Contain and absorb spill with sand, earth, inert material or vermiculite.
Major Spills	<ul style="list-style-type: none"> ▶ Clear area of personnel and move upwind. ▶ Alert Fire Brigade and tell them location and nature of hazard. ▶ May be violently or explosively reactive. ▶ Wear full body protective clothing with breathing apparatus.

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	<ul style="list-style-type: none"> ▶ DO NOT allow clothing wet with material to stay in contact with skin ▶ Avoid all personal contact, including inhalation. ▶ Wear protective clothing when risk of exposure occurs. ▶ Use in a well-ventilated area. ▶ WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
Other information	<ul style="list-style-type: none"> ▶ Store in original containers. ▶ Keep containers securely sealed. ▶ Store in a cool, dry, well-ventilated area. ▶ Store away from incompatible materials and foodstuff containers.

Conditions for safe storage, including any incompatibilities

Suitable container	<ul style="list-style-type: none"> ▶ DO NOT use aluminium or galvanised containers ▶ Check regularly for spills and leaks ▶ Lined metal can, lined metal pail/ can. ▶ Plastic pail. ▶ Polyliner drum. ▶ Packing as recommended by manufacturer. <p>For low viscosity materials</p> <ul style="list-style-type: none"> ▶ Drums and jerricans must be of the non-removable head type. ▶ Where a can is to be used as an inner package, the can must have a screwed enclosure. <p>For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.):</p> <ul style="list-style-type: none"> ▶ Removable head packaging; ▶ Cans with friction closures and ▶ low pressure tubes and cartridges <p>may be used.</p>
Storage incompatibility	<ul style="list-style-type: none"> ▶ Inorganic acids are generally soluble in water with the release of hydrogen ions. The resulting solutions have pH's of less than 7.0. ▶ Inorganic acids neutralise chemical bases (for example: amines and inorganic hydroxides) to form salts - neutralisation can generate dangerously large amounts of heat in small spaces.

SULFURIC ACID

- ▶ The dissolution of inorganic acids in water or the dilution of their concentrated solutions with additional water may generate significant heat.
 - ▶ 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
- Sulfuric acid :
- ▶ is a strong oxidiser
 - ▶ reacts with water or steam
 - ▶ reacts violently with many substances including reducing agents, combustible materials, organic substances, alkalis, ammonium tetraperoxochromate, aniline, 1,2-ethanediamine, ethanolamine, isoprene, mesityl oxide, endo-norbornedicarboxylic acid ethyl ester, perchlorates, sodium carbonate, zinc chloride
 - ▶ reacts, possibly causing ignition or explosion, with many substances, including non-oxidising mineral acids, organic acids, bases, reducing agents, acetic anhydride, acetone cyanohydrin, acetonitrile, acrolein, acrylates, acrylonitrile, alcohols, aldehydes, alkylene oxides, allyl alcohol, allyl chloride, substituted allyls, 2-aminoethanol, ammonium hydroxide, bromine pentafluoride, n-butylaldehyde, caprolactam solution, carbides, caesium acetylene carbide, chlorine trifluoride, chlorates, chlorosulfonic acid, cresols, cuprous nitride, diisobutylene, ethylene cyanohydrin, ethylene diamine, ethylene glycol, ethyleneimine, fulminates, glycols, hydrochloric acid, iodine heptafluoride, iron, isocyanates, ketones, lithium silicide, mercuric nitride, 2-methylacetonitrile, powdered metals, nitric acid, p-nitrotoluene, pentasilver trihydroxydiaminophosphate, perchloric acid, phenols, phosphorus, picrates, potassium chlorate, potassium permanganate, beta-propiolactone, propylene oxide, pyridine, rubidium acetylene, silver permanganate, sodium, sodium chlorate, sodium hydroxide, styrene monomer, zinc phosphide
 - ▶ increases the explosive sensitivity of nitromethane
 - ▶ incompatible with 2-amino-5-nitrothiazole, 2-aminothiazole, ammonia, aliphatic amines, alkanolamines, amides, organic anhydrides, isocyanate, vinyl acetate, alkylene oxides, epichlorohydrin
 - ▶ attacks some plastics, rubber and coatings
 - ▶ reacts with metals to produce flammable hydrogen gas

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

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	<p>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.</p> <p>The basic types of engineering controls are:</p> <p>Process controls which involve changing the way a job activity or process is done to reduce the risk.</p> <p>Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment.</p>
Personal protection	
Eye and face protection	<ul style="list-style-type: none"> ▶ 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. ▶ Full face shield (20 cm, 8 in minimum) may be required for supplementary but never for primary protection of eyes; these afford face protection. ▶ Alternatively a gas mask may replace splash goggles and face shields.
Skin protection	See Hand protection below
Hands/feet protection	<ul style="list-style-type: none"> ▶ Elbow length PVC gloves ▶ When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots. <p>The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.</p> <p>The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.</p> <p>Personal hygiene is a key element of effective hand care.</p>
Body protection	See Other protection below
Other protection	<ul style="list-style-type: none"> ▶ Overalls. ▶ PVC Apron. ▶ PVC protective suit may be required if exposure severe. ▶ Eyewash unit.
Thermal hazards	Not Available

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:

Respiratory protection

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

SULFURIC ACID

"Forsberg Clothing Performance Index".

The effect(s) of the following substance(s) are taken into account in the **computer-generated** selection:

SULFURIC ACID

Material	CPI
NATURAL RUBBER	A
NATURAL+NEOPRENE	A
NEOPRENE	A
NEOPRENE/NATURAL	A
NITRILE	A
PE	A
PVC	A
SARANEX-23	A

* 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.

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	Colourless, oily, dense, HIGHLY CORROSIVE liquid. Faint acid odour. Material is a powerful oxidising and dehydrating agent causing rapid human tissue destruction on contact. Concentrated acid is very exothermic (generates heat) when mixed with water.		
Physical state	Liquid	Relative density (Water = 1)	1.6-1.84 @ 15
Odour	Not Available	Partition coefficient n-octanol / water	Not Available
Odour threshold	Not Available	Auto-ignition temperature (°C)	Not Applicable
pH (as supplied)	0.9	Decomposition temperature	Not Available
Melting point / freezing point (°C)	3-10	Viscosity (cSt)	Not Available
Initial boiling point and boiling range (°C)	315-338	Molecular weight (g/mol)	98.07
Flash point (°C)	Not Applicable	Taste	Not Available
Evaporation rate	Non Vol. @ 38C	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)	0.133 @ 146C	Gas group	Not Available
Solubility in water (g/L)	Miscible	pH as a solution (1%)	1
Vapour density (Air = 1)	3.40	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	Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may produce toxic effects; these may be fatal. The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage. Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness.
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Continued...

SULFURIC ACID

	High concentrations cause inflamed airways and watery swelling of the lungs with oedema. Mists are highly irritating to eyes, mucous membranes and respiratory tract and high mist concentrations may lead to pulmonary oedema.
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. The material is not thought to produce adverse health effects following ingestion (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum.
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. Skin contact is not thought to produce harmful health effects (as classified under EC Directives using animal models). Systemic harm, however, has been identified following exposure of animals by at least one other route and the material may still produce health damage following entry through wounds, lesions or abrasions. 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. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected. Topical application of a 10% solution to skin on the scapula or waist produces only negligible evidence of irritation.
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. Mild burns of the epithelia generally recover rapidly and completely.
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. Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure. Strong inorganic acid mists containing sulfuric acid can cause cancer.

sulfuric acid	TOXICITY	IRRITATION
	Inhalation (guinea pig) LC50: 0.018 mg/L/8hr ^[2]	Eye (rabbit): 1.38 mg SEVERE
	Inhalation (mouse) LC50: 0.32 mg/L/2hr ^[2]	Eye (rabbit): 5 mg/30sec SEVERE
	Inhalation (rat) LC50: 0.51 mg/L/2hr ^[2]	
	Oral (rat) LD50: 2140 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 SDS. 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. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. WARNING: For inhalation exposure <u>ONLY</u> : This substance has been classified by the IARC as Group 1: CARCINOGENIC TO HUMANS
WATER	Occupational exposures to strong inorganic acid mists of sulfuric acid: No significant acute toxicological data identified in literature search.

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 available but does not fill the criteria for classification
✓ – Data available to make classification
⊘ – Data Not Available to make classification

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

Ingredient	Endpoint	Test Duration (hr)	Species	Value	Source
sulfuric acid	LC50	96	Fish	=8mg/L	1
sulfuric acid	EC50	48	Crustacea	=42.5mg/L	1
sulfuric acid	EC50	240	Algae or other aquatic plants	2.5000mg/L	4
sulfuric acid	NOEC	7200	Fish	0.13mg/L	2

Legend: Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data

Prevent, by any means available, spillage from entering drains or water courses.

For Sulfuric Acid:

Environmental Fate: Large discharges of sulfuric acid may contribute to the acidification of water and be fatal to aquatic life and soil micro-organisms, and may contribute to the acidification of effluent treatment systems and injure sewage treatment organisms. The substance will react violently with a variety of other chemicals, as well as water.

Atmospheric Fate: Sulfuric acid is removed from the air by dry/wet deposition. In the stratosphere, sulfuric acid aerosols have lifetimes of about 14 and 2.4 days, at altitudes of 15 and 20 km, respectively.

DO NOT discharge into sewer or waterways.

[Sulfuric acid is soluble in water and remains indefinitely in the environment as sulfate.]Large discharges may contribute to the acidification of water and be fatal to aquatic life and soil micro-organisms.[Large discharges may contribute to the acidification of effluent treatment systems and injure sewage treatment organisms. [ICI UK]

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	<ul style="list-style-type: none"> ▶ Containers may still present a chemical hazard/ danger when empty. ▶ Return to supplier for reuse/ recycling if possible. <p>Otherwise:</p> <ul style="list-style-type: none"> ▶ If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill. ▶ Where possible retain label warnings and SDS and observe all notices pertaining to the product. <p>Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.</p> <p>A Hierarchy of Controls seems to be common - the user should investigate:</p> <ul style="list-style-type: none"> ▶ Reduction ▶ Reuse ▶ Recycling ▶ Disposal (if all else fails) <p>This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use.</p> <ul style="list-style-type: none"> ▶ DO NOT allow wash water from cleaning or process equipment to enter drains. ▶ It may be necessary to collect all wash water for treatment before disposal. ▶ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ▶ Where in doubt contact the responsible authority. ▶ 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. ▶ Treat and neutralise at an approved treatment plant. Treatment should involve: Neutralisation with soda-ash or soda-lime followed by: burial in a land-fill specifically licensed to accept chemical and / or pharmaceutical wastes or Incineration in a licensed apparatus (after admixture with suitable combustible material).
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SECTION 14 TRANSPORT INFORMATION

Labels Required

	
Marine Pollutant	NO
HAZCHEM	2P

Land transport (ADG)

UN number	1830
UN proper shipping name	SULPHURIC ACID with more than 51% acid
Transport hazard class(es)	Class : 8 Subrisk : Not Applicable
Packing group	II
Environmental hazard	Not Applicable
Special precautions for user	Special provisions : Not Applicable Limited quantity : 1 L

Air transport (ICAO-IATA / DGR)

UN number	1830	
UN proper shipping name	Sulphuric acid with more than 51% acid	
Transport hazard class(es)	ICAO/IATA Class	8
	ICAO / IATA Subrisk	Not Applicable
	ERG Code	8L
Packing group	II	
Environmental hazard	Not Applicable	
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	
UN proper shipping name	SULPHURIC ACID with more than 51% acid	
Transport hazard class(es)	IMDG Class	8
	IMDG Subrisk	Not Applicable
Packing group	II	
Environmental hazard	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 and the IBC code

Source	Product name	Pollution Category	Ship Type
IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk	Sulphuric acid	Y	3

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

The 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. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

Definitions and abbreviations

PC – TWA: Permissible Concentration-Time Weighted Average
PC – STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit,
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index

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Infosafe No™	1CH6G	Issue Date : May 2018	RE-ISSUED by CHEMSUPP
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Product Name : **SODIUM HYPOCHLORITE Solution 8 -12.5% avail. Chlorine**

Classified as hazardous

1. Identification

GHS Product Identifier SODIUM HYPOCHLORITE Solution 8 -12.5% avail. Chlorine

Company Name CHEM-SUPPLY PTY LTD (ABN 19 008 264 211)

Address 38 - 50 Bedford Street GILLMAN
SA 5013 Australia

Telephone/Fax Number Tel: (08) 8440-2000
Fax: (08) 8440-2001

Recommended use of the chemical and restrictions on use Bleaching agent, water purification, pharmaceuticals, fungicides, household bleach, intermediate, organic chemicals, swimming pool disinfectant, laundering, germicide and laboratory reagent.

Other Names	Name	Product Code
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Pool chlorine, Dakins solution		
SODIUM HYPOCHLORITE Solution 8 -12.5% avail. Chlorine		ST044

Other Information EMERGENCY CONTACT NUMBER: +61 08 8440 2000
Business hours: 8:30am to 5:00pm, Monday to Friday.

Chem-Supply Pty Ltd does not warrant that this product is suitable for any use or purpose. The user must ascertain the suitability of the product before use or application intended purpose. Preliminary testing of the product before use or application is recommended. Any reliance or purported reliance upon Chem-Supply Pty Ltd with respect to any skill or judgement or advice in relation to the suitability of this product of any purpose is disclaimed. Except to the extent prohibited at law, any condition implied by any statute as to the merchantable quality of this product or fitness for any purpose is hereby excluded. This product is not sold by description. Where the provisions of Part V, Division 2 of the Trade Practices Act apply, the liability of Chem-Supply Pty Ltd is limited to the replacement of supply of equivalent goods or payment of the cost of replacing the goods or acquiring equivalent goods.

2. Hazard Identification

GHS classification of the substance/mixture Skin Corrosion/Irritation: Category 1B
Specific target Organ Toxicity - Single Exposure Category 3 (respiratory tract irritation)
Hazardous to the Aquatic Environment - Acute Hazard: Category 1

Signal Word (s) DANGER

Hazard Statement (s) H314 Causes severe skin burns and eye damage.
H335 May cause respiratory irritation.
H400 Very toxic to aquatic life.

Pictogram (s) AUH031 Contact with acids liberates toxic gas
Corrosion, Environment, Exclamation mark



Precautionary statement – Prevention P260 Do not breathe dust/fume/gas/mist/vapours/spray.
P264 Wash thoroughly after handling.
P273 Avoid release to the environment.

Precautionary statement – Response P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P301+P330+P331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303+P361+P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.

Precautionary statement – Storage P363 Wash contaminated clothing before reuse.
P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P310 Immediately call a POISON CENTER or doctor/physician.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P405 Store locked up.



Infosafe No™	1CH6G	Issue Date : May 2018	RE-ISSUED by CHEMSUPP
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Product Name : **SODIUM HYPOCHLORITE Solution 8 -12.5% avail. Chlorine**

Classified as hazardous

Precautionary statement – Disposal P501 Dispose of contents/container to an approved waste disposal plant.

3. Composition/information on ingredients

Chemical Characterization	Liquid				
Ingredients	<u>Name</u>	<u>CAS</u>	<u>Proportion</u>	<u>Hazard Symbol</u>	<u>Risk Phrase</u>
	Water	7732-18-5	87.5-92 %		
	Sodium Hypochlorite	7681-52-9	8-12.5 %	C	R31, R34

4. First-aid measures

Inhalation	If inhaled, remove from contaminated area to fresh air immediately. Apply artificial respiration if not breathing. If breathing is difficult, give oxygen. Consult a physician.
Ingestion	Rinse mouth thoroughly with water immediately, repeat until all traces of product have been removed. DO NOT INDUCE VOMITING. Seek immediate medical advice.
Skin	If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. Wash clothing before reuse. Decontaminate clothing, shoes and leather goods before re-use, or discard. Seek medical attention.
Eye contact	If in eyes, hold eyelids apart and flush the eye continuously with running water. Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. Seek immediate medical assistance.
First Aid Facilities	Maintain eyewash fountain and drench facilities in work area.
Advice to Doctor	Treat symptomatically and supportively. Consider oral administration of sodium thiosulfate solutions if sodium hypochlorite is ingested. Do not administer neutralizing substances (e.g., acid antidotes) since the resultant exothermic reaction could further damage tissue. Sodium thiosulphate immediately reduces hypochlorite to non toxic products but may produce hydrogen sulphide in contact with acids. Endotracheal intubation could be needed if glottic oedema compromises the airway. For individuals with significant inhalation exposure, monitor arterial blood gases and chest x-ray. Symptoms of pulmonary oedema can be delayed up to 48 hours after exposure.
Protection for First Aiders	No action shall be taken involving any personal risk or without suitable training. Take proper precautions to ensure your own safety before attempting rescue; (e.g. wear appropriate protective equipment, use the 'buddy' system.) Can release corrosive chlorine gas. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Avoid mouth-to-mouth contact by using mouth guards or shields. Wash contaminated clothing thoroughly with water before removing or wear gloves.
Other Information	For advice, contact a Poisons Information Centre (Phone eg Australia 13 1126; New Zealand 0800 764 766) or a doctor.

5. Fire-fighting measures

Hazards from Combustion Products	Dangerous, corrosive, irritating, toxic and/or hazardous combustion fumes, vapours, or gases including chlorine gas (above 35 °C, or when mixed with chemicals (e.g. ammonia, acids, detergents, etc.) or organic matter (e.g. urine, faeces, etc.)), hydrogen chloride gas (HCl), hydrochloric acid, sodium chlorate, oxygen gas (when exposed to sunlight), chloramine gas (when mixed with ammonia), flammable hydrogen gas (upon contact with metals) and sodium oxide (Na ₂ O) (at high temperatures).
Specific Methods	Use extinguishing media most appropriate for the surrounding fire. This product contains a substantial proportion of water therefore there are no restrictions on the type of extinguishing media which may be used.
Specific hazards arising from the chemical	Material does not burn. Fire or heat will produce irritating, poisonous and/or corrosive gases. Containers may explode when heated.
Hazchem Code	2X
Decomposition Temp.	> 35 °C; 96 - 120 °C at 1013 hPa (boiling point).
Precautions in connection with Fire	Wear SCBA and chemical splash suit. Fully-encapsulating, gas-tight suits should be worn for maximum protection. Structural firefighter's uniform is NOT effective for these materials.

6. Accidental release measures



Infosafe No™	1CH6G	Issue Date : May 2018	RE-ISSUED by CHEMSUPP
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Product Name : **SODIUM HYPOCHLORITE Solution 8 -12.5% avail. Chlorine**

Classified as hazardous

Personal Precautions	Evacuate the area of all non-essential personnel. Do not breathe fumes, vapour, gas. Avoid inhalation, contact with skin, eyes and clothing.
Personal Protection	Wear protective clothing specified for normal operations (see Section 8)
Clean-up Methods - Small Spillages	Absorb or contain liquid with sand, earth or spill control material. Shovel up using non sparking tools and place in a labelled, sealable container for subsequent safe disposal. Put leaking containers in a labelled drum or overdrum. The flush area with a large quantity of water.
Environmental Precautions	Prevent from spreading or entering into drains, ditches or rivers by using sand, earth, or other appropriate barriers.

7. Handling and storage

Precautions for Safe Handling	Avoid ingestion and inhalation of vapour (or) spray mist. Avoid contact with eyes, skin, or clothing. Avoid prolonged or repeated exposure. Ensure adequate ventilation when using. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Wear appropriate protective equipment and clothing. Wash hands after use. It is essential that all who come into contact with this material, maintain high standards of personal hygiene i.e. washing hands prior to eating, drinking, smoking or going to the toilet. Do not mix with other chemicals. Do not mix with different types of chlorinating chemicals. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, metals, acids. Limited shelf life.
Conditions for safe storage, including any incompatibilities	Corrosives area. Store under cover in a suitable, light-resistant, labelled, tightly closed containers, in a dry, clean, cool, well ventilated place away from sunlight. Cannot be stored indefinitely. May decompose forming gaseous products, especially when stored over long periods. Store and transport in an upright container. Close containers in such a way to enable internal pressure to escape (e.g. excess pressure valve). Store away from incompatible materials. Do not mix with other chemicals. Do not mix with different types of chlorinating chemicals. Store away from flammable, combustible and reducing substances, acids, alkalies, food and feedstuffs. Store away from sources of heat or ignition. Vent caps should be checked with full personal protection. Containers of this material may be hazardous when empty since they retain product residues (vapours, liquid); observe all warnings and precautions listed for the product.
Corrosiveness	Corrosivity to Metals: Sodium hypochlorite solutions (20%) are corrosive to brass (aluminium, naval and silicon) bronze, carbon steel, cast iron, Hastelloy, Inconel, nickel, stainless steels (types 304/347, 316 and 400 series) and silicon copper. Concentrated sodium hypochlorite is corrosive to most metals, including aluminium, copper, brass, bronze, carbon steel, Hastelloy, Inconel, lead, Monel, nickel and stainless steel type 400 series. Sodium hypochlorite solutions are not corrosive to tantalum, titanium and zirconium. Dilute solutions are not corrosive to Hastelloy C/C-276 (10%), Incolloy (5%) and high silicon iron. Corrosivity to Non-Metals: Sodium hypochlorite solutions attack some plastics (such as nylon, Bisphenol A-fumarate and isophthalic polyesters), elastomers (such as soft rubber, neoprene and nitrile Buna-N) and coatings (such as coal tar epoxy, epoxy and vinyls). Sodium hypochlorite solutions do not attack acrylonitrile-butadiene-styrene (ABS), Butyl rubber, isoprene, hard rubber, natural rubber, polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polyethylene, polypropylene, polystyrene, Teflon and Viton.
Storage Regulations	Refer Australian Standard AS 3780-1994 'The storage and handling of corrosive substances'.
Storage Temperatures	Below 25°C.
Unsuitable Materials	Metal, ceramic and glass containers.

8. Exposure controls/personal protection

Other Exposure Information	A time weighted average (TWA) has been established for Chlorine (Safe Work Australia) of 3 mg/m ³ (Peak limitation), (1 ppm). 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. Peak Limitation - a ceiling concentration which should not be exceeded over a measurement period which should be as short as possible but not exceeding 15 minutes.
Appropriate engineering controls	Provide sufficient ventilation to ensure that the working environment is below the TWA (time weighted average). Where vapours or mists are generated, particularly in enclosed areas, and natural ventilation is inadequate, a flame proof exhaust ventilation system is required. Refer to AS 1940-The storage and handling of flammable and combustible liquids and AS 2430-Explosive gas atmospheres for further information concerning ventilation requirements.
Respiratory Protection	Where ventilation is not adequate, respiratory protection may be required. Avoid breathing vapours or mists. Select and use respirators in accordance with AS 1716 - Respiratory Protective Devices and be selected in accordance with AS 1715 - Selection, Use and Maintenance of Respiratory Protective



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Product Name : **SODIUM HYPOCHLORITE Solution 8 -12.5% avail. Chlorine**

Classified as hazardous

Eye Protection	Devices. When mists or vapours exceed the exposure standards then the use of the following is recommended: Approved respirator with organic vapour and dust/mist filters. Filter capacity and respirator type depends on exposure levels.
Hand Protection	The use of a face shield, chemical goggles or safety glasses with side shield protection as appropriate. Must comply with Australian Standards AS 1337 and be selected and used in accordance with AS 1336.
Footwear	Hand protection should comply with AS 2161, Occupational protective gloves - Selection, use and maintenance. Recommendation: Excellent: Vinyl gloves. Good: Nitrile rubber gloves Fair: NR latex and neoprene.
Body Protection	Safety boots in industrial situations is advisory, foot protection should comply with AS 2210, Occupational protective footwear - Guide to selection, care and use.
Hygiene Measures	Flame retardant antistatic protective clothing. Clean clothing or protective clothing should be worn, preferably with an apron. Clothing for protection against chemicals should comply with AS 3765 Clothing for Protection Against Hazardous Chemicals.
	Always wash hands before smoking, eating or using the toilet. Wash contaminated clothing and other protective equipment before storing or re-using.

9. Physical and chemical properties

Form	Liquid
Appearance	Clear, pale yellow or greenish liquid.
Odour	Characteristic, pungent, chlorine-like (bleach) odour; disagreeable, sweetish odour.
Decomposition Temperature	> 35 °C; 96 - 120 °C at 1013 hPa (boiling point).
Melting Point	-6 °C (5% solution); -25 °C approx. (12% solution).
Boiling Point	96 - 120 °C at 1013 hPa (decomposition).
Solubility in Water	Miscible (soluble) in all proportions.
Solubility in Organic Solvents	Reacts with many organic solvents.
Specific Gravity	Approx. 1.1 (6% aqueous solution); 1.21 (14% aqueous solution) (water = 1).
pH	Approx. 13 (Alkaline).
Vapour Pressure	17.4 - 25 hPa at 20 °C.
Evaporation Rate	Not available; probably very low.
Odour Threshold	Not applicable. Odour is due to breakdown products such as chlorine.
Partition Coefficient: n-octanol/water	Log P(oct) = -3.42 (estimated).
Flammability	Non combustible material.
Explosion Properties	Slightly explosive in presence of heat. Explosive decomposition may occur under fire conditions and closed containers may rupture violently due to rapid decomposition, if exposed to fire or excessive heat for a sufficient period of time. The anhydrous solid obtained by dessication of the sodium hypochlorite pentahydrate will decompose violently on heating or friction. May react to form normal chloroamines, which are explosive. Interaction with ethyleneimine gives the explosive N-chloro compound. Removal of formic acid from industrial waste streams with sodium hypochlorite solution becomes explosive at 55 °C. Several explosions involving methanol and sodium hypochlorite were attributed to formation of methyl hypochlorite, especially in presence of acid or other esterification catalyst. Use of sodium hypochlorite solution to destroy acidified benzyl cyanide residues caused a violent explosion, thought to have been due to formation of nitrogen trichloride. Containers may rupture from pressure build-up.
Molecular Weight	74.44
Oxidising Properties	Sodium hypochlorite solutions give off oxygen when heated or when exposed to sunlight. However, the amount is small and will not cause or contribute to combustion. The solutions are, therefore, not considered to be oxidizing agents.
Dynamic Viscosity	2.6 mPas (20 °C).

