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Senex Energy Ltd

Atlas Stage 3 DCCEEW PD Response

Drilling Chemical Risk Assessment

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Table of Abbreviations

CMA	Cumulative Management Area
COC	Contaminant of Concern
CRA	Chemical Risk Assessment
CRAF	Chemical Risk Assessment Framework
CSG	Coal seam gas
DCCEEW	Department of Climate Change, Energy, Environment and Water
DES	Department of Environment and Science
EA	Environmental Authority
EPHC	Environment Protection and Heritage Council
ESL	Ecological screening levels
EVNT	Endangered, Vulnerable and Near Threatened
GAB	Great Artesian Basin
GDE	Groundwater Dependent Ecosystems
HPWBM	High performance water-based mud
MNES	Matters of National Environmental Significance
OGIA	Office of Groundwater Impact Assessment
PBT	Persistence, bioaccumulative and toxic
RE	Regional Ecosystem
ROP	Resource Operations Plan
SDS	Safety data sheet
TEC	Threatened ecological communities
WCM	Walloon Coal Measures

CLARIFICATIONS REGARDING THIS REPORT

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1 INTRODUCTION

Senex Energy Pty Ltd (Senex), on behalf of its subsidiaries Senex Assets Pty Ltd and Senex Assets 2 Pty Ltd, is proposing to develop, operate, decommission and rehabilitate new coal seam gas (CSG) wells and associated infrastructure on Authority to Prospect (ATP) 2059, Petroleum Lease (PL) 445, the northern portion of PL 209 and parts of PL 1037 in the central part of the Surat Basin, Queensland (the proposed action) (Figure 2.1). The proposed action is referred to as the Atlas Stage 3 Gas Project (referred to herein as 'the Project'). KCB Australia Pty Ltd (KCB) has been commissioned by Senex Energy Ltd (Senex) to undertake a Chemical Risk Assessment for chemicals to be used in CSG extraction as part of the Project (drilling and completions).

Hydraulic fracturing is **NOT** proposed for this project.

The objective of this assessment is to assess the potential impact to water resources and water dependent assets from chemicals used in CSG extraction under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) (Commonwealth of Australia 2016) as a result of the proposed activities associated with the Project. This assessment is conducted with reference to the following guidelines:

- Significant Impact Criteria provided in 'Significant impact guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources' (Commonwealth of Australia 2022b);
- Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (MNES) (Commonwealth of Australia 2013); and
- The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) information guidelines (IESC 2018). These information guidelines include a checklist for information related to CSG well construction and operation, which includes information requirements for chemicals.

This document was prepared in accordance with the Chemical Risk Assessment Framework (CRAF) (Appendix I). The CRAF incorporates leading practice risk assessment methodologies for the assessment of the potential impacts of the chemicals proposed to be used in CSG operations on MNES.

The assessment process is designed to assess the full lifecycle of chemicals that are stored, handled, used and/or disposed of during or following drilling activities.

1.1 Objectives of this Report

The objectives of the Chemical Risk Assessment are to:

- Evaluate the potential risks and effects of chemicals used during CSG operations (drilling and completions) to MNES.
- Evaluate the potential risks and effects of geogenic chemicals to MNES that may be present in recovered drilling fluids and produced waters during coal seam gas operations.
- Demonstrate that potential risks to MNES associated with the chemicals used in CSG operations have been eliminated or reduced as much as it is reasonably practicable.

1.2 Report Structure

The report is structured as follows:

Section 1: Introduction to the Project, report purpose, report structure and IESC checklist.

Section 2: Project Description

Section 3: MNES Receptors

Section 4: Screening Assessment

Section 5: Geogenic Screening Risk Assessment

Section 6: Summary of Potential Impacts.

1.3 Peer Review

This risk assessment has been peer reviewed to evaluate the adequacy of the categorisation, mitigation and management measures, as per the process outlined in the CRAF.

Professor Barry Noller, Principal Research Fellow For Mined Land Rehabilitation, Sustainable Minerals Institute, The University of Queensland was commissioned to undertake the peer review. Professor Barry Noller has over 40 years-experience in human health and environmental risk assessment in Australia. Professor Noller holds a PhD in environmental chemistry and is a Fellow of the Royal Australian Chemical Institute, Royal Society of Chemistry and International Union of Pure and Applied Chemistry.

