GHD Advisory

Greater Parramatta and Olympic Peninsula Water Cycle Management Project

Preliminary Hazard Analysis Report

Sydney Water Corporation

22 January 2026

→ **The Power of Commitment**

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Executive summary

Sydney Water Corporation have proposed the construction of the Camellia-Rosehill Water Resource Recovery Facility (WRRF) located in Rosehill, NSW. The new WRRF would service the Greater Parramatta and Olympic Peninsula (GPOP) growth area. The GPOP Water Cycle Management (WCM) project (the project) is a state significant infrastructure project, and an Environmental Impact Statement (EIS) is required under Division 5.2 of the NSW Environmental Planning and Assessment Act 1979 (the EP&A Act).

GHD was commissioned to prepare a risk screening to determine if the proposed development is "potentially hazardous or offensive" in accordance with the State Environment Planning Policy (SEPP) (Resilience and Hazards). To fulfill this requirement, a summary of the Dangerous Goods (DGs) used on site during construction and operation, a risk screening of the DGs, and a Level 2 PHA were completed as outlined in this report.

Risk screening and hazard identification

The results of the DGs and transport risk screening indicate that the project exceeds the SEPP (Resilience and Hazards) thresholds. The materials which exceeded the thresholds were DG Class 8 PGII and PGIII (corrosive substances) and DG Class 2.1 (flammable gases). As a result, the project is 'potentially hazardous' and there is a requirement for a PHA to be completed.

The hazard identification (HAZID) found the following risks could lead to potential offsite impacts:

– Loss of containment of biogas from digester gas holders
– Interaction between incompatible chemicals
– Release of brine into the environment
– Release of treated water into the environment

The results of the risk screening and hazard identification showed that the project has a medium potential for harm, due to the presence of a flammable gas (biogas). As a result, a Level 2 PHA (semi-quantitative PHA) was required. Similarly, the risk of loss of containment of biogas from the digester gas holders was found to require further assessment to confirm the risk is reduced So Far As Is Reasonably Practicable (SFAIRP), considering standard design and operational controls. Therefore, consequence modelling on this scenario was completed in DNV's PHAST software, version 9.0.

The risk screening also found that the project is not considered "offensive", with implementation of standard mitigation measures.

Risk analysis and evaluation

The worst-case scenario for loss of containment of biogas from the digester gas holder was assessed, identifying the potential for a catastrophic rupture, ignition of the biogas, and vapour cloud explosion. The consequence modelling showed that in this event, only the injury threshold for explosion overpressure could encroach on neighbouring properties, depending on the weather conditions and wind direction. The fatality threshold for explosion overpressure was contained fully within the site boundaries. Therefore, this scenario does not contribute to offsite individual or societal risk.

The likelihood assessment and risk evaluation determined that the individual fatality risk criteria from , *Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning* (HIPAP No 4) [Ref. 2] were met by the project. The individual fatality risk was determined to be 9×10^{-7} per year, compared to the relevant criteria of 5×10^{-6} per year, a sufficiently low risk. In addition, this value represents the worst-case risk scenario, as it considers someone is guaranteed to be present. On-site operational and emergency protocols would be enacted to appropriately manage the onsite risk.

Given that no fatality consequence thresholds exceeded the site boundary, and the very low individual risk at the boundary, the societal risk is also acceptable.

The cumulative impacts to risk when considering other projects or increased population in the Camellia-Rosehill precinct and along the pipelines are negligible.

Recommendations and conclusions

The recommendations from the PHA include designing all chemical storage in accordance with the relevant Australian Standards, storage of chemical safety data sheets (SDSs) on site, and appropriate spill management procedures.

The hazard identification and analysis demonstrate that the project can be designed, constructed, and operated in a manner that will meet the relevant regulations, standards and policies and minimise hazardous impact to the public. Standard mitigation measures have been identified and recommended as part of the hazard identification.

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. Furthermore, this PHA is based on information provided in the Reference Design Report and other assumptions outlined throughout this report. Updates to these assumptions shall be captured in the detailed design and Final Hazard Analysis.

Terms and Abbreviations

Abbreviation	Description
ADG	Australian Dangerous Goods Code
AWTP	Advanced Water Treatment Plant
CEMP	Construction Environmental Management Plan
CIP	Clean in place
CNVPM	Construction Noise and Vibration Management Plan
DG	Dangerous Good
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EP&A	Environmental Planning and Assessment
GPOP	Greater Parramatta and Olympic Peninsula
HAZID	Hazard Identification
HIPAP	Hazardous Industry Planning Advisory Paper
kL	Kilolitres
MBR	Membrane bioreactor
MRAS	Membrane return activated sludge
NSOOS	Northern Suburbs Ocean Outfall Sewer
NSW	New South Wales
PG	Packing Group
PHA	Preliminary Hazard Analysis
PHAST	Process Hazard Analysis Software Tool (consequence and risk modelling software)
POEO	Protection of the Environment Operations
PST	Primary sedimentation tank
RO	Reverse osmosis
SDS	Safety Data Sheet
SEARs	Secretary's Environmental Assessment Requirements
SEPP	SEPP (Resilience and Hazards) 2021, formerly called State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
SFAIRP	So Far As Is Reasonably Practicable
t	Tonnes
UF	Ultrafiltration
UN	United Nations
UVAOP	Ultraviolet advance oxidation process
WAS	Waste activated sludge
WCM	Water Cycle Management
WRRF	Water Resource Recovery Facility

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1. Introduction

1.1 Background

Sydney Water is proposing to build and operate a new water resource recovery facility (WRRF) at Camellia-Rosehill. The new WRRF is needed to provide additional wastewater capacity to support growth across the northern suburbs of Sydney, and in the Greater Parramatta and Olympic Peninsula (GPOP) growth corridor. The WRRF and associated infrastructure together form the GPOP Water Cycle Management project (the project).

The additional growth would place pressure on the existing northern suburbs wastewater network, which includes the Northern Suburbs Ocean Outfall Sewer (NSOOS) and the North Head WRRF. These critical assets provide wastewater services to around 1.7 million people, and with current growth projections would reach capacity by 2031.

The GPOP WCM project has been designed to be efficient, sustainable, and cost effective for the community, as well as resilient and adaptable for future water uses.

The main elements of the project include:

– A new WRRF at Camellia-Rosehill to treat wastewater to produce advanced treated water
– Upgrades to the existing pumping station at Camellia
– A new wastewater transfer pipeline from Camellia pumping station to the WRRF
– A new and repurposed brine pipeline to transfer brine from the WRRF to the NSOOS
– A new river release pipeline to transfer advanced treated water from the WRRF to a release structure in Parramatta River at Meadowbank.

The location of the main elements of the project is provided in Figure 2.2.

The project is State significant infrastructure and Sydney Water is preparing an Environmental Impact Statement (EIS) to support an application to the Minister for Planning and Public Spaces.

1.2 Purpose of this report

GHD was commissioned by Sydney Water to prepare a risk screening to determine if the project is 'potentially hazardous or offensive' in accordance with the State Environmental Planning Policy (SEPP) (Resilience and Hazards) 2021 [Ref. 1], formerly named SEPP No. 33 - Hazardous and Offensive Development.

This assessment has been prepared to inform an EIS to support an application for approval of State significant infrastructure under Division 5.2 of the EP&A Act and in accordance with relevant statutory considerations. The EIS will be used to inform regulators, including the NSW Environment Protection Authority (EPA) and the Department of Planning, Housing, and Infrastructure (DPHI), approvals processes.

This report addresses the relevant criteria in the SEARs (as outlined in Section 1.5.1) and assesses the potential hazards and risks of the project under the SEPP (Resilience and Hazards).

This report provides information and an assessment of risks to demonstrate that the project would prevent, or mitigate the identified impacts associated with the project, including to people, the environment, and property, associated with the project and that the residual risk levels are acceptable in relation to the surrounding land use.

This report focuses on the impact of potential hazards associated with the use of dangerous goods (DGs) and hazardous substances that may arise during the construction and operation of the project. Specifically, this report:

- Introduces the project and the assessment
- Describes the location with respect to the project
- Describes the methodology for the assessment
- Screens the quantities of DGs expected to be used during construction and operation of the project to determine if it is a 'potentially hazardous or offensive industry'
- Assesses the impacts of construction and operation of the project specific to DGs and other hazardous substances
- Recommends measures to mitigate any impacts identified.

1.3 Scope

SEPP (Resilience and Hazards) 2021 presents a systematic approach to planning and assessing proposals for potentially hazardous and offensive developments.

For proposals classified as a 'potentially hazardous or offensive industry' the policy establishes a way to determine the risk to people, property and the environment at the proposed location and in the presence of controls.

The scope of this report, completed in accordance with SEPP (Resilience and Hazards) 2021 and the SEARs, includes a risk screening of DGs proposed to be stored onsite, hazard identification, and a Level 2 PHA. Other guidelines and policy requirements are listed in section 1.5.

1.4 Assumptions

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

- All requirements associated with Work, Health and Safety legislation are addressed by Sydney Water.
- DG quantities provided 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 in Appendix A.
- All plant and equipment items are installed and operated in accordance with appropriate Australian Standards, codes, and guidelines.
- DGs 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.
- The location of the Camellia-Rosehill WRRF as assessed in this report, is as shown in the site plan in section 2.1 and 2.2.
- Other DGs brought to site (not stored on-site) during construction and for routine work are minimal and are therefore not included in the assessment.
- Where design information was not available, the preliminary design information for the GPOP WCM project provided by Sydney Water was used.
- Other assumptions used for the risk screening, hazard identification, consequence modelling, and likelihood assessment as outlined throughout this report.
- The PHA is a reflection of the current stage of the design and will be updated with any necessary changes during detailed design in the Final Hazard Analysis (FHA).

1.5 Legislative and policy context

1.5.1 Secretary's Environmental Assessment Requirements

The SEARs relevant to hazards and risk, together with a reference to where they are addressed in this report, are outlined below and in Table 1.1.

"Undertake a preliminary risk screening in accordance with Chapter 3 of SEPP (Resilience and Hazards) 2021 and Applying SEPP 33 (DoP, 2011). If the screening indicates that the development is 'potentially hazardous', a Quantitative Risk Assessment (QRA) must be prepared in accordance with the Department's Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis'. The QRA must include and not be limited to the following"

Table 1.1 Hazard and risk SEARs

Requirements	Reference in this report
A) Identification of the quantity of dangerous goods to be stored, handled and transported to site and the associated locations	Section 4
B) Justification for the appropriate choice of dangerous goods/chemicals selected for the process to reduce the potential risk exposure to surrounding receivers	Section 4.5
C) An explanation of the processes/technologies proposed for the facility and any critical safeguards	Section 2.2 Section 5.1
D) Demonstration of compliance with relevant quantitative and qualitative risk criteria as set out in Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning	Section 6.6
E) Demonstration that the cumulative individual and societal risk from hazard sources (i.e. proposed facility, Dangerous Goods pipelines, and major hazards facility within Rosehill/Camellia precinct) would comply with all relevant land use safety risk criteria as set out in Hazardous Industry Planning Advisory Paper No. 4, with consideration of the population limits set out for Camellia-Rosehill Precinct	Section 6.6 Section 6.7
F) Demonstration that appropriate spill containment will be provided for storage, filling and loading of all fuels and other chemicals to be used on site	Section 5.2 Section 5.3.2
G) Demonstrated compliance with Part 9.3E of the POEO Act for the use of industrial chemicals, including details of activities involving Schedule 6 or Schedule 7 chemicals listed on the Industrial Chemicals Environmental Management Standard (IChEMS) register.	Section 4.4

1.5.2 State Environmental Planning Policy (Resilience and Hazards) 2021

The (then) NSW Department of Planning and Environment consolidated the state environmental planning policies (SEPPs) in December 2021, for introduction in March 2022. As a result, the previously named *SEPP 33 – hazardous and offensive development provisions* have been transferred to the SEPP (Resilience and Hazards) 2021. No policy changes have been made. The SEPP consolidation does not change the legal effect of the SEPPs being repealed and section 30A of the *Interpretation Act 1987* applies to the transferred provisions, meaning the transfer does not affect the operation or meaning of the SEPP provisions.

The (then) NSW Department of Planning, 2011, *Applying SEPP 33: Hazardous and Offensive Development Application Guidelines* continues to provide the process for assessing if developments are potentially hazardous or offensive, including threshold levels that trigger the potentially hazardous or offensive status. *Applying SEPP 33* is the main guidance document that has been followed for this PHA.

1.5.3 Hazardous Industry Planning Advisory Paper No 4

The Department of Planning, NSW, 2011, *Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning* (HIPAP No 4) [Ref. 2] sets out risk criteria for industries that are considered hazardous to comply with. This document is used when *Applying SEPP 33* [Ref. 3] indicates a development is potentially hazardous.

1.5.4 Hazardous Industry Planning Advisory Paper No 6

The Department of Planning, NSW, 2011, *Hazardous Industry Planning Advisory Paper No 6 – Guidelines for Hazard Analysis* (HIPAP No 6) [Ref. 4] lists the process required for undertaking a PHA. This document is used when *Applying SEPP 33* [Ref. 3].

1.5.5 POEO Act

The *Protection of the Environment Operations (POEO) Act 1997* establishes the NSW environmental regulatory framework. It includes licensing requirements for certain activities and aims to control pollution impacts. Part 9.3E of the POEO Act makes reference to the Industrial Chemicals Environmental Management Standard (IChEMS) Register which dictates the required risk management measures for various categories of industrial chemicals. The SEARs (7(g)) require assessment of Schedule 6 and Schedule 7 industrial chemicals as defined below:

– Schedule 6 – Relevant industrial chemicals that are likely to cause serious or irreversible harm to the environment with essential uses
– Schedule 7 – Relevant industrial chemicals that are likely to cause serious or irreversible harm to the environment with no essential uses.

2. Project summary

2.1 Project and site location

The key elements of the project are:

- The new Camellia-Rosehill WRRF in Rosehill that will produce advanced treated water from wastewater.
- A new river release pipeline from the WRRF to release the advanced treated water into the Parramatta River.
- Upgrade of the existing Camellia pumping station, located within the future Camellia-Rosehill Town Centre. The upgrade will occur within the Sydney Water owned pump station site.
- A new wastewater transfer pipe from Camellia pumping station to the new WRRF.
- A brine pipeline from the WRRF to Sydney Water's existing wastewater system (NSOOS) to discharge brine (expected to partially align with the transfer pipe route). The brine pipeline incorporates a new pipeline from the WRRF to Camellia pumping station, and an existing pipeline to be repurposed between Camellia pumping station and the NSOOS.
- The pipelines will require a number of creek crossings, which will be underbored.

For this assessment, the primary site under consideration is the Camellia-Rosehill WRRF, within the red box in Figure 2.1. The project overview map, including the new pipelines, is shown in Figure 2.2.

Figure 2.1 *Camellia-Rosehill WRRF site location*

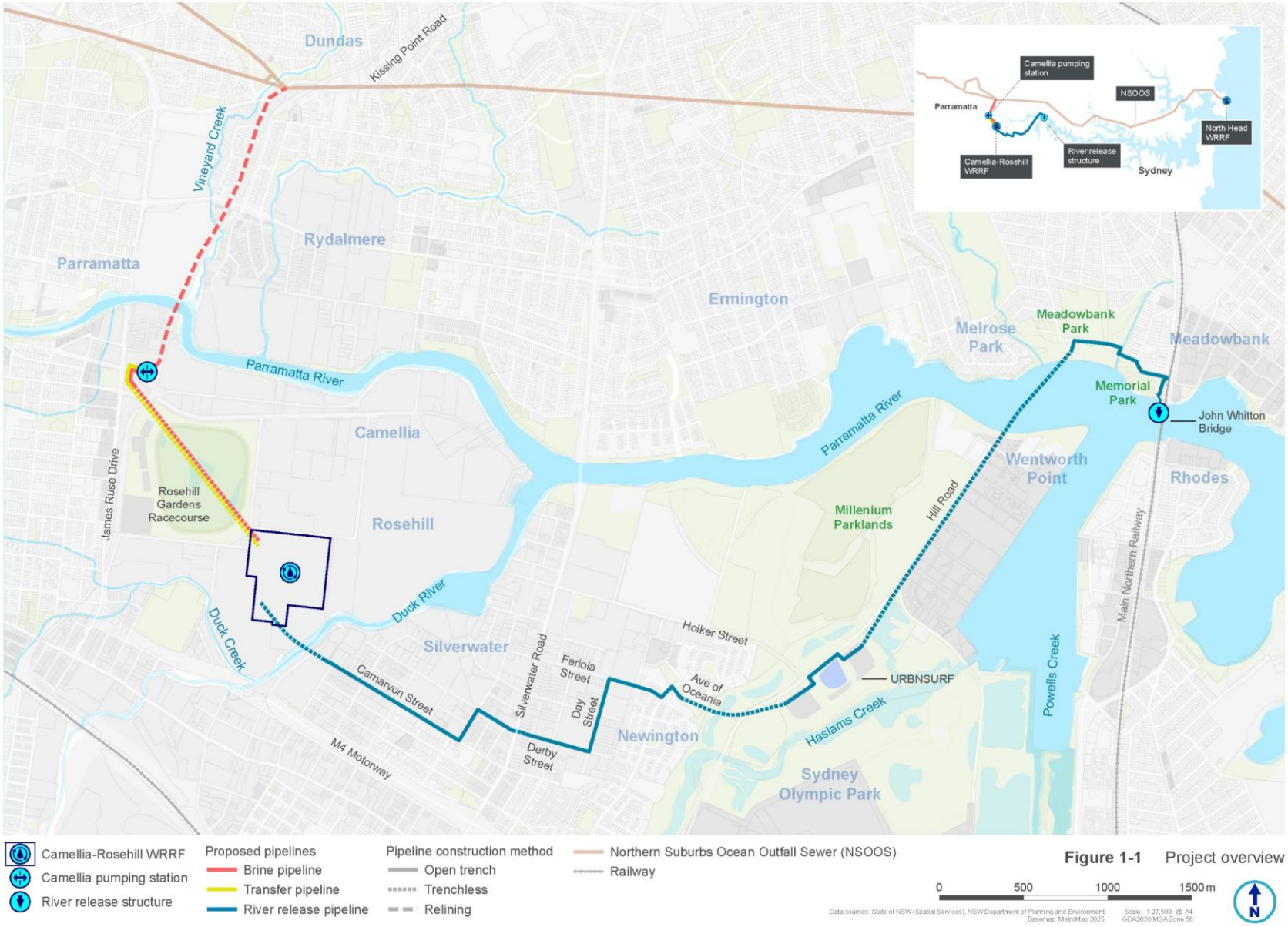

Figure 1-1 Project overview

Figure 2.2 Project Overview

The site is located within a primarily industrial and commercial area. Some key receptors nearby are listed in Table 2.1.

Table 2.1 Nearby receptors

Land use type	Facility / description	Location / distance from site
Industrial	Endeavour Energy Camellia Transmission Substation	North-west, opposite side of road
Industrial	Endeavour Energy Rosehill Zone Substation	North-west, opposite side of road
Industrial	Viva Energy Australia Clyde and Parramatta Terminal. The Clyde terminal is a Major Hazard Facility (MHF)	East, north-east, adjacent
Industrial	Other/various	North, east, and west of site, adjacent
Commercial / Recreational	Rosehill Gardens Racecourse	North-west, opposite side of road While the racecourse shares a border with the WRRF, the nearest occupied areas of the racecourse (i.e., buildings and stands) are on the western side, approximately 650m from the WRRF boundary.
Commercial	Other/various	North, east, and west of site, adjacent
Residential	Silverwater residential area, south of Duck River	South, ~400m, some residences within primarily commercial land use area
Residential	Rosehill residential area	East, ~900m
Transient population (public roadway)	Devon St	North, adjacent
Transient population (public roadway)	Colquhoun St	North-west, adjacent
Other	Duck River. While not a populated area, there is potential for environmental impacts to Duck River to result from the project	South, ~150m

2.2 Camellia-Rosehill WRRF

The site layout with the key areas relevant to this PHA is shown in Figure 2.3.

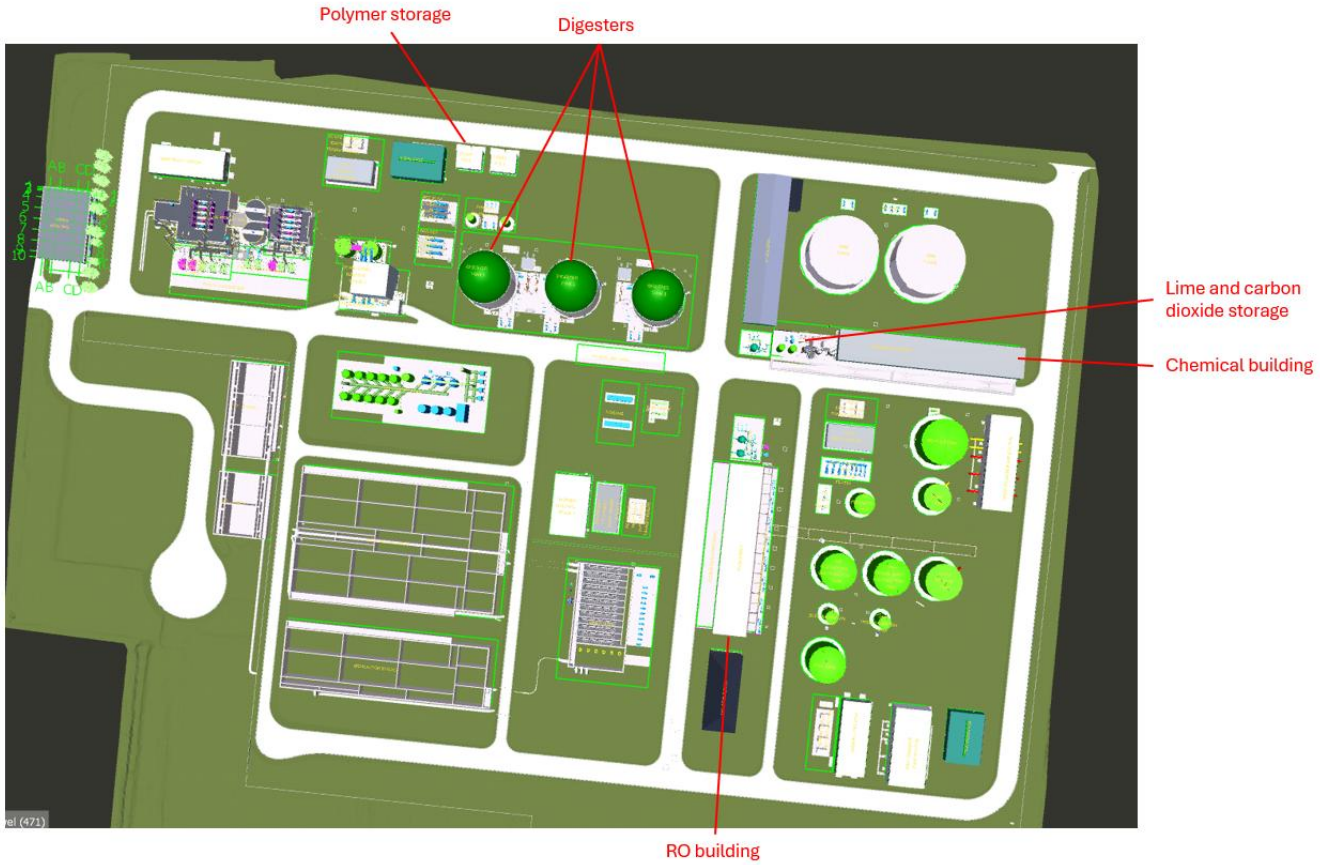

Figure 2.3 Indicative Camellia-Rosehill WRRF site layout

The main process areas of the Camellia-Rosehill WRRF consist of:

- Plant inlet works including coarse screening, grit removal and fine screening. Raw sewage is screened by coarse centre flow band screens, and grit is removed in two grit vortex chambers. Coarse-screened and degritted sewage is then directed to the fine centre flow band screens. Screenings and grit are separated from the sewage, prior to washing, dewatering, and loading into bins for removal from site.
- Primary sedimentation, where screened and degritted sewage is fed to the primary sedimentation tanks (PSTs). Ferric chloride is dosed upstream of the PSTs to optimise solids and phosphorous removal.
- Bioreactor tanks, including anaerobic, anoxic, aerobic, and swing zones which can function as either anoxic or aerobic zones. Settled sludge from the PSTs, and membrane return activated sludge (MRAS) is split equally via flow-splitting weirs to feed each bioreactor tank. Sucrose is dosed to enhance nitrogen removal, and ferric chloride is dosed for enhance phosphorous removal.
- Membrane bioreactors (MBRs), which are fed mixed liquor from the bioreactor tanks. The MBR includes six parallel membrane trains.
- Advanced Water Treatment Plant (AWTP), where the MBR filtrate is discharged to the Reverse Osmosis (RO) feed tank. The RO feed tank will feed the low pressure pumps and cartridge filters, through the header which supplies each of the high pressure pumps (one for each RO train). The RO concentrate (brine) will be discharged to the brine tank, while the RO permeate (ROP) will be stored in the ROP tank for use on site.
- Transfer pump stations, including the River Release Transfer Pump Station and Brine Transfer Pump Station.
- Sludge thickening, where waste activated sludge (WAS) from the bioreactor and primary sludge from the PSTs is thickened, each in a dedicated parallel process train with rotary drum thickeners.