10. Stability and reactivity

Chemical Stability	Sodium hypochlorite solutions decompose slowly on contact with carbon dioxide from air at normal temperatures releasing low concentrations of corrosive chlorine gas. Decomposition is influenced by temperature, concentration, pH, ionic strength, exposure to light and the presence of metals, such as copper, nickel or cobalt, metal oxides, e.g. rust and other impurities, such as acids and amines. Shelf life
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Classified as hazardous

Conditions to Avoid	is limited. Exposure to light, air or heat, acidic conditions, the presence of combustible materials, metals and other impurities and incompatible materials.
Incompatible Materials	Primary amines (e.g. ethylamine) and aromatic amines (e.g. aniline); ammonium salts (e.g. ammonium sulfate and ammonium nitrate), ammonia, urea or phenylacetonitrile if acid is present; acids (especially hydrochloric acid); metals (especially copper, nickel and cobalt); reducing agents (e.g. hydrides, such as lithium aluminium hydride); ethyleneimine (aziridine); methanol, especially in the presence of acids or other etherification catalysts; formic acid (at 55 °C); furfuraldehyde; ethanediol (ethylene glycol); sodium ethylenediaminetetracetate (EDTA) solution and sodium hydroxide solution + mixing.
Hazardous Decomposition Products	Dangerous, corrosive, irritating, toxic and/or hazardous combustion fumes, vapours, or gases including chlorine gas (above 35 °C, or when mixed with chemicals (e.g. ammonia, acids, detergents, etc.) or organic matter (e.g. urine, faeces, etc.)), hydrogen chloride gas (HCl), hydrochloric acid, sodium chlorate, oxygen gas (when exposed to sunlight), chloramine gas (when mixed with ammonia), flammable hydrogen gas (upon contact with metals) and sodium oxide (Na ₂ O) (at high temperatures).
Possibility of hazardous reactions	Reaction with primary amines (e.g. ethylamine) and aromatic amines (e.g. aniline) forms explosively unstable N-mono- or di- chloramines. Reaction with ammonium salts (e.g. ammonium sulfate and ammonium nitrate), ammonia, urea or phenylacetonitrile forms explosive nitrogen trichloride, if acid is present. Contact with acids (especially hydrochloric acid) releases toxic and corrosive chlorine gas. Reactions with reducing agents (e.g. hydrides, such as lithium aluminium hydride) are violent. Reactions with ethyleneimine (aziridine) form the explosive N- chloroethyleneimine. Reactions with methanol can form explosive methyl hypochlorite, especially in the presence of acids or other etherification catalysts. Reactions with formic acid become explosive at 55 °C. Dropwise addition of the furfuraldehyde to a 10% excess of sodium hypochlorite solution at 20-25 °C can lead to a violent explosion. Reaction with ethanediol (ethylene glycol) is explosively violent after an induction period of about 4 to 8 minutes. Reaction with sodium ethylenediaminetetracetate (EDTA) solution and sodium hydroxide solution with mixing leads to vigorous foaming decomposition.
Hazardous Polymerization	Will not occur.

11. Toxicological Information

Ingestion	Ingestion can cause irritation, pain and inflammation of the mouth, throat and stomach, as well as vomiting. In severe cases, serious effects including nausea, vomiting, choking, coughing, haemorrhage, oedema of the pharynx, glottis, larynx with stridor and obstruction, ulceration and perforation of the gastrointestinal tract, with mediastinitis or peritonitis, circulatory collapse, confusion, coma and possible death. Risk of aspiration! The amount ingested, the concentration and pH of the solution affect the severity of the symptoms. As little as 30 mL of a solution with 15% available chlorine may be lethal. Ingestion is not a typical route of occupational exposure.
Inhalation	Excessive inhalation of vapours, mists, or fumes, especially if the pH is lowered, if the solution is heated or if mixed with acids, resulting in the release of hazardous concentrations of chlorine, may cause irritations of the mucous membranes of the nose, throat and lungs, burning sensation, coughing, wheezing, dyspnoea, shortness of breath, sore throat, laryngitis, headache, nausea, vomiting, pulmonary oedema, pneumonitis and emphysema. Symptoms may be delayed. Additional effects have included circulatory collapse and confusion, delirium, coma, and even death.
Skin	May cause severe irritation or skin burns depending on the duration of contact, the concentration and pH of the solution. Contact with skin may also cause redness, itching, severe pain, vesicular eruptions and eczematoid dermatitis which becomes evident upon re-exposure.
Eye	Contact may cause severe irritation and corrosive injury, especially at higher concentration. May cause stinging, blurring, tearing, severe pain and possible permanent corneal damage. Risk of blindness! Heating or mixing with acids can cause significant concentrations of chlorine gas (a severe eye irritant) to be released. Chlorine concentrations of 1 ppm and higher have reportedly caused stinging, a burning sensation, rapid blinking, redness and watering of the eyes.
Carcinogenicity	Hypochlorite salts are evaluated in the IARC Monographs (Vol. 52; 1991) as Group 3: Not classifiable as to carcinogenicity to humans.
Chronic Effects	Prolonged or repeated inhalation may cause allergic respiratory reaction (asthma). Prolonged or repeated skin contact may cause redness, dryness, blistering, cracking, irritation, with possible dermatitis following. Prolonged or repeated eye contact may cause conjunctivitis.

12. Ecological information

Ecotoxicity	Forms corrosive mixtures with water even if diluted. Highly toxic for aquatic organisms. Harmful effect due to pH shift.
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Product Name : **SODIUM HYPOCHLORITE Solution 8 -12.5% avail. Chlorine**

Classified as hazardous

Persistence and degradability Methods for the determination of biodegradability are not applicable to inorganic substances.**Environmental Protection** Do not allow to enter waters, waste water, or soil!**13. Disposal considerations****Disposal Considerations** Whatever cannot be saved for recovery or recycling should be disposed of according to relevant local, state and federal government regulations.**14. Transport information****Transport Information** Dangerous goods of Class 8 (Corrosive) are incompatible in a placard load with any of the following: Class 1, Class 4.3, Class 5, Class 6, if the Class 6 dangerous goods are cyanides and the Class 8 dangerous goods are acids, Class 7; and are incompatible with food and food packaging in any quantity.**U.N. Number** 1791**UN proper shipping name** HYPOCHLORITE SOLUTION**Transport hazard class(es)** 8**Hazchem Code** 2X**Packaging Method** 3.8.8RT7,RT8**Packing Group** III**EPG Number** 8A1**IERG Number** 37**15. Regulatory information****Regulatory Information** Listed in the Australian Inventory of Chemical Substances (AICS).**Poisons Schedule** S5**16. Other Information****Literature References** 'Standard for the Uniform Scheduling of Medicines and Poisons .', Commonwealth of Australia.
Lewis, Richard J. Sr. 'Hawley's Condensed Chemical Dictionary 13th. Ed.', Rev., John Wiley and Sons, Inc., NY, 1997.
National Road Transport Commission, 'Australian Code for the Transport of Dangerous Goods by Road and Rail 7th. Ed.', 2007.
Safe Work Australia, 'National Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals', 2011.
Standards Australia, 'SAA/SNZ HB 76:2010 Dangerous Goods - Initial Emergency Response Guide', Standards Australia/Standards New Zealand, 2010.
Safe Work Australia, 'Approved Criteria for Classifying Hazardous Substances [NOHSC:1008 (2004)]'.
Safe Work Australia, 'Hazardous Substances Information System, 2005'.
Safe Work Australia, 'National Code of Practice for the Labelling of Safe Work Hazardous Substances (2011)'.
Safe Work Australia, 'National Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003(1995) 3rd Edition]'.**Contact****Person/Point**Paul McCarthy Ph. (08) 8440 2000 **DISCLAIMER STATEMENT:**

All information provided in this data sheet or by our technical representatives is compiled from the best knowledge available to us. However, since data, safety standards and government regulations are subject to change and the conditions of handling and use, or misuse, are beyond our control, we make no warranty either expressed or implied, with respect to the completeness or accuracy to the information contained herein. Chem-Supply accepts no responsibility whatsoever for its accuracy or for any results that may be obtained by customers from using the data and disclaims all liability for reliance on information provided in this data sheet or by our technical representatives.

Empirical Formula & Structural Formula NaOCl

...End Of MSDS...



chem-supply

Safety Data Sheet

infosafe
CS: 1.7.2

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Product Name : **SODIUM HYPOCHLORITE Solution 8 -12.5% avail. Chlorine**

Classified as hazardous

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SAFETY DATA SHEET



1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name: SODIUM HYDROXIDE 46% w/w LC585

Synonyms: UN 1824, SODIUM HYDROXIDE SOLUTION (contains sodium hydroxide)

Use: Cleaning, degreasing and raising pH.

Supplier: Advance Chemicals

ABN: 61 005 625 025

Street Address: 4 – 8 Malton Court, Altona, 3018

Telephone Number: (03) 9398 4444

Facsimile: (03) 9398 5278

Emergency Telephone: Ted Powell (03) 9398 4444 (Business Hours)
0425 800 022 (After Hours)

2. HAZARDS IDENTIFICATION

Classified as hazardous according to criteria of the Globally Harmonised System of Classification and Labelling of Chemicals 3rd Revised Edition.

Hazard Classification: HAZARDOUS SUBSTANCE, DANGEROUS GOODS.

Classification of the substance or mixture:

Skin Corrosion – Sub - category 1A

SIGNAL WORD: DANGER



Hazard Statement(s):

H314 – Causes severe skin burns and eye damage.

Precautionary Statement(s):

Prevention:

P260 – Do not breathe mist/vapour/spray

P264 – Wash hands thoroughly after handling

P280 - Wear protective gloves/eye protection/ face protection.

SAFETY DATA SHEET



Response:

P301 + P3330 +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
P321 – Specific treatment (see First Aid Measures on Safety Data Sheet)
P304 + P340 – IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312 – Call a POISON CENTRE or doctor/physician if you feel unwell
P305 + P351 + P338 – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Storage:

P405 – Store in a well-ventilated place. Keep cool.

Disposal:

P501: Dispose of contents/container in accordance with local waste management authority.

Poisons Schedule (Australia): 6

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Entity	C.A.S. No.	Proportion	Risk phrases
Sodium Hydroxide	1310-73-2	30 – 60%	H314
Water	7732-18-5	To 100%	

4. FIRST AID MEASURES

Inhalation: Remove victim to fresh air. Avoid becoming a casualty. Allow patient to assume most comfortable position and keep warm. Apply artificial respiration if person is not breathing. Seek medical attention.

Skin Contact: Remove contaminated clothing and wash affected areas with plenty of water. Wash contaminated clothing before re-use. Seek medical attention if irritation occurs.

Eye Contact: Eyelids to be held open. Wash continuously with water for at least 15 minutes. Seek medical attention.

Ingestion: Rinse mouth with water. Give water to drink. Do NOT induce vomiting. If vomiting occurs give further water to achieve effective dilution. Seek medical attention.

Notes to Doctor: Treat symptomatically as a strong alkaline corrosive material.

SAFETY DATA SHEET



5. FIRE FIGHTING MEASURES

Specific Hazards: Reaction with metals will produce flammable hydrogen gas.

Fire fighting advice: Fire fighters must wear self contained breathing apparatus if risk of exposure to product of combustion or decomposition. Water spray may be used to keep other containers cool.

Fire Extinguishing Media: Water Fog (or if unavailable, fine water spray), Foam, or Dry Agent (carbon dioxide, dry chemical powder).

Hazchem Code: 2R.

Flammability: Non combustible liquid.

6. ACCIDENTAL RELEASE MEASURES

Prevent product from entering drains and waterways. Use absorbent such as sand, soil or other inert material. Collect and seal in properly labelled drums for disposal to an Approved Trade Waste Facility.

7. HANDLING AND STORAGE

Handling advice: Wear appropriate protective equipment and clothing to prevent inhalation, skin and eye contact. Use in designated areas with adequate ventilation. Ensure a high level of personal hygiene is maintained when using this product. Always wash hands before eating, drinking, smoking or using the toilet.

Storage advice: Store in a cool, dry place away from direct sunlight. Store in a well ventilated area. Keep containers closed when not in use. Store away from oxidising agents, acids, aluminium, zinc, tin and ammonium salts.

8. EXPOSURE CONTROLS/ PERSONAL PROTECTION

Occupational Exposure Limits: TWA (sodium hydroxide) = 2 mg/m³.

Engineering Controls: Maintain air concentrations below recommended exposure standards. Avoid generating and inhaling mists and vapours. Keep containers closed when not in use.

Personal Protection Equipment: Wear safety goggles/glasses, chemically resistant P.V.C or nitrile gloves, protective clothing and protective footwear. If mists and vapours exist, wear a particulate/mist type respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716.

SAFETY DATA SHEET

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Water white to slightly opaque coloured liquid.

Boiling Point: 140°C

Melting Point: 12°C

Flash Point: Not Applicable.

Vapour Pressure: Not available.

Vapour Density (Air = 1): >1.

Flammability Limits: Not applicable.

Specific Gravity: 1.48 – 1.52

pH (neat): 14

Solubility in water: Soluble in water.

Corrosiveness: Corrosive.

10. STABILITY AND REACTIVITY

Stability: Stable when stored under normal conditions. Corrosive to aluminium, zinc, and tin. Reacts violently with acids and ammonium salts. Absorbs carbon dioxide from the air.

11. TOXICOLOGICAL INFORMATION

Acute Health Effects:

Ingested: Swallowing can result in nausea, vomiting, diarrhoea, abdominal pain, swelling of the larynx and subsequent suffocating, perforation of the gastrointestinal tract, cardiovascular collapse and coma.

Eye: Corrosive to the eyes; contamination of eye can cause corneal burns and result in permanent injury.

Skin: Contact with skin may cause skin burns and will result in severe irritation. Repeated or prolonged skin contact may lead to irritant contact dermatitis. Corrosive to skin.

Inhaled: Inhalation of mists will result in respiratory irritation and possible harmful corrosive effects including lesions of the nasal septum, pulmonary oedema, pneumonitis, and emphysema.

Chronic: Chronic effects are unlikely due to severity of acute effects.

12. ECOLOGICAL INFORMATION

Avoid contaminating waterways.

SAFETY DATA SHEET

13. DISPOSAL CONSIDERATIONS

Refer to Waste Management Authority.

14. TRANSPORT INFORMATION

UN Number: 1824

Proper Shipping Name: SODIUM HYDROXIDE SOLUTION (contains sodium hydroxide)

Dangerous Goods Class: 8

Subsidiary risk: N/A

Packing Group: II

Hazchem Code: 2R

Road and Rail Transport: Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code for transport by road and rail.



15. REGULATORY INFORMATION

Classified as hazardous according to criteria of the Globally Harmonised System of Classification and Labelling of Chemicals 3rd Revised Edition.

Hazard Classification: HAZARDOUS SUBSTANCE, DANGEROUS GOODS.

Classification of the substance or mixture:

Skin Corrosion – Sub - category 1A

SIGNAL WORD: DANGER



SAFETY DATA SHEET

Hazard Statement(s):

H314 – Causes severe skin burns and eye damage.

Poisons Schedule: 6

16. OTHER INFORMATION

This S.D.S. is valid for 5 years from the date of issue but may be withdrawn and revised anytime prior to that date. Please ensure that you are using the latest issue.

All information contained in this Safety Data Sheet is as accurate and up-to-date as possible. Since ADVANCE CHEMICALS cannot anticipate or control the conditions under which this information can be used, each user must review this information in the specific context of the intended application.

ADVANCE CHEMICALS will not be responsible for any damage or loss of any nature resulting from the use of or reliance upon this information. No expressed or implied warranties are given other than those mandated by Commonwealth, State or Territory legislation.

Issue date: December, 2020

ABBREVIATIONS:

AS/NZS	Australian Standards/New Zealand Standards
N/A	Not Applicable
PVC	Polyvinyl Chloride
TWA	Time Weighted Average
w/w	Weight/Weight

1. IDENTIFICATION

Product Name	Sodium Bisulphite Solution (>=25-50%)
Other Names	No Data Available
Uses	Oxygen scavenging and dechlorination; used in making paper and leather; food preservative; dye and chemical production.
Chemical Family	No Data Available
Chemical Formula	NaHSO ₃
Chemical Name	Sodium bisulphite solution (>=25-50%)
Product Description	No Data Available

Contact Details of the Supplier of this Safety Data Sheet

Organisation	Location	Telephone
Redox Ltd	2 Swettenham Road Minto NSW 2566 Australia	+61-2-97333000
Redox Ltd	11 Mayo Road Wiri Auckland 2104 New Zealand	+64-9-2506222
Redox Inc.	3960 Paramount Boulevard Suite 107 Lakewood CA 90712 USA	+1-424-675-3200
Redox Chemicals Sdn Bhd	Level 2, No. 8, Jalan Sapir 33/7 Seksyen 33, Shah Alam Premier Industrial Park 40400 Shah Alam Sengalor, Malaysia	+60-3-5614-2111

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)

Not Scheduled

Globally Harmonised System

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

Hazard Categories Corrosive to Metals - Category 1
 Acute Toxicity (Oral) - Category 4
 Skin Corrosion/Irritation - Category 2
 Serious Eye Damage/Irritation - Category 2A
 Specific Target Organ Toxicity (Single Exposure) - Category 3

Pictograms



Signal Word Danger

Hazard Statements

H290	May be corrosive to metals.
H302	Harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
AUH031	Contact with acids liberates toxic gas

Precautionary Statements

Prevention	P280	Wear protective gloves/eye protection/face protection.	
	P261	Avoid breathing mist/vapours/spray.	
	P270	Do not eat, drink or smoke when using this product.	
	P271	Use only outdoors or in a well-ventilated area.	
	Response	P390	Absorb spillage to prevent material-damage.
		P302 + P352	IF ON SKIN: Wash with plenty of water/...
		P312	Call a POISON CENTER or doctor if you feel unwell.
		P330	Rinse mouth.
		P332 + P313	If skin irritation occurs: Get medical advice/attention.
		P362	Take off contaminated clothing.
P304 + P340		IF INHALED: Remove victim to fresh air and keep comfortable for breathing.	
Storage	P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.	
	P337 + P313	If eye irritation persists: Get medical advice/attention.	
	P403 + P233	Store in a well-ventilated place. Keep container tightly closed.	
	P406	Store in corrosive resistant container with a resistant inner liner.	
	P405	Store locked up.	
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 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 Amendment Act 2015

HSNO Classifications	Health Hazards	6.1D	Substances that are acutely toxic - Harmful
		6.3A	Substances that are irritating to the skin
		6.4A	Substances that are irritating to the eye
		6.5B	Substances that are contact sensitisers
	Environmental Hazards	9.3C	Substances that are harmful to terrestrial vertebrates

3. COMPOSITION/INFORMATION ON INGREDIENTS*Ingredients*

Chemical Entity	Formula	CAS Number	Proportion
Sodium bisulphite	NaHSO ₃	7631-90-5	>=25 - 50 %
Water	H ₂ O	7732-18-5	Balance %

4. FIRST AID MEASURES*Description of necessary measures according to routes of exposure*

Swallowed	IF SWALLOWED: Rinse mouth, then drink plenty of water. Do not induce vomiting. Call a Poison Centre or doctor/physician for advice. Never give anything by mouth to an unconscious person.
Eye	IF IN EYES: Immediately flush eyes with running water for several minutes, holding eyelids open and occasionally lifting the upper and lower lids. Remove contact lenses if present and easy to do. Continue rinsing for at least 15 minutes. Immediately call a Poison Centre or doctor/physician for advice.
Skin	IF ON SKIN: Remove contaminated clothing and shoes immediately. Flush skin with running water for at least 15 minutes. If skin irritation occurs, get medical advice/attention. Wash contaminated clothing and shoes before reuse.
Inhaled	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a Poison Centre or doctor/physician for advice. Apply resuscitation if victim is not breathing - Do not use direct mouth-to-mouth method if victim ingested or inhaled the substance; use alternative respiratory method or proper respiratory device - Administer oxygen if breathing is difficult.
Advice to Doctor	Keep victim calm and warm - Obtain immediate medical care. Ensure that attending medical personnel are aware of the identity and nature of the product(s) involved, and take precautions to protect themselves.
Medical Conditions Aggravated by Exposure	Exposure may aggravate pre-existing eye, skin or respiratory conditions. A small percentage of the population are sensitive to sulfites. Those who have asthma are most at risk to sulfite sensitivity and other forms of sulfite reactions. This sensitivity can cause a wide range of allergic reactions ranging from mild to severe.

5. FIRE FIGHTING MEASURES

General Measures	If safe to do so, move undamaged containers from fire area. Cool containers with water spray until well after fire is out.
Flammability Conditions	Non-combustible; Material itself does not burn.
Extinguishing Media	If material is involved in a fire, use dry chemical, Carbon dioxide (CO ₂), foam or water spray for extinction - Do not use water jets.
Fire and Explosion Hazard	Containers may explode when heated. Contact with metals may evolve flammable hydrogen gas. Fire or heat will produce irritating, toxic and/or corrosive gases, including oxides of Sulfur.

Hazardous Products of Combustion

Special Fire Fighting Instructions	Contain runoff from fire control or dilution water - Runoff may be toxic and/or corrosive and may pollute waterways.
Personal Protective Equipment	Wear self-contained breathing apparatus (SCBA) and chemical splash suit. Fully-encapsulating, gas-tight suits should be worn for maximum protection. Structural firefighter's uniform is NOT effective for this material.
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	2X

6. ACCIDENTAL RELEASE MEASURES

General Response Procedure	Ensure adequate ventilation - Ventilate enclosed spaces before entering. ELIMINATE all ignition sources. Do not touch or walk through spilled material. Avoid breathing vapours and contact with eyes, skin and clothing.
Clean Up Procedures	Absorb with earth, sand or other non-combustible material and transfer to a suitable, properly labelled container for disposal (see SECTION 13).
Containment	Stop leak if safe to do so - Prevent entry into waterways, drains or confined areas.
Decontamination	Wash away remainder with plenty of water.
Environmental Precautionary Measures	Spillages and decontamination runoff should be prevented from entering drains and watercourses.
Evacuation Criteria	Spill or leak area should be isolated immediately. Keep unauthorised personnel away. Keep upwind and to higher ground. Large spill: Immediately contact Police or Fire Brigade; Consider initial downwind evacuation of areas within at least 250 m.
Personal Precautionary Measures	Do not touch damaged containers or spilled material unless wearing appropriate protective clothing (see SECTION 8). Large spill: Wear SCBA and chemical splash suit. Fully-encapsulating, gas-tight suits should be worn for maximum protection.

7. HANDLING AND STORAGE

Handling	Safety showers and eyewash facilities should be provided within the immediate work area for emergency use. Ensure adequate ventilation - Use only outdoors or in a well-ventilated area. Handle in accordance with good industrial hygiene and safety practice. Avoid breathing mist/vapours/spray and contact with eyes, skin and clothing. Do not ingest. Use personal protective equipment as required (see SECTION 8). Corrosive to metals: Absorb spillage to prevent material damage (see SECTION 6).
Storage	Store in a cool, dry and well-ventilated place, out of direct sunlight. Keep container tightly closed. Keep away from heat and sources of ignition - No smoking. Keep away from food/feedstuffs and incompatible materials (see SECTION 10). Store locked up.
Container	Keep only in the original container or corrosive-resistant container with a resistant inner liner.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

General	COMPONENT: Sodium bisulfite (CAS No. 7631-90-5): - Safe Work Australia Exposure Standard: TWA = 5 mg/m3. - New Zealand Workplace Exposure Standard: TWA = 5 mg/m3. - NIOSH REL: TWA = 5 mg/m3.
Exposure Limits	No Data Available

SAFETY DATA SHEET SODIUM BISULPHITE SOLUTION (>=25-50%) REVISION 3, DATE 05 SEP 18

Biological Limits	No information available.
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	- Respiratory protection: Wear respiratory protection in case of inadequate ventilation or if an inhalation risk exists. Recommended: Acid gas/particulate (E/P) filter respirator or supplied-air respirator (refer to AS/NZS 1715 & 1716). - Eye/face protection: Wear appropriate eye protection to prevent eye contact. Recommended: Chemical safety goggles. - Hand protection: Wear protective gloves. Recommended: Impervious gloves, e.g. Rubber or Nitrile. - Skin/body protection: Wear appropriate personal protective clothing to avoid skin contact. Recommended: Overalls, safety shoes (made from material which cannot be permeated or degraded by this substance).
Special Hazards Precautions	No information available.
Work Hygienic Practices	Do not eat, drink or smoke when using this product. 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	Liquid
Appearance	Liquid
Odour	Pungent, sulfurous
Colour	Pale yellow
pH	3.5 - 5.0 - Incompatible with acids! Reacts with acids!
Vapour Pressure	No Data Available
Relative Vapour Density	No Data Available
Boiling Point	No Data Available
Melting Point	No Data Available
Freezing Point	No Data Available
Solubility	Miscible with water
Specific Gravity	1.23 - 1.35
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	No Data Available
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	No information available.
Potential for Dust Explosion	Not applicable.

Fast or Intensely Burning Characteristics	No information available.
Flame Propagation or Burning Rate of Solid Materials	No information available.
Non-Flammables That Could Contribute Unusual Hazards to a Fire	No information available.
Properties That May Initiate or Contribute to Fire Intensity	Non-combustible; Material itself does not burn.
Reactions That Release Gases or Vapours	Fire or heat will produce irritating, toxic and/or corrosive gases, including oxides of Sulfur.
Release of Invisible Flammable Vapours and Gases	Contact with metals may evolve flammable hydrogen gas.

10. STABILITY AND REACTIVITY

General Information	May be corrosive to metals. Contact with acids liberates toxic gas: Sulfur dioxide.
Chemical Stability	Stable under recommended handling and storage conditions.
Conditions to Avoid	Extremely high or low temperatures.
Materials to Avoid	Incompatible/reactive with acids, strong oxidising agents, metals.
Hazardous Decomposition Products	Fire or heat will produce irritating, toxic and/or corrosive gases, including oxides of Sulfur. Contact with metals may evolve flammable hydrogen gas.
Hazardous Polymerisation	Hazardous polymerisation will not occur.

11. TOXICOLOGICAL INFORMATION

General Information	<ul style="list-style-type: none"> - Acute toxicity: Harmful if swallowed. May cause gastrointestinal irritation, abdominal pain, nausea, vomiting. Contact with acids liberates toxic gas and therefore may cause effects in individuals with high acid content in the stomach. - Skin corrosion/irritation: Causes skin irritation. - Eye damage/irritation: Causes serious eye irritation, with redness and swelling of the conjunctiva. - Respiratory/skin sensitisation: Not likely to be a skin or respiratory sensitiser in humans generally, except in sulfite sensitive individuals. This sensitivity can cause a wide range of reactions ranging from mild to severe dermatological, pulmonary, gastrointestinal or cardiovascular symptoms. Those who have asthma are most at risk to sulfite sensitivity and other forms of sulfite reactions. - Germ cell mutagenicity: Not considered to be genotoxic. - Carcinogenicity: Not considered to be carcinogenic. - Reproductive toxicity: Not considered to cause reproductive or developmental toxicity. - STOT (single exposure): May cause respiratory irritation. May irritate the nose and throat causing coughing and wheezing. - STOT (repeated exposure): Not considered to cause serious damage to health by repeated exposure. Repeated exposure may cause bronchitis to develop, with coughing, phlegm and/or shortness of breath. - Aspiration toxicity: No information available.
Acute	
Ingestion	<p>Acute toxicity (Oral):</p> <p>COMPONENT: Sodium bisulfite (CAS No. 7631-90-5):</p> <ul style="list-style-type: none"> - LD50, Rat: 2,000 mg/kg bw. [NICNAS].
Carcinogen Category	None

12. ECOLOGICAL INFORMATION

Ecotoxicity	No information available.
Persistence/Degradability	No information available.
Mobility	No information available.
Environmental Fate	Prevent entry into drains and waterways.
Bioaccumulation Potential	No information available.
Environmental Impact	No Data Available

13. DISPOSAL CONSIDERATIONS

General Information	Dispose of contents/container in accordance with local/regional/national regulations.
Special Precautions for Land Fill	No information available.