Based on the peer review completed for all of Tier 1, Tier 2 and Tier 3 chemical risk assessments reviewed (as listed in Attachment B), the following is concluded:

- All chemicals are correctly categorised as Tier 1, Tier 2 or Tier 3 chemicals.
- All chemical risk assessments have been prepared appropriately, in accordance with the requirements of the CRAF, and provide an evaluation of each chemical consistent with current scientific knowledge.
- Risks relevant to the use of Tier 1, Tier 2 and Tier 3 chemicals have been appropriately assessed.

The Peer review is presented in Appendix VI.

2 PROJECT DESCRIPTION

2.1 Project Overview

Atlas Stage 3 covers an area of approximately 98 km^2 and is located approximately 10 km southwest of the township of Wandoan. Atlas Stage 3 is located within ATP 2059, PL 445, northern PL 209 and a portion of PL1037 (hereafter referred to as the Project area) as shown in Figure 2.1.

A summary of the regional Project setting is provided below:

- The CSG target coal seams for the Project are the Walloon Coal Measures (WCM), of the Jurassic-Cretaceous Surat Basin, which is underlain by the Permo-Triassic Bowen Basin;
- The Project is located towards the headwaters of the Upper Dawson River Sub-Basin, which is part of the larger Fitzroy Basin; and
- The Surat Basin forms part of the Great Artesian Basin (GAB), which comprises several aquifers and confining aquitards. Aquifers of the Surat Basin are a significant source of water used for stock, public water and domestic supply.

CSG wells will be drilled as part of the development. This assessment is related to the use of drilling additives only, which occurs during initial drilling, maintenance and decommissioning.

2.2 Project Components

Gas field production activities, planned to commence in 2024, will include the following:

- Drilling, installation, operation and maintenance of up to 151 CSG production wells (all vertical), targeting the WCM. These wells will generally be spaced 500 – 750 m apart;
- Installation, operation and maintenance of gas and water gathering flowlines, developed progressively over a period of approximately 5 – 10 years;
- Installation, operation and maintenance of associated supporting infrastructure (e.g., temporary workforce accommodation, access roads, power and communication systems, laydowns, stockpiles and storage areas);
- Decommissioning and rehabilitation of infrastructure and disturbed areas (the disturbance area is anticipated to be up to 530 ha); and
- Installation, operation and maintenance of water storage and water management facilities.

Details of the Project components, including location and size, will be identified progressively over the life of the Project.