- Anaerobic digestion and biogas handling, where thickened sludge is treated in anaerobic digesters operated in series. The system produces biogas for heat generation (digester heating) and electricity production.
- Dewatering of the digested sludge, prior to transferring the biosolids to the storage and outloading system. The sludge is dewatered in centrifuges with a 95% solids capture rate, each with a designated polymer dosing pump. The sludge is then conveyed to the biosolids storage silo, then transferred via a screw conveyor to the truck outloading facility.
- Odour control system for the inlet works, bioreactor, PSTs, and biosolids handling.
- Chemical storage and dosing systems.
- Site services.

3. Methodology

The method to determine whether a project would be deemed potentially hazardous or potentially offensive and the required follow up assessments is guided by SEPP (Resilience and Hazards) and *Applying SEPP 33*, as outlined in provided in Table 3.1.

Table 3.1 Applying SEPP 33 method for potentially hazardous or offensive industries

Issue	Methodology to determine if potentially hazardous / offensive	Follow up assessment if confirmed as potentially hazardous / offensive industry
Potentially hazardous industry	*Applying SEPP 33* risk screening process	Preliminary Hazard Analysis (PHA) required
Potentially offensive industry	Review of potential impacts to the amenity of the site or discharges, such as emissions (e.g. noise, air).	Meeting any licencing requirements issued by relevant authorities e.g. NSW Environment Protection Authority (EPA) is required

The *Applying SEPP 33* process is discussed in Sections 3.1 to 3.3.

3.1 Risk screening

Applying SEPP 33 relates to any project which falls under the policy's definition of 'potentially hazardous industry' or 'potentially offensive industry'.

A 'hazardous industry' is one in which when all locational, technical, operational, and organisational safeguards are employed, continues to pose a significant risk, as per the requirements of SEPP (Resilience and Hazards) 2021. Under the SEPP (Resilience and Hazards) 2021, a 'potentially offensive industry' is one which would, in the absence of safeguards, emit a polluting discharge which would cause a significant level of offence.

SEPP (Resilience and Hazards) 2021 requires a screening process be undertaken. The overall risk screening process, as outlined in *Applying SEPP 33* is summarised in Figure 3.1.

The risk screening process concentrates on the storage of specific DG classes that have the potential for significant off-site effects. Specifically, the assessment involves the identification of classes and quantities of all DGs to be used, stored, or produced on-site with an indication of storage locations. The quantities of DGs are then assessed against the *Applying SEPP 33* threshold quantities. If any of the *Applying SEPP 33* threshold quantities are exceeded, then the project is potentially hazardous, and a PHA is required.

If the project is potentially offensive, after considering the quantity and nature of any discharges and the significance of the offence likely to be caused, having regard to surrounding land use and the proposed controls, then additional controls are required.

3.2 Hazard identification

Following screening, *Applying SEPP 33* requires a determination of whether the proposal poses significant risk or offence. This requires identification of potential hazards to highlight any risks associated with the interaction of the proposal (as a whole) with the surrounding environment (i.e. a systematic process to identify any potential off-site impacts).

The Hazard Identification (HAZID) process is a desktop assessment and involves documenting possible events that could lead to a possible off-site incident. The assessment then lists the potential causes of the incident, as well as identification of operational and organisational safeguards to prevent the incidents from occurring or mitigate their impact. The HAZID process identifies the scenarios relevant to the PHA, should it be required.

3.3 Preliminary hazard analysis

For a development proposal classified as 'potentially hazardous', a PHA is required to determine the risk to people, property, and the environment at the proposed location and in the presence of controls. Criteria of acceptability are used to determine if the development proposal is classified as a 'hazardous industry'. The criteria are provided in HIPAP No 4, as specified in the SEARs. If this is the case, the development may not be permissible.

The PHA identifies the potential hazards, analyses these hazards in terms of their impact to people and the environment and their likelihood of occurrence, quantifies the resulting risk to surrounding land uses and assesses the risk to demonstrate that the proposal will not impose an unacceptable level of risk.

Applying SEPP 33 identifies three levels of PHA. If a PHA is required, a judgement of the level of risk associated with the proposal is determined using the results of the screening and HAZID stages.

The three levels of PHA are:

– Level 1 – if low potential for harm is identified, a qualitative PHA is completed
– Level 2 – if medium potential for harm is identified, a semi-quantitative PHA is completed
– Level 3 – if high potential for harm is identified, a quantitative PHA is completed.

The PHA is completed according to the methodology in HIPAP No 6, as required by the SEARs. The main steps in a PHA include:

– System definition
– Risk screening and hazard identification (as described in section 3.1 and 3.2)
– Consequence analysis
– Likelihood analysis
– Risk assessment
– Risk evaluation

The system definition confirms the scope of the assessment, and includes determination of the site and process conditions. This information is then used to inform the rest of the assessment including the risk screening, hazard identification, and inputs into the consequence analysis. The risk screening and hazard identification process is described in sections 3.1 and 3.2.

Depending on the level of PHA required, the detail of the consequence analysis will vary. For a Level 2 PHA (conducted for this project), select hazard scenarios with the potential for offsite impacts are modelled using specialist risk modelling software (PHAST). The results of the modelling are then compared to the relevant risk criteria for different consequence types (i.e., flammable, explosion, or toxic impacts). Refer to section 6.2 for the risk criteria.

The likelihood analysis determines the frequency of an unwanted event occurring. For this PHA, a modified event tree approach was taken. For an event tree, the initiating event frequency (e.g., loss of containment) is assessed, and prevention or mitigation factors are identified, which reduce the likelihood of the unwanted outcome. These factors could include the likelihood of ignition of a flammable substance, and probability of a person being located within the consequence zone at the time of the event.

Risk assessment and evaluation involves consideration of both individual and societal risk. Individual risk is the expected frequency of a single fatality occurring. The HIPAP 4 risk criteria includes acceptable individual risk levels for different land use types including industrial, sporting complexes or open spaces, commercial developments, residential areas, and sensitive or vulnerable populations (e.g., schools and hospitals), as shown in section 6.2.3. Societal risk criteria are given to evaluate the risk of scenarios which could result in multiple fatalities. Should multiple fatalities be found as a credible risk, the results would require an FN curve to demonstrate societal risk, where N refers to the number of fatalities and F refers to the frequency of the event that would lead to that number of fatalities.

The risk evaluation also includes consideration of cumulative risk, considering the risk of other facilities which may have hazards resulting in offsite impacts. Developments in the vicinity of the project are assessed to determine if they may have an impact on the project, or if their cumulative risks will exceed the nominated risk criteria.

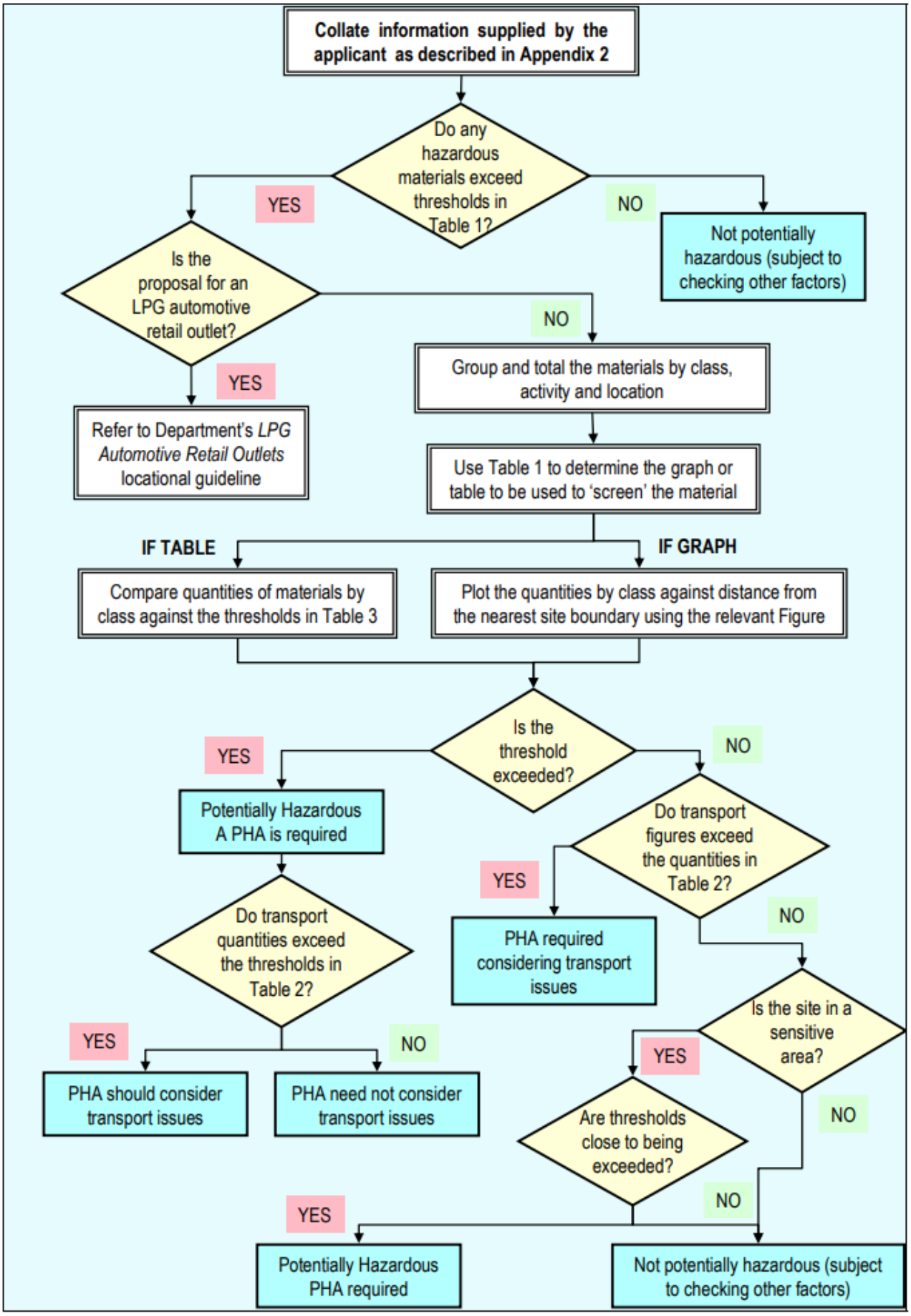

Figure 3.1 SEPP (Resilience and Hazards) 2021 risk screening process [Ref. 1]

4. Risk and emissions screening

4.1 Dangerous goods screening

A DG is a substance or article that poses a risk to people, property, or the environment [Ref. 3]. Each class represents a different type of DG. Some classes are divided into packing groups where Packing Group (PG) I substances present a high level of danger, PG II substances present a medium level of danger, and PG III substances present a low level of danger. A summary of the different DG classes is shown in Table 4.1.

Table 4.1 Dangerous good classes [Ref. 3]

DG Class	Packing Group	Description
1.1	N/A	Substances and articles which have a mass explosion hazard
1.2	N/A	Substances and articles which have a projection hazard but not a mass explosion hazard
1.3	N/A	Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both but not a mass explosion hazard
1.4	N/A	Substances and articles which present no significant hazard
1.5	N/A	Very insensitive substances which have a mass explosion hazard
1.6	N/A	Extremely insensitive articles which do not have a mass explosion hazard
2.1	N/A	Flammable gases
2.2	N/A	Non-flammable, non-toxic gases
2.3	N/A	Toxic gases
3	I, II, or III	Flammable liquids
4.1	I, II, or III	Flammable solids, self-reactive substances and solid desensitised explosives
4.2	I, II, or III	Substances liable to spontaneous combustion
4.3	I, II, or III	Substances which in contact with water emit flammable gases
5.1	I, II, or III	Oxidising substances
5.2	I, II, or III	Organic peroxides
6.1	I, II, or III	Toxic substances
6.2	I, II, or III	Infectious substances
7	N/A	Radioactive material
8	I, II, or III	Corrosive substances
9	I, II, or III	Miscellaneous dangerous goods and articles

Note, Class 1 combustible liquids are not classified as DGs under the United Nations (UN) but are considered hazardous under workplace legislation.

4.1.1 Construction of the project

At this stage of the project development, the chemicals used or stored on site during construction are unknown, a list of commonly used construction chemicals are detailed in Table 4.2. Based on the reference design for the project, the chemicals used during the construction of the project will be present in small quantities (hundreds of kilograms of storage). Therefore, the SEPP (Resilience and Hazards) 2021 threshold will not be exceeded. Should chemicals used onsite during construction be present in substantially larger quantities (tonnes of storage), the Construction Environmental Management Plan (CEMP) will capture additional relevant chemical handling mitigations.

Table 4.2 Commonly used construction chemicals

Chemical / product	UN #	DG class	Packing group	Indicative storage quantity	Indicative quantity (tonne)
LPG	1075	2.1	N/A	2 cylinders stored on site	0.09
Spray paint	multiple	2.1 - pressurised	N/A	Minimal amount stored on site	0.02
Acetylene (welding)	1001	2.1 - pressurised	N/A	1 ten m*3* cylinder stored on site	0.01
Oxygen (welding)	1072	5.1	N/A	1 cylinder stored on site	0.05
Paint (oil based considered worst case)	1263	3	II	Minimal amount stored on site	0.1
Solvents	multiple	3	II	Minimal amount stored on site	0.1
Epoxy resins	multiple	3	III	Minimal amount stored on site	0.1
Cleaning products	multiple	8	II	Minimal amount stored on site	0.005
Diesel (C1)	3082	9	III	Minimal amount stored on site	0.03
General oils and lubricants (C2)	1791	9	III	Minimal amount stored on site	0.5
Detergent	N/A	Not classified as DG		Minimal amount stored on site	0.005

4.1.2 Operation of the project

A summary of the chemicals proposed to be used and/ or stored on-site during operation of the project is shown in Table 4.3. Assumptions that have been made about the usage of these chemicals on-site, DG classification, quantities, and whether the chemicals exceed the SEPP (Resilience and Hazards) 2021 threshold have also been provided in Table 4.3. The information regarding chemical storage and quantities was sourced from the Reference Design report.

Table 4.3 Operations dangerous goods screening

Chemical/ product	UN #	DG class	Packing group	Expected storage quantity	Combined storage quantity per DG class and PG	SEPP (Resilience and Hazards) 2021 combined storage threshold	Exceedance of SEPP (Resilience and Hazards) 2021 threshold	Comments / assumptions
Adjacent to main chemical building								
Carbon Dioxide	1013	2.2	N/A	24t	24t	N/A	N/A	N/A
Lime	N/A	N/A	N/A	120kL	120kL	N/A	N/A	
Main chemical building								
Ferric Chloride	2582	8	III	135kL/194t	321kL/412t	50t	Exceeds threshold	N/A
Sodium Hypochlorite	1791	8	III	160kL/189t				
Ammonium hydroxide	2672	8	III	13.5kL/12t				
Sodium Bisulphite	2693	8	III	12.5kL/17t				
Sodium Hydroxide	1824	8	II	135kL/204t	157kL/247t	25t	Exceeds threshold	
Sulphuric acid	1830	8	II	10kL/18t				
Hydrogen peroxide	2014	8	II	22kL/25t				
Citric acid	N/A	N/A	N/A	13.5kL	13.5kL	N/A	N/A	
Sucrose	N/A	N/A	N/A	135kL	180kL	N/A	N/A	
Hypersperse MDC120 (Anti-scalant)	N/A	N/A	N/A	6kL	6kL	N/A	N/A	
Digesters, cogeneration, and waste gas burners								
Biogas (methane)	1971	2.1	N/A	~12t / 6000kL	~12t / 6000kL	0.1t	Exceeds threshold	2000m^3 x 3 digesters (6000m^3) @ 20mbar Note this mass amount is based on a biogas composition of 70% methane and 30% CO_2.
RO chemical area								
Biomate MBC781 (Biocide)	3265	8	II	1kL/1.03t	1kL/1.03t	25t	Does not exceed threshold	Stored in an IBC

Chemical/ product	UN #	DG class	Packing group	Expected storage quantity	Combined storage quantity per DG class and PG	SEPP (Resilience and Hazards) 2021 combined storage threshold	Exceedance of SEPP (Resilience and Hazards) 2021 threshold	Comments / assumptions
Thickening and dewatering facilities								
Liquid polymer emulsion	N/A	N/A	N/A	$10m^3$	$10m^3$	N/A	N/A	2 x $5m^3$ storage (for waste activated sludge and primary sedimentation rotary drum thickeners) Not expected to be a DG which exceeds the SEPP combined storage threshold
Powder polymer	N/A	N/A	N/A	$6m^3$	$6m^3$	N/A	N/A	Bulk storage volume, does not include batching tanks Not expected to be a DG which exceeds the SEPP combined storage threshold

4.2 Transport screening

4.2.1 Construction of the project

It is assumed that during construction of the project, there would be low volumes of DGs stored in the construction compound. Therefore, the transportation volumes of chemicals during construction are considered to be minimal and would not exceed the *Applying SEPP 33* transport thresholds for construction of the facility.

As the construction planning of the site is developed, and the types and quantities of the materials are confirmed, any increase in DG transport movements should be captured in the CEMP with appropriate transportation mitigations.

4.2.2 Operation of the project

This *Applying SEPP 33* transport screening relates to the carriage of DGs to and from the project site. Table 4.4 shows the transport screening for the operation of the project. This includes the expected vehicle movements of each DG class and the vehicle movement thresholds according to *Applying SEPP 33*.

At this stage of the project development, the transportation arrangements, including quantities transported and frequency of movements for DGs to site have not yet been determined. The number of transportation movements to the Camellia-Rosehill WRRF site, is based on the average weekly chemical consumption, and expected volumes of material delivered per transport movement. For the materials with larger storage quantities (ferric chloride, sodium hypochlorite, and sodium hydroxide), a delivery size of 45kL has been assumed. For the remaining Class 8 DGs stored in smaller quantities, a delivery size of 10kL has been assumed.

These transportation movements for the chemical are listed in Table 4.4, and show that the SEPP (Resilience and Hazards) thresholds are not exceeded for Class 8 DGs.

Table 4.4 Operations transport screening

Chemical/ product	DG Class	Combined quantity (as per Table 4.3)	Transport movements (annual)	Combined transport movements (annual)	Transport movements threshold (annual)	Exceedance of SEPP (Resilience and Hazards) 2021 threshold	Comments
Carbon dioxide	2.2	24t	73	N/A	N/A	Does not exceed threshold	Preliminary design information provided by Sydney Water
Ferric Chloride	8III	488kL	37	187	>500	Does not exceed threshold	
Sodium Hypochlorite	8III		44				
Ammonium hydroxide	8III		16				
Sodium Bisulphite	8III		16				
Sodium Hydroxide	8II		38				
Sulphuric acid	8II		10				
Hydrogen peroxide	8II		26				

4.3 Hazardous materials

4.3.1 Types of hazardous materials on site

The materials noted as DGs in the risk screening are summarised in the below sections.

Biogas

Biogas is produced in the digesters and stored in the digester gas holders at the Camellia-Rosehill WRRF. While the exact composition is unknown, typically biogas will be composed primarily of methane, with carbon dioxide and smaller amounts of nitrogen and hydrogen. In this project, the biogas is comprised of approximately 60-70% methane, with the balance containing CO_2 and other trace gases. As a conservative approach to the risk assessment and consequence modelling, the biogas was modelled as 70% methane and 30% CO_2.

Methane (CH_4) 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 (CO_2 = 1) of 25.

The biogas will also contain small amounts of hydrogen sulphide (H_2S). H_2S is a colourless gas that is both flammable and toxic. It is typically present in quantities of 1-2% of the total biogas produced from anaerobic digestion of wastewater sludges [Ref 18]. Due to the low expected concentration of H_2S in the biogas, the toxicity and flammability are not considered significant risks. The flammability of methane is the driving hazard associated with biogas, therefore the risk of H_2S has not been considered further in the PHA.

A key control for the hazards associated with biogas is the waste gas burner. The burner is designed to be a safe way to remove and burn the gas should the cogeneration system fail or be otherwise non-operational, resulting in excess biogas in the system. The waste gas burner is designed to be inherently safe, and as a control they are assumed to operate as intended. Therefore, loss of containment from the waste gas burner has not been considered further in the PHA.

Carbon dioxide

Carbon dioxide (CO_2) is stored adjacent to the main chemical building in the north-east corner of the site, and is dosed after chlorination for pH correction. CO_2 is a colourless, odourless, and non-flammable gas. It is non-toxic, though is an asphyxiant. It is also a greenhouse gas with global warming potential if released.

Ferric Chloride

Ferric chloride ($FeCl_3$) solution, dosed for phosphorous removal, 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. If combusted or upon decomposition, it may produce toxic fumes such as hydrogen chloride or chlorine gas. Due to its corrosive nature, ferric chloride is harmful to humans if ingested, inhaled, or touched.

Sodium Hydroxide

Sodium hydroxide (NaOH) solution, used for the RO clean in place (CIP) system 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.

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 used for multiple purposes at the WRRF including chloramine formation to prevent biofouling, CIP for MBR and ultrafiltration (UF) systems, neutralising residual chlorine following breakpoint chlorination, and emergency disinfection. 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.

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. It is dosed for neutralising residual chlorine following breakpoint chlorination and reducing chloramine for protection of HDPE pipelines.