14. TRANSPORT INFORMATION

General Information	Incompatible with acids - Reacts with acids, evolving sulphur dioxide, a toxic gas!
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Land Transport (Australia)

ADG Code

Proper Shipping Name	BISULPHITES, AQUEOUS SOLUTION, N.O.S. (Contains Sodium bisulphite)
Class	8 Corrosive Substances
Subsidiary Risk(s)	No Data Available
EPG	37 Toxic And/Or Corrosive Substances Non-Combustible
UN Number	2693
Hazchem	2X
Pack Group	III
Special Provision	No Data Available
Comments	Incompatible with acids - Reacts with acids, evolving sulphur dioxide, a toxic gas.

Land Transport (Malaysia)

ADR Code

Proper Shipping Name	BISULPHITES, AQUEOUS SOLUTION, N.O.S. (Contains Sodium bisulphite)
Class	8 Corrosive Substances
Subsidiary Risk(s)	No Data Available
EPG	37 Toxic And/Or Corrosive Substances Non-Combustible
UN Number	2693
Hazchem	2X
Pack Group	III
Special Provision	No Data Available
Comments	Incompatible with acids - Reacts with acids, evolving sulphur dioxide, a toxic gas.

Land Transport (New Zealand)

NZS5433

Proper Shipping Name	BISULPHITES, AQUEOUS SOLUTION, N.O.S. (Contains Sodium bisulphite)
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Class	8 Corrosive Substances
Subsidiary Risk(s)	No Data Available
EPG	37 Toxic And/Or Corrosive Substances Non-Combustible
UN Number	2693
Hazchem	2X
Pack Group	III
Special Provision	No Data Available
Comments	Incompatible with acids - Reacts with acids, evolving sulphur dioxide, a toxic gas.

Land Transport (United States of America)

US DOT

Proper Shipping Name	BISULPHITES, AQUEOUS SOLUTION, N.O.S. (Contains Sodium bisulphite)
Class	8 Corrosive Substances
Subsidiary Risk(s)	No Data Available
ERG	154 Substances - Toxic and/or Corrosive (Non-Combustible)
UN Number	2693
Hazchem	2X
Pack Group	III
Special Provision	No Data Available
Comments	Incompatible with acids - Reacts with acids, evolving sulphur dioxide, a toxic gas.

Sea Transport

IMDG Code

Proper Shipping Name	BISULPHITES, AQUEOUS SOLUTION, N.O.S. (Contains Sodium bisulphite)
Class	8 Corrosive Substances
Subsidiary Risk(s)	No Data Available
UN Number	2693
Hazchem	2X
Pack Group	III
Special Provision	No Data Available
EMS	F-A, S-B
Marine Pollutant	No
Comments	Stow separated from acids - Reacts with acids, evolving sulphur dioxide, a toxic gas.

Air Transport

IATA DGR

Proper Shipping Name	BISULPHITES, AQUEOUS SOLUTION, N.O.S. (Contains Sodium bisulphite)
Class	8 Corrosive Substances
Subsidiary Risk(s)	No Data Available
UN Number	2693
Hazchem	2X
Pack Group	III
Special Provision	No Data Available
Comments	Incompatible with acids - Reacts with acids, evolving sulphur dioxide, a toxic gas.

National Transport Commission (Australia)

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

SAFETY DATA SHEET SODIUM BISULPHITE SOLUTION (>=25-50%) REVISION 3, DATE 05 SEP 18

Dangerous Goods Classification

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) Not Scheduled

Environmental Protection Authority (New Zealand)

Hazardous Substances and New Organisms Amendment Act 2015

Approval Code HSR006577

National/Regional Inventories

Australia (AIC)	Listed
Canada (DSL)	Listed
Canada (NDSL)	Not Determined
China (IECSC)	Not Determined
Europe (EINECS)	231-548-0
Europe (REACH)	Not Determined
Japan (ENCS/METI)	Not Determined
Korea (KECI)	Listed
Malaysia (EHS Register)	Not Determined
New Zealand (NZIoC)	Listed
Philippines (PICCS)	Listed
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 SODBIS1000, SODBIS1001, SODBIS1002, SODBIS1003, SODBIS1005, SODBIS1006, SODBIS1007, SODBIS1100, SODBIS1110, SODBIS1801, SODBIS1802, SODBIS1803, SODBIS1804, SODBIS1805, SODBIS1806, SODBIS1807, SODBIS1808, SODBIS1809, SODBIS1810, SODBIS1811, SODBIS1812, SODBIS1813, SODBIS1814, SODBIS1815, SODBIS1816, SODBIS2000, SODBIS2500, SODBIS2600, SODBIS2700, SODBIS2800, SODBIS2900, SODBIS3000, SODBIS3500, SODBIS3501, SODBIS3900, SODBIS3901, SODBIS3902, SODBIS3903, SODBIS3904, SODBIS3905, SODBIS3906,

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SODBIS3907, SODBIS3910, SODBIS3911, SODBIS3912, SODBIS3913, SODBIS3915, SODBIS3940, SODBIS3945, SODBIS3950, SODBIS3951, SODBIS3952, SODBIS3955, SODBIS3956, SODBIS4000, SODBIS4500, SODBIS5000, SODBIS5500, SODBIS5501, SODBIS7700, SODBIS7701, SODBIS7702, SODBIS7703, SODBIS7704, SODBIS7705, SODBIS7710, SODBIS8000, SODBIS8200, SODBIS8800, SODBIS8801, SODBIS8810, SODBIS8825

Revision	3
Revision Date	05 Sep 2018
Reason for Issue	SDS updated
Key/Legend	<p>< 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</p>

SAFETY DATA SHEET SODIUM BISULPHITE SOLUTION (>=25-50%) REVISION 3, DATE 05 SEP 18

ug/24H Micrograms per 24 Hours

UN United Nations

wt Weight



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Product Name : **PHOSPHORIC ACID 25 - 85%**

Classified as hazardous

1. Identification

GHS Product Identifier PHOSPHORIC ACID 25 - 85%

Company Name CHEM-SUPPLY PTY LTD (ABN 19 008 264 211)

Address 38 - 50 Bedford Street GILLMAN
SA 5013 Australia

Telephone/Fax Number Tel: (08) 8440-2000

Emergency phone number CHEMCALL 1800 127 406 (Australia) / +64-4-917-9888 (International)

Recommended use of the chemical and restrictions on use Fertilizer; manufacturer of phosphate fertilizers and salts, polyphosphates, soil stabiliser, detergents, pharmaceutical chemicals, activated carbon, animal feed, ceramics, food additive, food processing, soap, rust inhibitors, wax and rubber latex; also used in electropolishing, engraving and photoengraving, printing, opal glasses, cotton dyeing, metal cleaning, sugar refining and water treatment. Petrol additive, soft drinks, and laboratory reagent.

Other Names	Name	Product Code
	PHOSPHORIC ACID 85% AR	PA000
	PHOSPHORIC ACID 85% LR	PL000
	PHOSPHORIC ACID 85% FCC	PP000
	PHOSPHORIC ACID 85% TG	PT000
	PHOSPHORIC ACID 25% w/w AR	PA384
	Orthophosphoric Acid	

Other Information

Chem-Supply Pty Ltd does not warrant that this product is suitable for any use or purpose. The user must ascertain the suitability of the product before use or application intended purpose. Preliminary testing of the product before use or application is recommended. Any reliance or purported reliance upon Chem-Supply Pty Ltd with respect to any skill or judgement or advice in relation to the suitability of this product of any purpose is disclaimed. Except to the extent prohibited at law, any condition implied by any statute as to the merchantable quality of this product or fitness for any purpose is hereby excluded. This product is not sold by description. Where the provisions of Part V, Division 2 of the Trade Practices Act apply, the liability of Chem-Supply Pty Ltd is limited to the replacement of supply of equivalent goods or payment of the cost of replacing the goods or acquiring equivalent goods.

2. Hazard Identification

GHS classification of the substance/mixture Corrosive to Metals: Category 1
Skin Corrosion/Irritation: Category 1B
Acute Toxicity - Inhalation: Category 4

Signal Word (s) DANGER

Hazard Statement (s) H290 May be corrosive to metals.
H314 Causes severe skin burns and eye damage.
H332 Harmful if inhaled.

Pictogram (s) Corrosion, Exclamation mark

**Precautionary statement – Prevention**

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

Precautionary statement – Response

P301+P330+P331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303+P361+P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P363 Wash contaminated clothing before reuse.
P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.



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Precautionary statement – Storage	P310 Immediately call a POISON CENTER or doctor/physician. P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P390 Absorb spillage to prevent material damage.
Precautionary statement – Disposal	P405 Store locked up. P406 Store in corrosive resistant/container with a resistant inner liner. P501 Dispose of contents/container to an approved waste disposal plant.

3. Composition/information on ingredients

Chemical	Liquid				
Characterization					
Ingredients	Name	CAS	Proportion	Hazard Symbol	Risk Phrase
	Phosphoric acid	7664-38-2	25-85 %		
	Water to make a total of 100%	7732-18-5	-		

4. First-aid measures

Inhalation	If inhaled, remove from contaminated area to fresh air immediately. Apply artificial respiration if not breathing. If breathing is difficult, give oxygen. Consult a physician.
Ingestion	Rinse mouth thoroughly with water immediately, repeat until all traces of product have been removed. DO NOT INDUCE VOMITING. Seek medical advice if effects persist. DO NOT INDUCE VOMITING. Wash out mouth with water, afterwards drink plenty of water. Seek immediate medical attention.
Skin	Immediately remove contaminated clothing and wash affected area with water for at least 15 minutes. Ensure contaminated clothing is washed before re-use. Seek medical advice /attention depending on the severity.
Eye contact	Immediately irrigate with copious quantity of water for at least 15 minutes. Eyelids to be held open. In all cases of eye contamination it is a sensible precaution to seek medical advice.
First Aid Facilities	Maintain eyewash fountain and safety shower in work area.
Advice to Doctor	Treat symptomatically based on judgement of doctor and individual reactions of the patient.
Other Information	For advice, contact the National Poisons Information Centre (Phone Australia 13 11 26; New Zealand 0800 764 766) or a doctor.

5. Fire-fighting measures

Hazards from Combustion Products	Phosphoric acid forms toxic phosphorous oxide fumes on combustion.
Specific Methods	Use extinguishing media most appropriate for the surrounding fire. No limitations to the type of extinguishing media. Small fire: Use dry chemical, CO2 or water spray. Large fire: Use water spray, fog or foam - Do NOT use water jets. If safe to do so, move undamaged containers from the fire area. Cool containers with flooding quantities of water until well after the fire is out. Avoid getting water inside the containers.
Specific hazards arising from the chemical	Material does not burn. Fire or heat will produce irritating, poisonous and/or corrosive gases. Containers may explode when heated.
Hazchem Code	2R
Precautions in connection with Fire	Wear SCBA and chemical splash suit. Fully encapsulating, gas-tight suits should be worn for maximum protection. Structural firefighter's uniform is NOT effective for these materials.

6. Accidental release measures

Personal Precautions	Avoid inhalation and ingestion. Avoid contact with skin, eyes and clothing. Evacuate the area of all non-essential personnel.
Personal Protection	Wear protective clothing specified for normal operations (see Section 8)
Clean-up Methods - Small Spillages	Absorb or contain liquid with sand, earth or spill control material. Shovel up using non sparking tools and place in a labelled, sealable container for subsequent safe disposal. Put leaking containers in a labelled drum or overdrum.



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Product Name : **PHOSPHORIC ACID 25 - 85%**

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Clean-up Methods - Seek expert advice on handling and disposal.**Large Spillages****Environmental**

Avoid release to the environment.

Precautions**7. Handling and storage**

Precautions for Safe Handling Avoid prolonged or repeated contact with skin, eyes and clothing . Wash hands and face thoroughly after working with material. Use with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles.

Conditions for safe storage, including any Store in well ventilated area. Store away from foodstuffs. Keep containers securely sealed and protected against physical damage. Store away from sources of heat or ignition. Keep dry and protect from direct sunlight. Protect from freezing.

incompatibilities**Corrosiveness**

Extremely corrosive in presence of copper, brass and stainless steel. Highly corrosive in presence of aluminium. Mild corrosive effect on bronze. Corrosive to ferrous metals and alloys. Non-corrosive in presence of glass.

Storage Regulations Refer Australian Standard AS 3780 - 1994 'The storage and handling of corrosive substances'.

8. Exposure controls/personal protection

Occupational exposure limit values	Name	STEL		TWA		Footnote
		mg/m3	ppm	mg/m3	ppm	
	Phosphoric acid	3		1		
Other Exposure Information	<p>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.</p> <p>A time weighted average (TWA) has been established for Phosphoric acid (Safe Work Australia) of 1 mg/m3. The corresponding STEL level is 3 mg/m3. The STEL (Short Term Exposure Limit) is an exposure value that should not be exceeded for more than 15 minutes and should not be repeated for more than 4 times per day. There should be at least 60 minutes between successive exposures at the STEL. 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.</p>					
Appropriate engineering controls	In industrial situations maintain the concentrations values below the TWA. This may be achieved by process modification, use of local exhaust ventilation, capturing substances at the source, or other methods. These methods should be used in preference to personal protective equipment.					
Respiratory Protection	Where ventilation is not adequate, respiratory protection may be required. Avoid breathing dust, vapours or mists. Respiratory protection should comply with AS 1716 - Respiratory Protective Devices and be selected in accordance with AS 1715 - Selection, Use and Maintenance of Respiratory Protective Devices. Filter capacity and respirator type depends on exposure levels. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.					
Eye Protection	The use of a face shield, chemical goggles or safety glasses with side shield protection as appropriate. Must comply with Australian Standards AS 1337 and be selected and used in accordance with AS 1336.					
Hand Protection	Avoid skin contact when removing gloves from hands, do not touch the gloves outer surface. Dispose of gloves as hazardous waste. Wear gloves of impervious material conforming to AS/NZS 2161: Occupational protective gloves - Selection, use and maintenance. Final choice of appropriate glove type will vary according to individual circumstances. This can include methods of handling, and engineering controls as determined by appropriate risk assessments.					
Personal Protective Equipment	Personal protective equipment should not solely be relied upon to control risk and should only be used when all other reasonably practicable control measures do not eliminate or sufficiently minimise risk. Guidance in selecting personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.					
Footwear	Safety boots in industrial situations is advisory, foot protection should comply with AS 2210, Occupational protective footwear - Guide to selection, care and use.					
Body Protection	Clean clothing or protective clothing should be worn, preferably with and apron. Clothing for protection against chemicals should comply with AS 3765 Clothing for Protection Against Hazardous Chemicals.					



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Hygiene Measures Always wash hands before smoking, eating or using the toilet. Wash contaminated clothing and other protective equipment before storing or re-using.

9. Physical and chemical properties

Form	Liquid
Appearance	Clear, colourless, syrupy liquid.
Odour	Odourless.
Melting Point	21 °C (85% phosphoric acid)
Boiling Point	158 °C (85% phosphoric acid)
Solubility in Water	Soluble in water.
Specific Gravity	1.685 (85% phosphoric acid)
pH	1 (100 g/l, H ₂ O, 20 °C)
Vapour Pressure	2.2 hPa (85% phosphoric acid)
Vapour Density (Air=1)	3.4 (85% phosphoric acid)
Flammability	Non combustible material.
Molecular Weight	98.0

10. Stability and reactivity

Chemical Stability Stable under normal use conditons.

Conditions to Avoid Incompatibles.

Incompatible Materials Acetulides, alcohols, aldehydes, amides, amines, ammonia or bleach, azo-compounds, carbides, carbamates, caustics, hlorides, combustible materials, cyanides, esters, epoxides, fluorides, glycols, halogenated organics, ketones, mercaptins, nitromethane, organic peroxides, organophosphates, phenols and cresols, phosphides, silicides, sodium tetrahydroborate, strong caustics, stainless steel, sulfides and unsaturated halides.

Possibility of hazardous reactions Phosphoric acid decomposes under formation of toxic fumes on contact with alcohols, cyanides, ketones, phenols, esters, sulfides, mercaptans and halogenated organic compounds. Liberates explosive hydrogen gas when reacting with chlorides and stainless steel. Exothermic reactions with aldehydes, amines, amides, alcohols and glycols, azo-compounds, carbamates, esters, caustics, phenols and cresols, organophosphates, epoxides, explosives, combustible materials, unsaturated halids, sodium tetrahydroborate, organic peroxides.

Hazardous Polymerization Will not occur.

11. Toxicological Information

Acute Toxicity - Oral LD50 (rat): 1,530 mg/kg (anhydrous) (IUCLID)

Acute Toxicity - Dermal LD50 (rabbit): 2,740 mg/kg (anhydrous)(IUCLID)

Ingestion Burns to the mouth, throat and stomach. Symptoms include sour acrid taste, coughing, difficult breathing and swallowing, conjunctivitis, severe gastrointestinal irritation, nausea, vomiting, bloody diarrhoea, severe abdominal pains, extreme thirst, convulsions.

Inhalation Harmful if inhaled. Vapour or mist can cause irritation of the nose, throat, and upper respiratory tract. Severe exposures can lead to a chemical pneumonitis.

Skin Corrosive. Concentrated acid solutions can cause redness, pain, itching, scaling, occasional blistering, and severe skin burns.

Eye Mists may cause eye irritation. Symptoms include of redness, pain, tearing, eyelid spasms, blurred vision, chemical conjunctivitis, burns and permanent eye damage. risk of blindness!

Carcinogenicity No evidence of carcinogenic properties.

Chronic Effects Dermatitis may occur from prolonged or repeated skin contact. Prolonged or over exposure to phosphoric acid can increase fluid levels in the lungs (pulmonary oedema). May cause clammy skin and dermatitis, weak and rapid pulse, shallow respiration, very little urine, bronchitis, shortness of breath.

Severe exposure to phosphoric acid can lead to shock, circulatory collapse and death.

Mutagenicity No evidence of mutagenic effects.

12. Ecological information



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Ecotoxicity	Quantitative data on the ecological effect of this product are not available.
Bioaccumulative Potential	Phosphate (formed when phosphoric acid is dissolved) is unlikely to bioaccumulate in most aquatic species.
Information on Ecological Effects	Excessive amounts of phosphoric acid can affect the pH shift leading to a potential risk to aquatic organisms.

13. Disposal considerations

Disposal Considerations	Whatever cannot be saved for recovery or recycling should be disposed of according to relevant local, state and federal government regulations.
Container Disposal	Dispose container as hazardous waste.

14. Transport information

Transport Information	Dangerous goods of Class 8 (Corrosive) are incompatible in a placard load with any of the following: Class 1, Class 4.3, Class 5, Class 6, if the Class 6 dangerous goods are cyanides and the Class 8 dangerous goods are acids, Class 7; and are incompatible with food and food packaging in any quantity.
U.N. Number	1805
UN proper shipping name	PHOSPHORIC ACID
Transport hazard class(es)	8
Hazchem Code	2R
Packaging Method	3.8.8RT8
Packing Group	III
EPG Number	8A1
IERG Number	37

15. Regulatory information

Regulatory Information	Listed in the Australian Inventory of Chemical Substances (AICS). Not listed under WHS Regulation 2011, Schedule 10 - Prohibited carcinogens, restricted carcinogens and restricted hazardous chemicals.
Poisons Schedule	S6

16. Other Information

Literature References	'Standard for the Uniform Scheduling of Medicines and Poisons.', Commonwealth of Australia. National Road Transport Commission, 'Australian Code for the Transport of Dangerous Goods by Road and Rail 7th. Ed.' Safe Work Australia, 'National Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals'. Standards Australia, 'SAA/SNZ HB 76:2010 Dangerous Goods - Initial Emergency Response Guide', Standards Australia/Standards New Zealand. Safe Work Australia, 'Hazardous Chemical Information System'. Safe Work Australia, 'National Code of Practice for the Labelling of Safe Work Hazardous Substances'. Safe Work Australia, 'National Exposure Standards for Atmospheric Contaminants in the Occupational Environment'.
Contact Person/Point	Paul McCarthy Ph. (08) 8440 2000 DISCLAIMER STATEMENT: All information provided in this data sheet or by our technical representatives is compiled from the best knowledge available to us. However, since data, safety standards and government regulations are subject to change and the conditions of handling and use, or misuse, are beyond our control, we make no warranty either expressed or implied, with respect to the completeness or accuracy to the information contained herein. Chem-Supply accepts no responsibility whatsoever for its accuracy or for any results that may be obtained by customers from using the data and disclaims all liability for reliance on information provided in this data sheet or by our technical representatives.
Empirical Formula & Structural Formula	H3 P O4 ...End Of MSDS...



chem-supply

Safety Data Sheet

infosafe
CS: 1.7.2

Page: 6 of 6

Infosafe No™	1CH4S	Issue Date : August 2019	RE-ISSUED by CHEMSUPP
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Product Name : **PHOSPHORIC ACID 25 - 85%**

Classified as hazardous

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SAFETY DATA SHEET

Creation Date 14-May-2010

Revision Date 24-Dec-2021

Revision Number 6

1. Identification

Product Name Phosphorous acid

Cat No. : AC201150000; AC201150010; AC201150020; AC201150050;
AC201150100; AC201155000

CAS No 13598-36-2
Synonyms Orthophosphorous acid

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company

Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US**:001-201-796-7100 / **Europe**: +32 14 57 52 99
CHEMTREC Tel. No.**US**:001-800-424-9300 / **Europe**:001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Corrosive to metals	Category 1
Acute oral toxicity	Category 4
Skin Corrosion/Irritation	Category 1 A
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements

May be corrosive to metals
 Harmful if swallowed
 Causes severe skin burns and eye damage
 May cause respiratory irritation



Precautionary Statements

Prevention

Wash face, hands and any exposed skin thoroughly after handling
 Do not eat, drink or smoke when using this product
 Do not breathe dust/fume/gas/mist/vapors/spray
 Wear protective gloves/protective clothing/eye protection/face protection
 Use only outdoors or in a well-ventilated area
 Keep only in original container

Response

Immediately call a POISON CENTER or doctor/physician

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
 Wash contaminated clothing before reuse

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing

Ingestion

Rinse mouth
 Do NOT induce vomiting

Spills

Absorb spillage to prevent material damage

Storage

Store locked up
 Store in a well-ventilated place. Keep container tightly closed
 Store in corrosive resistant polypropylene container with a resistant inliner
 Store in a dry place

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

None identified

3. Composition/Information on Ingredients

Component	CAS No	Weight %
Phosphorous acid	13598-36-2	>95

4. First-aid measures

General Advice

Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required. Keep eye wide open while rinsing.

Skin Contact	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Call a physician immediately.
Inhalation	Remove to fresh air. If not breathing, give artificial respiration. Call a physician or poison control center immediately. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
Ingestion	Immediate medical attention is required. Do NOT induce vomiting. Drink plenty of water. Never give anything by mouth to an unconscious person.
Most important symptoms and effects	Causes burns by all exposure routes. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	CO ₂ , dry chemical, dry sand, alcohol-resistant foam.
Unsuitable Extinguishing Media	No information available
Flash Point	> 100 °C / > 212 °F
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

The product causes burns of eyes, skin and mucous membranes.

Hazardous Combustion Products

Oxides of phosphorus. Phosphorus trihydride (phosphine).

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health 3	Flammability 1	Instability 1	Physical hazards N/A
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6. Accidental release measures

Personal Precautions	Use personal protective equipment as required. Evacuate personnel to safe areas. Avoid contact with skin, eyes or clothing.
Environmental Precautions	Should not be released into the environment. Do not allow material to contaminate ground water system.
Methods for Containment and Clean Up	Sweep up and shovel into suitable containers for disposal. Avoid dust formation.

7. Handling and storage

Handling	Do not get in eyes, on skin, or on clothing. Wear personal protective equipment/face protection. Use only under a chemical fume hood. Do not breathe dust. Do not ingest. If swallowed then seek immediate medical assistance.
Storage.	Keep containers tightly closed in a dry, cool and well-ventilated place. Corrosives area. Keep under nitrogen. Store under an inert atmosphere. Protect from moisture. Incompatible Materials. Strong bases. Metals.

8. Exposure controls / personal protection

Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Engineering Measures	Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.
Personal Protective Equipment	
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	A NIOSH/MSHA approved air purifying dust or mist respirator or European Standard EN 149.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Solid
Appearance	White
Odor	Odorless
Odor Threshold	No information available
pH	No information available
Melting Point/Range	73 °C / 163.4 °F
Boiling Point/Range	200 °C / 392 °F
Flash Point	> 100 °C / > 212 °F
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	Not applicable
Specific Gravity	No information available
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	> 180°C
Viscosity	Not applicable
Molecular Formula	H3 O3 P
Molecular Weight	82

10. Stability and reactivity

Reactive Hazard	None known, based on information available
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Stability	Stable under normal conditions. Hygroscopic. Air sensitive.
Conditions to Avoid	Exposure to air. Incompatible products. Exposure to moist air or water.
Incompatible Materials	Strong bases, Metals
Hazardous Decomposition Products	Oxides of phosphorus, Phosphorus trihydride (phosphine)
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Phosphorous acid	LD50 = 1895 mg/kg (Rat)	Not listed	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	Causes severe burns by all exposure routes
Sensitization	No information available
Carcinogenicity	The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
Phosphorous acid	13598-36-2	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects, both acute and delayed Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains. .