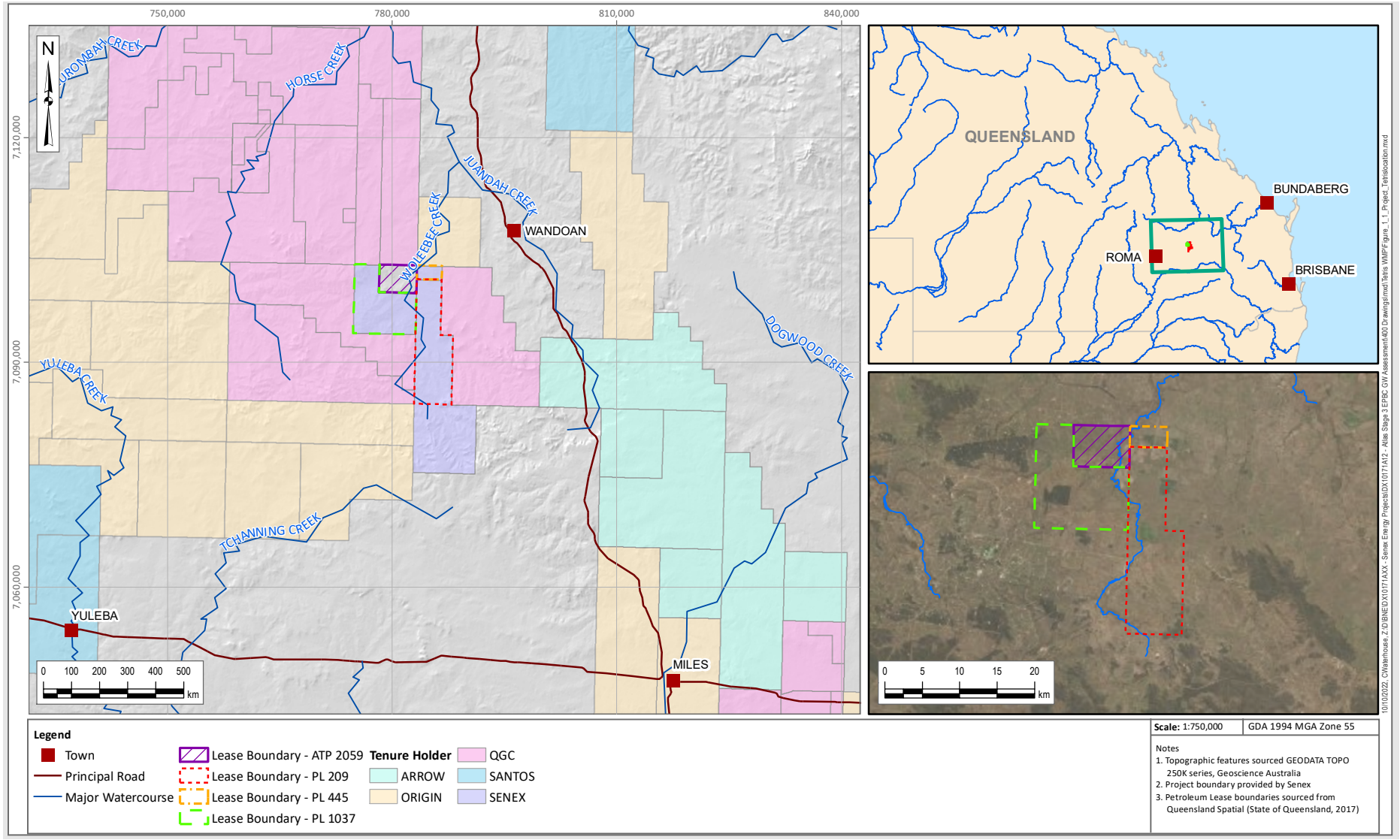

Figure 2.1 Atlas Stage 3 Location

2.3 Drilling Activities

2.3.1 Activity Description

The Project will involve drilling and completion of up to 151 CSG production wells over the estimated Project life. The actual number of CSG production wells to be developed will be determined based on a detailed assessment of all environmental, cultural heritage and land access constraints within the Project area. A description of the activities associated with the drilling is presented in Table 2.1.

Table 2.1 Description of Drilling Activity

Construction			Operations		
Activity	**Area**	**Timeframes**	**Activity**	**Area**	**Timeframes**
Drilling and completion of well using rotary mud or air drilling. Completion of well using completion rig; Equipment includes Fuel & Chemical Storage, Diesel Generator(s), above ground mud tanks, Flare Tank, Temporary drilling sumps, Temporary site buildings and storage unit(s). Transfer of produced water.	Drilling and completions rig, and associated equipment contained within the drill pad. Initial disturbance area of approximately 100 m x 100 m required.	Drill rig work 24-hour operations expected. Duration of drilling is expected to be less than 5 days. Completions working 12 or 24-hour operations duration expected to be less than 5 days.	Well Workover: workover operations to clean-out wells of solids, replace pump and down hole components, installation on new completions.	Workover rig will work within a flat pad area. Areas outside the required pad will be rehabilitated in the interim to final abandonment and rehabilitation.	The production well will remain operational for the life of the well (expected to be 20-50 years). Work over duration is expected to be between 1 to 4 days every 3 -5 years depending on the level of intervention required.

CSG production wells will optimally be set out with a target of 500 to 750 m grid spacing. Some locations may not be drilled depending on land access, cultural heritage and environmental constraints.

The operating life of a CSG production well is expected to be between 20 to 50 years. Once depleted of gas, CSG production wells will be plugged, abandoned and rehabilitated, with new CSG production wells drilled to maintain production needs.

2.3.2 Using Drilling Additives

While drilling, fluid will be circulated down the drill string and up the annulus (space) between the drill string and well wall. Drilling additives serve to lubricate the drilling assembly, assist with removal of the drilling cuttings, maintain control of the well and stabilise the hole being drilled.

Drilling fluids, or muds, generally consist of a mixture of water, clay, fluid loss control additives, density control additives, and viscosifiers.

To avoid well formation damage and to limit corrosion, a drilling fluid specific for each CSG production well will be selected that is appropriate to the well design, as well as local experience and anticipated geological conditions. The standard drilling fluid used by Senex is high

performance water-based mud (HPWBM). Potassium chloride (or similar) may be used as a weighting agent to help control swelling clay. Organic polymers and clay may be added to the base fluid to raise the viscosity and assist in removing drill cuttings. Biocides may be used during drilling and workover of production wells to prevent microbial growth and contamination and prevent the buildup of biofilms.