Sulphuric Acid

Sulphuric acid (H_2SO_4) is used at the WRRF for pH reduction in the RO feed tank, preventing phosphate scaling of membranes, and RO CIP. It is a strong acid with a pH of approximately 0.9. It may be corrosive to metals and is non-combustible. 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.

Ammonium Hydroxide

Ammonium hydroxide (NH_4OH, Ammonia 25% AR Solution), used for the chloramination process at the WRRF, 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 severe 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. It is used for monochloramine formation to prevent biofouling in the membrane systems.

Hydrogen peroxide

Hydrogen peroxide is dosed at the WRRF as an oxidant for the UVAOP process. It is a colourless liquid, with a mild odour and is harmful if ingested with specific target organ toxicity, and can cause serious eye and skin damage upon contact. At 35% concentration, it has a pH of 4.6. It is incompatible with some acids (nitric acid and sulphuric acid) and strong bases and corrosive to metals including carbon steel, nickel alloys, aluminium alloys, and copper.

4.3.2 Summary of chemical compatibility

The compatibility of chemicals stored within the main chemical building is demonstrated in Table 4.5 below [Ref 14]. Where chemicals are incompatible, they cannot be stored in the same bund. Should they come into contact with each other, hazardous reactions are expected, such as generation of heat or toxic gases, or an intense or explosive reaction. Where “Caution” is identified, it means that hazardous reactions may occur under certain conditions.

Table 4.5 Compatibility of chemicals stored on site

	Ferric chloride								
Sodium hypochlorite	Incompatible	Sodium hypochlorite							
Ammonium hydroxide	Incompatible	Incompatible	Ammonium hydroxide						
Sodium bisulphite	Incompatible	Incompatible	Caution	Sodium bisulphite					
Phosphonic acid	Caution	Incompatible	Caution	Incompatible	Phosphonic acid				
Sodium hydroxide	Incompatible	Incompatible	Caution	Caution	Incompatible	Sodium hydroxide			
Sulphuric acid	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Sulphuric acid		
Hydrogen peroxide	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible	Hydrogen peroxide	
Citric acid	Incompatible	Incompatible	Caution	Caution	Compatible	Incompatible	Incompatible	Incompatible	Citric acid
Sucrose	Caution	Incompatible	Compatible	Compatible	Compatible	Incompatible	Incompatible	Incompatible	Caution

4.4 Compliance with POEO Act

None of the chemicals listed in the above sections, nor in the risk screening tables above are in the IChEMS register (including Schedule 6 or Schedule 7 chemicals) [Ref 13]. Therefore, the site will comply with Part 9.3E of POEO Act [Ref 12] and the SEARs.

4.5 Chemical selection

Where there was a choice in chemicals which could provide similar functionalities in the wastewater treatment process, the chemical which resulted in the lowest risk to surrounding receivers was selected where appropriate. Other factors also contributed to the chemical selection, however, this section only describes the relevant hazard and risk factors.

For the application at Camillia-Rosehill WRRF, sucrose has been chosen as the carbon source within the bioreactor, instead of the alternative, methanol. Methanol is a highly flammable liquid, which if ignited could lead to a pool fire, either during storage or transport to site. Whereas sucrose is a non-flammable, non-toxic liquid, which if spilled, would only result in a minor safety hazard of operators slipping over the spilled chemical in the area.

Sodium hypochlorite has been selected to disinfect the water at the WRRF due to the site-specific operational requirements of the chloramination process. Sodium hypochlorite presents negligible risk to offsite receptors if a loss of containment of its storage was to occur. The alternative, chlorine gas, is toxic, so a loss of containment of could result in offsite impacts to the public.

The other chemicals were selected on an as-needs basis, where there was no suitable chemical substitution which resulted in a lower risk.

4.6 Summary of emissions

A ‘potentially offensive industry’ is one which would, in the absence of safeguards, emit a polluting discharge which would cause a significant level of offence. If unmitigated, the project is expected to release emissions, including air quality, noise, and vibration effects during its construction and operation. It is therefore considered a “potentially offensive” industry, as defined in SEPP (Resilience and Hazards).

4.6.1 Air quality

The effects on air quality from the GPOP WCM project have been assessed in a separate specialist study [Ref 20] and the results are summarised below.

The project has the potential to generate air quality impacts during construction and operation but the significance of these is expected to be low. During construction, dust is expected to be emitted primarily at the WRRF and along the pipeline alignments. Standard construction management measures for dust control can effectively manage these impacts. These measures may include watering exposed areas or modifying or ceasing work in windy conditions. With these mitigations in place, no significant residual impacts are expected across the project.

During operation, potential air quality impacts arise from odours (generated by wastewater treatment) and oxides of nitrogen (generated by combustion within the co-generation unit). To manage the odour emissions, an odour control unit is included in the design.

Odour releases, both from wastewater treatment and combustion in the co-generation unit have been modelled in a separate specialist study to determine the potential effect of these on the surrounding sensitive receptors, and if they meet the relevant EPA criteria. The results show that all odour concentration criteria at ground level outside the WRRF boundaries are met, and the impact to air quality from the project will be minimal. Additionally, standard odour mitigation measures can be implemented to further reduce the impacts of odour generated by the facility. These include procedural controls such as closing access chamber and maintenance holes, or adjusting the odour emissions rate from the odour control facility.

Should these controls be implemented, and EPA licence(s) adhered to, the impact to air quality from the project will be acceptable and will not be considered an offensive industry due to impacts to air quality.

4.6.2 Noise and vibration

A Noise and Vibration Impact Assessment [Ref 21] was conducted on the GPOP WCM project, summarised below.

The project is expected to generate moderate noise impacts during construction, and negligible impacts during operation.

Construction at the WRRF site is predicted to exceed noise management levels at sensitive receivers when considering the worst-case construction activities. Noise levels could be reduced by up to 10 dB(A) depending on the location of the construction equipment, and with implementation of temporary barriers or screens placed at a noise source or receiver. The CEMP will include standard daytime noise management safeguards including, but not limited to:

– Identify and consult with potentially affected residents prior to commencement of works
– Implement a noise complaints handling procedure
– Selection of appropriate plant for each task

The significance of impacts during construction will be greatest where work is required outside of standard construction hours, and where construction activities are required for extended periods. Where this is required, the delivery contractor would justify the need for out of hours work, night works, or why all other times are not feasible for delivery. They would also identify community notification requirements, and consider potential safeguards and other feasible management measures, in addition to those minimum requirements in the CEMP. Management of noisy activities (such as selection of types of equipment with lowest noise outputs) and ongoing consultation with nearby sensitive receivers will be essential in managing project noise impacts during construction.

Furthermore, minimum working distances have been provided that allow for compliance with the construction vibration criteria. Some works may potentially occur within the minimum working distances and mitigation measures to control excessive vibration have been recommended in the Noise and Vibration Impact Assessment.

Operational noise impacts from the WRRF will meet noise criteria at all sensitive receivers except for one near the Camellia Pumping Station. Appropriate building design will sufficiently control noise from the Camellia Pumping Station to the Camellia Town Centre.

In general, the project will be carried out in accordance with Sydney Water's Noise Management Procedure (SWEMS0056), and the Noise Policy for Industry (EPA, 2017).

Should these controls be implemented, and EPA licence(s) adhered to, the noise and vibration impacts from the project will be acceptable and will not be considered an offensive industry due to impacts from noise and vibration.

4.7 Summary of risk screening results

According to *Applying SEPP 33*, if any of the screening thresholds are exceeded then the proposed development should be considered a 'potentially hazardous industry' and a PHA is required.

The results of the dangerous goods screening indicate that the Camellia-Rosehill WRRF will exceed the thresholds within the SEPP (Resilience and Hazards) 2021 requirements for DG storage. The project is therefore considered a 'potentially hazardous industry' and a PHA is required. The results of the transport screening, however, do not exceed the DG movement thresholds.

At this stage of the design, sucrose is proposed to be used as the carbon source within the bioreactors, but it is noted that methanol would be a suitable alternative. Should it be decided during detailed design that methanol is the preferred material over sucrose, this will result in a change in the risk screening results.

The Hazard and Risk SEARs specify a QRA (Level 3 PHA) is required if the development was found to be potentially hazardous, however, a Level 2 PHA (semi-quantitative risk assessment) is considered appropriate given the level of risk found in the risk screening step and in consideration of the surrounding industrial land use. As discussed below in Section 5.3, the only material identified with the potential to result in offsite impact is the biogas, and a 'medium' potential of harm was identified.

Furthermore, as detailed in Section 5.3, the other chemicals, while exceeding the SEPP storage thresholds, do not pose a risk offsite. Risk to site personnel has sufficient prevention and mitigation measures (including emergency management procedures, chemical handling procedures and other WHS legislation requirements) to reduce and manage the risk sufficiently. Some key controls are listed in Table 5.1.

A Level 2 PHA has been completed and is discussed in Sections 5 and 6.

Furthermore, the summary of emissions found that if the environmental management controls are implemented and EPA licences in relation to air and noise emissions are adhered to, the project will not be an offensive industry.

5. Hazard identification and management

5.1 Hazard identification (HAZID)

The results of the HAZID associated with the Camellia-Rosehill WRRF are presented in Table 5.1. The hazard identification was conducted as a desktop study and focused specifically on the operational activities. Safeguards are also outlined in Table 5.1 and are required to manage the risk scenarios that were identified or controlled to an acceptable level.

The HAZID did not include hazards associated with construction activities due to the low number of DGs being present during this phase. General worker construction risks will be captured in the construction safety management plan.

In undertaking the HAZID, a number of assumptions were made, as listed in Section 1.4.

The key risks with the potential to cause offsite impacts are discussed in more detail in Section 5.2, including management strategies and controls.

Table 5.1 Identified hazards for the Camellia-Rosehill WRRF

ID	Hazard scenario	Cause	Consequences	Potential for off-site impact	Identified / recommended safeguards
1	Methane (biogas) release	Tank, pipework or flange leak. Tear in digester membrane gas holder.	Explosion in digestor tank / gas holder	Yes	– 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) – Signage, including “no mobile phones” near digesters
2	Explosive gas-air mixture forms in the odour control system, inlet works, or other process equipment	Accumulation of flammable gas	Explosion	No	– Comprehensive emergency plan and procedures provided for the site – SDSs held for all materials – PPE provided – Annual fire and evacuation training to be conducted – Ventilation on equipment as required – Air changes compliant with ACP0004
3	Release of corrosive material (e.g. sodium hydroxide)	Tank, pipework or flange leak	Potential for injury or environmental release	No	– Storage of chemicals as per AS3780 and AS1657 – Comprehensive emergency plan and procedures provided for handling corrosives – SDSs held for all materials – Emergency spill kits provided
4	Release of sulphuric acid	Tank, pipework or flange leak	Potential for injury or environmental release	No	– 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

ID	Hazard scenario	Cause	Consequences	Potential for off-site impact	Identified / recommended safeguards
5	Interaction of incompatible dangerous goods stored together	Inadequate storage Corrosion and leaks from the storage tanks	Fire, toxic gas production or potential for environmental release	Yes	– Chemicals segregated in accordance with the relevant Australian Standards, AS 3780, and SDSs – SDSs held for all materials – Emergency spill kits & PPE provided – Alarming of leak detection in locations where there is a potential for chemical interactions
6	Release of RO brine into the environment, prior to the intended release point	Pipework or flange leak	Potential for environmental release	Yes	– Design and operational measures in place to reduce the likelihood of a pipeline failure or leak – Systems to detect pipeline failure or leak – Quality / composition of brine not expected to result in environmental or safety impact
7	Release of treated water into the environment prior to the Parramatta River release point	Pipework or flange leak	Potential of environmental release	Yes	– Design and operational measures in place to reduce the likelihood of a pipeline failure or leak – Systems to detect pipeline failure or leak – Treated water to be compliant with requirements of environmental protection licence
8	Carbon dioxide release	Damage to pressurised cylinder or dosing line	Asphyxiation of personnel	No	– Storage of CO_2 in an open space – Site emergency procedures
9	Polymer powder fire	Spill of powder polymer during unloading, or from conveyors	Ignition resulting in dust fire or explosion	No	– Housekeeping practices and prompt clean-up of spilled polymer during transfer or normal operation – Polymer characteristics unlikely to cause formation of dust cloud or be ignited

5.2 Chemical and spill management

A common control for the hazards identified above is appropriate chemical handling. Any chemicals brought on-site should be stored in accordance with the relevant Australian Standards. It is recommended that each chemical have appropriate labelling, separation where necessary, and disposal in accordance with Australian Standards. Emergency services require access to the safety data sheet (SDS) register of all chemicals that are located on-site.

Additionally, appropriate safe work procedures should be implemented for the handling of all chemicals including transfer, storage, spill prevention, and clean up requirements.

5.3 Key hazardous scenarios

5.3.1 Loss of containment from biogas system

Loss of containment of the biogas system is most likely to be a result of a leak from the gas holders or associated pipework. The consequences of this occurring could include a fire or a vapour cloud explosion due to the release of methane.

There are multiple ways a loss of containment of the methane from the gas holders could occur, as listed below:

– A tear in the digester membrane gas holder
– A jet fire from an adjacent digester gas holder impinging the tank. The mechanism of this scenario could be:
  - Increase in temperature of the biogas resulting in increased pressure, and rupture of the membrane gas holder, or
  - Damage of the membrane by the jet fire, and rupture at the point of impingement.
– A vapour cloud explosion from a digester membrane gas holder, damaging a neighbouring digester membrane gas holder resulting in its rupture
– A hole in the digester membrane gas holder
– A leak from a damaged fitting (including flange, valve, or instrument) attached to the digester gas holder
– A leak from piping within the biogas system including the cogeneration and waste gas burners.

As there is a potential for offsite impact from these events, they are assessed further in section 6.

5.3.2 Interaction between incompatible chemicals

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 the formation of new substances which are corrosive, flammable, or toxic.

This risk is also relevant to chemicals which are not classified as dangerous goods. For example, citric acid (not a DG) can react with sodium bisulphite to produce sulphur dioxide gas, which is toxic.

For details on the chemical compatibility in different areas of the plant, refer to section 4.3.2.

The following controls are recommended to prevent the mixing of incompatible chemicals:

1. The tanks are to be segregated in accordance with the relevant Australian Standards, namely *AS 3780 – The Storage & handling of corrosive substances* [Ref 15]. AS 3780 also requires separate bunding and containment, and drainage systems for all DGs.
2. The design should consider having different connection types / sizes to make it impossible to connect and mix incompatible chemicals during unloading and normal operation.
3. Incompatible chemicals should be stored at least 5 metres away from each other, in a separately bunded area.

Should the storage recommendations of the chemicals be followed, the residual risk of this hazard will be reduced SFAIRP, and offsite impacts are expected to be negligible. Therefore, this scenario has not been included within the PHA.

5.3.3 Release of brine into the environment

The Camellia-Rosehill WRRF will produce a brine solution as a by-product of the reverse osmosis (RO) treatment process. The brine will be pumped offsite by the brine transfer pump station for disposal. While the project will ultimately release the brine into the environment, there is a possibility that a leak in the transfer pipeline could result in release prior to the planned release point. This could result in unintended environmental damage or human injury.

The indicative brine composition is shown in Table 5.2.

Table 5.2 Indicative RO brine composition

Analyte name	Abbreviation	Units	10%ile	50%ile	90%ile
Ammonia	NH4+ and NH3	mg/L	0.28	0.40	0.81
Potassium	K	mg/L	75	75	89
Sodium	Na	mg/L	537	537	634
Magnesium	Mg	mg/L	61	61	64
Calcium	Ca	mg/L	90	90	64
Strontium	Sr	mg/L	0.32	0.34	0.37
Carbonate (part of alkalinity measure)	CO_3	mg/L	1.7	2.3	3.8
Bi-carbonate (part of alkalinity measure)	HCO_3	mg/L	331	361	452
Nitrate	NO_3	mg/L	4.9	6.7	18.7
Chlorine	Cl	mg/L	804	823	854
Fluoride	F	mg/L	2.8	2.8	2.9
Sulfate	SO_4	mg/L	283	283	377
Silicon dioxide	SiO_2	mg/L	24	24	27
Boron	Boron	mg/L	0.13	0.13	0.13
Carbon dioxide	CO_2	mg/L	9.6	10.2	12.1
Total dissolved solids	TDS	mg/L	2235	2248	2622
pH	pH	pH units	7.5	7.6	7.7

While there are some chemicals with the potential to cause harm in the RO brine, their concentrations are sufficiently low such that it 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.

Furthermore, there will be both design and operational measures in place to prevent pipeline failure or leakage and detect and rectify the failure in the event that it occurs. These will be developed as the design progresses.

Given that any offsite impact from release of brine into the environment is expected to be negligible, it has been excluded from further assessment in the PHA.

5.3.4 Release of treated water into the environment

High quality treated water from the WRRF is released into the Parramatta River. There is a possibility that a leak in the release pipeline could result in environmental release of the treated water into the environment prior to the Parramatta River release point and result in environmental or safety impacts to that area. The river release pipeline route is shown in Figure 2.2.

It is expected that the treated water will be of a high enough quality such that negligible environmental contamination will occur as a result of a leak. Depending on the volume and rate of release, ground erosion may occur in the area around the leak, with potential runoff of soil or dirt into nearby waterways such as Ducks River, Haslams Creek, or the Parramatta River. No human impact is expected as a result of an environmental release of treated water.

As with the brine pipeline, design and operational control measures will be developed to prevent or detect a treated water pipeline leak. Due to these controls and the nature of the treated water, offsite impacts will be negligible, and this scenario has been excluded from further assessment in the PHA.

6. Preliminary Hazard Analysis (PHA)

6.1 Summary of hazard scenarios

Section 5.3 details the hazard scenarios which have not been managed SFAIRP and could lead to off-site impacts. These scenarios were carried forward for a Level 2 PHA (semi-quantitative analysis) and include the following:

1. Catastrophic rupture of the digester gas holder
2. Leak of the digester gas holder – 50-millimetre leak has been selected for the assessment

This is not an exhaustive list of loss of containment scenarios but rather include the worst-case scenario (rupture of the digester gas holder), and a less severe, but perhaps more frequent scenario. These are considered the most severe due to the large volume of gas that could be released in a loss of containment. The other scenarios listed in section 5.3.1 are expected to yield similar or lesser consequences to those chosen for modelling due to the smaller quantities of biogas expected to be released in a loss of containment event.

The consequence modelling for these scenarios was performed using specialist risk modelling software, DNV's PHAST version 9.0 commercial software package [Ref. 5]. A summary of the model input parameters is presented in Section 6.3.2.3.

6.2 Consequence and risk criteria

The identification of hazards and the quantification of risks outside the boundaries of a potentially hazardous development, and assessment of that risk in terms of the nature of land uses in the vicinity provide the basis for compatible land use safety planning.

The consequence, individual risk, and injury risk criteria and results are presented in the following sections.

6.2.1 Heat radiation criteria

The effects of various heat radiation levels are summarised in Table 6.1 as per the NSW Hazardous Industry Planning Paper (HIPAP) No. 4 [Ref. 2].

Table 6.1 Heat radiation criteria [Ref 2]

Heat radiation (kW/m^2)	Description / Name	Effect
4.7	Injury threshold	Will cause pain in 15 to 20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur)
12.6	Fatality threshold	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	Structural damage threshold	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	Instantaneous fatality threshold	Cellulosic material will pilot ignite within one minute's exposure Significant chance of fatality for people exposed instantaneously

6.2.2 Explosion overpressure criteria

The effects of various explosion overpressures are presented in Table 6.2 as per NSW HIPAP 4 [Ref. 2]. The overpressure levels reported in this assessment include 7 kPa, 14 kPa, 21 kPa and 35 kPa.

Table 6.2 Effects of explosion overpressure criteria [Ref. 2]

Explosion overpressure	Description / Name	Effect
7 kPa / 0.07 bar	Injury threshold	Damage to internal partitions and joinery but can be repaired Probability of injury is 10% No fatality
14 kPa / 0.14 bar	Building damage threshold	House uninhabitable and badly cracked
21 kPa / 0.21 bar	Structural damage threshold	Reinforced structures distort Storage tanks fail 20% chance of fatality to a person in a building
35 kPa / 0.35 bar	Fatality threshold	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

6.2.3 Risk criteria

The individual fatality risk criteria are outlined in Table 6.3.

Table 6.3 Individual fatality risk criteria

Land use type	Tolerable criteria (per million years)
Hospitals, schools, child-care facilities, old age housing	0.5
Residential, hotels, motels, tourist resorts	1
Commercial developments including retail centres, offices, and entertainment centres	5
Sporting complexes and active open space	10
Industrial	50

If there is a credible scenario which could result in multiple fatalities, the societal risk is assessed against an F-N curve. The societal risk criteria are given by an F-N curve, which gives criteria for broadly acceptable, tolerable if reduced As Low As Reasonably Practicable (ALARP) and intolerable risk.

6.3 Modelling assumptions

6.3.1 General modelling assumptions

The general assumptions and inputs for the model are shown in Table 6.4. Note that the modelling software, PHAST, does not consider site specific topography; therefore, all heights are measured from ground level (grade). The weather conditions are based on annual data from 1967 to 2025 at Parramatta North Weather Station obtained from the Bureau of Meteorology (BOM), and includes conditions across the seasons [Ref 10]. The average wind rose conditions for 9am and 3pm are shown in Figure 6.1 and Figure 6.2 respectively.