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Phosphorous acid	Not listed	LC50: 6980 - 9784 mg/L,	Not listed	Not listed

		96h static (Brachydanio rerio)		
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Persistence and Degradability Soluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN2834
 Proper Shipping Name PHOSPHOROUS ACID
 Hazard Class 8
 Packing Group III

TDG

UN-No UN2834
 Proper Shipping Name PHOSPHOROUS ACID
 Hazard Class 8
 Packing Group III

IATA

UN-No UN2834
 Proper Shipping Name PHOSPHOROUS ACID
 Hazard Class 8
 Packing Group III

IMDG/IMO

UN-No UN2834
 Proper Shipping Name PHOSPHOROUS ACID
 Hazard Class 8
 Packing Group III

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Phosphorous acid	13598-36-2	X	ACTIVE	-

Legend:

TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)

X - Listed

'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories

Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
Phosphorous acid	13598-36-2	X	-	237-066-7	X	X	X	X	X	KE-28491

KECL - NIER number or KE number (<http://ncis.nier.go.kr/en/main.do>)

U.S. Federal Regulations

SARA 313	Not applicable
SARA 311/312 Hazard Categories	See section 2 for more information
CWA (Clean Water Act)	Not applicable
Clean Air Act	Not applicable
OSHA - Occupational Safety and Health Administration	Not applicable
CERCLA	Not applicable

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Phosphorous acid	-	X	-	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	N
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Component	REACH (1907/2006) - Annex XIV - Substances Subject to Authorization	REACH (1907/2006) - Annex XVII - Restrictions on Certain Dangerous Substances	REACH Regulation (EC 1907/2006) article 59 - Candidate List of Substances of Very High Concern (SVHC)
Phosphorous acid	-	Use restricted. See item 75. (see link for restriction details)	-

<https://echa.europa.eu/substances-restricted-under-reach>

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

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
Phosphorous acid	13598-36-2	Listed	Not applicable	Not applicable	Not applicable

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
Phosphorous acid	13598-36-2	Not applicable	Not applicable	Not applicable	Not applicable

16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date	14-May-2010
Revision Date	24-Dec-2021
Print Date	24-Dec-2021
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

Danger**SECTION 1: Identification of the substance/mixture and of the company/undertaking****1.1. Product identifier**

Trade name	: Methane
SDS no	: 50006
Chemical description	: Methane
	CAS-No. : 74-82-8
	EC-No. : 200-812-7
	EC Index-No. : 601-001-00-4
REACH registration No	: 01-2119474442-39
Chemical formula	: CH ₄

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

Relevant identified uses	: Industrial and professional uses. Perform risk assessment prior to use. Test gas/Calibration gas. Chemical reaction / Synthesis. Laboratory use. Use as a fuel. Use for manufacture of electronic/photovoltaic components. Contact supplier for more information on uses.
Uses advised against	: Consumer use. Uses other than those listed above are not supported, contact your supplier for more information on other uses.

1.3. Details of the supplier of the safety data sheet

Company identification	: Air Liquide Australia Limited Level 12 / 600 St. Kilda Road 3004 Melbourne VIC Australia +61 3 9697 9888 ALAEquiries@AirLiquide.com
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1.4. Emergency telephone number

Emergency telephone number	: 1800 812 588
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SECTION 2: Hazards identification**2.1. Classification of the substance or mixture****Classification according to WHS Regulation**

Physical hazards	Flammable gases, Category 1A	H220
	Gases under pressure : Compressed gas	H280

2.2. Label elements**Classification according to WHS Regulation**

Hazard pictograms :



GHS02

GHS04

Signal word :

Danger

Hazard statements :

 H220 - Extremely flammable gas..
 H280 - Contains gas under pressure; may explode if heated..

Precautionary statements :

- Prevention : P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking..
- Response : P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely..
 P381 - In case of leakage, eliminate all ignition sources..
- Storage : P403 - Store in a well-ventilated place..
 P410+P403 - Protect from sunlight. Store in a well-ventilated place..

2.3. Other hazards

 : Asphyxiant in high concentrations.
 These high concentrations are within the flammability range.
 The substance/mixture has no endocrine disrupting properties.

SECTION 3: Composition/information on ingredients
3.1. Substances :

Name	Product identifier	%	Classification according to WHS Regulation
Methane	(CAS-No.) 74-82-8 (EC-No.) 200-812-7 (EC Index-No.) 601-001-00-4 (REACH-no) 01-2119474442-39	≤ 100	Flam. Gas 1A, H220 Press. Gas (Comp.), H280

Full text of H- and EUH-statements: see section 16

Contains no other components or impurities which will influence the classification of the product.
SECTION 4: First aid measures
4.1. Description of first aid measures

- Inhalation : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Perform cardiopulmonary resuscitation if breathing stopped.
- Skin contact : For liquid spillage - flush with water for at least 15 minutes.
- Eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes.
- Ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

 : In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation.
 See section 11.

4.3. Indication of any immediate medical attention and special treatment needed

: None.

SECTION 5: Firefighting measures
5.1. Extinguishing media

- Suitable extinguishing media : Water spray or fog.
Carbon dioxide.
Dry powder.
Shutting off the source of the gas is the preferred method of control.
Be aware of the risk of formation of static electricity with the use of CO₂ extinguishers. Do not use them in places where a flammable atmosphere may be present.
- Unsuitable extinguishing media : Do not use water jet to extinguish.

5.2. Special hazards arising from the substance or mixture

- Specific hazards : Exposure to fire may cause containers to rupture/explode.
Hazardous combustion products : Incomplete combustion may form carbon monoxide.

5.3. Advice for fire-fighters

- Specific methods : Use fire control measures appropriate for the surrounding fire. Exposure to fire and heat radiation may cause gas receptacles to rupture. Cool endangered receptacles with water spray jet from a protected position. Prevent water used in emergency cases from entering sewers and drainage systems.
If possible, stop flow of product.
Use water spray or fog to knock down fire fumes if possible.
Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire.
Move containers away from the fire area if this can be done without risk.
- Special protective equipment for fire fighters : In confined space use self-contained breathing apparatus.
Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.
Standard EN 469 - Protective clothing for firefighters. Standard - EN 659: Protective gloves for firefighters.
- Hazchem Code : 2SE

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

No additional information available

6.2. Environmental precautions

- : Try to stop release.

6.3. Methods and material for containment and cleaning up

- : Ventilate area.

6.4. Reference to other sections

- : See also sections 8 and 13.

SECTION 7: Handling and storage**7.1. Precautions for safe handling**

- Safe use of the product** : The product must be handled in accordance with good industrial hygiene and safety procedures.
Only experienced and properly instructed persons should handle gases under pressure.
Consider pressure relief device(s) in gas installations.
Ensure the complete gas system was (or is regularly) checked for leaks before use.
Do not smoke while handling product.
Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt.
Avoid suck back of water, acid and alkalis.
Assess the risk of potentially explosive atmospheres and the need for explosion-proof equipment.
Purge air from system before introducing gas.
Take precautionary measures against static discharge.
Keep away from ignition sources (including static discharges).
Consider the use of only non-sparking tools.
Do not breathe gas.
Avoid release of product into atmosphere.
Ensure equipment is adequately earthed.
- Safe handling of the gas receptacle** : Refer to supplier's container handling instructions.
Do not allow backfeed into the container.
Protect containers from physical damage; do not drag, roll, slide or drop.
When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders.
Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use.
If user experiences any difficulty operating valve discontinue use and contact supplier.
Never attempt to repair or modify container valves or safety relief devices.
Damaged valves should be reported immediately to the supplier.
Keep container valve outlets clean and free from contaminants particularly oil and water.
Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment.
Close container valve after each use and when empty, even if still connected to equipment.
Never attempt to transfer gases from one cylinder/container to another.
Never use direct flame or electrical heating devices to raise the pressure of a container.
Do not remove or deface labels provided by the supplier for the identification of the content of the container.
Suck back of water into the container must be prevented.
Open valve slowly to avoid pressure shock.

7.2. Conditions for safe storage, including any incompatibilities

- : Observe all regulations and local requirements regarding storage of containers.
Containers should not be stored in conditions likely to encourage corrosion.
Container valve guards or caps should be in place.
Containers should be stored in the vertical position and properly secured to prevent them from falling over.
Stored containers should be periodically checked for general condition and leakage.
Keep container below 50°C in a well ventilated place.
Store containers in location free from fire risk and away from sources of heat and ignition.
Keep away from combustible materials.
Segregate from oxidant gases and other oxidants in store.
All electrical equipment in the storage areas should be compatible with the risk of a potentially explosive atmosphere.

7.3. Specific end use(s)

- : None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

OEL (Occupational Exposure Limits) : No data available.

DNEL (Derived-No Effect Level) : No data available.

PNEC (Predicted No-Effect Concentration) : No data available.

8.2. Exposure controls

8.2.1. Appropriate engineering controls

- : Provide adequate general and local exhaust ventilation.
- Product to be handled in a closed system.
- Systems under pressure should be regularly checked for leakages.
- Ensure exposure is below occupational exposure limits (where available).
- Gas detectors should be used when flammable gases/vapours may be released.
- Consider the use of a work permit system e.g. for maintenance activities.

8.2.2. Individual protection measures, e.g. personal protective equipment

- : A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered:
PPE compliant to the recommended EN/ISO standards should be selected.

• Eye/face protection

- : Wear safety glasses with side shields.
- Standard EN 166 - Personal eye-protection - specifications

• Skin protection

- Hand protection

- : Wear working gloves when handling gas containers.
- Standard EN 388 - Protective gloves against mechanical risk.

- Other

- : Consider the use of flame resistant anti-static safety clothing.
- Standard EN ISO 14116 - Limited flame spread materials.
- Standard EN 1149-5 - Protective clothing: Electrostatic properties.
- Wear safety shoes while handling containers.
- Standard EN ISO 20345 - Personal protective equipment - Safety footwear.

• Respiratory protection

- : Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.
- Self contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmospheres.
- Self contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems.

• Thermal hazards

- : None in addition to the above sections

8.2.3. Environmental exposure controls

- : Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment.

SECTION 9: Physical and chemical properties**9.1. Information on basic physical and chemical properties**

Appearance

- Physical state at 20°C / 101.3kPa : Gas.
- Colour : Colourless.

Odour

- : Odourless.

Odour threshold

- : Odour threshold is subjective and inadequate to warn of overexposure.

pH value

- : Not applicable for gases and gas mixtures

Molar mass

- : 16 g/mol

Melting point

- : -182.5 °C

Boiling point

- : -161.5 °C

Flash point

- : Not applicable for gases and gas mixtures.

Critical temperature [°C]

- : -82 °C

Evaporation rate (ether=1)

- : No data available

Flammability range

- : 4.4 – 17 vol %

Vapour pressure [20°C]

- : Not applicable.

Vapour pressure [50°C]

- : Not applicable.

Relative density, gas (air=1)

- : 0.6

Relative density, liquid (water=1)

- : 0.42

Solubility in water	: 26 mg/l
Partition coefficient n-octanol/water [log Kow]	: 1.09
Auto-ignition temperature	: 595 °C
Decomposition point [°C]	: Not applicable.
Viscosity [20°C]	: No reliable data available.
Explosive Properties	: No data available
Oxidising Properties	: No oxidising properties

9.2. Other information

Other data	: None.
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SECTION 10: Stability and reactivity**10.1. Reactivity**

: No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability

: Stable under normal conditions.

10.3. Possibility of hazardous reactions

: Can form explosive mixture with air.
May react violently with oxidants.

10.4. Conditions to avoid

: Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
Avoid moisture in installation systems.

10.5. Incompatible materials

: Air, Oxidisers.
For additional information on compatibility refer to ISO 11114.

10.6. Hazardous decomposition products

: Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11: Toxicological information**11.1. Information on toxicological effects**

Acute toxicity	: Toxicological effects not expected from this product if occupational exposure limit values are not exceeded.
Skin corrosion/irritation	: No known effects from this product.
Serious eye damage/irritation	: No known effects from this product.
Respiratory or skin sensitisation	: No known effects from this product.
Germ cell mutagenicity	: No known effects from this product.
Carcinogenicity	: No known effects from this product.
Toxic for reproduction : Fertility	: No known effects from this product.
Toxic for reproduction : unborn child	: No known effects from this product.
STOT-single exposure	: No known effects from this product.
STOT-repeated exposure	: No known effects from this product.
Aspiration hazard	: Not applicable for gases and gas mixtures.
Other information	: The substance/mixture has no endocrine disrupting properties.

SECTION 12: Ecological information**12.1. Toxicity**

Assessment	: Classification criteria are not met.
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12.2. Persistence and degradability

Assessment : The substance is readily biodegradable. Unlikely to persist.

12.3. Bioaccumulative potential

Assessment : Not expected to bioaccumulate due to the low log Kow (log Kow < 4). See section 9.

12.4. Mobility in soil

Assessment : Because of its high volatility, the product is unlikely to cause ground or water pollution. Partition into soil is unlikely.

12.5. Results of PBT and vPvB assessment

Assessment : Not classified as PBT or vPvB.

12.6. Other adverse effects

Effect on the ozone layer : No known effects from this product.
Global warming potential [CO₂=1] : No effect on the ozone layer.
Effect on global warming : 25
: When discharged in large quantities may contribute to the greenhouse effect.
Contains greenhouse gas(es).

SECTION 13: Disposal considerations**13.1. Waste treatment methods**

Contact supplier if guidance is required.
Do not discharge into areas where there is a risk of forming an explosive mixture with air.
Waste gas should be flared through a suitable burner with flash back arrestor.
Do not discharge into any place where its accumulation could be dangerous.
Ensure that the emission levels from local regulations or operating permits are not exceeded.
Refer to the EIGA code of practice Doc.30 "Disposal of Gases", downloadable at <http://www.eiga.org> for more guidance on suitable disposal methods.
Return unused product in original container to supplier.

List of hazardous waste codes (from Commission Decision 2000/532/EC as amended)

: 16 05 04 *: Gases in pressure containers (including halons) containing hazardous substances.

13.2. Additional information

: External treatment and disposal of waste should comply with applicable local and/or national regulations

SECTION 14: Transport information**14.1. UN number**

UN-No. : 1971

14.2. UN proper shipping name

Transport by road/rail (ADG) : METHANE, COMPRESSED

Transport by air (ICAO-TI / IATA-DGR) : Methane, compressed

Transport by sea (IMDG) : METHANE, COMPRESSED

14.3. Transport hazard class(es)

Labelling :



2.1 : Flammable gases

Transport by road/rail (ADG)

Class : 2
Hazchem Code : 2SE
Hazard identification number : 23
Tunnel Restriction : B/D - Tank carriage : Passage forbidden through tunnels of category B, C, D and E. Other carriage : Passage forbidden through tunnels of category D and E

Transport by air (ICAO-TI / IATA-DGR)

Class / Div. (Sub. risk(s)) : 2.1

Transport by sea (IMDG)

Class / Div. (Sub. risk(s)) : 2.1
Emergency Schedule (EmS) - Fire : F-D
Emergency Schedule (EmS) - Spillage : S-U

14.4. Packing group

Transport by road/rail (ADR/RID) : Not applicable
Transport by air (ICAO-TI / IATA-DGR) : Not applicable
Transport by sea (IMDG) : Not applicable

14.5. Environmental hazards

Transport by road/rail (ADR/RID) : None.
Transport by air (ICAO-TI / IATA-DGR) : None.
Transport by sea (IMDG) : None.

14.6. Special precautions for user**No additional information availablePacking Instruction(s)**

Transport by road/rail (ADR/RID) : P200
Transport by air (ICAO-TI / IATA-DGR)
Passenger and Cargo Aircraft : Forbidden
Cargo Aircraft only : 200
Transport by sea (IMDG) : P200

Special transport precautions : Avoid transport on vehicles where the load space is not separated from the driver's compartment.
Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.
Before transporting product containers:
- Ensure there is adequate ventilation.
- Ensure that containers are firmly secured.
- Ensure valve is closed and not leaking.
- Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
- Ensure valve protection device (where provided) is correctly fitted.

HAZCHEM CODE : 2SE

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

: Not applicable.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture**National regulations**

Ensure all national/local regulations are observed.

15.2. Chemical safety assessment

: A CSA has been carried out.

SECTION 16: Other information

Indication of changes : Revised safety data sheet in accordance with commission regulation (EU) No 453/2010.

Abbreviations and acronyms : ATE - Acute Toxicity Estimate. CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008. REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) No 1907/2006. EINECS - European Inventory of Existing Commercial Chemical Substances. CAS# - Chemical Abstract Service number. PPE - Personal Protection Equipment. LC50 - Lethal Concentration to 50 % of a test population. RMM - Risk Management Measures. PBT - Persistent, Bioaccumulative and Toxic. vPvB - Very Persistent and Very Bioaccumulative. STOT- SE : Specific Target Organ Toxicity - Single Exposure. CSA - Chemical Safety Assessment. EN - European Standard. UN - United Nations. ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road. IATA - International Air Transport Association. IMDG code - International Maritime Dangerous Goods. RID - Regulations concerning the International Carriage of Dangerous Goods by Rail. WGK - Water Hazard Class. STOT - RE : Specific Target Organ Toxicity - Repeated Exposure. UFI : Unique Formula Identifier.

Training advice : Ensure operators understand the flammability hazard.

Full text of H-statements

Flam. Gas 1A	Flammable gases, Category 1A
H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
Press. Gas (Comp.)	Gases under pressure : Compressed gas

DISCLAIMER OF LIABILITY : Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out. Details given in this document are believed to be correct at the time of going to press. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted.

End of document



Infosafe No™	1CHH9	Issue Date : February 2019	RE-ISSUED by CHEMSUPP
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Product Name : **FERRIC CHLORIDE Solution**

Classified as hazardous

1. Identification

GHS Product Identifier FERRIC CHLORIDE Solution

Company Name CHEM-SUPPLY PTY LTD (ABN 19 008 264 211)

Address 38 - 50 Bedford Street GILLMAN
SA 5013 Australia

Telephone/Fax Number Tel: (08) 8440-2000
Fax: (08) 8440-2001

Emergency phone number CHEMCALL 1800 127 406 (Australia) / +64-4-917-9888 (International)

Recommended use of the chemical and restrictions on use Manufacture of pigments and ink, etchant for metals, catalyst in organic reactions and clinical reagent.

Other Names**Name****Product Code**

Iron (III) chloride solution

IRON(III) CHLORIDE 40% w/w Solution

FT021

Additional Information

When used for laboratory chemical analysis, it has no poison schedule. If this compound is used in human or animal application then it may acquire a poison schedule of S6, S5, S4 or S2.

Other Information

Chem-Supply Pty Ltd does not warrant that this product is suitable for any use or purpose. The user must ascertain the suitability of the product before use or application intended purpose. Preliminary testing of the product before use or application is recommended. Any reliance or purported reliance upon Chem-Supply Pty Ltd with respect to any skill or judgement or advice in relation to the suitability of this product of any purpose is disclaimed. Except to the extent prohibited at law, any condition implied by any statute as to the merchantable quality of this product or fitness for any purpose is hereby excluded. This product is not sold by description. Where the provisions of Part V, Division 2 of the Trade Practices Act apply, the liability of Chem-Supply Pty Ltd is limited to the replacement of supply of equivalent goods or payment of the cost of replacing the goods or acquiring equivalent goods.

2. Hazard Identification

GHS classification of the substance/mixture Corrosive to Metals: Category 1
Acute Toxicity - Oral: Category 4
Eye Damage/Irritation: Category 1
Skin Corrosion/Irritation: Category 1B

Signal Word (s) DANGER

Hazard Statement (s) H290 May be corrosive to metals.
H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.

Pictogram (s) Corrosion, Exclamation mark**Precautionary statement – Prevention**

P234 Keep only in original container.
P260 Do not breathe dust/fume/gas/mist/vapours/spray.
P264 Wash thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statement – Storage

P405 Store locked up.
P406 Store in corrosive resistant/... container with a resistant inner liner.

Precautionary statement – Disposal

P501 Dispose of contents/container to an approved waste disposal plant.

3. Composition/information on ingredients**Chemical** Liquid**Characterization**



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Product Name : **FERRIC CHLORIDE Solution**

Classified as hazardous

Iron (III) chloride	7705-08-0	40-42 %
Water to make total of 100%		-

4. First-aid measures

Inhalation	If inhaled, remove from contaminated area to fresh air immediately, avoid becoming a casualty. Make patient comfortable, keep warm and at rest until fully recovered. If breathing is difficult (or develops a bluish skin discolouration), supply oxygen by a qualified person. Apply artificial respiration with a respiratory medical device if not breathing. Do not use mouth to mouth resuscitation. Immediately medical attention is required.
Ingestion	Rinse mouth thoroughly with water immediately, repeat until all traces of product have been removed. Give water to drink. DO NOT INDUCE VOMITING. Seek medical advice if symptoms persist.
Skin	Immediately remove contaminated clothing and wash affected area with water for at least 15 minutes. Ensure contaminated clothing is washed before re-use. Seek medical advice /attention depending on the severity.
Eye contact	Immediately irrigate with copious quantity of water for at least 15 minutes. Eyelids to be held open. In all cases of eye contamination it is a sensible precaution to seek medical advice.
First Aid Facilities	Maintain eyewash fountain and safety shower in work area.
Advice to Doctor	Treat symptomatically based on judgement of doctor and individual reactions of the patient.
Other Information	Treat symptomatically as for acidic material and iron salts. Symptoms may be delayed for hours or days. For advice, contact the National Poisons Information Centre (Phone Australia 13 11 26; New Zealand 0800 764 766) or a doctor.

5. Fire-fighting measures

Hazards from Combustion Products	May evolve toxic fumes in fire such as hydrogen chloride and iron oxides.
Specific Methods	Use extinguishing media most appropriate for the surrounding fire. Small fire: Use dry chemical, CO2 or water spray. Large fire: Use dry chemical, CO2, foam or water spray - Do NOT use water jets. If safe to do so, move undamaged containers from the fire area. Cool containers with flooding quantities of water until well after the fire is out. Avoid getting water inside the containers.
Specific hazards arising from the chemical	Material does not burn. Fire or heat will produce toxic gases. Containers may explode when heated. Some may ignite combustibles (wood, paper, clothing, etc.) Contact with metals may evolve flammable hydrogen gas.
Hazchem Code	2X
Precautions in connection with Fire	Wear SCBA and chemical splash suit. Fully encapsulating, gas-tight suits should be worn for maximum protection. Structural firefighter's uniform is NOT effective for these materials.

6. Accidental release measures

Spills & Disposal	Do NOT touch or walk through this product. Do NOT touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if safe to do so. Prevent entry into waterways, drains, confined areas. Cover with DRY earth, sand or other non-combustible material followed by plastic sheet to minimise spreading or contact with rain.
Personal Precautions	Evacuate the area of all non-essential personnel. Avoid inhalation, contact with skin, eyes and clothing.
Personal Protection	Wear protective clothing specified for normal operations (see Section 8)
Clean-up Methods - Small Spillages	Absorb or contain liquid with sand, earth or spill control material. Shovel up using non sparking tools and place in a labelled, sealable container for subsequent safe disposal. Put leaking containers in a labelled drum or overdrum.
Clean-up Methods - Large Spillages	Seek expert advice on handling and disposal.
Environmental Precautions	Prevent contamination of soil and water.

7. Handling and storage

Precautions for Safe Handling	Do not breathe vapour. Avoid contact with eyes, skin and clothing. Avoid prolonged or repeated exposure. Wash hands and face thoroughly after working with material. Keep away from incompatibles. Use in well ventilated areas away from all ignition sources. In case of insufficient ventilation, wear suitable respiratory equipment.
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Product Name : **FERRIC CHLORIDE Solution**

Classified as hazardous

Conditions for safe storage, including any incompatibilities Store in cool place and out of direct sunlight. Store in well ventilated area. Store away from oxidizing agents. Keep containers closed at all times.

Corrosiveness Corrosive to most metals.

Storage Regulations Refer Australian Standard AS 3780 - 1994 'The storage and handling of corrosive substances'.

8. Exposure controls/personal protection

Occupational exposure limit values	<u>Name</u>	STEL		TWA		<u>Footnote</u>
		<u>mg/m3</u>	<u>ppm</u>	<u>mg/m3</u>	<u>ppm</u>	
	Iron (III) chloride			1		Iron salts, soluble (as Fe)
Other Exposure Information	<p>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.</p> <p>A time weighted average (TWA) has been established for Iron salts, soluble (as Fe) (Safe Work Australia) of 1 mg/m³ and for Hydrogen chloride (Safe Work Australia) of 7.5 mg/m³ - Peak limitation, 5 ppm. 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.</p> <p>PEAK LIMITATION: For some rapidly acting substances and irritants, averaging of airborne concentration over an eight hour period is inappropriate. These substances may induce acute effects after relatively brief exposure to high concentrations and so the exposure standard for these substances represents a maximum or peak concentration to which workers may be exposed.</p>					
Appropriate engineering controls	In industrial situations maintain the concentrations values below the TWA. This may be achieved by process modification, use of local exhaust ventilation, capturing substances at the source, or other methods. These methods should be used in preference to personal protective equipment.					
Respiratory Protection	Where ventilation is not adequate, respiratory protection may be required. Avoid breathing vapours or mists. Select and use respirators in accordance with AS 1716 - Respiratory Protective Devices and be selected in accordance with AS 1715 - Selection, Use and Maintenance of Respiratory Protective Devices. When mists or vapours exceed the exposure standards then the use of the following is recommended: Approved respirator with organic vapour and dust/mist filters. Filter capacity and respirator type depends on exposure levels.					
Eye Protection	The use of a face shield, chemical goggles or safety glasses with side shield protection as appropriate. Must comply with Australian Standards AS 1337 and be selected and used in accordance with AS 1336.					
Hand Protection	Hand protection should comply with AS 2161, Occupational protective gloves - Selection, use and maintenance. RECOMMENDATION: Excellent: Nitrile and Neoprene.					
Personal Protective Equipment	Personal protective equipment should not solely be relied upon to control risk and should only be used when all other reasonably practicable control measures do not eliminate or sufficiently minimise risk. Guidance in selecting personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.					
Footwear	Safety boots in industrial situations is advisory, foot protection should comply with AS 2210, Occupational protective footwear - Guide to selection, care and use.					
Body Protection	Clean clothing or protective clothing should be worn, preferably with an apron. Clothing for protection against chemicals should comply with AS 3765 Clothing for Protection Against Hazardous Chemicals.					
Hygiene Measures	Always wash hands before smoking, eating or using the toilet. Wash contaminated clothing and other protective equipment before storing or re-using.					

9. Physical and chemical properties

Form	Liquid
Appearance	Reddish or yellow liquid.
Odour	Odourless or faint odour of hydrogen chloride.
Solubility in Water	Soluble.



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Product Name : **FERRIC CHLORIDE Solution**

Classified as hazardous

Solubility in Organic Solvents Soluble in glycerol; practically insoluble in ethyl acetate**Specific Gravity**

1.49

pH

pH ~ 1.5; Acidic.

Flammability

Non combustible material.

10. Stability and reactivity**Chemical Stability** Stable under normal use conditons.**Conditions to Avoid** Incompatibles.**Incompatible Materials** Oxidising agents, cyanides, allyl chloride, metals (sodium and potassium).**Hazardous Decomposition Products** Hydrogen chloride and iron oxides.**Possibility of hazardous reactions**

Can liberate flammable hydrogen gas upon contact with most metals. Toxic hydrogen chloride is produced upon hydrolysis.

Hazardous Polymerization

Will not occur.

11. Toxicological Information**Acute Toxicity - Oral** LD50 (rat): 316 mg/kg - Ferric chloride anhydrous.

LD50 (rat): ~1160 mg/kg - (40% solution)

Ingestion

Corrosive. Harmful if swallowed. Swallowing can cause severe burns of the mouth, throat, pharynx, oesophagus and stomach. Can cause sore throat, vomiting, diarrhea, abdominal pain and circulatory collapse. Can cause corrosive damage to stomach and small intestine. Low systemic toxicity in small quantities but larger doses may cause systemic effects. Pink urine discoloration is a strong indicator of iron poisoning. Liver damage, coma and death may follow, sometimes delayed as long as three days.