Drilling additives are selected and managed to confirm all products are used in accordance with the manufacturer's recommendations and relevant safety data sheet (SDS). The name, type and quantity of each drilling fluid additive used on each well are recorded.

Information on drilling additives is also required to be included in the 'well completion report' for each well. This is required to be submitted to the Department of Resources under the *Petroleum and Gas (Production and Safety) Regulation 2004* (State of Queensland 2017a).

2.4 Waste Materials

Options for the management of residual drilling material to be used for the Project are detailed in Table 2.2.

The disposal of residual drilling material will be managed in accordance with state approvals and Environmental Authority (EA) conditions. Residual drilling waste can only be disposed of onsite:

a. By mix-bury-cover method if the residual material meets the approval quality criteria; or

b. If it is certified by a suitably qualified third party, as being of acceptable quality for disposal to land by the proposed method and that environmental harm will not result from the proposed disposal.

Off-site disposal of residual drilling material to a facility licensed to receive that type of waste will occur where the disposal criteria outlined above cannot be met.

Table 2.2 Waste Materials from Drilling and Disposal Options

Waste Material	Approximate Quantities	Disposal Options
Drill cuttings	10 – 20 m^3 per well	▪ Onsite management – mix-bury-cover or land application/spreading. ▪ Off-site disposal to landfill. ▪ Off-site recycling.
Residual muds	75 m^3 per well	▪ Onsite management – mix-bury-cover or land application/spreading. ▪ Waste solids to landfill, drill additives recycled where possible.

3 MNES RECEPTORS

The MNES receptors that could potentially be impacted by the chemicals in drilling additives in the Atlas Stage 3 Project area are summarised in Table 3.1 and, where relevant, are described further below.

Table 3.1 Matters of National Environmental Significance

MNES	Relevance
World heritage properties	No
National heritage places	No
Wetlands of international importance	No
Nationally threatened species and ecological communities	**Yes – Threatened species (and habitats) and ecological communities**
Migratory species	**Yes**
Commonwealth marine areas	No
The Great Barrier Reef Marine Park	No
Nuclear actions	No
A water resource	**Yes – Surface water and groundwater systems and ecological communities and species which rely on these systems**

3.1 Wetlands of International Importance (Ramsar)

The proposed activities are more than 300 km from the closest identified wetland (Great Sandy Strait). It is unlikely activities within the Project area will influence the Ramsar sites due to the distance to the wetland

3.2 Nationally Threatened Species and Ecological Communities

3.2.1 Ecological Communities

Site investigations have confirmed two terrestrially located threatened ecological communities (TEC) to be present within the Project area (Boobook 2022). These are summarised in Table 3.2.

Table 3.2 Threatened Ecological Communities Potentially Present in the Project Area (ERM; 2022b)

Threatened Ecological Communities	Regional Ecosystem (RE) Code
Brigalow (*Acacia harpophylla* dominant and codominant) (Brigalow TEC)	11.9.5 and 11.9.5a
Poplar Box Grassy Woodland on Alluvial Plains (Poplar Box TEC)	11.3.2

3.2.2 Threatened Species

Table 3.3 summarises the *EPBC Act* (Commonwealth of Australia 2022a) threatened species that are confirmed or have a high likelihood of occurrence in the Project area (Bookbook Ecological Consulting 2022; ERM 2023). Their habits and general dependence (other than water for drinking) is noted.

One *EPBC Act*-listed threatened flora species has been confirmed to be present by ground truthing:

- Ooline (*Cadellia pentastylis*).

Two *EPBC Act*-listed threatened fauna species have been confirmed to be present by ground truthing:

- Greater Glider (southern and central) (*Petauroides armillatus*); and
- White-throated Needletail (*Hirundapus caudacutus*).

In addition to the species confirmed or identified as likely to be present within the Project area (Table 3.3), a further two MNES threatened flora and nine threatened fauna species potentially occur in the Project area (Boobook 2022; ERM 2023).