Table 6.4 General modelling input parameters

Parameter	Value	Comment/Reference
Release location	Outside releases	
Terrain	Land	
Ambient temperature	18.7ºC	Bureau of Meteorology
Surface temperature	18.7ºC	Bureau of Meteorology
Relative Humidity	0.64	Bureau of Meteorology
Surface roughness	1m	Regular large obstacle coverage (forest, suburb)
Height of interest	1.5m	Assumed to be the chest or face height of an average human

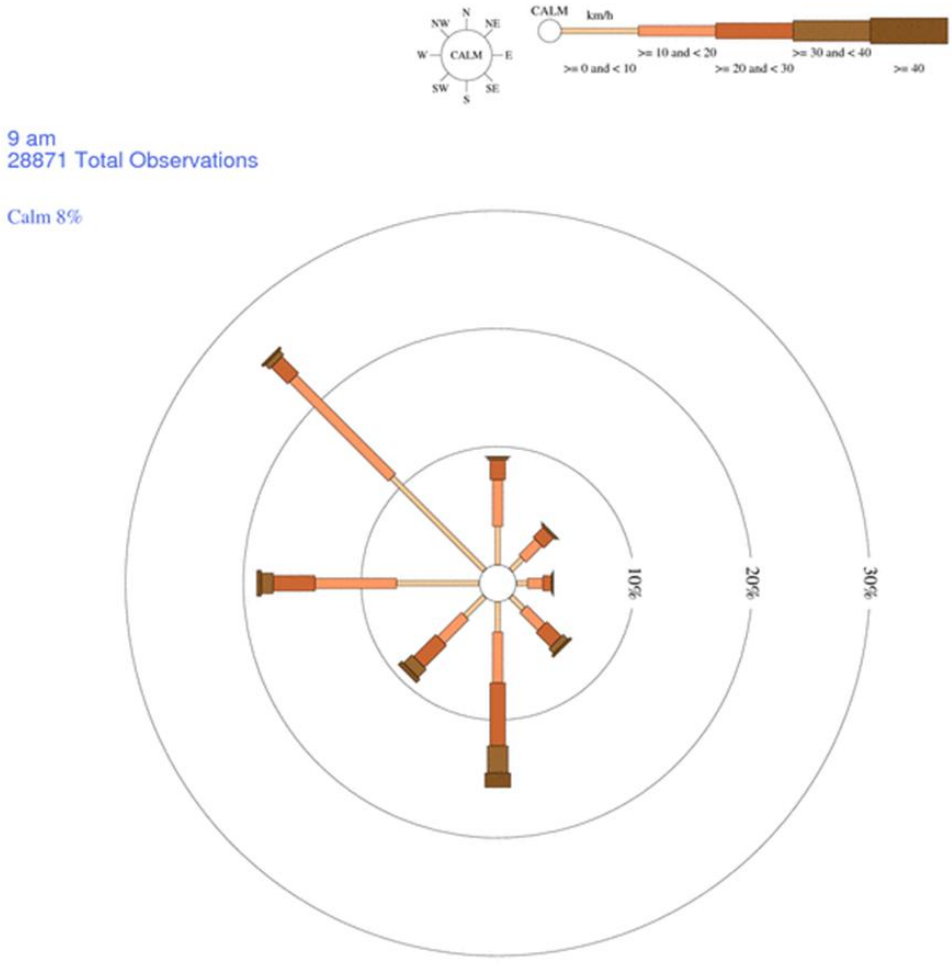

Figure 6.1 9am Wind Rose

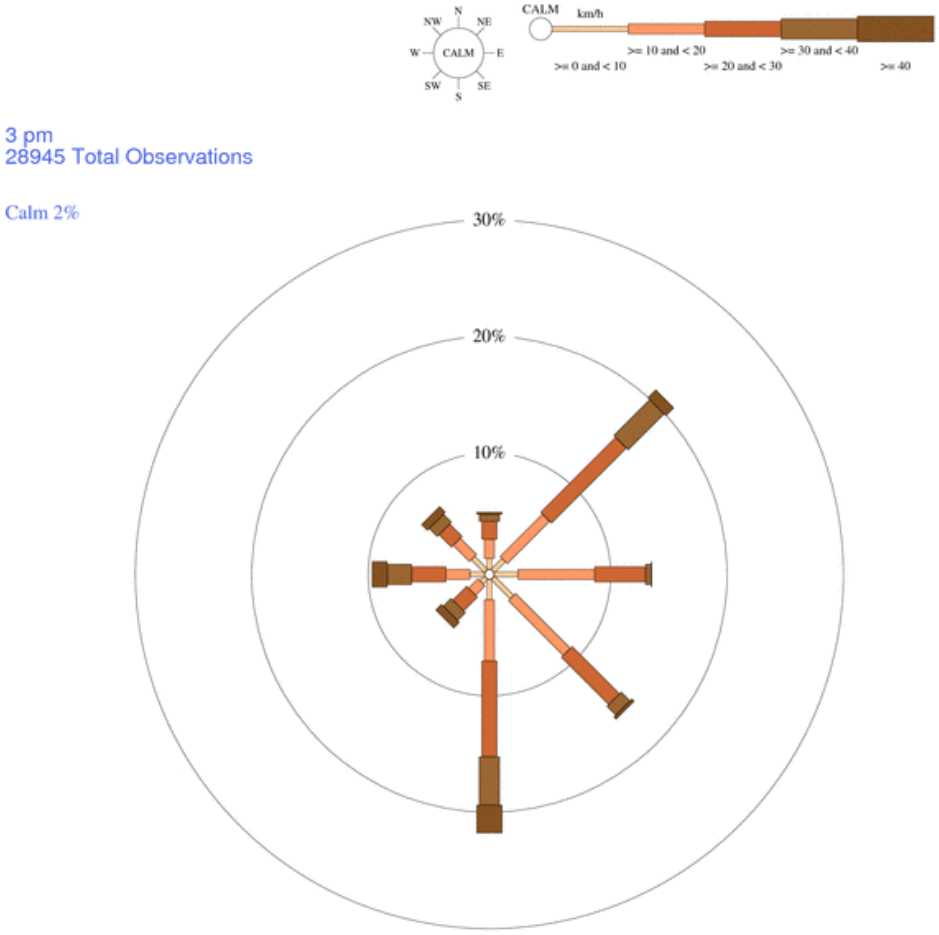

Figure 6.2 3pm Wind Rose

Using weather data from Parramatta, the weather conditions for Camellia-Rosehill WRRF have been estimated in Table 6.6, using the Pasquill stability scheme in Table 6.5, which is commonly used to describe the amount of turbulence in the atmosphere for consequence and dispersion modelling.

Table 6.5 Pasquill weather stability class definitions

Class	Type	Descriptions
A	Unstable	Day time – sunny, light winds
B	Unstable	Day time – moderately sunny, light to moderate winds
C	Unstable / Neutral	Day time – moderate winds, overcast or windy and sunny
D	Neutral	Day time – windy and overcast Night time – windy
E	Stable	Night time – moderate winds with little cloud / light winds with more clouds
F	Stable	Night time – light wind, little cloud

The weather classifications used in the modelling are provided in Table 6.6 and represent a range of weather conditions that could be experienced at the selected site for both day and night conditions. These conditions encapsulate year-round averages.

Table 6.6 Modelled weather conditions

Weather condition designation	Stability class	Average wind speed (m/s)
2/F	F	2
8/D	D	8
2.5/C	C	2.5

Depending on the release scenario and consequence type (explosion, jet fire, flash fire), the worst-case weather condition may vary. The worst-case weather condition is described for each consequence type in section 6.4.

6.3.2 Digester gas holder scenarios

6.3.2.1 Catastrophic rupture

A catastrophic rupture of the digester gas holder could occur from:

– A tear in the digester membrane gas holder
– A jet fire from an adjacent digester gas holder impinging the tank. The mechanism of this scenario could be increase in temperature of the biogas resulting in increased pressure, and rupture of the membrane gas holder, or damage of the membrane by the jet fire, and rupture at the point of impingement.

The flammable material within the digester holder is biogas, and is typically a mixture of methane and other gases. The biogas composition is assumed to be 70% methane and 30% carbon dioxide in the model.

The release height of the gas due to a catastrophic rupture is assumed to be at the top of the tank (i.e., the lowest point of the gas holder membrane). This is the worst-case scenario as it is closest to the height of interest (1.5 metres). The 3D model of the site layout [Ref 8] was used to determine the height of the tank, shown in Table 6.7.

Table 6.7 Release height calculation

Parameter	Value	Reference / Comment
Gas volume	2600m^3	Reference design report
Tank diameter	24.8m	3D Layout [Ref 8]
Tank height	16.6m	3D Layout [Ref 8]

6.3.2.2 50-millimetre leak

A leak of biogas from the digester gas holder could occur from:

– A hole in the digester membrane gas holder
– A leak from a damaged fitting (including flange, valve, or instrument) attached to the digester gas holder.

The release height of the 50-millimetre leak scenario was assumed to be 1 metre. It is assumed that a tank fitting is located at this height, and is the worst-case scenario for a 50-millimetre leak.

6.3.2.3 Summary of model input parameters

Table 6.8 shows the list of input parameters for the consequence model.

Table 6.8 Input parameters for digester gas holder scenarios

Scenario	Parameter	Input
General inputs	Vessel type	Pressure vessel
	Material	Biogas
	Temperature	39^{o}C
	Pressure	2.0kPa
	Volume inventory	2600m^3

Scenario	Parameter	Input
Scenario 1	Model type	Catastrophic rupture
	Release height	16.6m
Scenario 2	Model type	Leak
	Hole diameter	50mm
	Release height	1m

6.4 Consequence results

6.4.1 Catastrophic rupture of digester gas holder

A catastrophic rupture of the digester gas holder can result in the following consequence types:

– Fireball
– Flash fire
– Vapour cloud explosion.

The worst-case outcome for the catastrophic rupture scenario is a vapour cloud explosion. The injury threshold can occur up to 120 metres from the digester gas holder in the 8/D weather category, which was the worst-case weather condition for this event. The maximum distance from the vessel for a fatality to occur is 51 metres (at 35kPa). The digesters are located approximately 94 metres from the site boundary, meaning that the injury threshold is reached approximately 36 metres outside the site. Table 6.9 displays the consequence results for a vapour cloud explosion at the 8/D weather category.

Table 6.9 Vapour cloud explosion consequence results

Weather category	Overpressure level	Distance from source (m)
8/D	7kPa	120
	14kPa	77
	21kPa	63
	35kPa	51

Figure 6.3 displays the explosion overpressure contours at the 8/D weather category. To show the worst-case outcome of this scenario, a southerly wind was modelled, resulting in the consequence contours nearing or exceeding the northern site boundary.

The injury threshold (7kPa) exceeds the WRRF site boundary and into the neighbouring commercial properties to the north. The remaining thresholds for building damage, structural damage, and fatality are contained completely within the site boundary.

Full consequence results for the catastrophic rupture scenario are displayed in Appendix B-1.

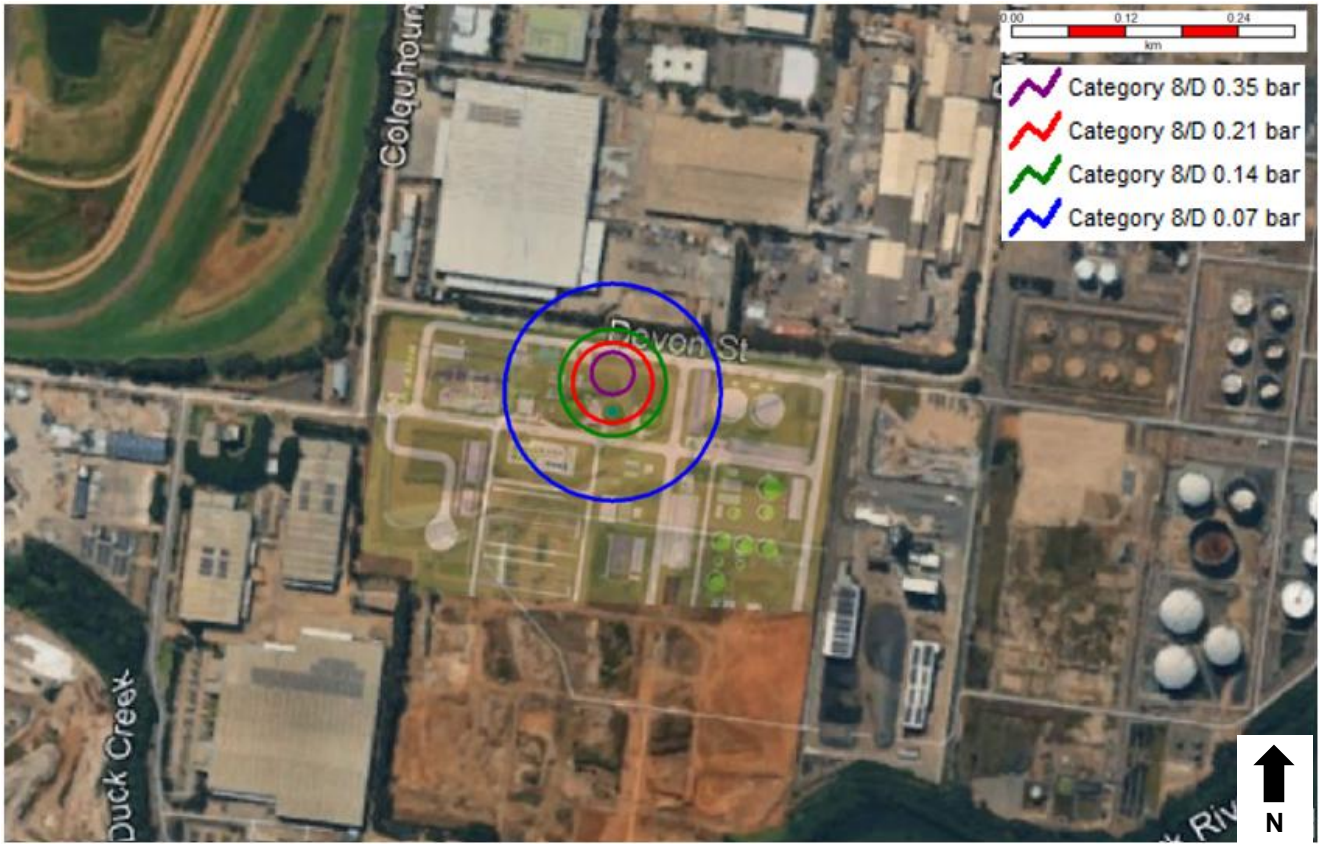

Figure 6.3 Vapour cloud explosion consequence diagram (8/D weather category)

The explosion contours show that the structural damage explosion overpressure threshold (21kPa) can overlap with the neighbouring digesters, therefore escalating to a second catastrophic rupture. Should this occur, the escalation of the event would likely result in a fireball due to immediate ignition of the gas, as opposed to delayed ignition and a second explosion. The fireball consequence results overlayed onto the site layout are shown in Figure 6.4. The worst-case weather for this scenario is the 8/D weather category.

The heat radiation injury threshold (4.7kW/m^2) is the only defined level that exceeds the site boundary. It can overlap with the public road on the northern site boundary. This road is considered a transient population, and it is not expected that people will be exposed to this level for the 30 seconds it will take to result in injury.

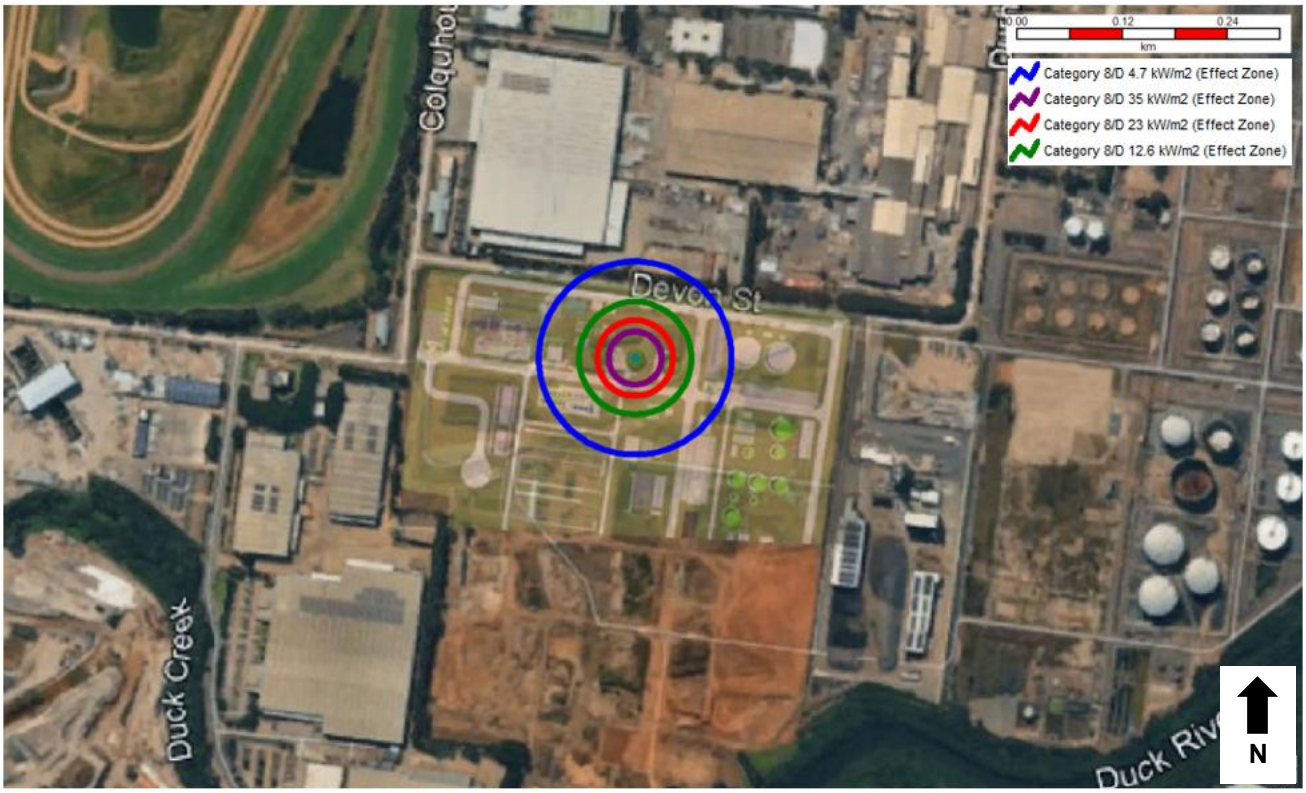

Figure 6.4 Fireball consequence diagram (8/D weather)

6.4.2 50-millimetre leak from digester gas holder

A 50 millimetre leak from the digester gas holder can result in the following consequence types:

– Jet fire (immediate and delayed ignition)
– Flash fire.

Neither of these scenarios result in significant consequences at the height of interest.

The maximum radiation from the jet fire at any weather condition is 2.1kW/m^2, and no injury is expected to occur. Furthermore, as the digester tanks are located approximately 20 metres away from each other, the results show that it is not feasible for a jet fire to impinge a neighbouring digestor, causing a rupture as described in section 6.3.2.1.

The flash fire could result in impacts to on-site personnel, depending on the height and direction of the leak. Figure 6.5 shows the worst-case flash fire envelope at the 2/F weather category, and a release height of one metre. It shows the distances the lower flammability limit (LFL) and 50% of the LFL (LFL fraction) can reach from the release point. The graph shows that the LFL fraction can extend approximately 3 metres, and the LFL can reach approximately 1.9 metres from the leak point. As a conservative approach, it is assumed that within the flash fire envelope, there is a 100% chance of fatality occurring, and outside the envelope there is no chance of a fatality. However, given the narrow cloud size (approximately 20-centimetre diameter of the LFL cloud), a person will not be completely enveloped in the flammable cloud. It can therefore be assumed that the chance of fatality if a person is within the gas cloud will be lower.

The flash fire envelope is completely within the site boundaries, and does not contribute to offsite risk.

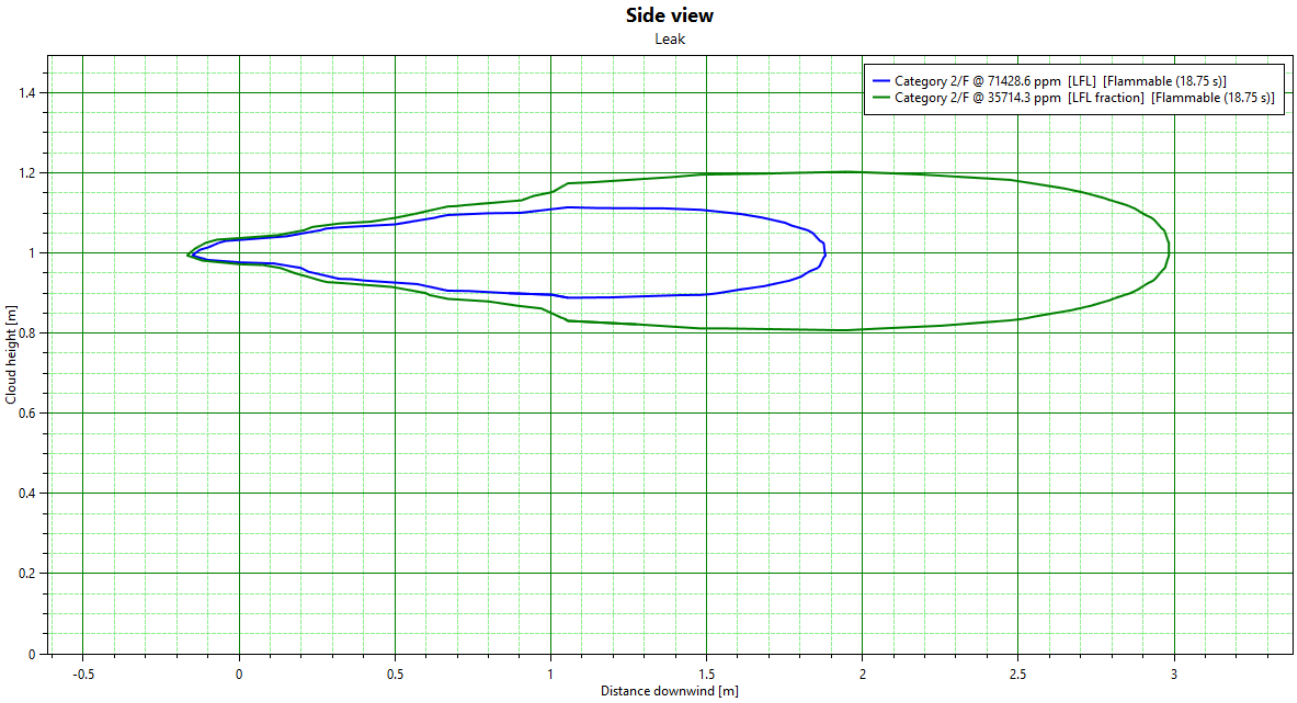

Figure 6.5 50-millimetre leak flash fire envelope

The full consequence results for the 50-millimetre leak are in Appendix B-2.

6.5 Likelihood assessment

The likelihood of the worst-case scenario was calculated. The assignment of the frequency and probability values has been made based on industry failure data, specialist risk management judgement, and the consequence results of the PHA. The scenario assessed was the ignition of gas released during a catastrophic rupture of the digester gas holder, given that this is the only scenario that contributes to the individual fatality risk and societal risk. The probability and frequency data are shown in Table 6.10.

Table 6.10 Likelihood assessment data

Event	Probability / Frequency	Reference
Frequency of pressure vessel catastrophic rupture	6 x 10^{-6} per annum	UK HSE failure rates [Ref 6]
Probability of ignition	1	IAOGP Ignition probabilities [Ref 11] Based on an instantaneous release with a rate of ~1700kg/s from a gas tank.
Number of vessels	3	
Base frequency of event	1.8 x 10^{-5} per annum	

The likelihood assessment shows that there is a frequency of 18 in one million years for a catastrophic rupture and ignition of the digester gas holders, which is considered a low likelihood.

6.6 Individual and societal risk evaluation

To assess compliance of the development with HIPAP-4, individual and societal risk targets must be met. At the northern boundary of the site, it is a commercial land use type, meaning that the tolerable individual fatality criterion is 5×10^{-6} per year.

Given that the only event with potential offsite consequences is a vapour cloud explosion due to catastrophic rupture of the digester gas holder, the determination of individual fatality risk has been limited to this scenario. It has been assumed that any ignition of the release gas in this scenario will result in a vapour cloud explosion, not a fireball or flash fire.

To aid in the determination of individual risk the explosion overpressure vs. distance downwind chart produced by PHAST, and other supporting data was used. This can be found in Appendix C.

Table 6.11 demonstrates the individual fatality risk.

Table 6.11 Individual fatality risk

Parameter	Value
Event	Catastrophic rupture and ignition of digester gas holder – vapour cloud explosion
Base frequency (per year)	1.8×10^{-5}
Distance to boundary	~94m
Effect at boundary	11kPa overpressure
Probability of fatality at boundary if event were to occur	0.05 [Ref 16]
Individual fatality risk at boundary (per year)	9×10^{-7}

Note that the value for individual risk determined does not consider the population of the affected area. The affected area will not be populated 100% of the time given that it is a commercial land use area and road, and the actual individual risk would be significantly reduced if considering occupancy of the affected area. As the risk at the boundary under worst case conditions (100% populated) meets HIPAP-4 criteria, determining the lesser risk of fatality due to actual occupancy at the boundary is not considered necessary.