Inhalation

Inhalation of mists or aerosols can produce respiratory irritation.

May be harmful if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation may result in spasm, inflammation and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Skin

Corrosive. Causes burns. Material is extremely destructive to tissue of the mucous membranes and skin. May be harmful if absorbed through the skin. Symptoms are characterised by pain, itching, scaling, reddening and occasional blistering and burns can occur.

Eye

Corrosive. Causes burns. Material is extremely destructive to tissue of the mucous membranes and eyes. Contact can cause blurred vision, redness, watering, pain and severe tissue burns. Risk of serious damage to eyes!

Carcinogenicity

Not listed in the IARC Monographs.

Chronic Effects

Inhalation may result in spasm, inflammation and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Repeated ingestion may cause liver and kidney damage. Repeated or prolonged contact with the skin may cause dermatitis. Prolonged exposure of the eyes may cause discoloration. Absorption of large quantities of this material may lead to metabolic acidosis, convulsions, cardiovascular disorders, acute liver necrosis that can result in death due to hepatic coma.

Mutagenicity

No evidence of mutagenic effects.

12. Ecological information**Ecotoxicity**

Quantitative data on the ecological effect of this product are not available.

13. Disposal considerations**Disposal Considerations**

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and disposed of according to relevant local, state and federal government regulations.

14. Transport information**Transport Information**

Dangerous goods of Class 8 (Corrosive) are incompatible in a placard load with any of the following: Class 1, Class 4.3, Class 5, Class 6, if the Class 6 dangerous goods are cyanides and the Class 8 dangerous goods are acids, Class 7; and are incompatible with food and food packaging in any quantity.

U.N. Number

2582



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Product Name : **FERRIC CHLORIDE Solution**

Classified as hazardous

UN proper shipping name FERRIC CHLORIDE SOLUTION**Transport hazard class(es)** 8**Hazchem Code** 2X**Packing Group** III**EPG Number** 8A1**IERG Number** 37**15. Regulatory information**

Regulatory Information Listed in the Australian Inventory of Chemical Substances (AICS). Not listed under WHS Regulation 2011, Schedule 10 - Prohibited carcinogens, restricted carcinogens and restricted hazardous chemicals.

Poisons Schedule Not Scheduled

16. Other Information

Literature References 'Standard for the Uniform Scheduling of Medicines and Poisons .', Commonwealth of Australia. Lewis, Richard J. Sr. 'Hawley's Condensed Chemical Dictionary 13th. Ed.', Rev., John Wiley and Sons, Inc., NY, 1997.
National Road Transport Commission, 'Australian Code for the Transport of Dangerous Goods by Road and Rail 7th. Ed.', 2007.
Safe Work Australia, 'National Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals', 2011.
Standards Australia, 'SAA/SNZ HB 76:2010 Dangerous Goods - Initial Emergency Response Guide', Standards Australia/Standards New Zealand, 2010.
Safe Work Australia, 'Approved Criteria for Classifying Hazardous Substances [NOHSC:1008 (2004)]'.
Safe Work Australia, 'Hazardous Chemical Information System, 2005'.
Safe Work Australia, 'National Code of Practice for the Labelling of Safe Work Hazardous Substances (2011)'.
Safe Work Australia, 'National Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003(1995) 3rd Edition]'.
Contact Person/Point Paul McCarthy Ph. (08) 8440 2000 **DISCLAIMER STATEMENT:**
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Empirical Formula & Structural Formula FeCl₃ + aq.
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Warning**SECTION 1: Identification of the substance/mixture and of the company/undertaking****1.1. Product identifier**

Trade name : Aligal 2, Lasal 2
SDS no : AL062

Chemical description : Carbon dioxide
CAS-No. : 124-38-9
EC-No. : 204-696-9
EC Index-No. : ---

REACH registration No : Listed in Annex IV / V REACH, exempted from registration.
Chemical formula : CO₂

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

Relevant identified uses : Extinguishing agent
Industrial and professional uses. Perform risk assessment prior to use.
Test gas/Calibration gas.
Purge gas, diluting gas, inerting gas.
Shield gas for welding processes.
Use for manufacture of electronic/photovoltaic components.
Food applications.
Consumer use.
Use as a biocide.

Uses advised against : None.

1.3. Details of the supplier of the safety data sheet

Company identification : Air Liquide Australia Limited
Level 12 / 600 St. Kilda Road
3004 Melbourne VIC Australia
+61 3 9697 9888
ALAEquiries@AirLiquide.com

1.4. Emergency telephone number

Emergency telephone number : 1800 812 588

SECTION 2: Hazards identification**2.1. Classification of the substance or mixture****Classification according to WHS Regulation**

Physical hazards : Gases under pressure : Liquefied gas H280

2.2. Label elements**Classification according to WHS Regulation**

Hazard pictograms :



GHS04

Signal word :

Warning

Hazard statements :

H280 - Contains gas under pressure; may explode if heated..

Precautionary statements

- Storage : P410+P403 - Protect from sunlight. Store in a well-ventilated place..

2.3. Other hazards

: Asphyxiant in high concentrations.
 Contact with liquid may cause cold burns/frostbite.
 In high concentrations CO₂ causes rapid circulatory insufficiency even at normal levels of oxygen concentration. Symptoms are headache, nausea and vomiting, which may lead to unconsciousness and death.
 The substance/mixture has no endocrine disrupting properties.

SECTION 3: Composition/information on ingredients
3.1. Substances

Name	Product identifier	%	Classification according to WHS Regulation
Carbon dioxide	(CAS-No.) 124-38-9 (EC-No.) 204-696-9 (EC Index-No.) --- (REACH-no) *1	≤ 100	Press. Gas (Liq.), H280

Full text of H- and EUH-statements: see section 16

Contains no other components or impurities which will influence the classification of the product.

*1: Listed in Annex IV / V REACH, exempted from registration.

*2: Registration deadline not expired.

*3: Registration not required: Substance manufactured or imported < 1t/y.

SECTION 4: First aid measures
4.1. Description of first aid measures

- Inhalation : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Perform cardiopulmonary resuscitation if breathing stopped.
- Skin contact : In case of frostbite spray with water for at least 15 minutes. Apply a sterile dressing. Obtain medical assistance.
- Eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes.
- Ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

: In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation.
 Low concentrations of CO₂ cause increased respiration and headache.
 See section 11.

4.3. Indication of any immediate medical attention and special treatment needed

: None.

SECTION 5: Firefighting measures

5.1. Extinguishing media

- Suitable extinguishing media : Water spray or fog.
Product does not burn, use fire control measures appropriate for the surrounding fire.
- Unsuitable extinguishing media : Do not use water jet to extinguish.

5.2. Special hazards arising from the substance or mixture

- Specific hazards : Exposure to fire may cause containers to rupture/explode.
- Hazardous combustion products : None.

5.3. Advice for fire-fighters

- Specific methods : Use fire control measures appropriate for the surrounding fire. Exposure to fire and heat radiation may cause gas receptacles to rupture. Cool endangered receptacles with water spray jet from a protected position. Prevent water used in emergency cases from entering sewers and drainage systems.
If possible, stop flow of product.
Use water spray or fog to knock down fire fumes if possible.
Move containers away from the fire area if this can be done without risk.
- Special protective equipment for fire fighters : In confined space use self-contained breathing apparatus.
Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.
Standard EN 469 - Protective clothing for firefighters. Standard - EN 659: Protective gloves for firefighters.
- Hazchem Code : 2T

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

No additional information available

6.2. Environmental precautions

- : Try to stop release.

6.3. Methods and material for containment and cleaning up

- : Ventilate area.

6.4. Reference to other sections

- : See also sections 8 and 13.

SECTION 7: Handling and storage**7.1. Precautions for safe handling**

- Safe use of the product : The product must be handled in accordance with good industrial hygiene and safety procedures.
Only experienced and properly instructed persons should handle gases under pressure.
Consider pressure relief device(s) in gas installations.
Ensure the complete gas system was (or is regularly) checked for leaks before use.
Do not smoke while handling product.
Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt.
Avoid suck back of water, acid and alkalis.
Do not breathe gas.
Avoid release of product into atmosphere.
Containers, which contain or have contained flammable or explosive substances, must not be inerted with liquid carbon dioxide. Potential production of solid CO₂ particles must be ruled out. In order to rule out potential electrostatic discharge production, the system must be adequately grounded.
Be aware of the risk of formation of static electricity with the use of CO₂ extinguishers. Do not use them in places where a flammable atmosphere may be present.

Safe handling of the gas receptacle : Refer to supplier's container handling instructions.
Do not allow backfeed into the container.
Protect containers from physical damage; do not drag, roll, slide or drop.
When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders.
Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use.
If user experiences any difficulty operating valve discontinue use and contact supplier.
Never attempt to repair or modify container valves or safety relief devices.
Damaged valves should be reported immediately to the supplier.
Keep container valve outlets clean and free from contaminants particularly oil and water.
Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment.
Close container valve after each use and when empty, even if still connected to equipment.
Never attempt to transfer gases from one cylinder/container to another.
Never use direct flame or electrical heating devices to raise the pressure of a container.
Do not remove or deface labels provided by the supplier for the identification of the content of the container.
Suck back of water into the container must be prevented.
Open valve slowly to avoid pressure shock.

7.2. Conditions for safe storage, including any incompatibilities

: Observe all regulations and local requirements regarding storage of containers.
Containers should not be stored in conditions likely to encourage corrosion.
Container valve guards or caps should be in place.
Containers should be stored in the vertical position and properly secured to prevent them from falling over.
Stored containers should be periodically checked for general condition and leakage.
Keep container below 50°C in a well ventilated place.
Store containers in location free from fire risk and away from sources of heat and ignition.
Keep away from combustible materials.

7.3. Specific end use(s)

: None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

OEL (Occupational Exposure Limits) : No data available.

DNEL (Derived-No Effect Level) : No data available.

PNEC (Predicted No-Effect Concentration) : No data available.

8.2. Exposure controls

8.2.1. Appropriate engineering controls

: Provide adequate general and local exhaust ventilation.
Systems under pressure should be regularly checked for leakages.
Ensure exposure is below occupational exposure limits (where available).
Oxygen detectors should be used when asphyxiating gases may be released.
Consider the use of a work permit system e.g. for maintenance activities.

8.2.2. Individual protection measures, e.g. personal protective equipment

: A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered:
PPE compliant to the recommended EN/ISO standards should be selected.

• Eye/face protection

: Wear goggles when transfilling or breaking transfer connections.
Standard EN 166 - Personal eye-protection - specifications

• Skin protection

- Hand protection

: Wear working gloves when handling gas containers.
Standard EN 388 - Protective gloves against mechanical risk.
Wear cold insulating gloves when transfilling or breaking transfer connections.
Standard EN 511 - Cold insulating gloves.

- Other : Wear safety shoes while handling containers.
Standard EN ISO 20345 - Personal protective equipment - Safety footwear.
- Respiratory protection : Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.
Self contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmospheres.
Self contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems.
- Thermal hazards : None in addition to the above sections
- 8.2.3. Environmental exposure controls**
: None necessary.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance

- Physical state at 20°C / 101.3kPa : Gas.
 - Colour : Colourless.
- Odour : Odourless.
- Odour threshold : Odour threshold is subjective and inadequate to warn of overexposure.
- pH value : Not applicable for gases and gas mixtures.
- Molar mass : 44 g/mol
- Melting point : -78.5 °C At atmospheric pressure dry ice sublimates into gaseous carbon dioxide.
- Boiling point : -56.6 °C
- Flash point : Not applicable for gases and gas mixtures.
- Critical temperature [°C] : 30 °C
- Evaporation rate (ether=1) : No data available
- Flammability range : Non flammable.
- Vapour pressure [20°C] : 57.3 bar(a)
- Vapour pressure [50°C] : Not applicable.
- Relative density, gas (air=1) : 1.52
- Relative density, liquid (water=1) : 0.82
- Solubility in water : 2000 mg/l
- Partition coefficient n-octanol/water [log Kow] : 0.83
- Auto-ignition temperature : Non flammable.
- Decomposition point [°C] : Not applicable.
- Viscosity [20°C] : No reliable data available.
- Explosive Properties : No data available
- Oxidising Properties : No oxidising properties

9.2. Other information

- Other data : Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

SECTION 10: Stability and reactivity

10.1. Reactivity

- : No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability

- : Stable under normal conditions.

10.3. Possibility of hazardous reactions

: None.

10.4. Conditions to avoid

: Avoid moisture in installation systems.

10.5. Incompatible materials

: For additional information on compatibility refer to ISO 11114.

10.6. Hazardous decomposition products

: None.

SECTION 11: Toxicological information**11.1. Information on toxicological effects****Acute toxicity**

: Toxicological effects not expected from this product if occupational exposure limit values are not exceeded.

Skin corrosion/irritation

: No known effects from this product.

Serious eye damage/irritation

: No known effects from this product.

Respiratory or skin sensitisation

: No known effects from this product.

Germ cell mutagenicity

: No known effects from this product.

Carcinogenicity

: No known effects from this product.

Toxic for reproduction : Fertility

: No known effects from this product.

Toxic for reproduction : unborn child

: No known effects from this product.

STOT-single exposure

: No known effects from this product.

STOT-repeated exposure

: No known effects from this product.

Aspiration hazard

: Not applicable for gases and gas mixtures.

Other information: Unlike simple asphyxiants, carbon dioxide has the ability to cause death even when normal oxygen levels (20-21%) are maintained. 5% CO₂ has been found to act synergistically to increase the toxicity of certain other gases (CO, NO₂). CO₂ has been shown to enhance the production of carboxy- or met-hemoglobin by these gases possibly due to carbon dioxide's stimulatory effects on the respiratory and circulatory systems. For more information, see 'EIGA Safety Info 24: Carbon Dioxide, Physiological Hazards' at www.eiga.eu. The substance/mixture has no endocrine disrupting properties**SECTION 12: Ecological information****12.1. Toxicity****Assessment**

: No ecological damage caused by this product.

12.2. Persistence and degradability**Assessment**

: No ecological damage caused by this product.

12.3. Bioaccumulative potential**Assessment**

: No ecological damage caused by this product. Not expected to bioaccumulate due to the low log Kow (log Kow < 4). See section 9.

12.4. Mobility in soil**Assessment**

: No ecological damage caused by this product.

12.5. Results of PBT and vPvB assessment**Assessment**

: Not classified as PBT or vPvB.

12.6. Other adverse effects

: No known effects from this product.

Effect on the ozone layer	: No effect on the ozone layer.
Global warming potential [CO2=1]	: 1
Effect on global warming	: When discharged in large quantities may contribute to the greenhouse effect. Contains greenhouse gas(es).

SECTION 13: Disposal considerations**13.1. Waste treatment methods**

List of hazardous waste codes (from Commission Decision 2000/532/EC as amended)

May be vented to atmosphere in a well ventilated place.
Do not discharge into any place where its accumulation could be dangerous.
Return unused product in original container to supplier.

: 16 05 05 : Gases in pressure containers other than those mentioned in 16 05 04.

13.2. Additional information

: None.
External treatment and disposal of waste should comply with applicable local and/or national regulations

SECTION 14: Transport information**14.1. UN number**

UN-No. : 1013

14.2. UN proper shipping name

Transport by road/rail (ADG) : CARBON DIOXIDE

Transport by air (ICAO-TI / IATA-DGR) : Carbon dioxide

Transport by sea (IMDG) : CARBON DIOXIDE

14.3. Transport hazard class(es)

Labelling :



2.2 : Non-flammable, non-toxic gases

Transport by road/rail (ADG)

Class : 2
Hazchem Code : 2T
Hazard identification number : 20
Tunnel Restriction : C/E - Tank carriage : Passage forbidden through tunnels of category C, D and E. Other carriage : Passage forbidden through tunnels of category E

Transport by air (ICAO-TI / IATA-DGR)

Class / Div. (Sub. risk(s)) : 2.2

Transport by sea (IMDG)

Class / Div. (Sub. risk(s)) : 2.2
Emergency Schedule (EmS) - Fire : F-C
Emergency Schedule (EmS) - Spillage : S-V

14.4. Packing group

Transport by road/rail (ADR/RID) : Not applicable

Transport by air (ICAO-TI / IATA-DGR) : Not applicable

Transport by sea (IMDG) : Not applicable

14.5. Environmental hazards

Transport by road/rail (ADR/RID) : None.

Transport by air (ICAO-TI / IATA-DGR) : None.

Transport by sea (IMDG) : None.

14.6. Special precautions for user

No additional information availablePacking Instruction(s)

Transport by road/rail (ADR/RID) : P200

Transport by air (ICAO-TI / IATA-DGR)

Passenger and Cargo Aircraft : 200

Cargo Aircraft only : 200

Transport by sea (IMDG) : P200

Special transport precautions : Avoid transport on vehicles where the load space is not separated from the driver's compartment.
Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.
Before transporting product containers:
- Ensure there is adequate ventilation.
- Ensure that containers are firmly secured.
- Ensure valve is closed and not leaking.
- Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
- Ensure valve protection device (where provided) is correctly fitted.

HAZCHEM CODE : 2T

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

: Not applicable.

SECTION 15: Regulatory information

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

National regulations

Ensure all national/local regulations are observed.

15.2. Chemical safety assessment

: A CSA does not need to be carried out for this product.

SECTION 16: Other information

Indication of changes : Revised safety data sheet in accordance with commission regulation (EU) No 453/2010.

- Abbreviations and acronyms : ATE - Acute Toxicity Estimate. CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008. REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) No 1907/2006. EINECS - European Inventory of Existing Commercial Chemical Substances. CAS# - Chemical Abstract Service number. PPE - Personal Protection Equipment. LC50 - Lethal Concentration to 50 % of a test population. RMM - Risk Management Measures. PBT - Persistent, Bioaccumulative and Toxic. vPvB - Very Persistent and Very Bioaccumulative. STOT- SE : Specific Target Organ Toxicity - Single Exposure. CSA - Chemical Safety Assessment. EN - European Standard. UN - United Nations. ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road. IATA - International Air Transport Association. IMDG code - International Maritime Dangerous Goods. RID - Regulations concerning the International Carriage of Dangerous Goods by Rail. WGK - Water Hazard Class. STOT - RE : Specific Target Organ Toxicity - Repeated Exposure. UFI : Unique Formula Identifier.
- Training advice : The hazard of asphyxiation is often overlooked and must be stressed during operator training. For more guidance, refer to EIGA SL 01 "Dangers of Asphyxiation", downloadable at <http://www.eiga.eu..>

Full text of H-statements

H280	Contains gas under pressure; may explode if heated.
Press. Gas (Liq.)	Gases under pressure : Liquefied gas

- DISCLAIMER OF LIABILITY : Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out. Details given in this document are believed to be correct at the time of going to press. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted.



SAFETY DATA SHEET

BIOMATE* MBC781

1. Identification

Product identifier BIOMATE MBC781
Other means of identification None.
Recommended use Biocide
Recommended restrictions None known.

Company/undertaking identification

SUEZ WTS USA, Inc.
4636 Somerton Road
Trevose, PA 19053
T 215 355 3300, F 215 953 5524

Emergency telephone

(800) 877 1940

2. Hazard(s) identification

Physical hazards Not classified.
Health hazards Skin corrosion/irritation Category 1
Serious eye damage/eye irritation Category 1
Sensitization, skin Category 1
Specific target organ toxicity, single exposure Category 3 respiratory tract irritation
OSHA defined hazards Not classified.

Label elements



Signal word Danger

Hazard statement Causes severe skin burns and eye damage. May cause an allergic skin reaction. Causes serious eye damage. May cause respiratory irritation.

Precautionary statement

Prevention Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe mist or vapor. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. Contaminated work clothing must not be allowed out of the workplace. Wear protective gloves/protective clothing/eye protection/face protection.

Response If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor/. Specific treatment (see this label). If skin irritation or rash occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

Storage Store in a well-ventilated place. Keep container tightly closed. Store locked up.

Disposal Dispose of contents/container to an approved facility.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information None.

3. Composition/information on ingredients

Mixtures

Components	CAS #	Percent
Magnesium nitrate	10377-60-3	1 - 2.5
Mixture of: 5-chloro-2-methyl-4-isothiazolin-3-one [EC no. 247-500-7] and 2-methyl-4-isothiazolin-3-one [EC no. 220-239-6] (3:1)	55965-84-9	1 - 2.5

Composition comments Information for specific product ingredients as required by the U.S. OSHA HAZARD COMMUNICATION STANDARD is listed. Refer to additional sections of this SDS for our assessment of the potential hazards of this formulation.

4. First-aid measures

Inhalation If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.

Skin contact Remove contaminated clothing immediately and wash skin with soap and water. Call a physician or poison control center immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.

Eye contact Rinse immediately with plenty of water for at least 20 minutes. Remove contact lenses, if present and easy to do. Keep eyelids apart. Continue rinsing. Call a physician or poison control center immediately.

Ingestion If ingestion of a large amount does occur, call a poison control center immediately. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Most important symptoms/effects, acute and delayed Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. May cause respiratory irritation.

Indication of immediate medical attention and special treatment needed Provide general supportive measures and treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim under observation. Symptoms may be delayed. Corrosive material. Possible mucosal damage may contraindicate the use of gastric lavage. It may not be advisable to induce vomiting.

General information IF exposed or concerned: Get medical advice/attention. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Wash contaminated clothing before reuse.

5. Fire-fighting measures

Suitable extinguishing media Water fog. Foam. Dry chemical powder. Carbon dioxide (CO₂).

Unsuitable extinguishing media Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical During fire, gases hazardous to health may be formed. Corrosive liquid.

Special protective equipment and precautions for firefighters Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.

Fire fighting equipment/instructions In case of fire and/or explosion do not breathe fumes. Use standard firefighting procedures and consider the hazards of other involved materials. Move containers from fire area if you can do so without risk. Cool containers / tanks with water spray.

General fire hazards No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep out of low areas. Wear appropriate protective equipment and clothing during clean-up. Do not breathe mist or vapor. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up Absorb the spill with spill pillows or inert solids such as clay or vermiculite. Transfer contaminated materials to suitable containers for disposal. Deactivate spill area with freshly prepared solution of 5% sodium bicarbonate and 5% sodium hypochlorite in water. Apply solution to the spill area at a ratio of 10 volumes deactivation solution per estimated volume of residual spill to deactivate any residual active ingredient. Let stand for 30 minutes. Flush the spill area with copious amounts of water to chemical sewer in accordance with local procedures, permits and regulations. DO NOT add deactivation solution to the waste pail to deactivate the adsorbed material. For waste disposal, see section 13 of the SDS.

Environmental precautions Avoid discharge into drains, water courses or onto the ground. Water contaminated with this product may be sent to a sanitary sewer treatment facility, or a permitted waste treatment facility, in accordance with any local agreements.

7. Handling and storage

Precautions for safe handling Avoid all contact with reducing agents, oils, greases, organics and acids. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe mist or vapor. Do not get this material in contact with eyes. Do not get this material in contact with skin. Do not get this material on clothing. Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities Store locked up. Store upright in original vented container. Product evolves carbon dioxide gas slowly. Store samples in plastic bottles only. Store away from incompatible materials (see Section 10 of the SDS). Store in accordance with local/regional/national/international regulation.

8. Exposure controls/personal protection

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection

Hand protection Chemical resistant gloves. The choice of an appropriate glove does not only depend on its material but also on other quality features and is different from one producer to the other. Glove selection must take into account any solvents and other hazards present.

Other Wear appropriate chemical resistant clothing. Use of an impervious apron is recommended.

Respiratory protection If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. A RESPIRATORY PROTECTION PROGRAM THAT MEETS OSHA'S 29 CFR 1910.134 AND ANSI Z88.2 REQUIREMENTS MUST BE FOLLOWED WHENEVER WORKPLACE CONDITIONS WARRANT A RESPIRATOR'S USE.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Contaminated work clothing should not be allowed out of the workplace.

9. Physical and chemical properties

Appearance

Color Yellow to blue-green

Physical state Liquid

Odor Slight

Odor threshold Not available.

pH (concentrated product) 3

pH in aqueous solution 4 (5% SOL.)

Melting point/freezing point 28 °F (-2 °C)

Initial boiling point and boiling range 220 °F (104 °C)

Flash point Not applicable.

Evaporation rate < 1 (Ether = 1)

Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	18 mm Hg / 2.4 kPa
Vapor pressure temp.	70 °F (21 °C)
Vapor density	< 1 (Air = 1)
Relative density	1.03
Relative density temperature	70 °F (21 °C)
Solubility(ies)	
Solubility (water)	100 %
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	8 cps
Viscosity temperature	70 °F (21 °C)
Other information	
Pour point	33 °F (1 °C)
Specific gravity	1.033
VOC	0 % (Calculated)

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials. None under normal conditions.
Incompatible materials	Strong oxidizing agents. Reducing agents. Amines. mercaptans
Hazardous decomposition products	Oxides of carbon, nitrogen, and sulphur evolved in fire. Hydrogen chloride.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause irritation to the respiratory system.
Skin contact	Causes severe skin burns. May cause an allergic skin reaction.
Eye contact	Causes serious eye damage.
Ingestion	Causes digestive tract burns.

Symptoms related to the physical, chemical and toxicological characteristics Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. May cause respiratory irritation.

Information on toxicological effects

Acute toxicity Causes severe skin burns and eye damage. May cause respiratory irritation. May cause an allergic skin reaction.

Product	Species	Test Results
BIOMATE MBC781 (CAS Mixture)		
Acute		
<i>Dermal</i>		
LD50	Rabbit	> 5000 mg/kg

Product	Species	Test Results
<i>Inhalation</i>		
LC50	Rat	> 5 mg/l, 4 Hours
<i>Oral</i>		
LD50	Rat	4468 mg/kg
Components	Species	Test Results

Magnesium nitrate (CAS 10377-60-3)

Acute

Dermal

LD50 Rabbit > 5000 mg/kg

Oral

LD50 Rat 5400 mg/kg

Mixture of: 5-chloro-2-methyl-4-isothiazolin-3-one [EC no. 247-500-7] and 2-methyl-4-isothiazolin-3-one [EC no. 220-239-6] (3:1) (CAS 55965-84-9)

Acute

Dermal

LD50 Rabbit 90 mg/kg

Inhalation

LC50 Rat 0.33 mg/l, 4 Hour

Oral

LD50 Rat 67 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation Causes skin burns.

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization This product is not expected to cause respiratory sensitization.

Skin sensitization May cause an allergic skin reaction.

Germ cell mutagenicity Not classified.

Carcinogenicity This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure May cause respiratory irritation.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Based on available data, the classification criteria are not met.