Table 3.3 MNES Threatened Species Confirmed, with High Likelihood or Potential for Occurrence in the Project Area (Boobook 2022; ERM 2023)

Common Name	Scientific Name	EPBC Act Status	Habitat	Dependence on Water
Threatened Flora				
Ooline	*Cadellia pentastylis*	Vulnerable	Grows in semi-evergreen vine thickets and sclerophyll vegetation, normally on upper and mid-slopes of the landscape. *Confirmed to be present by ground truthing.*	No direct dependence
Belson's panic	*Homopholis belsonii*	Vulnerable	Habitat includes areas of drainage lines and alluvial areas. It is known to occur in dry woodlands and rocky hills and is mostly found in well-drained soils. *Potentially present - not detected during ground truthing.*	No direct dependence
Slender Tylophora	*Vincetoxicum forsteri (syn. Tylophora linearis)*	Endangered	The species occurs in shrubby dry sclerophyll woodland and forest. *Potentially present - not detected during ground truthing.*	No direct dependence
Threatened Fauna				
Koala	*Phascolarctos cinereus*	Endangered	Habitat comprises all areas of eucalypt-dominated remnant and mature regrowth woodland and open forest within the Project Area. The species requires eucalypt feed trees, shelter trees with dense canopies and access to riparian vegetation and water sources within 1 km of their habitat areas. *Likely to be present - several trees with scratches that may possibly have been caused by Koala were recorded in the Project area.*	A primary threat is an increase in the frequency and severity of drought. Koalas are thus probably indirectly dependent on groundwater if and where refuges or food trees use groundwater.
Greater glider (central and southern)	*Petauroides armillatus*	Vulnerable	Habitat comprises remnant-only woodland within the well-connected riparian corridors along Wandoan Creek and Woleebee Creek in the north of the Project Area, as well as larger contiguous areas of remnant eucalypt woodland and open forest south of Giligulgul Road. The species requires large hollow-bearing trees in areas with eucalypt feed trees. *Confirmed to be present by ground truthing.*	No direct dependence
Squatter Pigeon (Southern Subspecies)	*Geophaps scripta*	Vulnerable	Mapped General Habitat comprises remnant and regrowth of eucalypt-dominated woodland and open forest within largely wooded landscapes. The species favours grassy woodland areas with patchy ground cover. *Potentially present - not detected during ground truthing*.	No direct dependence
Yellow-bellied Glider (Southern Subspecies)	*Petaurus australis*	Vulnerable	Habitat comprises larger contiguous areas of remnant-only eucalypt woodland and open forest of the nominated RE. The species requires large hollow-bearing trees for dense and preferred feed tree species (selected eucalypts). *Potentially present - not detected during ground truthing.*	No direct dependence
Australian Painted-Snipe	*Rostratula australis*	Endangered	Mapped general habitat comprises wetland areas and wetland-associated RE. The species favours wetland areas with dense low vegetation, muddy banks and	Potential dependence where wetlands are associated with TGDEs. Individuals may sometimes occur in the Project Area.

Common Name	Scientific Name	EPBC Act Status	Habitat	Dependence on Water
			shallow water. The Project Area is within the species' known range. Partially migratory. *Potentially present - not detected during ground truthing.*	However, there is very limited suitable habitat in the Project Area (ephemeral wetlands on drainage lines and farm dams), and this would only support occasional transient visitors.
Dulacca Woodland Snail	*Adclarkia dulacca*	Endangered	This snail inhabits vine thicket, Brigalow woodland/open forest, ironbark woodland, Lancewood woodland and Gum-topped Box woodland. It is largely confined to the Dulacca Downs subregion where it is found in a highly fragmented landscape, living in patches or strips of habitat retained on roadsides, shade lines and/or ridges. *Likely to be present - the species has previously been collected from an area of RE 11.9.5a and 11.7.2 in the south of the Project Area. Likely to be present.*	No direct dependence
South-eastern Glossy Black Cockatoo	*Calyptorhynchus lathami lathami*	Vulnerable	Distributed through coastal areas and ranges of eastern Australia with scattered records further inland. This is a specialised feeder dependent on seeds of Casuarinaceae (She-oak) trees. Breeding pairs nest in large hollows generally high up in large eucalypt trees or stags near water and food sources. The species is capable of moving among isolated trees and small habitat patches within fragmented landscapes. *Likely to be present.*	Areas of roosting and breeding habitat occur along Wandoan and Woleebee Creeks where there are larger hollow-bearing trees. This breeding habitat is a potential alluvial GDE.
Corben's long-eared Bat	*Nyctophilus corbeni*	Vulnerable	The Project Area is within the species' known range, which includes the Murray-Darling basin and Dawson River catchment. Inhabits shrubby woodland, particularly Box / Ironbark / Cypress Pine vegetation with a dense cluttered understory. Roosts solitarily, in tree hollows and crevices and under loose bark *Potentially present - not detected during ground truthing*.	No direct dependence
Collared Delma	*Delma torquata*	Vulnerable	Mapped General Habitat comprises larger contiguous areas of remnant and regrowth woodland and forest. The species requires areas with abundant leaf litter and woody debris or rocks. *Potentially present - not detected during ground truthing*.	No direct dependence
Yakka Skink	*Egernia rugosa*	Vulnerable	The species lives in woodland and open forests, also grassland with regrowth trees; requires suitable soils for burrows, sinkholes, abandoned rabbit warrens, large hollow logs, or piles of woody debris for shelter. *Potentially present - not detected during ground truthing*.	No direct dependence
Dunmall's Snake	*Furina dunmalli*	Vulnerable	The species occupies woodlands and open forests and may be reliant on the presence of abundant fallen woody debris. *Potentially present - not detected during ground truthing*.	No direct dependence
Southern white face	*Aphelocephala leucopsis*	Vulnerable	Inhabits a variety of open woodlands and shrublands that have a grassy and/or shrubby understorey and are dominated by acacia and eucalypt species. This species nests and roosts in tree hollows, in either live or dead standing trees.	No direct dependence