Societal risk criteria are given by acceptable or tolerable limits for offsite fatalities per year. No scenarios modelled have fatality consequences that extend beyond the site boundary, and there are no credible scenarios that could result in multiple offsite fatalities. Societal risk from the project is therefore negligible.

Population limits associated with the Camellia-Rosehill Precinct are not expected to be impacted by the project. The WRRF is designed to minimise the need for large numbers of staff to operate the facility, with a maximum of 10 personnel. This small increase in population, the lack of fatality risk beyond the project boundary and the separation distance from existing major hazard facility and other fatal hazards that could impact the WRRF site will not result in a material change to the existing Camellia-Rosehill Precinct societal risk profile.

The results of the risk evaluation show that the development is compliant with the HIPAP 4 risk criteria for all land uses, not just commercial land uses.

6.7 Cumulative risk evaluation

A cumulative risk evaluation was completed to assess the cumulative impacts of this project and other projects in the area. The assessment included a review of projects within the cumulative impact search area defined for the project in accordance with the Cumulative Impact Assessment Guidelines for State Significant Projects (DPIE, October 2022).

The projects identified to have potential cumulative impacts associated with hazards and risk are shown in Table 6.12. The projects are at various stages in their development, and cumulative risk assessment is relevant to the information known at the time of this PHA. Key findings for these projects are included in Table 6.12.

Table 6.12 Potential cumulative risk evaluation of relevant future projects

Relevant future project	Project Address	Scope	Approximate location (relative to the project)	Cumulative Impact Assessment
Strategic / land use				
Camellia-Rosehill Place Strategy	Camellia-Rosehill	Renewal to area over 20 years - town centre, entertainment, new urban services, and land retained for heavy industry. New transport and public open spaces	Overlaps with project	Strategy and masterplan completed. No risk contours from Camellia-Rosehill Place Strategy overlap with the Camellia-Rosehill WRRF or pipelines in the project, so cumulative impact considered negligible. In the current draft for the proposed Camellia-Rosehill Place Strategy, the potentially impacted commercial sites (under the worst case events) are planned to continue to be of a commercial land use.
Sydney Olympic Park Master Plan 2050	Sydney Olympic Park	Master Plan 2050 proposes to deliver a total of up to 13,000 homes, 32,000 jobs, 5 to 10 percent affordable housing, new hotel accommodation, more space for education and health, new community sports and leisure centres, a new library and community hub, a new cultural centre, 2 new school education sites, 7 new public spaces, 4 new sports fields and over 10 playgrounds.	Overlaps with pipeline – 4km from site	Potential simultaneous construction will require coordination. Due to the nature of the development, cumulative hazard and risk impacts are not considered likely.
Industrial / Infrastructure				
Parramatta Light Rail Stage 2	Parramatta CBD, Sydney Olympic Park, Camellia, Rydalmere, Ermington, Melrose Park, and Wentworth Point	Construction and operation of an approx. ten-kilometre two-way light rail line connecting Stage 1 and the Parramatta CBD to Sydney Olympic Park via Camellia, Rydalmere, Ermington, Melrose Park and Wentworth Point.	Overlaps with project	EIS completed. Potential simultaneous construction will require coordination. Due to the nature of the development, cumulative hazard and risk impacts are not considered likely.
Rosehill Resource Recovery Facility	12A Grand Avenue, Rosehill	Construction and operation of a resource recovery facility (RRF) and concrete batching plant. The RRF has a proposed capacity of 250,000 tonnes per annum.	0.85km NE of site	EIS in preparation. It is assumed that hazards and risk for the project would be effectively managed within the site. There is expected to be negligible likelihood of cumulative hazard and risk impacts for the project.
SAMI – Camellia Bitumen Plan Redevelopment	12 Grand Avenue, Rosehill	Redevelopment of an existing bitumen storage and processing facility, with ancillary office and laboratory to service operations on the site.	0.85km NE of site	EIS in preparation. It is assumed that hazards and risk for the project would be effectively managed within the site. There is expected to be negligible likelihood of cumulative hazard and risk impacts for the project.

Relevant future project	Project Address	Scope	Approximate location (relative to the project)	Cumulative Impact Assessment
Sydney Metro West – Rail infrastructure, stations, precincts and operations	Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont, Sydney CBD	Application for major civil construction (consisting of tunnel fit-out, station building and fit-out) and operation of the line between Westmead and Sydney CBD.	~1km from project / site	EIS completed. Due to the distance between the project and this site, cumulative hazard and risk impacts are not considered likely.
Central Sydney Industrial Estate SSD 10459 Mod 5	12 Grand Avenue, Rosehill	Very early in project phase, with no available details on work. Expected to relate to industrial subdivision.	To be confirmed	Due to the expected nature of the development, cumulative hazard and risk impacts are not considered likely.
Mod 4 – Downer Sustainable Road Resource Centre (DSRRC) throughput increase	12 Grand Avenue, Rosehill	Downer proposes to modify the consent to enable an increase in annual RAP processing from 250,000 to 375,000 tpa.	Neighbouring facility	The site has been operational for a number of years, with hazards and risks appropriately managed during that time. The increase in plant capacity is not expected to have a significant effect on the management of offsite risk, and operational hazards and risk for the project would continue to be managed effectively. There is expected to be negligible likelihood of cumulative operational hazard and risk impacts for the project.
Commercial / Mixed Use				
Mixed Use Development with In-fill Affordable Housing – Melrose Park South-East	Melrose Park and Melrose Park South	Construction of a mixed-use development comprising approximately 98,619sqm, basement carparking and servicing, and landscaping and construction of 3 public open spaces including one new waterfront park	1km NW of pipeline (4km from site)	Due to the nature of the residential / mixed use developments, cumulative hazard and risk impacts are not considered likely.
River Road West Build-to-Rent	10-12 River Road West, Parramatta	Construction of affordable housing for rental purposes	0.5km from pipeline (2km from site)	
Residential development with affordable housing – Llewellyn Street, Rhodes	Blaxland Road, Cavell Avenue, Concord Road, and Llewellyn Street, Rhodes	Demolition of existing buildings and hardstand areas. Construction of four (4) residential flat buildings with infill affordable housing, ranging in height from 12 to 26 storeys with carparking and through site link.	1km from pipeline - 5+ km from site	
Mixed-use development with affordable housing – 23-29 Marquet Street, Rhodes	23-29 Marquet Street, Rhodes	Construction of a 42 storey mixed-use development with affordable housing component, basement car parking and publicly accessible open space.	1km from pipeline - 5+ km from site	

Several of the projects listed above will result in a population increase in their local areas, both in residential and commercial types (such as the two developments in Rhodes with affordable housing), and industrial (including Rosehill Resource Recovery Facility). The majority of these will be in the vicinity of the project pipelines. As discussed in section 5.3.1 to 5.3.4, the offsite risk as a result of loss of containment of these pipelines is low as the materials are not toxic or flammable.

The risk to populations nearer the Camellia-Rosehill WRRF is also low, meeting the nominated risk criteria. Any potential increase in population in the area, primarily commercial and industrial types, will also have negligible effect on societal risk, given the relatively small consequence impact areas that extend offsite from the WRRF.

In addition to these future projects, there are a number of existing DG pipelines and DGs stored in other facilities in the Camellia-Rosehill Precinct and in the vicinity of the project, though none going through the WRRF site. There is therefore no risk of impacting DG pipelines during construction of the WRRF. Furthermore, the consequence results showed that no flammable or overpressure effects extend into offsite areas where DGs are stored, and escalation of a potential loss of containment event to a neighbouring site is not credible.

The risk profile, including population changes, of the other Major Hazard Facilities in the Camellia-Rosehill Precinct also needs to be considered in the cumulative risk assessment. The GPOP WCM project is expected to increase the population of the area during both construction and operation, though not significantly enough to materially change the risk profile. During construction, the population increase will be the greatest, though this will only be a temporary increase. During normal operation, there is expected to only be a small number of operations and maintenance personnel on site.

Depending on the locations of other pipelines and utilities, there is potential for impact to DG pipelines during construction of other areas of the GPOP WCM project, including the Brine Pipeline and River Release Pipeline. These DG pipelines are expected to adhere to relevant standards and design requirements (such as AS2885), and will be managed accordingly by their responsible parties, as these are not owned and operated by Sydney Water. During design of the pipelines, Sydney Water will identify all DG pipelines with the potential to be impacted during construction and operation of the GPOP WCM project. Sydney Water will engage with pipeline owners as required, and design the pipeline to be constructed and operated safely.

Given the extremely low risk of offsite impacts, the project poses negligible risk to DG pipelines or facilities. This includes the risk of escalation of a potential event resulting in loss of containment and subsequent ignition. Any impact to proposed developments is also expected to be negligible.

7. Recommendations

Several management procedures are recommended to be implemented to incorporate practices that will prevent the risk scenarios described in this report. These are included in Table 7.1.

Table 7.1 PHA recommendations

Recommendation	Prevented or mitigated risk	Timing of implementation
Any chemicals brought on-site should be stored in accordance with the relevant Australian Standards. It is recommended that each chemical have separation where necessary, and disposal in accordance with Australian Standards and Sydney Water specifications. Chemicals and fuels transported to site should be tightly secured. All chemicals should be clearly labelled.	– Chemical spills, and human contact – Incompatible chemical interactions	Operation
Holding safety data sheets (SDSs) for all chemicals stored onsite for reference by site personnel. Emergency services require access to the SDS register of all chemicals that are located on-site.	– Fire or explosion, including offsite impacts	Operation
Appropriate safe work procedures should be implemented for the handling of all chemicals including transfer, storage, spill prevention, and clean up requirements.	– Chemical spills and human contact – Incompatible chemical interactions	Operation
Storage of all DGs and chemicals safely (following AS3780, and ensuring incompatible materials are kept separated), including appropriate bunding, appropriate separation distances etc. In the current design, the required separation distances from protected places and boundaries for all Class 8 DGs is 5 meters. Incompatible chemicals must be segregated in accordance with section 6.3.3 of AS3780 (i.e. 5 metre segregation, and kept in different bunded compounds)	– Incompatible chemical interactions	Operation

The risk assessment process will continue through subsequent phases of the project in line with industry practice, legislative requirements, and in accordance with Sydney Water standards.

8. Conclusions

This report includes a risk screening of the project in accordance with the requirements of the SEPP (Resilience and Hazards) 2021. The results indicate that:

– The screening thresholds for DG storage during operation of the project are exceeded by the DGs proposed to be stored and is therefore considered “potentially hazardous”. Specifically, the materials which exceeded the screening thresholds were corrosive substances (Class 8-II and 8-III) and flammable gases (Class 2.1).
– The project will produce emissions and is therefore considered “potentially offensive”. However, if the controls listed in Section 4.6 are implemented, and relevant environmental licences are adhered to, the project will not be “offensive”.

While the SEARs required a full QRA (Level 3 PHA) to be completed if the facility was found to be “potentially hazardous” it was determined that a Level 2 PHA was sufficient to demonstrate the risks are low, given the nature of the hazard (low pressure release of flammable gas) and the surrounding industrial/ commercial land use.

The Level 2 PHA involved a desktop semi-quantitative risk analysis including consequence modelling and a likelihood assessment. The scenarios with the potential to cause off-site impacts were identified, and those resulting in health and safety impacts were modelled to determine their consequence severities. These scenarios were:

– Catastrophic rupture of the digester gas holders
– 50 millimetre leak of the digester gas holders.

It was found that the catastrophic rupture of the digester gas holders resulted in the worst-case consequences, with the overpressure contours from a vapour cloud explosion exceeding the site boundaries and very slightly into neighbouring industrial and commercial sites.

The likelihood assessment and risk evaluation of the project demonstrated that offsite risk, in terms of individual fatality risk and societal risk, are compliant with the HIPAP 4 criteria. The only scenario which contributes to offsite risk is a vapour cloud explosion resulting from catastrophic rupture of the digester gas holders.

The consequence results show that the most likely area for a fatality to occur is on the WRRF site, and onsite operational and emergency response procedures should adequately manage this risk.

The risk results for the project demonstrate that risks are sufficiently low. Subject to the risk recommendations listed in Section 7, the risks can be effectively controlled by Sydney Water to an acceptable level of risk. The offsite risk level posed by the project meets the HIPAP No 4 risk criteria for both individual and societal risk.

Therefore, whilst the risk screening process identified the project as a ‘potentially hazardous industry’, the risk modelling shows that the risk criteria are met by the project, and the outcome of this PHA is that the project is not a “hazardous industry”.

Furthermore, as no Schedule 6 or Schedule 7 chemicals on the IChEMS Register will be used in this project, the project will comply with Part 9.3E of the POEO Act.

This risk screening, hazard identification, and PHA demonstrate that the risk of the project is sufficiently low. Risks are managed by the existing design and controls, such that offsite risk is negligible. The project meets the criteria for both individual and societal risk, and cumulative risk impacts from other nearby projects are negligible.

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Appendices

Appendix A

Safety Data Sheets

SAFETY DATA SHEET

Version 6.17
Revision Date 14.11.2024
Print Date 12.02.2025

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Ammonium hydroxide solution

Product Number : 221228
Brand : Sigma-Aldrich

1.2 Other means of identification

No data available

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

Identified uses : For R&D use only. Not for pharmaceutical, household or other uses.

1.4 Details of the supplier of the safety data sheet

Company : Merck Life Science Pty Ltd
Ground Floor, Building 1, 885 Mountain Highway
BAYSWATER VIC 3153
AUSTRALIA

Telephone : +61 1800 800 097
E-mail address : customersupport.anz@merckgroup.com

1.5 Emergency telephone

Emergency Phone # : Free call (24/7): 1800 862 115
Int'l (24/7): +61 2 9037 2994
(CHEMTREC)

SECTION 2: Hazards identification

2.1 GHS Classification

Skin corrosion/irritation (Category 1), H314
Serious eye damage/eye irritation (Category 1), H318
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal Word Danger

Hazard Statements
H314 Causes severe skin burns and eye damage.
H335 May cause respiratory irritation.
H410 Very toxic to aquatic life with long lasting effects.

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Precautionary Statements

Prevention

P261	Avoid breathing mist or vapors.
P264	Wash skin thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response

P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
P305 + P351 + P338 + P310	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.
P391	Collect spillage.

Storage

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

2.3 Other hazards

Lachrymator.

SECTION 3: Composition/information on ingredients

Substance / Mixture : Mixture

3.2 Mixtures

Formula : H_5NO

Molecular weight : 35.05 g/mol

Hazardous ingredients

Component		Classification	Concentration
ammonia solution			
CAS-No. EC-No. Index-No.	1336-21-6 215-647-6 007-001-01-2	Acute Tox. 4; Skin Corr./Irrit. 1B; Eye Dam./Irrit. 1; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H332, H314, H318, H335, H400, H410 Concentration limits: >= 5 %: STOT SE 3, H335; M-Factor - Aquatic Acute: 10 M-Factor - Aquatic Chronic: 1	>= 30 - < 50 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact
After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation). Call a physician immediately. Do not attempt to neutralise.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Nitrogen oxides (NOx)
Not combustible.
Ambient fire may liberate hazardous vapours.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

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6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up with liquid-absorbent and neutralising material (e.g. Chemizorb® OH^-, Merck Art. No. 101596). Dispose of properly. Clean up affected area.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Avoid contact with skin and eyes. Always open containers slowly to allow any excess pressure to vent.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed.
Storage stability Recommended storage temperature
2 - 8 °C
May develop pressure. Refrigerate before opening. Handle and open container with care.

Storage class
Storage class (TRGS 510): 8B: Non-combustible, corrosive hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.3 no other specific uses are stipulated.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

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The selected protective gloves have to satisfy the specifications of Regulation (EU) 2016/425 and the standard EN 374 derived from it.

Full contact
Material: butyl-rubber
Minimum layer thickness: 0.3 mm
Break through time: 480 min
Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 240 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
protective clothing

Respiratory protection
required when vapours/aerosols are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Physical state	liquid
b)	Color	colorless
c)	Odor	No data available
d)	Melting point/freezing point	-60 °C
e)	Initial boiling point and boiling range	38 - 100 °C at 1,013 hPa
f)	Flammability (solid, gas)	No data available
g)	Upper/lower flammability or explosive limits	Upper explosion limit: 27 %(V) Lower explosion limit: 16 %(V)
h)	Flash point	Not applicable
i)	Autoignition	Not applicable

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	temperature	
j)	Decomposition temperature	No data available
k)	pH	11.7 at 20 °C
l)	Viscosity	Viscosity, kinematic: No data available Viscosity, dynamic: No data available
m)	Water solubility	at 20 °C soluble
n)	Partition coefficient: n-octanol/water	No data available
o)	Vapor pressure	153 hPa at 20 °C
p)	Density	0.9 g/cm3 at 25 °C - lit.
	Relative density	No data available
q)	Relative vapor density	No data available
r)	Particle characteristics	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	none

9.2 Other safety information

Relative vapor density	1.21 - (Air = 1.0)

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Violent reactions possible with:
The generally known reaction partners of water.

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Copper, Iron, Zinc

10.6 Hazardous decomposition products
In the event of fire: see section 5

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SECTION 11: Toxicological information

11.1 Information on toxicological effects

Mixture

Acute toxicity
Oral: No data available

Inhalation: No data available

Symptoms: mucosal irritations, Cough, Shortness of breath, Possible damages:, damage of respiratory tract
Dermal: No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
Remarks: Mixture causes serious eye damage.
Risk of blindness!

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
No data available

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
Mixture may cause respiratory irritation.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Other dangerous properties can not be excluded.

Handle in accordance with good industrial hygiene and safety practice.

Components

ammonia solution

Acute toxicity
Oral: No data available
LC50 Inhalation - Rat - male - 4 h - 4.9 mg/l - dust/mist
Remarks: (ECHA)
Dermal: No data available

Skin corrosion/irritation
Remarks: Causes skin burns.
Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

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Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
No data available

Reproductive toxicity
No data available

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

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

SECTION 12: Ecological information

12.1 Toxicity

Mixture
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

Components

ammonia solution

Toxicity to fish	flow-through test LC50 - Pimephales promelas (fathead minnow) - 0.068 mg/l - 96 h Remarks: (ECHA) The value is given in analogy to the following substances: ammonium sulphate
Toxicity to daphnia and other aquatic invertebrates	static test LC50 - Daphnia magna (Water flea) - 101 mg/l - 48 h Remarks: (ECHA) anhydrous

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Toxicity to fish(Chronic toxicity)	flow-through test NOEC - Ictalurus punctatus - 0.048 mg/l - 31 d (OECD Test Guideline 215) Remarks: anhydrous
Toxicity to daphnia and other aquatic invertebrates(Chronic toxicity)	flow-through test LC50 - Daphnia magna (Water flea) - 4.07 mg/l - 96 h (US-EPA) Remarks: The value is given in analogy to the following substances: The value is given in analogy to the following substances: ammonium chloride
	flow-through test NOEC - Daphnia magna (Water flea) - 0.79 mg/l - 96 h (US-EPA) Remarks: The value is given in analogy to the following substances: The value is given in analogy to the following substances: ammonium chloride

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

14.1 UN number

ADR/RID: 2672 IMDG: 2672 IATA-DGR: 2672

14.2 UN proper shipping name

ADR/RID: AMMONIA SOLUTION
IMDG: AMMONIA SOLUTION
IATA-DGR: Ammonia solution

14.3 Transport hazard class(es)

ADR/RID: 8 IMDG: 8 IATA-DGR: 8

14.4 Packaging group

ADR/RID: III IMDG: III IATA-DGR: III

14.5 Environmental hazards

ADR/RID: yes IMDG Marine pollutant: yes IATA-DGR: no

14.6 Special precautions for user

None

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14.7 Incompatible materials
Copper, Iron, Zinc

Other regulations
Hazchem Code : 2X

SECTION 15: Regulatory information

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

Therapeutic Goods (Poisons Standard) Instrument	:	No poison schedule number allocated

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3.

H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H332	Harmful if inhaled.
H335	May cause respiratory irritation.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

Further information
The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
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SAFETY DATA SHEET

Version 6.2
Revision Date 15.11.2023
Print Date 13.07.2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Carbon dioxide

Product Number : 295108
Brand : Aldrich
CAS-No. : 124-38-9

1.2 Other means of identification

No data available

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

Identified uses : For R&D use only. Not for pharmaceutical, household or other uses.

1.4 Details of the supplier of the safety data sheet

Company : Merck Life Science Pty Ltd
Ground Floor, Building 1, 885 Mountain Highway
BAYSWATER VIC 3153
AUSTRALIA

Telephone : +61 1800 800 097
E-mail address : customersupport.anz@merckgroup.com

1.5 Emergency telephone

Emergency Phone # : Free call (24/7): 1800 862 115
Int'l (24/7): +61 2 9037 2994
(CHEMTREC)

SECTION 2: Hazards identification

2.1 GHS Classification

Gases under pressure (Liquefied gas), H280

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal Word Warning

Hazard statement(s)
H280 Contains gas under pressure; may explode if heated.

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Precautionary statement(s)

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

2.3 Other hazards
May displace oxygen and cause rapid suffocation.

SECTION 3: Composition/information on ingredients

Substance / Mixture : Substance

3.1 Substances

Formula : CO_2
Molecular weight : 44.01 g/mol
CAS-No. : 124-38-9
EC-No. : 204-696-9

Hazardous ingredients

Component	Classification	Concentration
carbon dioxide		
	Press. Gas Liquefied gas; H280	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.

In case of eye contact
After eye contact: rinse out with plenty of water. Remove contact lenses.

If swallowed
After swallowing: make victim drink water (two glasses at most). Consult doctor if feeling unwell.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

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SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides
Not combustible.
Ambient fire may liberate hazardous vapours.

5.3 Advice for firefighters

In the event of fire, wear self-contained breathing apparatus.

5.4 Further information

none

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Do not breathe gas. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

No special precautionary measures necessary.

6.3 Methods and materials for containment and cleaning up

Observe possible material restrictions (see sections 7 and 10). Stop flow of gas, move leaking cylinder to open air if without risk.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Keep away from combustible materials and sources of ignition.

Contents under pressure. Avoid heating above: 50°C

Storage class
Storage class (TRGS 510): 2A: Gases

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.3 no other specific uses are stipulated.

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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
carbon dioxide	124-38-9	STEL	30,000 ppm 54,000 mg/m3	Australia. Workplace Exposure Standards for Airborne Contaminants.
		TWA	5,000 ppm 9,000 mg/m3	Australia. Workplace Exposure Standards for Airborne Contaminants.
		TWA	12,500 ppm 22,500 mg/m3	Australia. Workplace Exposure Standards for Airborne Contaminants.
		STEL	30,000 ppm 54,000 mg/m3	Australia. Workplace Exposure Standards for Airborne Contaminants.

8.2 Exposure controls

Appropriate engineering controls
Change contaminated clothing. Wash hands after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

The selected protective gloves have to satisfy the specifications of Regulation (EU) 2016/425 and the standard EN 374 derived from it.