12. Ecological information

Ecotoxicity

Product	Species	Test Results
BIOMATE MBC781 (CAS Mixture)		
LC50	Bluegill Sunfish	12.1 mg/L, Static Acute Bioassay, 96 hour
	Fathead Minnow	6.6 mg/L, Flow-Thru Bioassay, 96 hour
	Sheepshead Minnow	20 mg/L, Static Acute Bioassay, 96 hour
LOEC	Fathead Minnow	4 mg/L, Early Life Stage Test, 36 day

Product		Species	Test Results
	NOEL	Bluegill Sunfish	6.5 mg/L, Static Acute Bioassay, 96 hour
		Fathead Minnow	2.5 mg/L, Flow-Thru Bioassay, 96 hour
			1.3 mg/L, Early Life Stage Test, 36 day
		Sheepshead Minnow	12 mg/L, Static Acute Bioassay, 96 hour
Aquatic			
Crustacea	10% Mortality	Daphnia magna	0.6 mg/L, Flow-Thru Bioassay, 48 hour
	LC50	Daphnia magna	2.9 mg/L, Flow-Thru Bioassay, 48 hour
Fish	LC50	Rainbow Trout	8.7 mg/L, Static Acute Bioassay, 96 hour
			4.6 mg/L, Chronic Bioassay, 14 day
	NOEL	Rainbow Trout	6.5 mg/L, Static Acute Bioassay, 96 hour
			3.3 mg/L, Chronic Bioassay, 14 day

Bioaccumulative potential No information available.

Partition coefficient n-octanol / water (log Kow)

Mixture of: 5-chloro-2-methyl-4-isothiazolin-3-one [EC no. 247-500-7] and 2-methyl-4-isothiazolin-3-one [EC no. 220-239-6] (3:1) 0.486

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

Persistence and degradability

- COD (mgO₂/g) 17 (calculated data)
- BOD 5 (mgO₂/g) 0 (calculated data)
- BOD 28 (mgO₂/g) 0 (calculated data)
- Closed Bottle Test (% Degradation in 28 days) 0 (calculated data)
- Zahn-Wellens Test (% Degradation in 28 days) 0 (calculated data)
- TOC (mg C/g) 6 (calculated data)

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Incinerate the material under controlled conditions in an approved incinerator. Dispose of contents/container in accordance with local/regional/national/international regulations. Dispose of in approved pesticide facility or according to label instructions.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company. D002= Corrosive

Waste from residues / unused products Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT	
UN number	UN3265
UN proper shipping name	Corrosive liquid, acidic, organic, n.o.s. (5-CHLORO-2-METHYL-4-ISOTHIAZOLIN-3-ONE)
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	II
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
ERG number	153

Some containers may be exempt from Dangerous Goods/Hazmat Transport Regulations, please check BOL for exact container classification.

IATA

UN number UN3265
UN proper shipping name CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (Mixture of: 5-chloro-2-methyl-4-isothiazolin-3-one [EC no. 247-500-7] and 2-methyl-4-isothiazolin-3-one [EC no. 220-239-6] (3:1))
Transport hazard class(es)
Class 8
Subsidiary risk -
Packing group II
Environmental hazards Yes
ERG Code 153
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number UN3265
UN proper shipping name CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (Mixture of: 5-chloro-2-methyl-4-isothiazolin-3-one [EC no. 247-500-7] and 2-methyl-4-isothiazolin-3-one [EC no. 220-239-6] (3:1)), MARINE POLLUTANT
Transport hazard class(es)
Class 8
Subsidiary risk -
Packing group II
Environmental hazards
Marine pollutant Yes
EmS F-A, S-B
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.

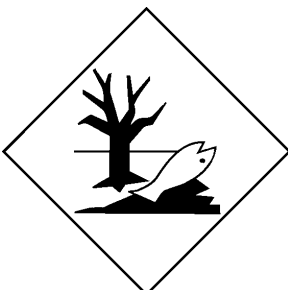
DOT



IATA; IMDG



Marine pollutant



General information IMDG Regulated Marine Pollutant.

15. Regulatory information

US federal regulations

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

This is an EPA registered biocide and is exempt from TSCA inventory requirements. See FIFRA registry number.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes

Delayed Hazard - No

Fire Hazard - No

Pressure Hazard - No

Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Magnesium nitrate	10377-60-3	1 - 2.5

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130) Hazardous substance

Safe Drinking Water Act (SDWA) Not regulated.

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

FIFRA registration number 3876-143

TSCA This is an EPA registered biocide and is exempt from TSCA inventory requirements.

FIFRA hazard statement This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets, and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label:

DANGER

Corrosive

Causes irreversible eye damage and skin burns

May be fatal if absorbed through skin

Harmful if swallowed

Prolonged or frequently repeated skin contact may cause allergic reaction in some individuals

This chemical is toxic to terrestrial and aquatic plants, fish and aquatic invertebrates

US state regulations

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

No ingredient listed.

US - California Proposition 65 - CRT: Listed date/Developmental toxin

No ingredient listed.

US - California Proposition 65 - CRT: Listed date/Female reproductive toxin

No ingredient listed.

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

No ingredient listed.

US - Massachusetts RTK - Substance List

Magnesium nitrate (CAS 10377-60-3)

US - Pennsylvania RTK - Hazardous Substances

Magnesium nitrate (CAS 10377-60-3) Listed.

US - Rhode Island RTK

Magnesium nitrate (CAS 10377-60-3)

US. New Jersey Worker and Community Right-to-Know Act

Magnesium nitrate (CAS 10377-60-3) Listed.

US. Pennsylvania Worker and Community Right-to-Know Law

Magnesium nitrate (CAS 10377-60-3) Hazardous substance

US. California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

16. Other information, including date of preparation or last revision

Issue date Dec-12-2014

Revision date Apr-06-2018

Version # 3.1

List of abbreviations CAS: Chemical Abstract Service Registration Number
ACGIH: American Conference of Governmental Industrial Hygienists
TWA: Time Weighted Average
STEL: Short Term Exposure Limit
LD50: Lethal Dose, 50%
LC50: Lethal Concentration, 50%
NOEL: No Observed Effect Level
COD: Chemical Oxygen Demand
BOD: Biochemical Oxygen Demand
TOC: Total Organic Carbon
IATA: International Air Transport Association
IMDG: International Maritime Dangerous Goods Code
TSRN indicates a Trade Secret Registry Number is used in place of the CAS number.

References: No data available

Disclaimer The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Revision information This document has undergone significant changes and should be reviewed in its entirety.

Prepared by This SDS has been prepared by SUEZ Regulatory Department (1-215-355-3300).

* Trademark of SUEZ. May be registered in one or more countries.

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

1.1 Product identifier

Product name LIQUEFIED PETROLEUM GAS (LPG)
Synonyms AUTOGAS • BUTANE • LIQUEFIED PETROLEUM GAS • LP GAS • LPG • PROPANE

1.2 Uses and uses advised against

Uses AUTOMOTIVE FUEL • FUEL • INDUSTRIAL APPLICATIONS

1.3 Details of the supplier of the product

Supplier name ELGAS LTD
Address 10 Julius Ave, North Ryde, NSW, 2113, AUSTRALIA
Telephone 131 161
Website <https://www.elgas.com.au/>

1.4 Emergency telephone numbers

Emergency 1800 819 783 (24 hours)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

CLASSIFIED AS HAZARDOUS ACCORDING TO SAFE WORK AUSTRALIA CRITERIA

Physical Hazards

Flammable Gases: Category 1A
Gases Under Pressure: Liquefied gas

Health Hazards

Not classified as a Health Hazard

Environmental Hazards

Not classified as an Environmental Hazard

2.2 GHS Label elements

Signal word DANGER

Pictograms



Hazard statements

H220 Extremely flammable gas.
H280 Contains gas under pressure; may explode if heated.

Prevention statements

P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response statements

P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 In case of leakage, eliminate all ignition sources.

Storage statements

P410 + P403 Protect from sunlight. Store in a well-ventilated place.

PRODUCT NAME LIQUEFIED PETROLEUM GAS (LPG)**Disposal statements**

None allocated.

2.3 Other hazards

No information provided.

3. COMPOSITION/ INFORMATION ON INGREDIENTS

3.1 Substances / Mixtures

Ingredient	CAS Number	EC Number	Content
BUTANE	106-97-8	203-448-7	<99%
ISOBUTANE	75-28-5	200-857-2	<99%
PROPANE	74-98-6	200-827-9	<99%
PROPYLENE	115-07-1	204-062-1	<60%
ETHANE	74-84-0	200-814-8	<5%
ETHYL MERCAPTAN	75-08-1	200-837-3	0.0025%

4. FIRST AID MEASURES

4.1 Description of first aid measures

Eye	Cold burns: Immediately flush with tepid water or with sterile saline solution. Hold eyelids apart and irrigate for 15 minutes. Seek medical attention.
Inhalation	If inhaled, remove from contaminated area. To protect rescuer, use an Air-line respirator or Self Contained Breathing Apparatus (SCBA). Be aware of possible explosive atmospheres. Apply artificial respiration if not breathing. Give oxygen if available.
Skin	Cold burns: Remove contaminated clothing and gently flush affected areas with warm water (30°C) for 15 minutes. It is recommended that warm water is applied to clothing before removing it so as to prevent further skin damage. Apply 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	Ingestion is not considered a potential route of exposure.
First aid facilities	Eye wash facilities and safety shower should be available.

4.2 Most important symptoms and effects, both acute and delayed

In high concentrations may cause asphyxiation. Direct contact with the liquefied material or escaping compressed gas may cause frostbite injury.

4.3 Immediate medical attention and special treatment needed

Treat symptomatically. Severe inhalational exposure may sensitise the heart to catecholamine induced arrhythmias. Do not administer catecholamines to an overexposed person.

5. FIRE FIGHTING MEASURES

5.1 Extinguishing media

Stop flow of gas if safe to do so, such as by slowly closing the cylinder valve.

5.2 Special hazards arising from the substance or mixture

Extremely flammable. Eliminate all ignition sources including cigarettes, open flames, spark producing switches/tools, heaters, naked lights, pilot lights, mobile phones etc. when handling.

5.3 Advice for firefighters

Temperatures in a fire may cause cylinders to rupture and internal pressure relief devices to be activated. Cool cylinders or containers exposed to fire by applying water from a protected location. Do not approach cylinders or containers suspected of being hot. This material is capable of forming explosive mixtures in air.

5.4 Hazchem code

2YE	
2	Fine Water Spray.
Y	Risk of violent reaction or explosion. Wear full fire kit and breathing apparatus. Contain spill and run-off.
E	Evacuation of people in and around the immediate vicinity of the incident should be considered.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

If the cylinder is leaking, evacuate area of personnel. Inform manufacturer/supplier of leak. Use Personal Protective Equipment (PPE) as detailed in Section 8 of the SDS. Ventilate area where possible and eliminate ignition sources.

6.2 Environmental precautions

Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

6.3 Methods of cleaning up

Stop the flow of material, if this is without risk. If the leak is irreparable, move the cylinder to a safe and well ventilated area, and allow to discharge. Keep area evacuated and free from ignition sources until any leaked or spilled liquid has evaporated.

6.4 Reference to other sections

See Sections 8 and 13 for exposure controls and disposal.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Before use carefully read the product label. Use of safe work practices are recommended to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating. Prohibit eating, drinking and smoking in contaminated areas.

7.2 Conditions for safe storage, including any incompatibilities

Do not store near incompatible substances and sources of ignition. Cylinders should be stored: upright, prevented from falling, in a secure area; below 65°C, in a dry, well ventilated area constructed of non-combustible material with firm level floor (preferably concrete), away from areas of heavy traffic and emergency exits.

7.3 Specific end uses

No information provided.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

Exposure standards

Ingredient	Reference	TWA		STEL	
		ppm	mg/m ³	ppm	mg/m ³
Butane	SWA [AUS]	800	1900	--	--
Butane	SWA [Proposed]	--	--	1000	2370
Ethane	SWA [AUS]	Asphyxiant			
Ethyl mercaptan	SWA [AUS]	0.5	1.3	--	--
Isobutane	SWA [AUS]	1000	--	--	--
Propane	SWA [AUS]	Asphyxiant			
Propylene	SWA [AUS]	Asphyxiant			

Biological limits

No biological limit values have been entered for this product.

8.2 Exposure controls

Engineering controls

Avoid inhalation. Use in well ventilated areas. Where an inhalation risk exists, mechanical explosion proof extraction ventilation is recommended. Maintain vapour levels below the recommended exposure standard.

PRODUCT NAME LIQUEFIED PETROLEUM GAS (LPG)

PPE

Eye / Face	Wear safety glasses.
Hands	Wear leather or insulated gloves.
Body	Wear coveralls.
Respiratory	Where an inhalation risk exists, wear Self Contained Breathing Apparatus (SCBA) or an Air-line respirator.



9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance	COLOURLESS GAS (LIQUEFIED UNDER PRESSURE)
Odour	CHARACTERISTIC ODOUR
Flammability	EXTREMELY FLAMMABLE
Flash point	-104°C to -60°C
Boiling point	-42°C to -0.5°C
Melting point	NOT RELEVANT
Evaporation rate	NOT AVAILABLE
pH	NOT RELEVANT
Vapour density	NOT AVAILABLE
Relative density	0.510 to 0.568
Solubility (water)	SLIGHTLY SOLUBLE
Vapour pressure	520 kPa to 1530 kPa @ 40°C
Upper explosion limit	10.9 % (Propane)
Lower explosion limit	1.7 % (Propane)
Partition coefficient	NOT AVAILABLE
Autoignition temperature	450°C (Propane)
Decomposition temperature	NOT AVAILABLE
Viscosity	NOT AVAILABLE
Explosive properties	NOT AVAILABLE
Oxidising properties	NOT AVAILABLE
Odour threshold	NOT AVAILABLE

9.2 Other information

Density	1.86 kg/m ³ to 2.47 kg/m ³ @ 15°C
Specific heat value	2.386 to 2.512 kJ/kg

10. STABILITY AND REACTIVITY

10.1 Reactivity

Carefully review all information provided in sections 10.2 to 10.6.

10.2 Chemical stability

Stable under recommended conditions of storage.

10.3 Possibility of hazardous reactions

Polymerization will not occur.

10.4 Conditions to avoid

Avoid heat, sparks, open flames and other ignition sources.

10.5 Incompatible materials

Incompatible with oxidising agents (e.g. hypochlorites), acids (e.g. nitric acid), heat and ignition sources. Do not use natural rubber flexible hoses. Also incompatible (potentially violently) with oxygen, halogens and metal halides.

10.6 Hazardous decomposition products

May evolve toxic gases if heated to decomposition.

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity No known toxicological effects from this product. Based on available data, the classification criteria are not met.

Information available for the ingredients:

Ingredient	Oral LD50	Dermal LD50	Inhalation LC50
BUTANE	Study not feasible	Study not feasible	658000 mg/m ³ /4H (rat)
PROPANE	Study not feasible	Study not feasible	> 800000 ppm/15M (rat)
PROPYLENE	--	--	> 65000 ppm/4hrs (rat)
ETHANE	--	--	658 mg/L/4hrs (rat)
ETHYL MERCAPTAN	682 mg/kg (rat)	--	2770 ppm/4 hours (mouse)

Skin Not classified as a skin irritant. Contact with the liquefied material or escaping compressed gas may cause frostbite injury.

Eye Not classified as an eye irritant. Contact with the liquefied material or escaping compressed gas may cause frostbite injury.

Sensitisation Not classified as causing skin or respiratory sensitisation.

Mutagenicity Not classified as a mutagen.

Carcinogenicity Not classified as a carcinogen.

Reproductive Not classified as a reproductive toxin.

STOT - single exposure Asphyxiant. Effects are proportional to oxygen displacement. Over exposure may result in dizziness, drowsiness, weakness, fatigue, breathing difficulties and unconsciousness.

STOT - repeated exposure Not classified as causing organ damage from repeated exposure.

Aspiration Not classified as causing aspiration.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Not expected to be harmful to the environment.

12.2 Persistence and degradability

No information provided.

12.3 Bioaccumulative potential

This product is not expected to bioaccumulate through food chains in the environment.

12.4 Mobility in soil

Spillages are unlikely to penetrate the soil.

12.5 Other adverse effects

Gas at standard temperature and pressure and is expected to partition primarily to air.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Waste disposal Cylinders should be returned to the manufacturer or supplier for disposal of contents.

Legislation Dispose of in accordance with relevant local legislation.

14. TRANSPORT INFORMATION

CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE



	LAND TRANSPORT (ADG)	SEA TRANSPORT (IMDG / IMO)	AIR TRANSPORT (IATA / ICAO)
14.1 UN Number	1075	1075	1075
14.2 Proper Shipping Name	PETROLEUM GASES, LIQUEFIED	PETROLEUM GASES, LIQUEFIED	PETROLEUM GASES, LIQUEFIED
14.3 Transport hazard class	2.1	2.1	2.1
14.4 Packing Group	None allocated.	None allocated.	None allocated.

14.5 Environmental hazards

Not a Marine Pollutant.

14.6 Special precautions for user

Hazchem code 2YE

GTEPG 2A2

EmS F-D, S-U

Other information Ensure cylinder is separated from driver and that outlet of relief device is not obstructed.

15. REGULATORY INFORMATION

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

Poison schedule A poison schedule number has not been allocated to this product using the criteria in the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).

Classifications Safe Work Australia criteria is based on the Globally Harmonised System (GHS) of Classification and Labelling of Chemicals (GHS Revision 7).

Inventory listings **AUSTRALIA: AIIC (Australian Inventory of Industrial Chemicals)**
All components are listed on AIIC, or are exempt.

16. OTHER INFORMATION

Additional information ASPHYXIANTS (1): When present in the atmospheres in high concentrations, asphyxiants reduce the oxygen concentration by displacement. Atmospheres deficient in oxygen do not provide adequate sensory warning of danger and most simple asphyxiants are odourless. Therefore it is not appropriate to recommend an exposure standard for each asphyxiant, but to maintain oxygen concentrations. However, some asphyxiants may be given an exposure standard due to the potential for narcotic effects at high concentrations or an explosion hazard.

ASPHYXIANTS (2): There is a significant hazard associated with workers entering poorly ventilated areas (e.g. tanks) where oxygen may be deficient. An air supplied breathing apparatus may be required if adequate ventilation is not ensured.

PERSONAL PROTECTIVE EQUIPMENT GUIDELINES:

The recommendation for protective equipment contained within this report is provided as a guide only. Factors such as form of product, method of application, working environment, quantity used, product concentration and the availability of engineering controls should be considered before final selection of personal protective equipment is made.

PRODUCT NAME LIQUEFIED PETROLEUM GAS (LPG)

HEALTH EFFECTS FROM EXPOSURE:

It should be noted that the effects from exposure to this product will depend on several factors including: form of product; frequency and duration of use; quantity used; effectiveness of control measures; protective equipment used and method of application. Given that it is impractical to prepare a report which would encompass all possible scenarios, it is anticipated that users will assess the risks and apply control methods where appropriate.

Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
CAS #	Chemical Abstract Service number - used to uniquely identify chemical compounds
CNS	Central Nervous System
EC No.	EC No - European Community Number
EMS	Emergency Schedules (Emergency Procedures for Ships Carrying Dangerous Goods)
GHS	Globally Harmonized System
GTEPG	Group Text Emergency Procedure Guide
IARC	International Agency for Research on Cancer
LC50	Lethal Concentration, 50% / Median Lethal Concentration
LD50	Lethal Dose, 50% / Median Lethal Dose
mg/m ³	Milligrams per Cubic Metre
OEL	Occupational Exposure Limit
pH	relates to hydrogen ion concentration using a scale of 0 (high acidic) to 14 (highly alkaline).
ppm	Parts Per Million
STEL	Short-Term Exposure Limit
STOT-RE	Specific target organ toxicity (repeated exposure)
STOT-SE	Specific target organ toxicity (single exposure)
SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
SWA	Safe Work Australia
TLV	Threshold Limit Value
TWA	Time Weighted Average

Report status

This document has been compiled by RMT on behalf of the manufacturer, importer or supplier of the product and serves as their Safety Data Sheet ('SDS').

It is based on information concerning the product which has been provided to RMT by the manufacturer, importer or supplier or obtained from third party sources and is believed to represent the current state of knowledge as to the appropriate safety and handling precautions for the product at the time of issue. Further clarification regarding any aspect of the product should be obtained directly from the manufacturer, importer or supplier.

While RMT has taken all due care to include accurate and up-to-date information in this SDS, it does not provide any warranty as to accuracy or completeness. As far as lawfully possible, RMT accepts no liability for any loss, injury or damage (including consequential loss) which may be suffered or incurred by any person as a consequence of their reliance on the information contained in this SDS.

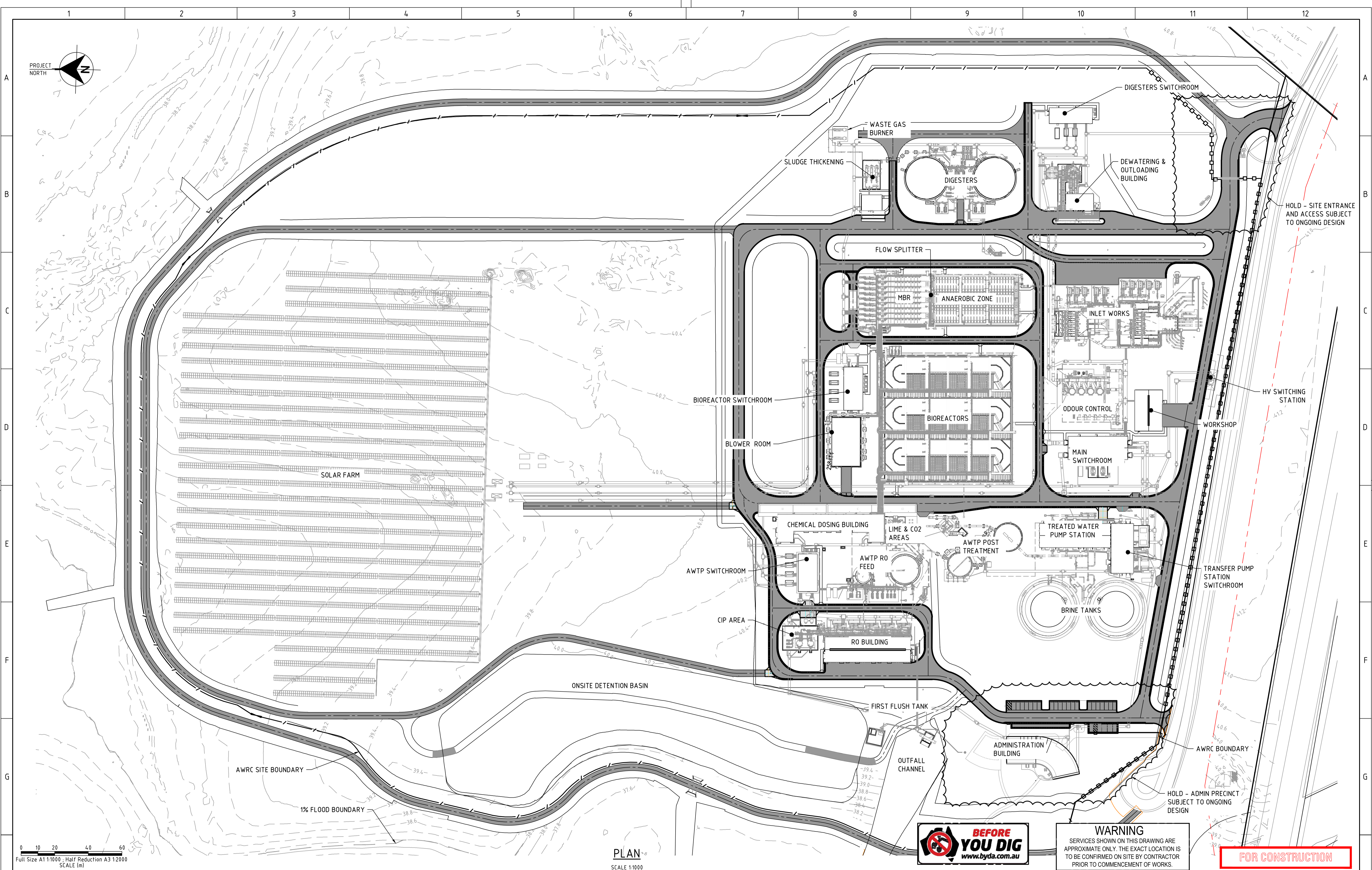
Prepared by

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[End of SDS]

Appendix B

Hazardous materials storage location



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Full Size A1 1:1000 ; Half Reduction A3 1:2000
SCALE (m)

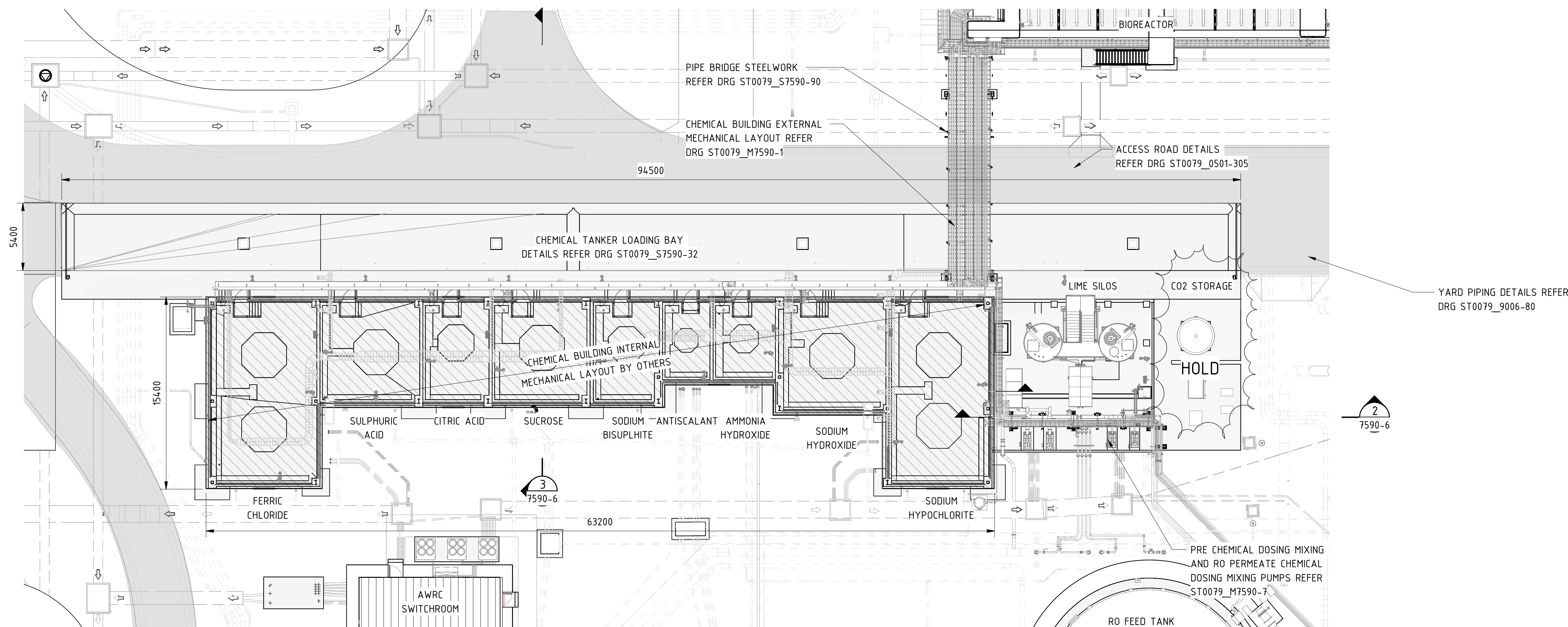
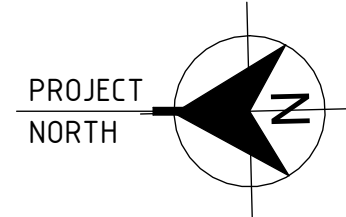
PLAN
SCALE 1:1000



WARNING
SERVICES SHOWN ON THIS DRAWING ARE APPROXIMATE ONLY. THE EXACT LOCATION IS TO BE CONFIRMED ON SITE BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.