Full contact
Material: butyl-rubber
Minimum layer thickness: 0.3 mm
Break through time: 480 min
Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

Splash contact
Material: Chloroprene
Minimum layer thickness: 0.6 mm
Break through time: 30 min
Material tested:Camapren® (KCL 722 / Aldrich Z677493, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

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If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
protective clothing

Respiratory protection
required Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
No special precautionary measures necessary.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Physical state	Liquefied gas
b)	Color	No data available
c)	Odor	No data available
d)	Melting point/freezing point	Melting point/range: -78.5 °C - lit.
e)	Initial boiling point and boiling range	No data available
f)	Flammability (solid, gas)	The product is not flammable.
g)	Upper/lower flammability or explosive limits	No data available
h)	Flash point	Not applicable
i)	Autoignition temperature	No data available
j)	Decomposition temperature	No data available
k)	pH	No data available
l)	Viscosity	Viscosity, kinematic: No data available Viscosity, dynamic: No data available
m)	Water solubility	No data available
n)	Partition coefficient: n-octanol/water	No data available
o)	Vapor pressure	57,249 hPa at 20 °C

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p)	Density	1.56 g/cm3 at -79 °C
	Relative density	No data available
q)	Relative vapor density	No data available
r)	Particle characteristics	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information

Relative vapor density	1.52 - (Air = 1.0)

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Risk of explosion with:
Powdered metals
Peroxides
(sodium salt)
Risk of ignition or formation of inflammable gases or vapours with:
acetylidene
barium peroxide
metallic oxides
Lithium
lithium aluminium hydride
sodium
Exothermic reaction with:
Amines
Ammonia
Strong bases
acryl aldehyde
polymerisable

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
In the event of fire: see section 5

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SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available
Inhalation: No data available
Dermal: No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
No data available

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

RTECS: FF6400000
Nausea, Dizziness, Headache, Low to medium concentrations of carbon dioxide can:, affect regulation of blood circulation, affect the acidity of body fluids, respiratory difficulties, At high concentrations:, Breathing difficulties, Increased pulse rate, change in body acidity, Very high concentrations can cause:, Unconsciousness, death
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

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12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. Pressurised gas bottle: dispose of only in empty condition! See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

14.1 UN number
ADR/RID: 1013 IMDG: 1013 IATA-DGR: 1013

14.2 UN proper shipping name
ADR/RID: CARBON DIOXIDE
IMDG: CARBON DIOXIDE
IATA-DGR: Carbon dioxide

14.3 Transport hazard class(es)
ADR/RID: 2.2 IMDG: 2.2 IATA-DGR: 2.2

14.4 Packaging group
ADR/RID: - IMDG: - IATA-DGR: -

14.5 Environmental hazards
ADR/RID: no IMDG Marine pollutant: no IATA-DGR: no

14.6 Special precautions for user
None

14.7 Incompatible materials
Strong oxidizing agents

Other regulations
Hazchem Code : 2T

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SECTION 15: Regulatory information

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

Standard for the Uniform Scheduling of Medicines and Poisons	:	No poison schedule number allocated

SECTION 16: Other information

-

Full text of H-Statements referred to under sections 2 and 3.

H280	Contains gas under pressure; may explode if heated.

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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ChemicalBook

Chemical Safety Data Sheet MSDS / SDS

Ferric chloride

Revision Date:2025-02-01 Revision Number:1

SECTION 1: Identification of the substance/mixture and of the company/undertaking

Product identifier

Product name	: Ferric chloride
CBnumber	: CB5444364
CAS	: 7705-08-0
EINECS Number	: 231-729-4
Synonyms	: FeCl3,Ferric Chloride

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

Relevant identified uses	: For R&D use only. Not for medicinal, household or other use.
Uses advised against	: none

Company Identification

Company	: Chemicalbook
Address	: Building 1, Huihuang International, Shangdi 10th Street, Haidian District, Beijing
Telephone	: 400-158-6606

SECTION 2: Hazards identification

GHS Label elements, including precautionary statements

Symbol(GHS)

Signal word Danger

Precautionary statements

P261 Avoid breathing dust/fume/gas/mist/vapours/spray.

P273 Avoid release to the environment.

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

P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.

Continuerinsing.

P309 IF exposed or if you feel unwell:

P310 Immediately call a POISON CENTER or doctor/physician.

Hazard statements

H226 Flammable liquid and vapour

H290 May be corrosive to metals

H302 Harmful if swallowed

H314 Causes severe skin burns and eye damage

H315 Causes skin irritation

H318 Causes serious eye damage

H335 May cause respiratory irritation

H411 Toxic to aquatic life with long lasting effects

SECTION 3: Composition/information on ingredients

Substance

Product name	: Ferric chloride
Synonyms	: FeCl3,Ferric Chloride
CAS	: 7705-08-0
EC number	: 231-729-4
MF	: Cl3Fe
MW	: 162.2

SECTION 4: First aid measures

Description of first aid measures

General advice

Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.

In case of eye contact

After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed

After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

Extinguishing media

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media

For this substance/mixture no limitations of extinguishing agents are given.

Special hazards arising from the substance or mixture

Hydrogen chloride gas Iron oxides

Not combustible.

Ambient fire may liberate hazardous vapours.

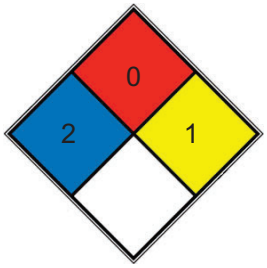
Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

NFPA 704



■	HEALTH	2	Intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury (e.g. diethyl ether, ammonium phosphate, iodine)
■	FIRE	0	Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand. Materials that will not burn in air when exposed to a temperature of 820 °C (1,500 °F) for a period of 5 minutes.(e.g. Carbon tetrachloride)
■	REACT	1	Normally stable, but can become unstable at elevated temperatures and pressures (e.g. propene)
□	SPEC. HAZ.		

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.

For personal protection see section 8.

Environmental precautions

Do not let product enter drains.

Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

Precautions for safe handling

For precautions see section 2.2.

Conditions for safe storage, including any incompatibilities

Storage conditions

Store under inert gas. No metal containers.

Tightly closed. Dry. hygroscopic

Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

---

SECTION 8: Exposure controls/personal protection

control parameter

Hazard composition and occupational exposure limits

Does not contain substances with occupational exposure limits.

Exposure controls

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other

substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0,11 mm Break through time: 480 min

Material tested:KCL 741 Dermatril? L

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving

in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Splash contact Material: Nitrile rubber

Minimum layer thickness: 0,11 mm Break through time: 480 min

Material tested:KCL 741 Dermatril? L

Body Protection

protective clothing

Respiratory protection

Recommended Filter type: Filter B-(P2)

The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer.

These measures have to be properly documented.

Control of environmental exposure

Do not let product enter drains.

SECTION 9: Physical and chemical properties

Information on basic physicochemical properties

Appearance	solid
Odour	pungent
Odour Threshold	No data available
pH	1 (200g/l, H2O, 20℃)
Melting point/freezing point	Melting point: 306 °C - (ECHA)
Initial boiling point and boiling range	Decomposes below the boiling point.
Flash point	Not applicable
Evaporation rate	No data available
Flammability (solid, gas)	does not ignite - A.10. (Regulation (EC) No 440/2008, Annex A)
Upper/lower flammability or explosive limits	No data available
Vapour pressure	< 1 hPa at 20 °C
Vapour density	5,60 - (Air = 1.0)
Relative density	2,800 g/cm3 2,89 at 25 °C
Water solubility	soluble
Partition coefficient: n-octanol/water	No data available
Autoignition temperature	No data available
Decomposition temperature	316 °C -
Viscosity	Viscosity, kinematic: No data available Viscosity, dynamic: No data available
Explosive properties	No data available
Oxidizing properties	No data available

Other safety information

Relative vapor density

5,60 - (Air = 1.0)

SECTION 10: Stability and reactivity

Reactivity

No data available

Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

Possibility of hazardous reactions

Risk of explosion with:

Alkali metals Ethylene oxide

Violent reactions possible with:

Aluminum with Heat.

Generates dangerous gases or fumes in contact with: Water

Conditions to avoid

no information available

Incompatible materials

Copper, Light metalsMetals

Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

Information on toxicological effects

Acute toxicity

LD50 Oral - Mouse - female - 1.300 mg/kg Remarks: (ECHA)

Inhalation

LD50 Dermal - Rat - male and female - > 2.000 mg/kg (OECD Test Guideline 402)

Remarks: (in analogy to similar products)

The value is given in analogy to the following substances: iron dichloride

Skin corrosion/irritation

Skin - Rabbit

Result: Irritating to skin. - 4 h (OECD Test Guideline 404)

Remarks: (in analogy to similar products)

The value is given in analogy to the following substances: Ferrous sulfate heptahydrate

Serious eye damage/eye irritation

Eyes - Rabbit

Result: Causes serious eye damage. (OECD Test Guideline 405)

Remarks: (in analogy to similar products)

The value is given in analogy to the following substances: iron dichloride

Respiratory or skin sensitization

(OECD Test Guideline 429)

Remarks: (in analogy to similar products)

Germ cell mutagenicity

Test Type: Ames test

Method: OECD Test Guideline 471 Result: negative

Test Type: In vitro mammalian cell gene mutation test Test system: mouse lymphoma cells

Metabolic activation: with and without metabolic activation Method: OECD Test Guideline 476

Result: negative

The value is given in analogy to the following substances: Ferrous sulfate heptahydrateTest Type: Mutagenicity (mammal cell test): micronucleus.

Test system: Chinese hamster lung cells

Metabolic activation: with and without metabolic activation Method: OECD Test Guideline 487

Result: negative

Test Type: In vivo micronucleus test Species: Mouse

Application Route: Oral

Result: negative Remarks: (ECHA)

Carcinogenicity

No data available

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard

No data available

Toxicity

LD50 orally in Rabbit: 316 mg/kg

SECTION 12: Ecological information

Toxicity

No data available

Persistence and degradability

Biodegradability Result: - Readily biodegradable.

Bioaccumulative potential

No data available

Mobility in soil

No data available

Results of PBT and vPvB assessment

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

Other adverse effects

No data available

SECTION 13: Disposal considerations

Waste treatment methods

Product

See www.retrologistik.com for processes regarding the return of chemicals and

containers, or contact us there if you have further questions.

Incompatibilities

Aqueous solutions are a strong acid. Violent reaction with bases, allyl chloride; sulfuric acid; water. Shock- and friction-sensitive explosive material forms with potassium, sodium and other active metals. Attacks metals when wet.

Waste Disposal

Neutralize with lime or soda ash and bury in an approved landfill.

SECTION 14: Transport information

UN number

ADR/RID: 1773 IMDG: 1773 IATA: 1773

UN proper shipping name

ADR/RID: FERRIC CHLORIDE, ANHYDROUS IMDG: FERRIC CHLORIDE, ANHYDROUS

IATA: Ferric chloride, anhydrous

Transport hazard class(es)

ADR/RID: 8 IMDG: 8 IATA: 8

Packaging group

ADR/RID: III IMDG: III IATA: III

Environmental hazards

ADR/RID: yes IMDG Marine pollutant: yes IATA: no

Special precautions for user

No data available

SECTION 15: Regulatory information

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

Regulations on the Safety Management of Hazardous Chemicals

China Catalog of Hazardous chemicals 2015:Listed. website: https://www.mem.gov.cn/

Measures for Environmental Management of New Chemical Substances

Chinese Chemical Inventory of Existing Chemical Substances (China IECSC):Listed. website: https://www.mee.gov.cn/

EC Inventory:Listed.

European Inventory of Existing Commercial Chemical Substances (EINECS):Listed. website: https://echa.europa.eu/

Korea Existing Chemicals List (KECL):Listed. website: http://ncis.nier.go.kr

New Zealand Inventory of Chemicals (NZIoC):Listed. website: https://www.epa.govt.nz/

Philippines Inventory of Chemicals and Chemical Substances (PICCS):Listed. website: https://emb.gov.ph/

United States Toxic Substances Control Act (TSCA) Inventory:Listed. website: https://www.epa.gov/

Vietnam National Chemical Inventory:Listed. website: https://chemicaldata.gov.vn/

SECTION 16: Other information

Abbreviations and acronyms

ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road

CAS: Chemical Abstracts Service

EC50: Effective Concentration 50%

IATA: International Air Transportation Association

IMDG: International Maritime Dangerous Goods

LC50: Lethal Concentration 50%

LD50: Lethal Dose 50%

RID: Regulation concerning the International Carriage of Dangerous Goods by Rail

STEL: Short term exposure limit

TWA: Time Weighted Average

References

【1】CAMEO Chemicals, website: http://cameochemicals.noaa.gov/search/simple

【2】ChemIDplus, website: http://chem.sis.nlm.nih.gov/chemidplus/chemidlite.jsp

【3】ECHA - European Chemicals Agency, website: https://echa.europa.eu/

【4】eChemPortal - The Global Portal to Information on Chemical Substances by OECD, website: http://www.echemportal.org/echemportal/index?pageID=0&request_locale=en

【5】ERG - Emergency Response Guidebook by U.S. Department of Transportation, website: http://www.phmsa.dot.gov/hazmat/library/erg

【6】Germany GESTIS-database on hazard substance, website: http://www.dguv.de/ifa/gestis/gestis-stoffdatenbank/index-2.jsp

【7】HSDB - Hazardous Substances Data Bank, website: https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm

【8】IARC - International Agency for Research on Cancer, website: http://www.iarc.fr/

【9】IPCS - The International Chemical Safety Cards (ICSC), website: http://www.ilo.org/dyn/icsc/showcard.home

【10】Sigma-Aldrich, website: https://www.sigmaaldrich.com/

Other Information

UN number 1773 corresponds to the anhydrous form; UN number 2582 corresponds to the solution.The apparent melting point caused by loss of crystal water is given.

Disclaimer:
The information in this MSDS is only applicable to the specified product, unless otherwise specified, it is not applicable to the mixture of this product and other substances. This MSDS only provides information on the safety of the product for those who have received the appropriate professional training for the user of the product. Users of this MSDS must make independent judgments on the applicability of this SDS. The authors of this MSDS will not be held responsible for any harm caused by the use of this MSDS.

SAFETY DATA SHEET

Creation Date 22-Sep-2009 **Revision Date** 24-Dec-2021 **Revision Number** 12

1. Identification

Product Name **Hydrogen Peroxide (30% in water)**

Cat No. : **BP2633-500; NC1592410**

Synonyms Hydrogen Dioxide; Peroxide; Carbamide Peroxide

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

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)

Oxidizing liquids	Category 2
Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Dusts and Mists	Category 4
Skin Corrosion/Irritation	Category 1 A
Serious Eye Damage/Eye Irritation	Category 1

Label Elements

Signal Word
Danger

Hazard Statements
May intensify fire; oxidizer
Harmful if swallowed or if inhaled
Causes severe skin burns and eye damage

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray
Wear protective gloves/protective clothing/eye protection/face protection
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep/Store away from clothing/ other combustible materials
Take any precaution to avoid mixing with combustibles
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
Fire
In case of fire: Use water spray/fog or regular foam to extinguish
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
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 %
Water	7732-18-5	65 - 80
Hydrogen peroxide	7722-84-1	20 - 35

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.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Remove and wash contaminated clothing and gloves, including the inside, before re-use. Call a physician

immediately.

Inhalation If not breathing, give artificial respiration. Remove from exposure, lie down. 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. Call a physician immediately.

Ingestion Do NOT induce vomiting. Clean mouth with water. Never give anything by mouth to an unconscious person. Call a physician immediately.

Most important symptoms and effects Causes severe eye damage. 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 Water spray. Foam. Carbon dioxide (CO_2).

Unsuitable Extinguishing Media Dry chemical

Flash Point Not applicable
Method - No information available

Autoignition Temperature No information available

Explosion Limits
Upper No data available
Lower No data available

Oxidizing Properties Oxidizer

Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Oxidizer: Contact with combustible/organic material may cause fire. In the event of fire and/or explosion do not breathe fumes. Containers may explode when heated. May ignite combustibles (wood paper, oil, clothing, etc.).

Hazardous Combustion Products
Hydrogen. Oxygen.

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	Flammability	Instability	Physical hazards
3	0	2	OX

6. Accidental release measures

Personal Precautions Use personal protective equipment as required. Ensure adequate ventilation. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.

Environmental Precautions Should not be released into the environment. See Section 12 for additional Ecological Information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Do not breathe mist/vapors/spray. Do not ingest. If swallowed then seek

immediate medical assistance. Ensure adequate ventilation.

Storage. Keep away from combustible material. Keep cool and protect from sunlight. Keep container tightly closed in a dry and well-ventilated place. Do not store in metal containers. Keep only in the original container. Incompatible Materials. Finely powdered metals. copper. Reducing Agent. Strong bases. Combustible material. Organic materials.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH	Mexico OEL (TWA)
Hydrogen peroxide	TWA: 1 ppm	(Vacated) TWA: 1 ppm (Vacated) TWA: 1.4 mg/m^3 TWA: 1 ppm TWA: 1.4 mg/m^3	IDLH: 75 ppm TWA: 1 ppm TWA: 1.4 mg/m^3	TWA: 1 ppm

Legend

ACGIH *- American Conference of Governmental Industrial Hygienists*
OSHA *- Occupational Safety and Health Administration*
NIOSH: *NIOSH - National Institute for Occupational Safety and Health*

Engineering Measures Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

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 Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Recommended Filter type: Particulates filter conforming to EN 143. Inorganic gases and vapours filter. Type B. Grey. conforming to EN14387.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Clear
Odor	pungent
Odor Threshold	No information available
pH	3.3 (30 %)
Melting Point/Range	-33 °C / -27.4 °F
Boiling Point/Range	108 °C / 226.4 °F @ 760 mmHg
Flash Point	Not applicable
Evaporation Rate	>1.0 (Butyl Acetate = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	23 mmHg @ 30 °C
Vapor Density	1.10
Specific Gravity	1.11

Solubility	Miscible with water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	H2O2
Molecular Weight	34.01

10. Stability and reactivity

Reactive Hazard Yes

Stability Oxidizer: Contact with combustible/organic material may cause fire. Light sensitive.

Conditions to Avoid Incompatible products. Excess heat. Exposure to light. Combustible material.

Incompatible Materials Finely powdered metals, copper, Reducing Agent, Strong bases, Combustible material, Organic materials

Hazardous Decomposition Products Hydrogen, Oxygen

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50 Category 4. ATE = 300 - 2000 mg/kg.

Dermal LD50 Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Mist LC50 Category 4. ATE = 1 - 5 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Water	-	-	-
Hydrogen peroxide	376 mg/kg (Rat) (90%) 910 mg/kg (Rat) (20-60%) 1518 mg/kg (Rat) (8-20% sol)	>2000 mg/kg (Rabbit)	LC50 = 2000 mg/m³ (Rat) 4 h

Toxicologically Synergistic Products No information available

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

Irritation Causes 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
Water	7732-18-5	Not listed	Not listed	Not listed	Not listed	Not listed
Hydrogen peroxide	7722-84-1	Not listed	Not listed	A3	Not listed	A3

IARC (International Agency for Research on Cancer)

IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

ACGIH: (American Conference of Governmental Industrial Hygienists)

A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

Mexico - Occupational Exposure Limits - Carcinogens
A1 - Confirmed Human Carcinogen

A2 - Suspected Human Carcinogen
A3 - Confirmed Animal Carcinogen
A4 - Not Classifiable as a Human Carcinogen
A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed 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

Contains a substance which is:. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not empty into drains. Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Hydrogen peroxide	EC50 2.5 mg/L/72h	LC50: 16.4 mg/L/96h (P.promelas)	Not listed	EC50 7.7 mg/L/24h

Persistence and Degradability Persistence is unlikely based on information available. Miscible with water

Bioaccumulation/ Accumulation No information available.

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

Component	log Pow
Hydrogen peroxide	-1.1

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 UN2014
Proper Shipping Name HYDROGEN PEROXIDE, AQUEOUS SOLUTIONS
Hazard Class 5.1
Subsidiary Hazard Class 8
Packing Group II

TDG

UN-No UN2014
Proper Shipping Name HYDROGEN PEROXIDE, AQUEOUS SOLUTION
Hazard Class 5.1
Subsidiary Hazard Class 8

Packing Group II

IATA

UN-No UN2014
Proper Shipping Name HYDROGEN PEROXIDE, AQUEOUS SOLUTION
Hazard Class 5.1
Subsidiary Hazard Class 8
Packing Group II

IMDG/IMO

UN-No UN2014
Proper Shipping Name HYDROGEN PEROXIDE, AQUEOUS SOLUTION
Hazard Class 5.1
Subsidiary Hazard Class 8
Packing Group II

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Water	7732-18-5	X	ACTIVE	-
Hydrogen peroxide	7722-84-1	X	ACTIVE	-

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA - Per 40 CFR 751, Regulation of Certain Chemical Substances & Mixtures, Under TSCA Section 6(h) (PBT) Not applicable

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
Water	7732-18-5	X	-	231-791-2	X	X		X	X	KE-35400
Hydrogen peroxide	7722-84-1	X	-	-	X	X	X	X	X	KE-20204

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

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Hydrogen peroxide	-	TQ: 7500 lb

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability

Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Hydrogen peroxide	-	1000 lb

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
Water	-	-	X	-	-
Hydrogen peroxide	X	X	X	-	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 contains the following DHS chemicals:
Legend - STQs = Screening Threshold Quantities, APA = A placarded amount

Component	DHS Chemical Facility Anti-Terrorism Standard
Hydrogen peroxide	Theft STQs - 400lb (concentration >=35%)

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Component	CAS No	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)
Water	7732-18-5	-	-	-
Hydrogen peroxide	7722-84-1	-	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)
Water	7732-18-5	Listed	Not applicable	Not applicable	Not applicable
Hydrogen peroxide	7722-84-1	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)
Water	7732-18-5	Not applicable	Not applicable	Not applicable	Not applicable
Hydrogen peroxide	7722-84-1	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	22-Sep-2009
Revision Date	24-Dec-2021
Print Date	24-Dec-2021
Revision Summary	SDS sections updated. 7.

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

GE Power & Water
Water & Process Technologies

SAFETY DATA SHEET

HYPERSPERSE* MDC120

1. Identification

Product identifier **HYPERSPERSE MDC120**

Other means of identification Not available.

Recommended use Membrane antiscalant/antifoulant

Recommended restrictions None known.

Company/undertaking identification

GE Betz, 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 Not classified.

OSHA defined hazards Not classified.

Label elements

Hazard symbol None.

Signal word Not available.

Hazard statement The mixture does not meet the criteria for classification.

Precautionary statement

Prevention Observe good industrial hygiene practices.

Response Wash hands after handling.

Storage Store away from incompatible materials.

Disposal Dispose of waste and residues in accordance with local authority requirements.

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

Supplemental information None.

3. Composition/information on ingredients

Mixtures

This material is not considered to be hazardous according to regulatory guidelines (see Section 15 of the SDS).

Composition comments This product does not contain hazardous ingredients in reportable concentrations. 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 physician if symptoms develop or persist.

Skin contact	Rinse skin with water/shower. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. If ingestion of a large amount does occur, call a poison control center immediately.
Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

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.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire-fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
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. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Avoid prolonged exposure. Use care in handling/storage.
Conditions for safe storage, including any incompatibilities	Do not freeze. If frozen, thaw completely and mix thoroughly prior to use. Store in original tightly closed container. 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

Occupational exposure limits	No exposure limits noted for ingredient(s).
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.

Individual protection measures, such as personal protective equipment

Eye/face protection	Splash proof chemical goggles.
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 suitable protective clothing. Chemical resistant gloves.

Respiratory protection	If ventilation is insufficient, suitable respiratory protection must be provided. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. Respiratory protection not required. 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.

9. Physical and chemical properties

Appearance	
Color	Colorless to brown
Physical state	Liquid
Odor	Mild
Odor threshold	Not available.
pH (concentrated product)	3.5
pH in aqueous solution	4.2 (5% SOL.)
Melting point/freezing point	32 °F (0 °C)
Initial boiling point and boiling range	220 °F (104 °C)
Flash point	> 200 °F (> 93 °C) P-M(CC)
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
Vapor pressure temp.	70 °F (21 °C)
Vapor density	< 1 (Air = 1)
Relative density	1.2
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	50 cps
Viscosity temperature	70 °F (21 °C)
Other information	
Percent volatile	0 (Calculated)
Pour point	37 °F (3 °C)
Specific gravity	1.2

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	Protect from freezing.

Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	Oxides of carbon evolved in fire.

11. Toxicological information

Information on likely routes of exposure

Ingestion	Expected to be a low ingestion hazard. May cause slight gastrointestinal irritation.
Inhalation	Mists/aerosols may cause irritation to upper respiratory tract.
Skin contact	Prolonged or repeated contact may cause irritation.
Eye contact	Direct contact with eyes may cause temporary irritation.
Symptoms related to the physical, chemical and toxicological characteristics	Prolonged and repetitive exposure, depending on the route(s), may develop transient irritation on skin, eyes, ingestion tract, and/or respiratory tract.

Information on toxicological effects

Acute toxicity

Product	Species	Test Results
HYPERSPERSE MDC120 (CAS Mixture)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg, (Calculated according to GHS additivity formula)
Oral		
LD50	Rat	> 5000 mg/kg, (Calculated according to GHS additivity formula)

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

Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Respiratory or skin sensitization	
Respiratory sensitization	Not available.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Based on available data, the classification criteria are not met. May be harmful if swallowed and enters airways.
Chronic effects	Prolonged inhalation may be harmful.
Further information	This product has no known adverse effect on human health.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Product	Species	Test Results
HYPERSPERSE MDC120 (CAS Mixture)		
LC50	Fathead Minnow	4710 mg/L, Static Renewal Bioassay, 96 hour, (pH adjusted)

Product		Species	Test Results
		Mysid Shrimp	1768 mg/L, Static Acute Bioassay, 48 hour, (pH adjusted)
		Sheepshead Minnow	> 10000 mg/L, Static Acute Bioassay, 96 hour, (pH adjusted)
	NOEL	Fathead Minnow	2750 mg/L, Static Renewal Bioassay, 96 hour, (pH adjusted)
		Mysid Shrimp	156 mg/L, Static Acute Bioassay, 48 hour, (pH adjusted)
Crustacea	LC50	Daphnia magna	1130 mg/L, Static Renewal Bioassay, 48 hour, (pH adjusted)
	NOEL	Daphnia magna	625 mg/L, Static Renewal Bioassay, 48 hour, (pH adjusted)

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

Bioaccumulative potential No data available.

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.

Environmental fate The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Persistence and degradability

No data available

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site.

Local disposal regulations Dispose in accordance with all applicable regulations.

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

Waste from residues / unused products Dispose of in accordance with local regulations. 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 Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

Not regulated as dangerous goods.

Some containers may be DOT exempt, please check BOL for exact container classification.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory information

US federal regulations This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

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 listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Not regulated.

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.

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).

Food and drug administration The ingredients in this product are approved by FDA under 21 CFR 173.73.

US state regulations 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.

US - Massachusetts RTK - Substance List

Not regulated.

US - Pennsylvania RTK - Hazardous Substances

Not regulated.

US - Rhode Island RTK

Not regulated.

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)

Not listed.

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

Not regulated.

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.

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.

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

Issue date Nov-28-2014

Revision date Nov-28-2014

Version # 1.0

List of abbreviations	CAS: Chemical Abstract Service Registration Number TWA: Time Weighted Average STEL: Short Term Exposure Limit TLV: Threshold Limit Value 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 NFPA: National Fire Protection Association ACGIH: American Conference of Governmental Industrial Hygienists 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. The information in the sheet was written based on the best knowledge and experience currently available.
Revision Information	Product and Company Identification: Commercial Names Composition / Information on Ingredients: Ingredients Toxicological Information: Toxicological Data HazReg Data: International Inventories GHS: Classification
Prepared by	This SDS has been prepared by GE Water & Process Technologies Regulatory Department (1-215-355-3300).

* Trademark of General Electric Company. May be registered in one or more countries.

SAFETY DATA SHEET

Version 6.3
Revision Date 19.12.2024
Print Date 11.02.2025

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Methane

Product Number : 295477
Brand : Aldrich
CAS-No. : 74-82-8

1.2 Other means of identification

No data available

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

Identified uses : For R&D use only. Not for pharmaceutical, household or other uses.

1.4 Details of the supplier of the safety data sheet

Company : Merck Life Science Pty Ltd
Ground Floor, Building 1, 885 Mountain Highway
BAYSWATER VIC 3153
AUSTRALIA

Telephone : +61 1800 800 097
E-mail address : customersupport.anz@merckgroup.com

1.5 Emergency telephone

Emergency Phone # : Free call (24/7): 1800 862 115
Int'l (24/7): +61 2 9037 2994
(CHEMTREC)

SECTION 2: Hazards identification

2.1 GHS Classification

Flammable gases (Category 1), H220
Gases under pressure (Compressed gas), H280

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

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/ sparks/ open flames/ hot surfaces. No

The life science business of Merck operates as MilliporeSigma in the US and Canada

smoking.

Response

P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381	Eliminate all ignition sources if safe to do so.

Storage

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

2.3 Other hazards

May displace oxygen and cause rapid suffocation.

SECTION 3: Composition/information on ingredients

Substance / Mixture : Substance

3.1 Substances

Formula	:	CH_4
Molecular weight	:	16.04 g/mol
CAS-No.	:	74-82-8
EC-No.	:	200-812-7
Index-No.	:	601-001-00-4

No components need to be disclosed according to the applicable regulations.

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.

In case of eye contact

After eye contact: rinse out with plenty of water. Remove contact lenses.

If swallowed

After swallowing: make victim drink water (two glasses at most). Consult doctor if feeling unwell.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Water Foam Carbon dioxide (CO2) Dry powder

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Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Combustible.
Pay attention to flashback.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
In the event of fire, wear self-contained breathing apparatus.

5.4 Further information
Remove container from danger zone and cool with water.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Do not breathe gas. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
No special precautionary measures necessary.

6.3 Methods and materials for containment and cleaning up
Observe possible material restrictions (see sections 7 and 10). Stop flow of gas, move leaking cylinder to open air if without risk.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on protection against fire and explosion
Keep away from open flames, hot surfaces and sources of ignition.

Hygiene measures
Change contaminated clothing. Wash hands after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Keep away from combustible materials and sources of ignition.

Contents under pressure.

Storage class
Storage class (TRGS 510): 2A: Gases

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.3 no other specific uses are stipulated.

SECTION 8: Exposure controls/personal protection

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8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Methane	74-82-8	TWA	0.1 mg/m3	Australia. Workplace Exposure Standards for Airborne Contaminants.

8.2 Exposure controls

Appropriate engineering controls
Change contaminated clothing. Wash hands after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

The selected protective gloves have to satisfy the specifications of Regulation (EU) 2016/425 and the standard EN 374 derived from it.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 60 min
Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Flame retardant antistatic protective clothing.

Respiratory protection
required when vapours/mists are generated. Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
No special precautionary measures necessary.

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SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Physical state	gaseous
b)	Color	colorless
c)	Odor	odorless
d)	Melting point/freezing point	Melting point/ range: -183 °C - lit.
e)	Initial boiling point and boiling range	-161 °C - lit.
f)	Flammability (solid, gas)	No data available
g)	Upper/lower flammability or explosive limits	Upper explosion limit: 15 %(V) Lower explosion limit: 5 %(V)
h)	Flash point	-188 °C - closed cup
i)	Autoignition temperature	No data available
j)	Decomposition temperature	No data available
k)	pH	No data available
l)	Viscosity	Viscosity, kinematic: No data available Viscosity, dynamic: No data available
m)	Water solubility	24.4 g/l at 25 °C
n)	Partition coefficient: n-octanol/water	log Pow: 1.09 - Bioaccumulation is not expected., (ECHA)
o)	Vapor pressure	45,200 hPa at -83 °C
p)	Density	0.716 g/cm3 at 25 °C - lit.
	Relative density	No data available
q)	Relative vapor density	No data available
r)	Particle characteristics	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information

Relative vapor density	0.55 - (Air = 1.0)

SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

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10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available
Inhalation: No data available
Dermal: No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
Test Type: Ames test
Test system: Salmonella typhimurium
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative
Test Type: Chromosome aberration test in vitro
Test system: Human lymphocytes
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 473
Result: negative

Carcinogenicity
No data available

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

RTECS: PA1490000

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To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. Pressurised gas bottle: dispose of only in empty condition!

SECTION 14: Transport information

14.1 UN number
ADR/RID: 1971 IMDG: 1971 IATA-DGR: 1971

14.2 UN proper shipping name
ADR/RID: METHANE, COMPRESSED
IMDG: METHANE, COMPRESSED
IATA-DGR: Methane, compressed
Passenger Aircraft: Not permitted for transport

14.3 Transport hazard class(es)
ADR/RID: 2.1 IMDG: 2.1 IATA-DGR: 2.1

14.4 Packaging group
ADR/RID: - IMDG: - IATA-DGR: -

14.5 Environmental hazards
ADR/RID: no IMDG Marine pollutant: no IATA-DGR: no

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14.6 Special precautions for user
None

14.7 Incompatible materials
Strong oxidizing agents

Other regulations
Hazchem Code : 2SE

SECTION 15: Regulatory information

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

Therapeutic Goods (Poisons Standard) Instrument	:	No poison schedule number allocated

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3.

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

Further information
The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
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SAFETY DATA SHEET

Version 6.15
Revision Date 13.11.2024
Print Date 14.11.2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Sodium bisulfite

Product Number : 243973
Brand : SIGALD
CAS-No. : 7631-90-5

1.2 Other means of identification

Sodium hydrogensulfite

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

Identified uses : For R&D use only. Not for pharmaceutical, household or other uses.

1.4 Details of the supplier of the safety data sheet

Company : Merck Life Science Pty Ltd
Ground Floor, Building 1, 885 Mountain Highway
BAYSWATER VIC 3153
AUSTRALIA

Telephone : +61 1800 800 097
E-mail address : customersupport.anz@merckgroup.com

1.5 Emergency telephone

Emergency Phone # : Free call (24/7): 1800 862 115
Int'l (24/7): +61 2 9037 2994
(CHEMTREC)

SECTION 2: Hazards identification

2.1 GHS Classification

Acute toxicity, Oral (Category 4), H302

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal Word Warning

Hazard Statements
H302 Harmful if swallowed.

Precautionary Statements

Prevention
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.

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Response

P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.

Disposal

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

2.3 Other hazards

Contact with acids liberates toxic gas.

SECTION 3: Composition/information on ingredients

Substance / Mixture : Mixture

3.2 Mixtures

Synonyms : Sodium hydrogensulfite

Formula : NaHSO3

Molecular weight : 104.06 g/mol

Hazardous ingredients

Component		Classification	Concentration
sodium hydrogensulphite			
CAS-No.	7631-90-5	Acute Tox. 4; H302	<= 100 %
EC-No.	231-548-0		
Index-No.	016-064-00-8		

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.

In case of eye contact

After eye contact: rinse out with plenty of water. Remove contact lenses.

If swallowed

After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

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SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Sulfur oxides
Sodium oxides
Not combustible.
Ambient fire may liberate hazardous vapours.

5.3 Advice for firefighters

In the event of fire, wear self-contained breathing apparatus.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry.
Do not store near acids.

Air and moisture sensitive.

Storage class
Storage class (TRGS 510): 13: Non Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.3 no other specific uses are stipulated.

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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
sodium hydrogensulphite	7631-90-5	TWA	5 mg/m3	Australia. Workplace Exposure Standards for Airborne Contaminants.

8.2 Exposure controls

Appropriate engineering controls
Change contaminated clothing. Preventive skin protection recommended. Wash hands after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

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SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Physical state	solid
b)	Color	white
c)	Odor	No data available
d)	Melting point/freezing point	Melting point/ range: 300 °C
e)	Initial boiling point and boiling range	No data available
f)	Flammability (solid, gas)	The product is not flammable.
g)	Upper/lower flammability or explosive limits	No data available
h)	Flash point	Not applicable
i)	Autoignition temperature	Not applicable
j)	Decomposition temperature	No data available
k)	pH	4.3 at 10 g/l
l)	Viscosity	Viscosity, kinematic: No data available Viscosity, dynamic: No data available
m)	Water solubility	ca.42 g/l at 20 °C - completely soluble
n)	Partition coefficient: n-octanol/water	Not applicable for inorganic substances
o)	Vapor pressure	No data available
p)	Density	1.348 g/cm3 at 20 °C - OECD Test Guideline 109
	Relative density	No data available
q)	Relative vapor density	No data available
r)	Particle characteristics	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	none

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

Contact with acids liberates toxic gas.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

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10.3 Possibility of hazardous reactions
Generates dangerous gases or fumes in contact with:
Acids

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Strong oxidizing agents, Strong acids

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Mixture

Acute toxicity
Oral: No data available
LD50 Oral - Rat - male and female - 1,540 mg/kg
(OECD Test Guideline 401)
LC50 Inhalation - Rat - male and female - 4 h - > 5.5 mg/l - dust/mist

(OECD Test Guideline 403)
Remarks: (ECHA)
The value is given in analogy to the following substances: sodium sulphite
LD50 Dermal - Rat - male and female - > 2,000 mg/kg
(OECD Test Guideline 402)
Remarks: (ECHA)
The value is given in analogy to the following substances: sodium sulphite

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation
(OECD Test Guideline 404)
Remarks: (in analogy to similar products)

Serious eye damage/eye irritation
Eyes - In vitro study
Result: negative
(OECD Test Guideline 491)

Respiratory or skin sensitization
Local lymph node assay (LLNA) - Mouse
Result: negative
(OECD Test Guideline 429)
Remarks: (ECHA)
The value is given in analogy to the following substances: sodium sulphite

Germ cell mutagenicity

Test Type: Mutagenicity (mammal cell test): chromosome aberration.
Species: Rat

Result: negative
Remarks: (ECHA)

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Carcinogenicity
Carcinogenicity classification not possible from current data.

Reproductive toxicity
Weight of evidence does not support classification for reproductive toxicity

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

Repeated dose toxicity - Rat - male and female - Oral
Remarks: (ECHA)

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, chest pain
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Other dangerous properties can not be excluded.

Handle in accordance with good industrial hygiene and safety practice.

Components

sodium hydrogensulphite

Acute toxicity
LD50 Oral - Rat - male and female - 1,540 mg/kg
(OECD Test Guideline 401)
LC50 Inhalation - Rat - male and female - 4 h - > 5.5 mg/l - dust/mist
(OECD Test Guideline 403)
Remarks: (ECHA)
The value is given in analogy to the following substances: sodium sulphite
LD50 Dermal - Rat - male and female - > 2,000 mg/kg
(OECD Test Guideline 402)
Remarks: (ECHA)
The value is given in analogy to the following substances: sodium sulphite

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation
(OECD Test Guideline 404)
Remarks: (in analogy to similar products)

Serious eye damage/eye irritation
Eyes - In vitro study
Result: negative
(OECD Test Guideline 491)

Respiratory or skin sensitization
Local lymph node assay (LLNA) - Mouse
Result: negative
(OECD Test Guideline 429)
Remarks: (ECHA)

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The value is given in analogy to the following substances: sodium sulphite

Germ cell mutagenicity
Species: Rat - male
Result: negative
Remarks: (ECHA)

Carcinogenicity
Carcinogenicity classification not possible from current data.

Reproductive toxicity
Weight of evidence does not support classification for reproductive toxicity

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure

Aspiration hazard
No data available

SECTION 12: Ecological information

12.1 Toxicity

Mixture

Toxicity to fish	static test LC50 - Leuciscus idus (Golden orfe) - > 215 - < 464 mg/l - 96 h Remarks: (ECHA) The value is given in analogy to the following substances: potassium sulfite
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - 89 mg/l - 48 h Remarks: (ECHA) The value is given in analogy to the following substances: sodium metabisulphite
Toxicity to algae	static test ErC50 - Desmodesmus subspicatus (green algae) - 43.8 mg/l - 72 h (OECD Test Guideline 201) Remarks: (ECHA) The value is given in analogy to the following substances: sodium metabisulphite
Toxicity to bacteria	static test EC50 - activated sludge - > 1,000 mg/l - 3 h (OECD Test Guideline 209) Remarks: (ECHA) The value is given in analogy to the following substances: sodium sulphite
Toxicity to fish(Chronic toxicity)	flow-through test NOEC - Danio rerio (zebra fish) - >= 316 mg/l - 34 d (OECD Test Guideline 210)
Toxicity to daphnia and other aquatic invertebrates(Chronic toxicity)	semi-static test NOEC - Daphnia magna (Water flea) - > 10 mg/l - 21 d (OECD Test Guideline 211)

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12.2 Persistence and degradability
Not applicable for inorganic substances

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

Components

sodium hydrogensulphite

Toxicity to fish	static test LC50 - Leuciscus idus (Golden orfe) - > 215 - < 464 mg/l - 96 h Remarks: (ECHA) The value is given in analogy to the following substances: potassium sulfite
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - 89 mg/l - 48 h Remarks: (ECHA) The value is given in analogy to the following substances: sodium metabisulphite
Toxicity to algae	static test ErC50 - Desmodesmus subspicatus (green algae) - 43.8 mg/l - 72 h (OECD Test Guideline 201) Remarks: (ECHA) The value is given in analogy to the following substances: sodium metabisulphite
Toxicity to bacteria	static test EC50 - activated sludge - > 1,000 mg/l - 3 h (OECD Test Guideline 209) Remarks: (ECHA) The value is given in analogy to the following substances: sodium sulphite
Toxicity to fish(Chronic toxicity)	flow-through test NOEC - Danio rerio (zebra fish) - >= 316 mg/l - 34 d (OECD Test Guideline 210)
Toxicity to daphnia and other aquatic invertebrates(Chronic toxicity)	semi-static test NOEC - Daphnia magna (Water flea) - > 10 mg/l - 21 d (OECD Test Guideline 211)

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

14.1 UN number

ADR/RID: - IMDG: - IATA-DGR: -

14.2 UN proper shipping name

ADR/RID: Not dangerous goods
IMDG: Not dangerous goods
IATA-DGR: Not dangerous goods

14.3 Transport hazard class(es)

ADR/RID: - IMDG: - IATA-DGR: -

14.4 Packaging group

ADR/RID: - IMDG: - IATA-DGR: -

14.5 Environmental hazards

ADR/RID: no IMDG Marine pollutant: no IATA-DGR: no

14.6 Special precautions for user

14.7 Incompatible materials

Strong oxidizing agents, Strong acids

Further information
Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

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

Therapeutic Goods (Poisons Standard) Instrument : No poison schedule number allocated

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3.

H302 Harmful if swallowed.

Further information
The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact

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SAFETY DATA SHEET

Creation Date 16-Jun-2009 **Revision Date** 07-Sep-2023 **Revision Number** 8

1. Identification

Product Name **Sodium hydroxide**

Cat No. : **BP359-500; BP359-212**

CAS No 1310-73-2
Synonyms Caustic soda

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

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 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
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
Causes severe skin burns and eye damage
May cause respiratory irritation

Precautionary Statements
Prevention
Do not breathe dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
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
IF SWALLOWED: 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 %
Sodium hydroxide	1310-73-2	100

4. First-aid measures

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

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 breathing is difficult, give oxygen. 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. Call

a physician or poison control center immediately.

Ingestion Do NOT induce vomiting. Immediate medical attention is required. Never give anything by mouth to an unconscious person. Drink plenty of water.

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 Not combustible. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media Do not use a solid water stream as it may scatter and spread fire

Flash Point No information available
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. Reacts violently with water. Contact with metals may evolve flammable hydrogen gas.

Hazardous Combustion Products
Hydrogen. Sodium oxides.
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	Flammability	Instability	Physical hazards
3	0	1	N/A

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 Do not allow material to contaminate ground water system. Should not be released into the environment. Do not flush into surface water or sanitary sewer system. See Section 12 for additional Ecological Information.

Methods for Containment and Clean Up Avoid dust formation. Sweep up and shovel into suitable containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Use only under a chemical fume hood. Do not get in eyes, on skin, or on clothing. 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.

Incompatible Materials. Strong oxidizing agents. Acids. Metals. Water.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH	Mexico OEL (TWA)
Sodium hydroxide	Ceiling: 2 mg/m³	Ceiling: 2 mg/m³ TWA: 2 mg/m³	IDLH: 10 mg/m³ Ceiling: 2 mg/m³	Ceiling: 2 mg/m³

Legend

ACGIH *- American Conference of Governmental Industrial Hygienists*
OSHA *- Occupational Safety and Health Administration*
NIOSH: *NIOSH - National Institute for Occupational Safety and Health*

Engineering Measures Use only under a chemical fume hood. 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. Tight sealing safety goggles. Face protection shield.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Recommended Filter type: Particulates filter conforming to EN 143.

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	14 (5 %)
Melting Point/Range	318 °C / 604.4 °F
Boiling Point/Range	1390 °C / 2534 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	Not flammable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	1 mbar @ 700 °C
Vapor Density	Not applicable
Specific Gravity	No information available
Bulk Density	2.13 g/cm3
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	H Na O

Molecular Weight 40

10. Stability and reactivity

Reactive Hazard Yes

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat.

Incompatible Materials Strong oxidizing agents, Acids, Metals, Water

Hazardous Decomposition Products Hydrogen, Sodium oxides

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
Sodium hydroxide	140 - 340 mg/kg (Rat)	1350 mg/kg (Rabbit)	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
Sodium hydroxide	1310-73-2	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. Large amounts will affect pH and harm aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Sodium hydroxide	Not listed	LC50: = 45.4 mg/L, 96h static (Oncorhynchus mykiss)	Not listed	Not listed

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 UN1823
Proper Shipping Name SODIUM HYDROXIDE, SOLID
Hazard Class 8
Packing Group II

TDG

UN-No UN1823
Proper Shipping Name SODIUM HYDROXIDE, SOLID
Hazard Class 8
Packing Group II

IATA

UN-No UN1823
Proper Shipping Name Sodium hydroxide, solid
Hazard Class 8
Packing Group II

IMDG/IMO

UN-No UN1823
Proper Shipping Name Sodium hydroxide, solid
Hazard Class 8
Packing Group II

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Sodium hydroxide	1310-73-2	X	ACTIVE	-

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA - Per 40 CFR 751, Regulation of Certain Chemical Substances & Mixtures, Under TSCA Section 6(h) (PBT) Not applicable

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
Sodium hydroxide	1310-73-2	X	-	215-185-5	X	X	X	X	X	KE-31487

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)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Sodium hydroxide	X	1000 lb	-	-

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Sodium hydroxide	1000 lb	-

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
Sodium hydroxide	X	X	X	-	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
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	CAS No	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)
Sodium hydroxide	1310-73-2	-	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)
Sodium hydroxide	1310-73-2	Listed	Not applicable	Not applicable	Not applicable

Contains component(s) that meet a 'definition' of per & poly fluoroalkyl substance (PFAS)?
Not applicable

Other International Regulations

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)
Sodium hydroxide	1310-73-2	Not applicable	Not applicable	Not applicable	Annex I - Y35

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

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Print Date 07-Sep-2023
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

SAFETY DATA SHEET

Version 6.6
Revision Date 10.07.2024
Print Date 11.07.2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Sodium hypochlorite solution

Product Number : 425044
Brand : SIGALD

1.2 Other means of identification

No data available

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

Identified uses : For R&D use only. Not for pharmaceutical, household or other uses.