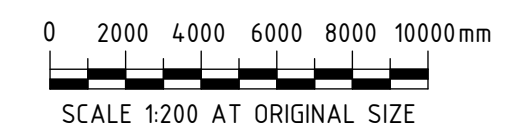
FOR CONSTRUCTION

 JOHN HOLLAND PTY LTD ABN 11 004 282 268 LVL3, 63-65 PIRRAMA RD, PYRMONT NSW 2009 PH: 1021 9552 4288	 TRILITY PTY LTD ABN 48 053 122 562 LVL10, 115 GRENFELL ST, ADELAIDE SA 5000 PH: 1081 8108 6500	 GHD PTY LTD ABN 39 408 488 373 LVL15, 133 CASTLEREAGH ST, SYDNEY NSW 2000 PH: 1021 9239 7100	 JACOBS GROUP(AUST) PTY LTD ABN: 37 001 024 095 LVL7, 177 PACIFIC HWY, NORTH SYDNEY NSW 2060 PH: 1021 9928 2100	DESIGNED L. SIMPSON DIV	COPYRIGTH THIS DESIGN IS NOT TO BE COPIED OR AMENDED WITHOUT WRITTEN PERMISSION FROM SYDNEY WATER 	THIS DRAWING SUPERSEDES RECOMMENDED SYDNEY WATER ACCEPTED CLIENT SYDNEY WATER		KEMPS CREEK SEWERAGE NETWORK ST0079 WATER RESOURCE RECOVERY FACILITY - KEMPS CREEK SITE WIDE GENERAL ARRANGEMENT PLAN SHEET 1		DRAWING No. ST0079 0501-5
				DRAWN K. ALLAER DIV		VERIFIED G. BERRYMAN DIV	APPROVED S. ADAMS DIV	ISSUED FOR CONSTRUCTION LETTER DETAILS OF AMENDMENT	SA 24/04/24 DATE	A1 PROJ No. 20036026 DRAWING STATUS: FOR CONSTRUCTION



PLAN
SCALE 1 : 200

HOLDS
1. CARBON DIOXIDE AND DOSING SYSTEM TBC - AWAITING FINAL DESIGN AND SELECTION OF VENDOR.



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DESIGNED	S.YAMIN D.JV	27.03.24
DRAWN	D.VELLA D.JV	27.03.24
VERIFIED	J.FELLINGHAM D.JV	27.03.24
APPROVED	S.ADAMS D.JV	27.03.24
LETTER	A	ISSUED FOR CONSTRUCTION
APP'D	SA	27.03.24
DATE		

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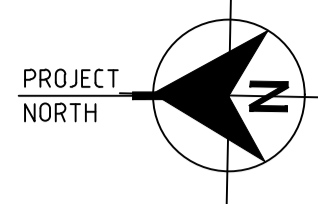
KEMPS CREEK SEWERAGE NETWORK
ST0079 WATER RESOURCE RECOVERY FACILITY - KEMPS CREEK
CHEMICAL DOSING AREA
GENERAL ARRANGEMENT - PLAN

A1	PROJ No.20036007	DRAWING STATUS: FOR CONSTRUCTION
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DRAWING No.	ST0079
	7590-5
ISSUE	A
SHEET No.	-

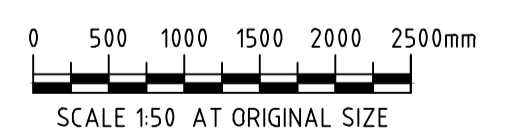
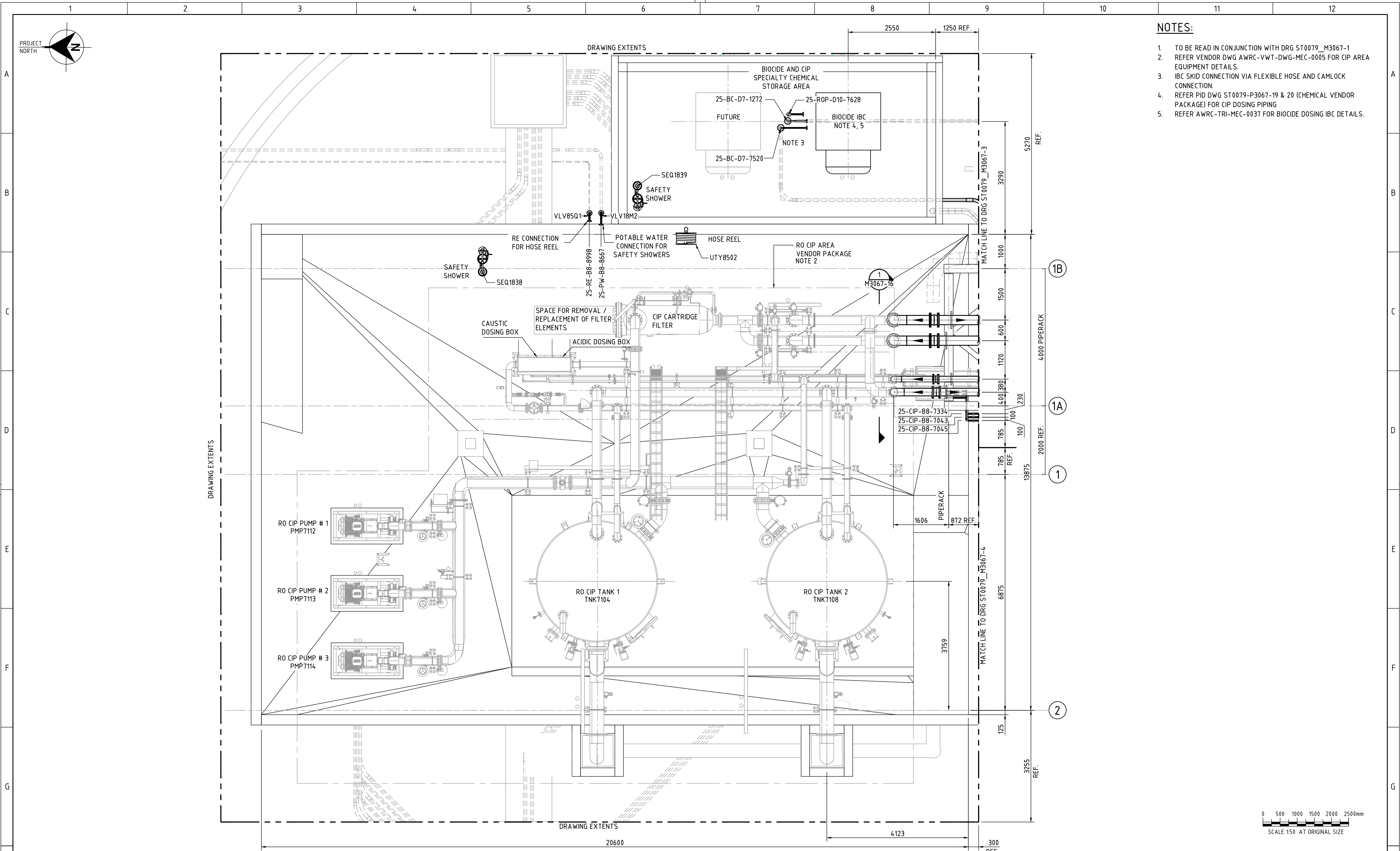
SMA-EXT AUG 2014

841



NOTES:

1. TO BE READ IN CONJUNCTION WITH DRG ST0079_M3067-1
2. REFER VENDOR DWG AWRC-VWT-DWG-MEC-0005 FOR CIP AREA EQUIPMENT DETAILS.
3. IBC SKID CONNECTION VIA FLEXIBLE HOSE AND CAMLOCK CONNECTION.
4. REFER PID DWG ST0079-P3067-19 & 20 (CHEMICAL VENDOR PACKAGE) FOR CIP DOSING PIPING
5. REFER AWRC-TRI-MEC-0037 FOR BIOCIDES DOSING IBC DETAILS.



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	DRAWN L. RUSSELL DIV	15/03/24		RECOMMENDED		ST0079					
VERIFIED J. FELLINGHAM DIV	15/03/24	APPROVED	SA	SYDNEY WATER	ISSUE	SHEET No.					
APPROVED S. ADAMS DIV	15/03/24	ISSUED FOR CONSTRUCTION	SA	CLIENT SYDNEY WATER	A1	-					
801 1 Plot Date: 18 March 2024 - 10:44 AM Plotted by: Leslie Russell	2 Cad File No: C:\CAD\Collaboration\Cache\VP3D-AWRC\0rthos\DWGs\M3067-2.dwg	3 	4 	5 	6 	7 	8 	9 	10 	11 	12

Appendix C

**AS 3780 The storage and handling of
corrosive substances**

The Conditions of Approval required verification to Australian Standards for the storage and handling of dangerous goods at the AWRC site.

This review only included AS 3780, it is assumed all dangerous goods are stored in accordance with the Australian Dangerous Goods Code (ADG Code), relevant standards and guidelines, even if not a licensable quantity.

Table 17 AS 3780 requirements

Section	Subsection	Response
Section 2 – Minor storage	Not applicable	In the design all DGs are stored in quantities greater than 1,000 kg
Section 3 – Transit storage	Not applicable	In the design no DGs are stored for transit
Section 4 – Loading and unloading areas	4.1 Scope of section	The design includes: <ul style="list-style-type: none"> - BIOMATE MBC 781 which is stored in intermediate bulk containers (IBCs)
	4.2 Specifications for loading and unloading areas	The design includes: <ul style="list-style-type: none"> - Loading and unloading of IBCs will occur via a telehandler forklift from outside of the IBC bund eliminating the need for direct vehicle access within the bund
Section 5 – Storage and handling of packages	Not applicable	In the design no packages are handled or stored
Section 6 - Storage and handling in tanks	6.2 Tank types	In the design all DGs are stored in either a portable tank or a fixed tank that is filled and discharged in situ
	6.3 Location of tanks	In the design: <ul style="list-style-type: none"> - All tanks for DGs are above ground - Appropriate separation between tanks and protected places and boundaries (ST0079_7590-5) in accordance with Sydney Water specifications - All tanks are kept in separate compounds for appropriate segregation
	6.4 Bunds and compounds	In the design: <ul style="list-style-type: none"> - In the design all bunds have a total storage capacity above 110% - Wall cladding is provided on all sides to above 2.5m from the bund wall - Each is bund is provided with a sump and submersible pump - Bunds to be constructed of concrete for corrosion resistance - Bunds are coated for corrosion resistance to the specific chemical that it contains - Spills are contained within the banded areas and pumped to the drainage system AWTP Drainage Pump Station
	6.5 Design and construction requirements applicable to all tanks	In the design: <ul style="list-style-type: none"> - Tanks are constructed of glass reinforced plastic (GRP) for corrosion resistance - Each tank is fixed to a raised reinforced concrete plinth on top of to the concrete building foundation - Tanks are appropriate vented - All liquid lines are provided with isolation valves as required - Fixed transfer points are designed to enable deliveries from vehicles within the delivery bund - Pipework is designed to handle the appropriate corrosive substances and is labelled for identification of the contents as per AS 1345 - Electrical equipment has been selected to handle the appropriate corrosive substances

	6.6 Additional requirements for portable tanks	In the design: <ul style="list-style-type: none"> - BIOMATE MBC 781 is dosed via an enclosed IBC facility - Sydney Water is a mature organisation with a safety management system (SMS) embed into its system including appropriate O&M (operational and maintenance) manuals
	6.7 Additional requirements for fixed tanks	In the design: <ul style="list-style-type: none"> - Tanks are constructed of glass reinforced plastic (GRP) for corrosion resistance - Vendor specifications for each tank contain information regarding service life - Each tank has level instrumentation and a visual means of level indication Design provided to constructors such that they will manage appropriate testing requirements.
	6.8 Filling of tanks	In the design: <ul style="list-style-type: none"> - Fixed transfer points are designed to enable deliveries from vehicles within the delivery bund with designated transfer hose connection - Each tank has level instrumentation and a visual means of level indication to monitor safe filling level - Operational procedures are in place for filling - Chemical unloading area is adjacent to tanks - Unloading area is bunded with the appropriate capacity Operational procedures are in place for managing chemical spills to ensure safe disposal
	6.9 Spill management and chemical barrier protection	Where pipework and ancillary equipment failure could lead to a loss in tank contents, the design has located them within bund area
Section 7 – Storage and handling of solids	Not applicable	In the design no DGs are stored in solid form
Section 8 – Operational and personnel safety		In the design: <ul style="list-style-type: none"> - Access to unloading area is restricted - Safety showers are provided in each bunded area and along the length of the unloading area - Louvers are included for ventilation of head space - Further to this Sydney Water is a mature organisation with an SMS embed into its system including appropriate O&M (operational and maintenance) manuals and procedures
Section 9 – Emergency management		Sydney Water is a mature organisation with a SMS embed into its system that includes emergency management processes
Section 10 – Fire protection		In the design: <ul style="list-style-type: none"> - Fire safety study was conducted during the design phase and the findings were implemented in the design - Chemical dosing building has fire hydrant coverage to meet NCC requirements
Section 11 – Waste storage and disposal		In the design: <ul style="list-style-type: none"> - Waste streams pumped to drainage system - Operational procedures are in place for spill and stormwater management and disposal - Neutralisation and/or other removal means are proposed when necessary

Appendix D

Release inputs

Digester gas holder

Input Report

Workspace: AWRC Model - larger map

AWRC

Study

AWRC Model - larger map

Tab	Group	Field	Value	Units
Context of calculations	Selection of context	Weathers to use for this study	Weather folder	
		Parameters to use for this study	Parameter set	
		Obstructions to use for this study		
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
Dispersion	Distances of interest	Distances of interest		m

Gas Holder 1

Pressure vessel

AWRC Model - larger map\AWRC

Tab	Group	Field	Value	Units
Material	Material	Material	METHANE	
		Specify volume inventory?	Yes	
		Mass inventory	1213.35	kg
		Volume inventory	1900	m3
		Material to track	METHANE	
	Phase	Specified condition	Pressure/temperature	
		Temperature	41	degC
		Pressure (gauge)	0.025	bar
		Fluid state	Vapour	
		Liquid mole fraction	0	fraction
Scenario	Pipe dimensions	Pipe length		m
	Release location	Elevation	14.5	m
		Tank head	0	m
	Direction	Outdoor release direction	Horizontal	
		Outdoor release angle	0	deg
Discharge parameters	Model settings	Atmospheric expansion method	DNV GL recommended	
		Phase change upstream of orifice?	Disallow liquid phase change only (metastable liquid)	
	Droplet break-up mechanism	Droplet break-up mechanism - instantaneous	Use flashing correlation	
		Droplet break-up	Do not force correlation	

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		mechanism - continuous		
Short pipe	Pipe characteristics	Pipe roughness	0.045	mm
	Frequencies	Frequency of bends in pipe	0	/m
		Frequency of couplings in pipe	0	/m
		Frequency of junctions in pipe	0	/m
	Frequencies of valves	Frequency of excess flow valves	0	/m
		Frequency of non-return valves	0	/m
		Frequency of shut-off valves	0	/m
	Velocity head losses	Excess flow valve velocity head losses	0	
		Non-return valve velocity head losses	0	
		Shut-off valve velocity head losses	0	
Time varying releases	Modelling of time-varying leaks and line ruptures	Vacuum relief valve	Operating	
		Vacuum relief valve set point	0	bar
	Inventory data for time-varying releases	Tank volume	1900	m3
		Tank vapour volume	1900	m3
		Tank liquid volume	0	m3
		Tank liquid level	0	m
		Maximum vapour release height		m
		Minimum mass inventory	0.1	kg
		Maximum mass inventory	1E+09	kg
	Safety system modelling for time-varying releases	Safety system modelling (isolation and blowdown)	No	
Dispersion	Dispersion scope	Concentration of interest		ppm
		Averaging time for concentration of interest		
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
	Building definition	Release building		
		In-building release?	Outdoor	
		Building wake effect	Roof/lee	
		Wind or release angle from North	0	deg

		Handling of droplets	Trapped	
		Indoor mass modification factor	3	
Explosion parameters	Explosion method (Consequence calculations only)	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	20	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Crosswind angle	0	deg
		Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	

	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s
Geometry	Geometry	East	-88	m
		North	-306	m

D1-Cat_Rupture

Catastrophic rupture

AWRC Model - larger map\AWRC\Gas Holder 1

Tab	Group	Field	Value	Units
Scenario	Release location	Elevation	14.5	m
		Tank head	0	m
	Fireball emissive power	Use vessel burst pressure	No	
		Vessel burst pressure - gauge		bar
Material	Material	Material characteristics	Flammable only	
		Material to track	METHANE	
		Type of risk effects to model	Flammable only	
Discharge parameters	Droplet break-up mechanism	Droplet break-up mechanism - instantaneous	Use flashing correlation	
Dispersion	Dispersion scope	Concentration of interest	22000	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	

		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	20	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

Digester gas flare

Input Report

Workspace: AWRC Model - larger map

AWRC

Study

AWRC Model - larger map

Tab	Group	Field	Value	Units
Context of calculations	Selection of context	Weathers to use for this study	Weather folder	
		Parameters to use for this study	Parameter set	
		Obstructions to use for this study		
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Toxic parameters	Indoor toxic calculations	Specify the downwind building type	Unselected	
		Building type (downwind building type)	Buildings\Building type	
Dispersion	Distances of interest	Distances of interest		m

Gas Flare 1

Pressure vessel

AWRC Model - larger map\AWRC

Tab	Group	Field	Value	Units
Material	Material	Material	METHANE	
		Specify volume inventory?	Yes	
		Mass inventory	1213.35	kg
		Volume inventory	1900	m3
		Material to track	METHANE	
	Phase	Specified condition	Pressure/temperature	
		Temperature	41	degC
		Pressure (gauge)	0.025	bar
		Fluid state	Vapour	
		Liquid mole fraction	0	fraction
Scenario	Pipe dimensions	Pipe length		m
	Release location	Elevation	1	m
		Tank head	0	m
	Direction	Outdoor release direction	Horizontal	
		Outdoor release angle	0	deg
Discharge parameters	Model settings	Atmospheric expansion method	DNV GL recommended	
		Phase change upstream of orifice?	Disallow liquid phase change only (metastable liquid)	
	Droplet break-up mechanism	Droplet break-up mechanism - instantaneous	Use flashing correlation	
		Droplet break-up	Do not force correlation	

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		mechanism - continuous		
Short pipe	Pipe characteristics	Pipe roughness	0.045	mm
	Frequencies	Frequency of bends in pipe	0	/m
		Frequency of couplings in pipe	0	/m
		Frequency of junctions in pipe	0	/m
	Frequencies of valves	Frequency of excess flow valves	0	/m
		Frequency of non-return valves	0	/m
		Frequency of shut-off valves	0	/m
	Velocity head losses	Excess flow valve velocity head losses	0	
		Non-return valve velocity head losses	0	
		Shut-off valve velocity head losses	0	
Time varying releases	Modelling of time-varying leaks and line ruptures	Vacuum relief valve	Operating	
		Vacuum relief valve set point	0	bar
	Inventory data for time-varying releases	Tank volume	1900	m3
		Tank vapour volume	1900	m3
		Tank liquid volume	0	m3
		Tank liquid level	0	m
		Maximum vapour release height		m
		Minimum mass inventory	0.1	kg
		Maximum mass inventory	1E+09	kg
	Safety system modelling for time-varying releases	Safety system modelling (isolation and blowdown)	No	
Dispersion	Dispersion scope	Concentration of interest	22000	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
	Building definition	Release building		
		In-building release?	Outdoor	
		Building wake effect	Roof/lee	
		Wind or release angle from North	0	deg

		Handling of droplets	Trapped	
		Indoor mass modification factor	3	
Explosion parameters	Explosion method (Consequence calculations only)	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	No ignition location	
		Location of late ignition		m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	20	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Crosswind angle	0	deg
		Horizontal options	Use standard method	
		Correlation	Recommended	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	

	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s
Geometry	Geometry	East	-59	m
		North	-215	m

Short pipe

Short pipe

AWRC Model - larger map\AWRC\Gas Flare 1

Tab	Group	Field	Value	Units
Scenario	Scenario	Scenario type	Line rupture	
	Pipe dimensions	Pipe internal diameter	100	mm
		Pipe length	1	m
	Hole	Orifice diameter		mm
	Release location	Elevation	1	m
		Tank head	0	m
	Flow control	Flow controller	None	
		Input option	Not applicable	
		Fixed flow rate		kg/s
		Pump head		m
	Direction	Outdoor release direction	Vertical	
		Outdoor release angle	90	deg
Material	Material	Material characteristics	Flammable only	
		Material to track	METHANE	
		Type of risk effects to model	Flammable only	
	Phase	Phase to be released	Vapour	
Discharge parameters	Model settings	Atmospheric expansion method	DNV GL recommended method	
	Droplet break-up mechanism	Droplet break-up mechanism - instantaneous	Use flashing correlation	
		Droplet break-up mechanism - continuous	Do not force correlation	
Short pipe	Pipe characteristics	Pipe roughness	0.045	mm
	Frequencies	Frequency of bends in pipe	0	/m
		Frequency of couplings in pipe	0	/m
		Frequency of junctions in pipe	0	/m
	Frequencies of valves	Frequency of excess flow valves	0	/m
		Frequency of non-return valves	0	/m
		Frequency of shut-off valves	0	/m
	Velocity head losses	Excess flow valve velocity	0	

		head losses		
		Non-return valve velocity head losses	0	
		Shut-off valve velocity head losses	0	
Dispersion	Dispersion scope	Concentration of interest	22000	ppm
		Averaging time for concentration of interest	Flammable	
		Specify user-defined averaging time	No	
		User defined averaging time		s
	Distances of interest	Distances of interest		m
	Averaging time for reports	ERPG [1 hr]	No	
		IDLH [30 mins]	No	
		STEL [15 mins]	No	
Bund, building and terrain	Terrain and bund definition	Type of terrain for dispersion	Land	
		Type of pool substrate and bunds	Concrete, no bund	
Explosion parameters	Explosion method	Explosion method	Multi-Energy: Uniform confined	
	Ignition	Supply late ignition location	Ignition location supplied	
		Location of late ignition	0	m
	Vapour liquid method	Use explosion mass modification factor	Yes	
		Explosion mass modification factor	3	
Fireball	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Mass modification factor	3	
		Fireball maximum exposure duration	20	s
	Calculation method	Fireball model	Martinsen time varying	
		TNO model flame temperature	1726.85	degC
Jet fire	Jet fire method	Jet fire method	Cone model	
	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	Yes	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	

		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Rate modification factor	3	
		Jet fire maximum exposure duration	20	s
	Cone model data	Correlation	Recommended	
		Horizontal options	Use standard method	
		Flame-shape adjustment if grounded	Yes	
	Surface emissive power	Calculation method for surface emissive power	Calculate SEP	
		Flame emissive power		kW/m2
		Emissivity fraction		fraction
Pool fire	Result types to calculate	Calculate probit	No	
		Calculate dose	No	
		Calculate lethality	No	
	Radiation levels	Number of input radiation levels	3	
		Intensity levels	4, 12.5, 37.5	kW/m2
		Probit levels	2.73, 3.72, 7.5	
		Dose levels	1.27E+06, 5.8E+06, 2.51E+07	
		Lethality levels	0.01, 0.1, 0.99	fraction
	Parameters	Radiative fraction for general fires	0.4	fraction
		Pool fire maximum exposure duration	20	s

Appendix E

Consequence Calculations

Consequence Modelling

Contents taken from Caltex Kurnell Report- Appendix V Consequence Models Rev A

A part of the risk assessment process involves generating consequences for the release events identified. The steps involved in determining consequences are:

- ▶ Determine release conditions based upon materials involved, process conditions and available inventory etc;
- ▶ Based on release conditions, determine the types of events which will occur (eg jet fire, toxic cloud, evaporating pool or explosion etc);
- ▶ Calculate the extent of the consequences; and
- ▶ Establish the impact of the consequence (e.g. proportion of people killed when exposed to a toxic dose)

The consequences are calculated using empirically derived models, which can then be used to determine which release cases generate offsite effects and should be included in the risk model. The level at which fatal consequences are considered to occur will directly influence the risks.

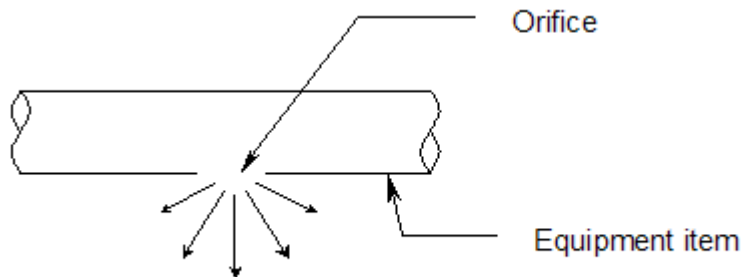
This Appendix discusses basic concepts and theory behind the various consequence models used in the analysis. The models discussed are:

- ▶ Discharge Modelling
- ▶ Dispersion
- ▶ Flammable Effects
 - Jet Fire;
 - Pool Fire;
 - Fireball;
 - Multi Energy Explosion;

Discharge Modelling

If there is a hole in a pipeline, vessel, flange or other piece of process equipment, the fluid inside will be released through the opening, provided the process pressure or static head is higher than ambient pressure. The properties of the fluid upon exiting the hole play a large role in determining consequences, eg, vapour or liquid, velocity of release etc. Figure 13 illustrates an example scenario.

Figure 13 Typical Discharge



The discharge can be considered to have two stages, the first is expansion from initial storage conditions to orifice conditions, the second from orifice conditions to ambient conditions.

The conditions at the orifice are calculated by assuming isentropic expansion, ie, entropy before release = entropy at orifice. This allows enthalpy and specific volume at the orifice to be calculated.

The equations for mass flow rate (\dot{m}) and discharge velocity (u_0) are then given by:

$$\dot{m} = C_d A_o \rho_o \sqrt{-2(H_o - H_i)}$$

$$\text{And } u_0 = C_d \sqrt{-2(H_o - H_i)}$$

Where

- C_d = Discharge coefficients
- A_o = Area of the orifice
- ρ_o = density of the material in the orifice
- H_o = Enthalpy at the orifice
- H_i = Enthalpy at initial storage conditions

The discharge parameters passed forward to the dispersion model are as follows:

- ▶ release height (m) and orientation;
- ▶ thermodynamic data: release temperature (single phase) (°C) or liquid mass fraction (two-phase), initial drop size (m);
- ▶ other data:
 - for instantaneous release: mass of released material (kg), expansion energy (J)
 - for continuous release: release angle (degrees), rate of release (kg/s), release velocity (m/s), release duration (s).

Dispersion

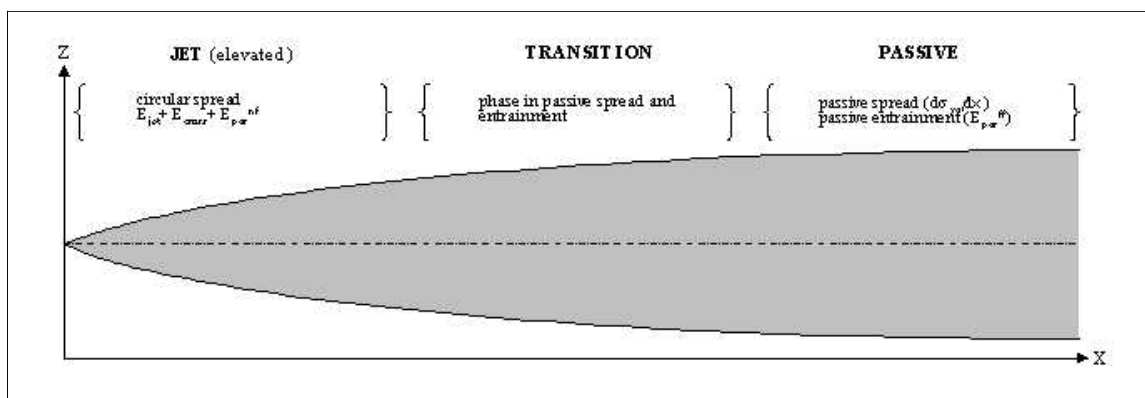
When a vapour leak occurs, some material will be released into the atmosphere. Upon being released it will start to disperse and dilute into the surrounding atmosphere. The limiting (lowest) concentration of interest is related to flammable and toxic limits for flammable and toxic substances respectively. The model used to determine extent of release is described below, along with some of the key input parameters.

The consequence modelling package PHAST utilises the Unified Dispersion Model (Witlox *et al*, 1999). This models the dispersion following a ground level or elevated two phase unpressurised or pressurised release. It allows for continuous, instantaneous, constant finite duration and general time varying releases. It includes a unified model for jet, heavy and passive two phase dispersion including possible droplet rain out, pool spreading and re-evaporation. SAFETI is built on the base models in PHAST.

Jet Dispersion

For a continuous, pressurised release, a vapour is released as a jet, ie, high momentum release. The jet eventually loses momentum and disperses as a passive cloud. Figure 14 below shows a typical release and the various phases involved.

Figure 14 Jet Dispersion



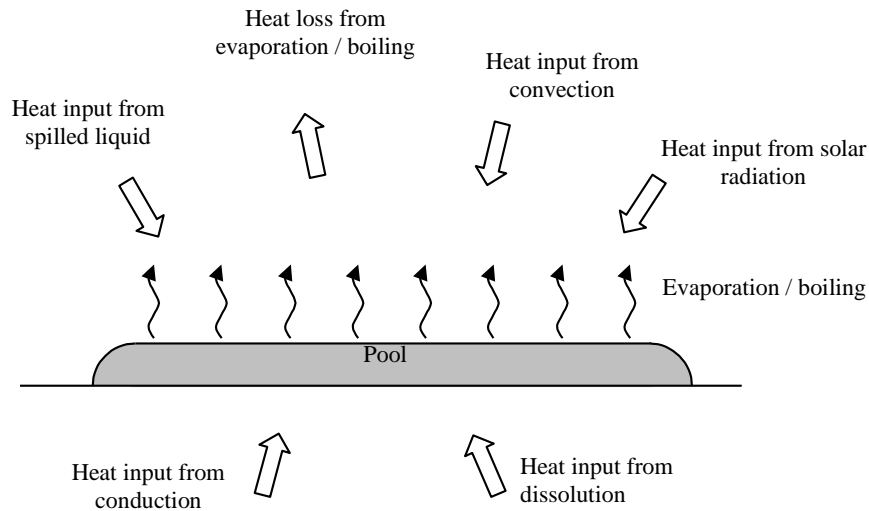
The cloud is diluted by air entrainment until it eventually reaches the lower limit of concern. During the jet phase, the mixing is turbulent and much air is entrained. In the passive phase, less air is potentially entrained, and it occurs via a different mechanism to the turbulent jet phase. The calculation of the plume therefore depends on many factors, the key parameters being:

- Vapour released, specifically molecular weight;
- Discharge conditions including phase(s) of release, velocity etc;
- Atmospheric conditions (a cloud will generally travel further in more stable conditions with lower wind speeds).

Dispersion from Pool Evaporation

If a rupture occurs from a tank or vessel containing a liquefied gas, the liquefied gas pools on the ground whilst rapid vaporisation occurs forming a vapour cloud, which ultimately disperses, as a low momentum cloud. Due to the low momentum, the cloud is not turbulent, which is a significant factor in air entrainment and dilution of the cloud. Figure 15 below shows a typical release and some of the inputs into the calculation.

Figure 15 Pool Evaporation Heat Balance



The rate of the evaporation depends on numerous factors, the most important ones being:

- ▶ Surface it is released onto (e.g. its thermal properties and temperature);
- ▶ Atmospheric conditions (a cloud will generally travel further in more stable conditions with lower wind speeds).
- ▶ Boiling point of the liquid;
- ▶ Pool size.

The concentration of interest is normally related to the flammable, or toxic limits or specified Emergency Response Planning Guideline (ERPGs) limits set for the contained hazardous material. .

Flammable Effects

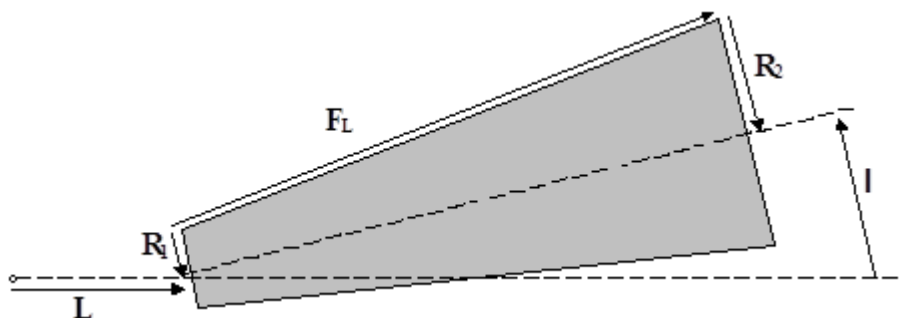
If the release is of a flammable material, it is possible for the release to be ignited. The type of fire which results (eg jet, pool fire, flash fire etc) depends on the physical properties of the release and whether the ignition is immediate or delayed. This chapter discusses the various flammable effects, which can occur.

Jet Fire

Jet fires are a result of high momentum releases. If a flammable release is ignited instantaneously, a jet fire will result. The flame will have a degree of 'lift off' as the flammable mixture has to dilute to be within the flammable limits. This section briefly discusses the model used for jet fires as well as key parameters in the calculation.

The jet fire calculation utilises the Chamberlain model (Chamberlain 1987). In this model, jet fires are modelled as a conical flame, with the ignited portion lift off, inclination and shape being determined by the material being released, the pressure at which it is being released and the hole size that it is being released through. These release parameters are the main inputs to the jet fire radiation calculations. Figure 16 below shows a graphical representation of the jet fire model.

Figure 16 Truncated Cone Jet Fire Model



Where;

- L = Lift off
- I = Flame Inclination
- R₁ = Flame Base Radius
- R₂ = Flame End Radius
- F_L = Flame Length

The jet fire calculations model radiation from the entire surface of the ignited portion of the jet. This includes radiation from the cone forming the body of the flame, as well as from the ends of the cone. The amount of radiation that a nearby receiver is exposed to is determined by its distance from the flame surface, as well as by the orientation of the flame relative to the receiver. The key parameters in the calculation of the radiation exposure of a receiver are therefore the flame lift off, the flame inclination, and the dimensions of the ignited portion of the jet (i.e. flame length and end radii).

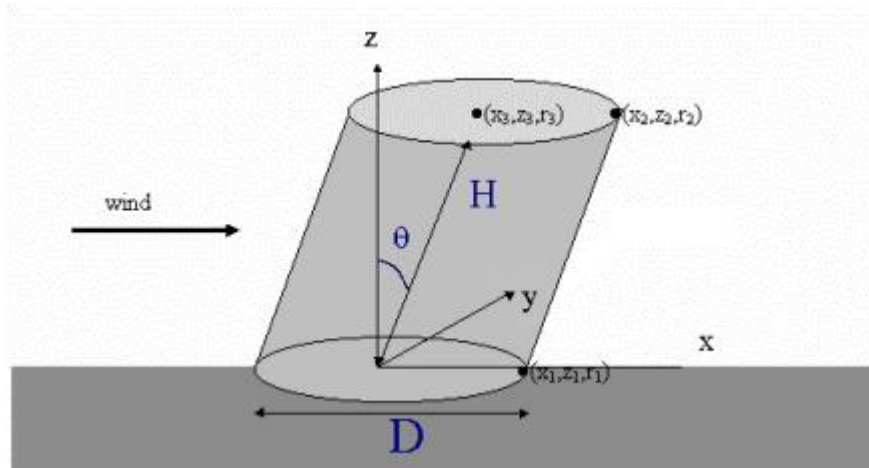
Pool Fire

If a flammable/combustible liquid spill ignites it will form a pool fire. Pools can also form if a pressurised liquid is released and then 'rains out' to form a pool. Pool fires have low momentum flames and therefore their direction is dependent on wind conditions. This section describes the pool fire model and the equations used in calculating size and radiation emitted from a pool fire.

Pool fire flames are modelled as cylinders sheared in the direction of the wind, with diameter D , height H and tilt angle q (measured from the vertical). The flame is described by three circles (c_1 , c_2 , c_3) arranged along the centreline of the flame, each defined by the downwind co-ordinate x and elevation z of the centre of the

circle, and by the radius r . These flame-circle co-ordinates are the main input to the radiation calculations. Figure 17 below shows a graphical representation of the pool fire model.

Figure 17 'Sheared Cylinder' Pool Fire Model



With these three circles, the radiation calculations will model radiation from two surfaces: from the side of the flame between c_1 and c_2 , and from the top of the flame between c_2 and c_3 . This approach ensures that the bottom of the pool fire is not treated as a radiating surface.

The flame length H , flame diameter D and tilt angle θ are used to calculate three co-ordinates of the flame, as follows:

$x_1 = 0.0$	$x_2 = H \sin \theta$	$x_3 = H \sin \theta$
$z_1 = d_{\text{elev}}$	$z_2 = H \cos \theta + d_{\text{elev}}$	$z_3 = H \cos \theta + d_{\text{elev}}$
$r_1 = D/2$	$r_2 = D/2$	$r_3 = 0.0$

Where:

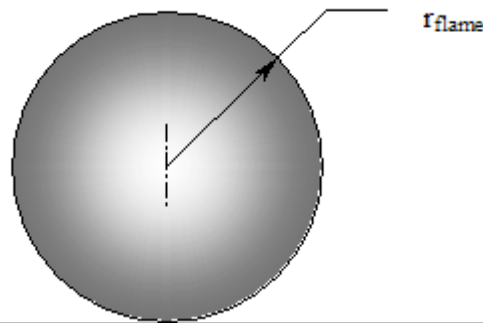
d_{elev} = elevation of flame surface above ground.

BLEVE Model

A BLEVE is a 'Boiling Liquid Expanding Vapour Explosion' and refers to the release of energy when a vessel of liquefied gas erupts due to flame impingement. If there is direct flame impingement beneath the liquid line on the vessel, the evaporating liquid will provide cooling to the vessel walls. If designed correctly, the vessel pressure relief ensures that the pressure inside the vessel does not rise above design limits. If the flame impingement is on the vapour space, the pressure will also increase but there is inadequate cooling of the vessel wall. The metal temperature will rise to an extent where the mechanical strength is reduced. A point will be reached where the mechanical integrity of the vessel is insufficient for the pressure inside the vessel and the vessel erupts in a BLEVE. The BLEVE itself is the explosion resulting from rapid evaporation of the liquefied gas as it is released to atmospheric pressure. This section describes the equations used to determine BLEVE properties and key input parameters.

BLEVEs are modelled as spheres as shown in Figure 18, with the shape described by ten circles. The method of using circles is also used for pool and jet fires. These circles are equally spaced along the flame diameter. Each circle is defined by the elevation z of the centre of the circle and the radius r . The centre of the fireball is located immediately above the point of release, at a height equal to the radius of the fireball.

Figure 18 BLEVE Model



The radius of the BLEVE is calculated from:

$$r_{flame} = 2.9M_{BLEVE}^{\frac{1}{3}}$$

Where M_{BLEVE} is the flammable mass involved in the BLEVE. This is a function of the total mass released and the vapour fraction.

The duration of the BLEVE is important as it gives the time for which personnel are exposed to the effects of the fireball. It is a function of the BLEVE mass, and is given by the equations below:

$$t_{flame} = \begin{cases} 0.45M_{BLEVE}^{\frac{1}{3}}, & M_{BLEVE} < 37000kg \\ 2.59M_{BLEVE}^{\frac{1}{6}}, & M_{BLEVE} \geq 37000kg \end{cases}$$

The amount of radiation that a person receives is dependent not only on the duration of exposure but also on their distance from the fireball and the heat emitted by the fireball. The emissive power of the flame surface is a function of M_{BLEVE} , heat of combustion of the material and fire ball size and duration.

Multi Energy Explosion Model

The Multi Energy Model gives overpressure of an explosion as a function of distance from the explosion. The explosion is modelled as a sphere and overpressure is calculated based on scaled distance from the centre. This section explains the key parameters involved in the multi energy model.

The energy released by the explosion, E, is calculated as the product of the mass of fuel in the cloud and the heat of combustion. This assumes a stoichiometric mixture of fuel and air.

The distance scaling factor, S, is related to the energy released by the explosion and the atmospheric pressure by

$$S = \left[\frac{E}{P_a} \right]^{\frac{1}{3}}$$

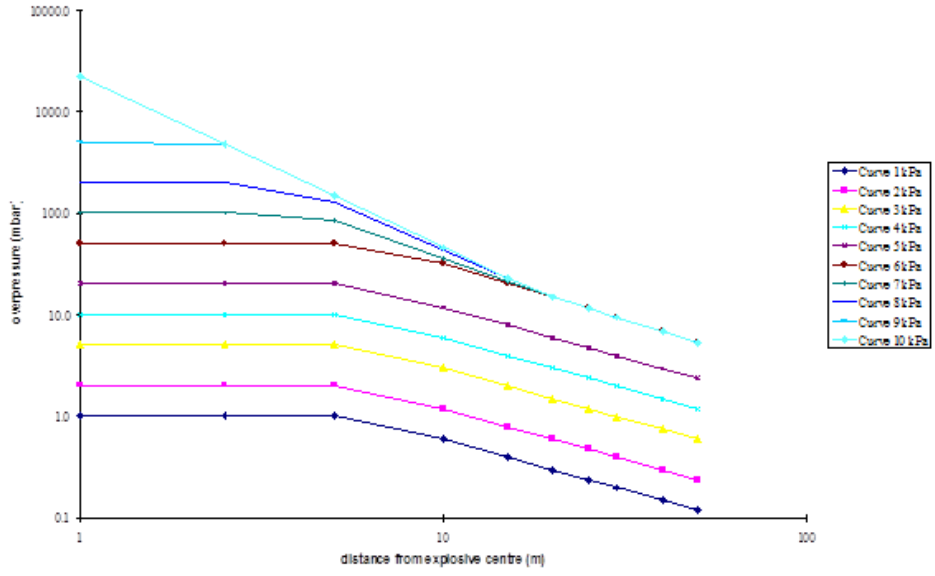
The scaled distance r is then given by

$$r = \frac{d}{S}$$

where d is the actual distance of the receiver from the cloud centre.

To calculate overpressure a set of 10 curves is used. The actual curve used depends on the degree of confinement, with a confinement of 1 being least confined and 10 most confined. Process plants generally have a confinement factor of 7, though it needs to be assessed for each individual process. The graph showing the 10 curves is included in Figure 19 below.

Figure 19 Multi Energy Curves



Validation

Verification and validation of consequence models for accidental releases of toxic or flammable chemicals to the atmosphere

The UDM is an enhanced model used to predict gas dispersion patterns. It now considers time-varying effects due to pressure drops in vessels or pipes and rainout from pools. Specifically designed for heavy-gas low-momentum releases at low wind speeds. Figure C.1 showcases an improved model for predicting gas dispersion rested against the HEGADAS-FT model for elevated releases from pipelines and rainout cases. Figure C.2 showcases validation against the Kit Fox experiments (20-second releases of CO2 from a ground-level area source during both neutral and stable conditions).

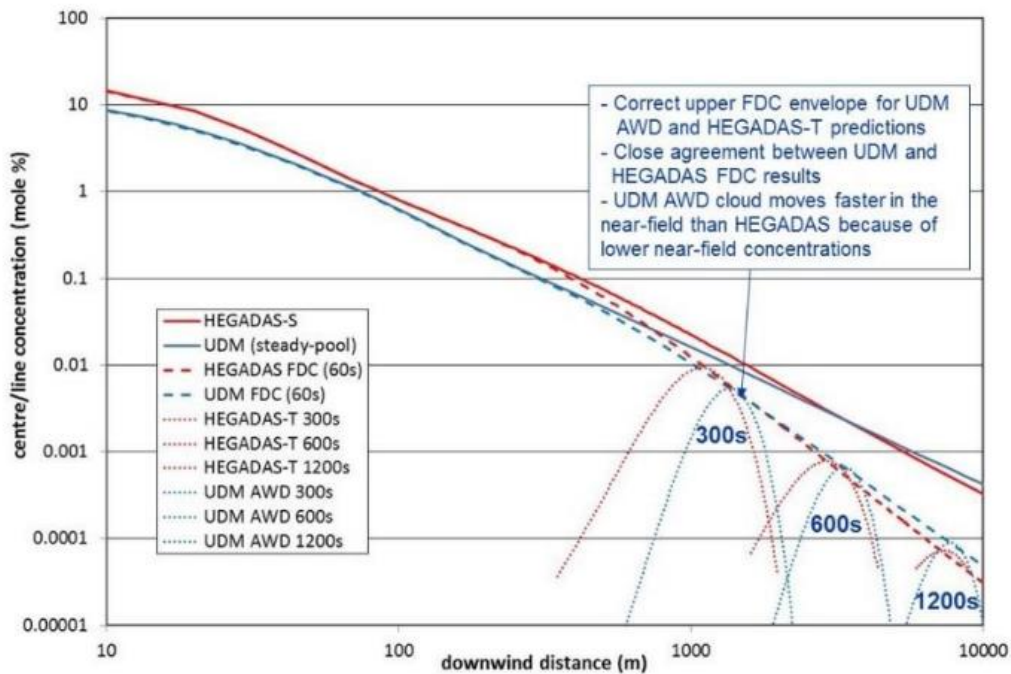


Figure E.1 UDM Verification against HEDGAS for 60s spill of butane (pool on water with bund radius 10m: dispersion over land) – (Witlox et al., 2015)

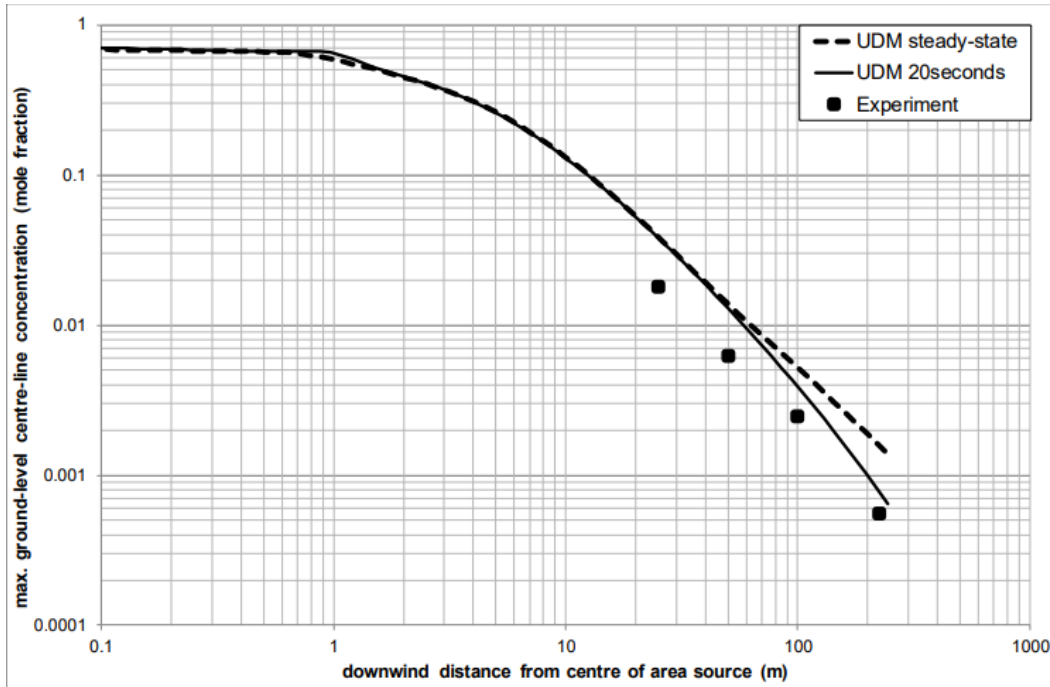


Figure E.2 UDM Validation for Kit Fox experiment KF0706 (20 second release) (Witlox and Harper, 2014)

Validation of obstructed region explosion model

BFETS2 was conducted by the Steel Construction institute for 1d vapour cloud explosions and BFETS3a was a follow-on project carried out by British Gas to investigate gas explosions. Figure C.3 compares the predicted side-on overpressures of ME and BST against the measurements. The BST model with a given correction factor of 2 has significantly under predicted when compare with the ME predictions.

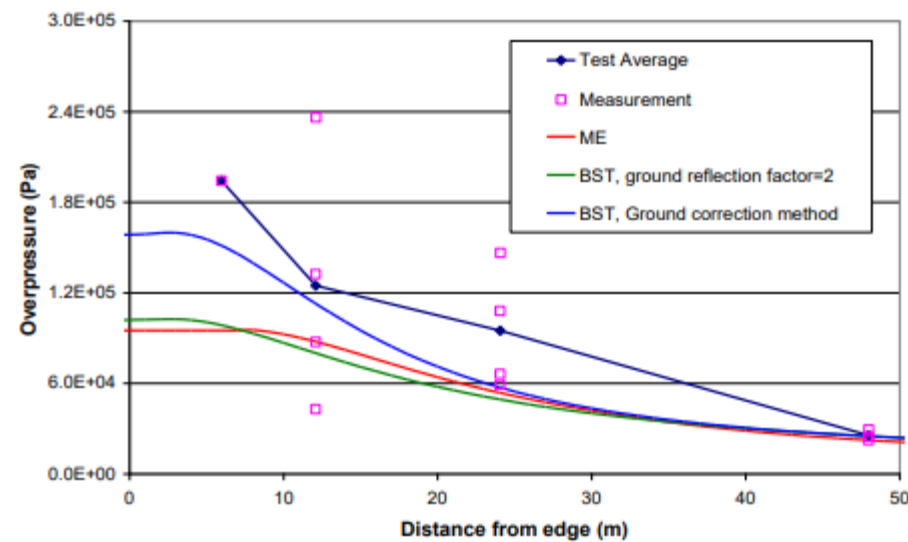


Figure E.3 Plot of BGET3a_A, 2D, high congestion, methane tests: measured, ME and BST predicted overpressures as a function of distance (Fitzgerald, 2021)

References

Chamberlain, G. A., 1987, Developments in design methods for predicting thermal radiation from flares, Chem. Eng. Res. Des. v65 (1987).

Lees, F.P., "Loss Prevention in the Process Industries", Vol 2, Butterworth Heinemann, Oxford, United Kingdom, 1996.

SAFETI (Software for the Assessment of Fire Explosion and Toxic Impact) v6.4.2 help file.

TNO Yellow book, 2nd edition, TNO, The Netherlands (1992).

Wilton, H.W.M. Harper M., Natarajan S., and Williamson A., 2015. Modelling of time varying dispersion for elevated pressurised releases without rainout, Journal loss prevention in Process Industries 35, 283-292

Wilton, H.W.M. and Harper M., 2014. Modelling of time-varying dispersion for releases including potential rainout, Process Safety Progress 33 (3), 256-273

Wilton, H.W.M. and Holt, A., "A unified model for jet, heavy and passive dispersion including droplet rainout and re-evaporation", CCPS 1999 ADM paper.

Wilton, H.W.M, Fenandex M, Harper, M, Oke A, Jan, S and Xu, Y, Verification and validation of consequence models for accidental releases of toxic or flammable chemicals to the atmosphere, DNV, 2023

Fitzgerald, G., A Comparison of Simple Vapor Cloud Explosion Prediction methodologies, Second Annual Symposium, Mary Kat O'Connor Process Safety Center, Texas A&M University, October, 2021.

Appendix F

Final Hazard Analysis Team

The Final Hazard Analysis was completed and reviewed by the follow Jacobs GHD (USC) JV team in Table D.1.

Table F.1 FHA Team

Name	Title	Qualifications	Years of Experience
Leonard Gawecki	Executive Advisor - Risk	Bachelor of Engineering (Chemical) Master of Business (Administration) Member of the Institution of Engineers Australia	30+
Fiona Duncan	Executive Advisor - Risk	Bachelor of Engineering (Chemical) Bachelor of Business (Administration)	20+
Monique Weiner	Graduate Advisor - Risk	Bachelor of Engineering (Chemical)	2
Michaela Collard	Graduate Advisor - Risk	Bachelor of Engineering (Chemical) Bachelor of Science (Applied Chemistry)	2