1.4 Details of the supplier of the safety data sheet

Company : Merck Life Science Pty Ltd
Ground Floor, Building 1, 885 Mountain Highway
BAYSWATER VIC 3153
AUSTRALIA

Telephone : +61 1800 800 097
E-mail address : customersupport.anz@merckgroup.com

1.5 Emergency telephone

Emergency Phone # : Free call (24/7): 1800 862 115
Int'l (24/7): +61 2 9037 2994
(CHEMTREC)

SECTION 2: Hazards identification

2.1 GHS Classification

Corrosive to Metals (Category 1), H290
Skin corrosion/irritation (Category 1), H314
Serious eye damage/eye irritation (Category 1), H318
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal Word Danger

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Hazard Statements

H290	May be corrosive to metals.
H314	Causes severe skin burns and eye damage.
H400	Very toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

Precautionary Statements

Prevention

P264	Wash skin thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response

P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
P305 + P351 + P338 + P310	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.
P390	Absorb spillage to prevent material damage.
P391	Collect spillage.

Disposal

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

2.3 Other hazards

Contact with acids liberates toxic gas.

SECTION 3: Composition/information on ingredients

Substance / Mixture : Mixture

3.2 Mixtures

Formula : ClNaO

Molecular weight : 74.44 g/mol

Hazardous ingredients

Component		Classification	Concentration
sodium hypochlorite solution			
CAS-No. EC-No. Index-No.	7681-52-9 231-668-3 017-011-00-1	Met. Corr. 1; Skin Corr./Irrit. 1B; Eye Dam./Irrit. 1; Aquatic Acute 1; Aquatic Chronic 1; H290, H314, H318, H400, H410 M-Factor - Aquatic Acute: 10 - Aquatic Chronic: 1	>= 10 - < 20 %

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For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact
After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation). Call a physician immediately. Do not attempt to neutralise.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Hydrogen chloride gas
Sodium oxides
Not combustible.
Ambient fire may liberate hazardous vapours.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up with liquid-absorbent material (e.g. Chemizorb®). Dispose of properly. Clean up affected area.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
No metal containers.
Tightly closed.
Do not store near acids.
Storage stability Recommended storage temperature
2 - 8 °C
Storage class
Storage class (TRGS 510): 8B: Non-combustible, corrosive hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.3 no other specific uses are stipulated.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

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Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection
Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Body Protection
protective clothing

Respiratory protection
required when vapours/aerosols are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Physical state	liquid
b)	Color	light green
c)	Odor	No data available
d)	Melting point/freezing point	-28.9 °C
e)	Initial boiling point and boiling range	111 °C
f)	Flammability (solid, gas)	No data available
g)	Upper/lower flammability or explosive limits	No data available
h)	Flash point	Not applicable

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i)	Autoignition temperature	Not applicable
j)	Decomposition temperature	No data available
k)	pH	12 - 13 at 20 °C
l)	Viscosity	Viscosity, kinematic: No data available Viscosity, dynamic: No data available
m)	Water solubility	completely miscibleat 20 °C soluble
n)	Partition coefficient: n-octanol/water	No data available
o)	Vapor pressure	23.3 hPa at 20 °C
p)	Density	1.206 g/mL at 25 °C
	Relative density	No data available
q)	Relative vapor density	No data available
r)	Particle characteristics	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	none

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Violent reactions possible with:
Generates dangerous gases or fumes in contact with:
Acids
The generally known reaction partners of water.

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Strong acids, Organic materials, Powdered metals, Forms shock-sensitive mixtures with certain other materials., Amines, Reacts violently with ammonium salts, aziridine,

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methanol, and phenylaceto primary aliphatic or aromatic amines to form explosively unstable n-chlor 55°C.Metals

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Mixture

Acute toxicity
Oral: No data available
Symptoms: If ingested, severe burns of the mouth and throat, as well as a danger of perforation of the esophagus and the stomach.
Symptoms: mucosal irritations, Cough, Shortness of breath, Possible damages:, damage of respiratory tract
Dermal: No data available

Skin corrosion/irritation
Remarks: No data available
Remarks: Mixture causes burns.

Serious eye damage/eye irritation
Remarks: No data available
Remarks: Mixture causes serious eye damage.
Risk of blindness!

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
No data available

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Other dangerous properties can not be excluded.

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Handle in accordance with good industrial hygiene and safety practice.

Components

sodium hypochlorite solution

Acute toxicity
LD50 Oral - Rat - male - 1,100 mg/kg
(OECD Test Guideline 401)
Inhalation: No data available
LD50 Dermal - Rabbit - male and female - > 20,000 mg/kg
(OECD Test Guideline 402)

Skin corrosion/irritation
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

Serious eye damage/eye irritation
Remarks: Causes serious eye damage.

Respiratory or skin sensitization
- Guinea pig
Result: Not a skin sensitizer.
(OECD Test Guideline 406)

Germ cell mutagenicity
Result: negative
Method: Mutagenicity (micronucleus test)
Species: Mouse - male
Result: negative

Carcinogenicity
No data available

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

SECTION 12: Ecological information

12.1 Toxicity

Mixture
No data available

12.2 Persistence and degradability
No data available

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12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

Components

sodium hypochlorite solution

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 0.08 mg/l - 96 h Remarks: (Regulation (EC) No 1272/2008, Annex VI) (ECOTOX Database)
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.04 mg/l - 48 h Remarks: (Regulation (EC) No 1272/2008, Annex VI) (ECOTOX Database)
Toxicity to algae	static test ErC50 - Pseudokirchneriella subcapitata - 0.036 mg/l - 72 h (OECD Test Guideline 201) static test EC10 - Pseudokirchneriella subcapitata - 0.02 mg/l - 72 h (OECD Test Guideline 201)
Toxicity to bacteria	static test EC50 - activated sludge - 77.1 mg/l - 3 h (OECD Test Guideline 209) Remarks: (ECHA)

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

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SECTION 14: Transport information

14.1 UN number

ADR/RID: 1791 IMDG: 1791 IATA-DGR: 1791

14.2 UN proper shipping name

ADR/RID: HYPOCHLORITE SOLUTION
IMDG: HYPOCHLORITE SOLUTION (sodium hypochlorite solution)
IATA-DGR: Hypochlorite solution
Passenger Aircraft: Not permitted for transport
Cargo Aircraft: Not permitted for transport

14.3 Transport hazard class(es)

ADR/RID: 8 IMDG: 8 IATA-DGR: 8

14.4 Packaging group

ADR/RID: III IMDG: III IATA-DGR: III

14.5 Environmental hazards

ADR/RID: yes IMDG Marine pollutant: yes IATA-DGR: no

14.6 Special precautions for user

None

14.7 Incompatible materials

Strong acids, Organic materials, Powdered metals, Forms shock-sensitive mixtures with certain other materials., Amines, Reacts violently with ammonium salts, aziridine, methanol, and phenylaceto primary aliphatic or aromatic amines to form explosively unstable n-chlor 55°C.Metals

Other regulations

Hazchem Code : 2X

SECTION 15: Regulatory information

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

Therapeutic Goods (Poisons Standard) Instrument : No poison schedule number allocated

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3.

H290	May be corrosive to metals.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
H411	Toxic to aquatic life with long lasting effects.

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Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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SAFETY DATA SHEET

Version 6.11
Revision Date 07.03.2024
Print Date 13.07.2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Sulfuric acid

Product Number : 339741
Brand : Aldrich
CAS-No. : 7664-93-9

1.2 Other means of identification

No data available

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

Identified uses : For R&D use only. Not for pharmaceutical, household or other uses.

1.4 Details of the supplier of the safety data sheet

Company : Merck Life Science Pty Ltd
Ground Floor, Building 1, 885 Mountain Highway
BAYSWATER VIC 3153
AUSTRALIA

Telephone : +61 1800 800 097
E-mail address : customersupport.anz@merckgroup.com

1.5 Emergency telephone

Emergency Phone # : Free call (24/7): 1800 862 115
Int'l (24/7): +61 2 9037 2994
(CHEMTREC)

SECTION 2: Hazards identification

2.1 GHS Classification

Corrosive to Metals (Category 1), H290
Skin corrosion/irritation (Sub-category 1A), H314
Serious eye damage/eye irritation (Category 1), H318

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal Word Danger

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Hazard Statements

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

Precautionary Statements

Prevention

P234	Keep only in original packaging.
P264	Wash skin thoroughly after handling.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response

P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
P305 + P351 + P338 + P310	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.
P390	Absorb spillage to prevent material damage.

Storage

P405	Store locked up.

Disposal

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

2.3 Other hazards - none

SECTION 3: Composition/information on ingredients

Substance / Mixture : Substance

3.1 Substances

Formula	:	H_2O_4S
Molecular weight	:	98.08 g/mol
CAS-No.	:	7664-93-9
EC-No.	:	231-639-5
Index-No.	:	016-020-00-8

Hazardous ingredients

Component	Classification	Concentration
sulphuric acid		
	Met. Corr. 1; Skin Corr./Irrit. 1A; Eye Dam./Irrit. 1; H290, H314, H318 Concentration limits: >= 0.3 %: Met. Corr. 1, H290; >= 15 %: Skin Corr. 1A, H314; 5 - < 15	<= 100 %

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	%: Skin Irrit. 2, H315; 5 - < 15 %: Eye Irrit. 2, H319;	

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact
After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation). Call a physician immediately. Do not attempt to neutralise.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Sulfur oxides
Not combustible.
Ambient fire may liberate hazardous vapours.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

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5.4 Further information
Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up with liquid-absorbent and neutralising material (e.g. Chemizorb® H^+, Merck Art. No. 101595). Dispose of properly. Clean up affected area.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
No metal containers.
Tightly closed.

Storage class
Storage class (TRGS 510): 8B: Non-combustible, corrosive hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.3 no other specific uses are stipulated.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
sulphuric acid	7664-93-9	STEL	3 mg/m3	Australia. Workplace Exposure Standards for Airborne Contaminants.

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		TWA	1 mg/m3	Australia. Workplace Exposure Standards for Airborne Contaminants.

8.2 Exposure controls

Appropriate engineering controls
Change contaminated clothing and immerse in water. Preventive skin protection Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection
This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Full contact
Material: Viton®
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Splash contact
Material: butyl-rubber
Minimum layer thickness: 0.7 mm
Break through time: 120 min
Material tested:Butoject® (KCL 898)

Body Protection
Acid-resistant protective clothing

Respiratory protection
required when vapours/aerosols are generated. Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

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SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Physical state	clear, liquid
b)	Color	colorless
c)	Odor	odorless
d)	Melting point/freezing point	Melting point: 10.31 °C
e)	Initial boiling point and boiling range	290 °C - lit.
f)	Flammability (solid, gas)	No data available
g)	Upper/lower flammability or explosive limits	No data available
h)	Flash point	No data available
i)	Autoignition temperature	No data available
j)	Decomposition temperature	No data available
k)	pH	1.2 at 5 g/l
l)	Viscosity	Viscosity, kinematic: No data available Viscosity, dynamic: 23 mPa.s at 20 °C
m)	Water solubility	soluble
n)	Partition coefficient: n-octanol/water	Not applicable for inorganic substances
o)	Vapor pressure	1.33 hPa at 145.8 °C
p)	Density	1.84 g/cm3 at 25 °C - lit.
	Relative density	No data available
q)	Relative vapor density	No data available
r)	Particle characteristics	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information

Surface tension	55.1 mN/m at 20 °C
Relative vapor	3.39 - (Air = 1.0)

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density

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
A risk of explosion and/or of toxic gas formation exists with the following substances:
Water
Alkali metals
alkali compounds
Ammonia
Aldehydes
acetonitrile
Alkaline earth metals
alkalines
Acids
alkaline earth compounds
Metals
metal alloys
Oxides of phosphorus
phosphorus
hydrides
halogen-halogen compounds
oxyhalogenic compounds
permanganates
nitrates
carbides
combustible substances
organic solvent
acetylidene
Nitriles
organic nitro compounds
anilines
Peroxides
picrates
nitrides
lithium silicide
iron(III) compounds
bromates
chlorates
Amines
perchlorates
hydrogen peroxide

10.4 Conditions to avoid
no information available

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10.5 Incompatible materials
animal/vegetable tissuesContact with metals liberates hydrogen gas.

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - male and female - 2,140 mg/kg
Remarks: (ECHA)
Inhalation: No data available
Dermal: No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Extremely corrosive and destructive to tissue.
Remarks: (IUCLID)

Serious eye damage/eye irritation
Remarks: Causes serious eye damage.

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
Test Type: Ames test
Test system: Salmonella typhimurium
Result: negative
Remarks: (HSDB)

Carcinogenicity
No data available

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

RTECS: WS5600000
Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, Pulmonary edema. Effects may be delayed.

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To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After inhalation of aerosols: damage to the affected mucous membranes. After skin contact: severe burns with formation of scabs. After eye contact: burns, corneal lesions. After swallowing: severe pain (risk of perforation!), nausea, vomiting and diarrhoea. After a latency period of several weeks possibly pyloric stenosis.

Other dangerous properties can not be excluded.

Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - > 100 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae	static test ErC50 - Desmodesmus subspicatus (green algae) - > 100 mg/l - 72 h (OECD Test Guideline 201)

12.2 Persistence and degradability

The methods for determining the biological degradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

Biological effects:
Harmful effect due to pH shift.
Caustic even in diluted form.
Does not cause biological oxygen deficit.
Endangers drinking-water supplies if allowed to enter soil and/or waters in large quantities.
Neutralisation possible in waste water treatment plants.
Discharge into the environment must be avoided.

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

14.1 UN number

ADR/RID: 1830 IMDG: 1830 IATA-DGR: 1830

14.2 UN proper shipping name

ADR/RID: SULPHURIC ACID
IMDG: SULPHURIC ACID
IATA-DGR: Sulphuric acid

14.3 Transport hazard class(es)

ADR/RID: 8 IMDG: 8 IATA-DGR: 8

14.4 Packaging group

ADR/RID: II IMDG: II IATA-DGR: II

14.5 Environmental hazards

ADR/RID: no IMDG Marine pollutant: no IATA-DGR: no

14.6 Special precautions for user

None

14.7 Incompatible materials

animal/vegetable tissuesContact with metals liberates hydrogen gas.

Other regulations
Hazchem Code : 2P

SECTION 15: Regulatory information

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

Therapeutic Goods (Poisons Standard) Instrument : No poison schedule number allocated

SECTION 16: Other information

-

Full text of H-Statements referred to under sections 2 and 3.

H290 May be corrosive to metals.

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H314	Causes severe skin burns and eye damage.
H315	Causes skin irritation.
H318	Causes serious eye damage.
H319	Causes serious eye irritation.

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Appendix B

Consequence Results

B-1 Digester rupture consequence results

Table B.1 Fireball consequence results

Weather category	Fireball diameter (m)	Distance downwind to 4.7kW/m^2 (m)	Distance downwind to 12.6kW/m^2 (m)	Distance downwind to 23kW/m^2 (m)	Distance downwind to 35kW/m^2 (m)
2/F	72	109	64	43	30
8/D	72	109	64	43	30
2.5/C	72	109	64	43	30

Table B.2 Flash fire consequence results

Weather category	Distance downwind to LFL at height of interest (m)
2/F	4
8/D	14
2.5/C	7

Table B.3 Explosion consequence results

Weather category	Maximum distance to overpressure 7kPa (m)	Maximum distance to overpressure 14kPa (m)	Maximum distance to overpressure 21kPa (m)	Maximum distance to overpressure 35kPa (m)
2/F	120	77	62	51
8/D	134	86	72	62
2.5/C	118	76	62	50

B-2 Digester 50 millimetre leak consequence results

Table B.4 Jet fire and delayed jet fire consequence results

Weather category	Flame length (m)	Distance downwind to 4.7kW/m^2 (m)	Distance downwind to 12.6kW/m^2 (m)	Distance downwind to 23kW/m^2 (m)	Distance downwind to 35kW/m^2 (m)
2/F	5	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest
8/D	6	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest
2.5/C	5	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest

Table B.5 Flash fire consequence results

Weather category	Distance downwind to LFL at height of interest (m)
2/F	LFL not reached at height of interest
8/D	LFL not reached at height of interest
2.5/C	LFL not reached at height of interest

B-3 Fireball consequence results

Table B.6 Fireball 4.7 consequence results

Weather category	Fireball diameter (m)	Distance downwind to 4.7kW/m^2 (m)	Distance downwind to 12.6kW/m^2 (m)	Distance downwind to 23kW/m^2 (m)	Distance downwind to 35kW/m^2 (m)
2/F	72	214	132	97	78
8/D	72	214	132	97	78
2.5/C	72	214	132	97	78

Appendix C

Risk evaluation supporting material

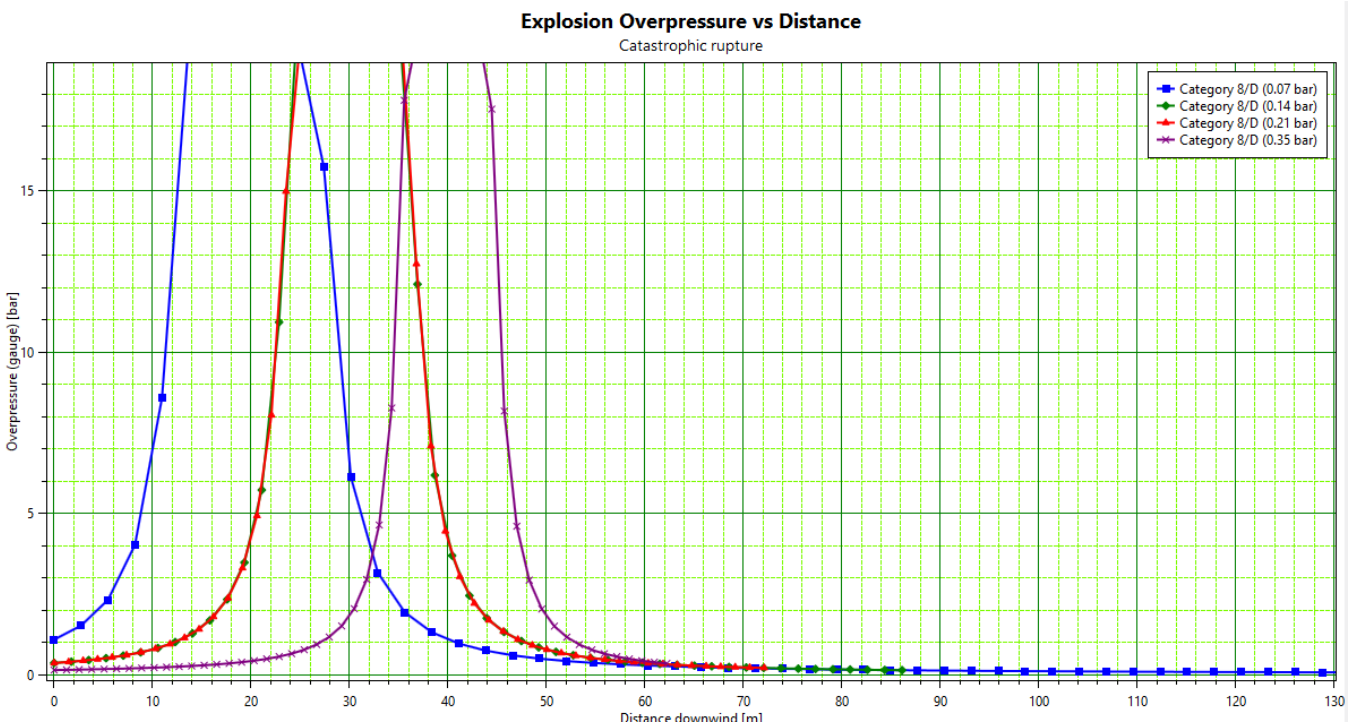

Figure C.1 Explosion overpressure vs Distance downwind for vapour cloud explosion

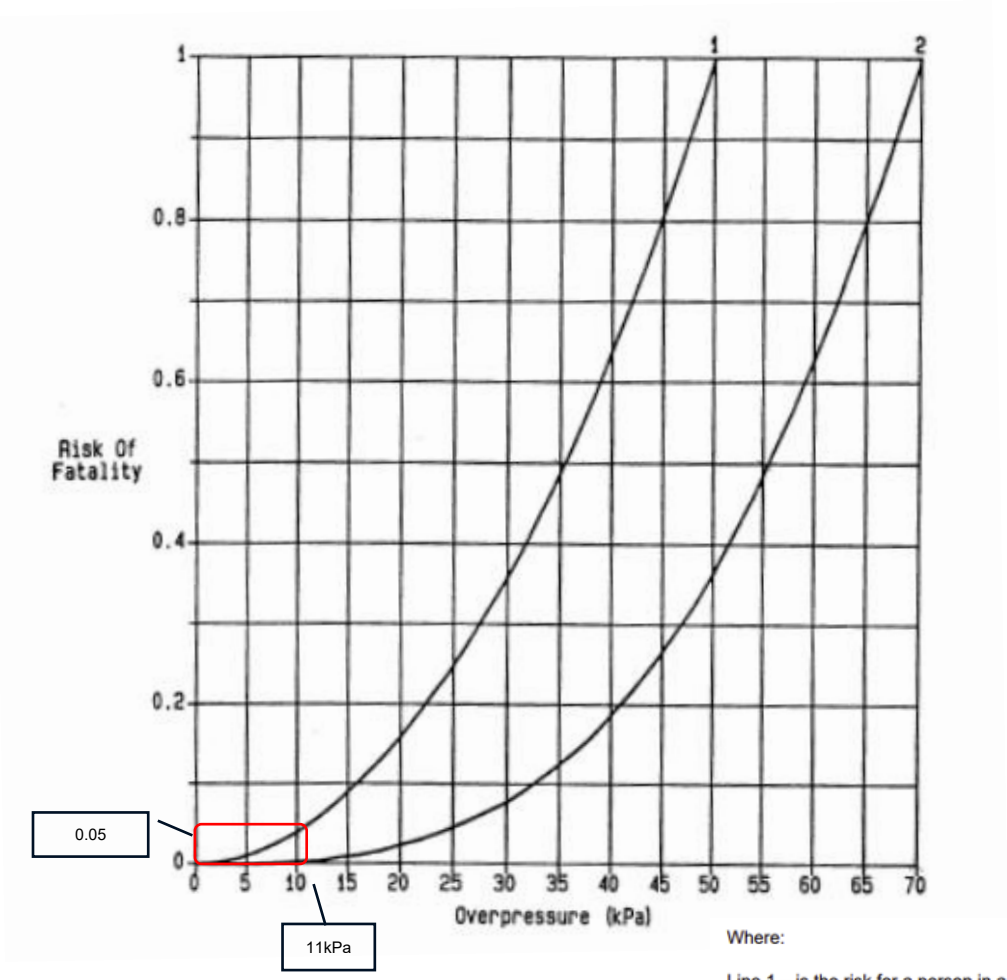

Figure C.2 Risk of fatality vs Overpressure [Ref 16]

Where:

Line 1 – is the risk for a person in a conventional building, and

Line 2 - is the risk for a person in the open

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