Common Name	Scientific Name	EPBC Act Status	Habitat	Dependence on Water
			Potentially present - not detected during ground truthing.	
Brown Treecreeper (south-eastern)	*Climacteris picumnus victoriae*	Vulnerable	The species inhabit open dry eucalypt forest and woodlands, mainly areas that are dominated by stringybarks or other rough-barked eucalypt species. The understorey is usually open and grassy, sometimes with few shrubs. *Potentially present - not detected during ground truthing*.	No direct dependence
Painted Honeyeater	*Grantiella picta*	Vulnerable	The species usually occurs in areas with flowering and fruiting mistletoe and flowering Eucalypts in dry, open forests and woodlands. Mistletoe is present sparingly in Eucalypt woodlands across the Project Area that could be utilised as habitat for this species. *Potentially present - not detected during ground truthing*.	No direct dependence
Diamond Firetail	*Stagonopleura guttata*	Vulnerable	Found in grassy eucalypt, acacia or casuarina woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. *Potentially present - not detected during ground truthing*.	No direct dependence
Northern Quoll	*Dasyurus hallucatus*	Endangered	The northern quoll occurs in a range of habitats, including open dry sclerophyll forest and woodland, riparian woodland, low dry vine thicket, the margins of notophyll vineforest, sugarcane farms and in urban areas. They are most abundant in hilly or rocky areas close to permanent water. Potential suitable rocky areas for breeding, denning and foraging habitat limited to the south-eastern corner of the Project Area. *Potentially present - not detected during ground truthing*.	No direct dependence
Five-clawed worm-skink	*Anomalopus mackayi*	Vulnerable	This species is associated with deep cracking clays that provide individuals with shelter. Habitat areas include Bluegrass and/or Mitchell Grass dominated grassland and other grasslands categorised as RE 11.3.21; River Red Gum - Coolibah-Bimble/Poplar Box and Weeping Myall grassy woodlands; White Box grassy woodland; Myall woodland, and Brigalow (Acacia harpophylla dominant and codominant). *Potentially present - not detected during ground truthing*.	No direct dependence
Grey Snake	*Hemiaspis damelii*	Endangered	This species inhabits Brigalow Acacia harpophylla and Belah Casuarina cristata woodlands on dark brown to black cracking clay soils. *Potentially present - not detected during ground truthing*.	No direct dependence
Migratory Fauna				
White-throated Needletail (also considered	*Hirundapus caudacutus*	Vulnerable, Migratory	An aerial insectivore presents in eastern and south-eastern Australia as a spring/summer non-breeding migrant. Shows a general preference for wooded	No direct dependence

Common Name	Scientific Name	EPBC Act Status	Habitat	Dependence on Water
Threatened Fauna)			landscapes but it is not tied to any specific vegetation or habitat features in the Project Area. *Confirmed to be present.*	
Fork-tailed Swift	*Apus pacificus*	Migratory	Aerial spring/summer migrant and insectivore, present over most habitat types including disturbed areas. *Confirmed to be present.*	No direct dependence
Oriental Cuckoo	*Cuculus optatus*	Migratory	The species is found in forest canopy, open wooded areas and orchards, often in hill country, also in coniferous forest and in birch (Betula) above the treeline. The species may occur in association with remnant and regrowth RE types 11.3.2, 11.3.25, 11.9.4, 11.9.5, 11.9.5a, 11.9.10, 11.3.19, 11.5.1 within a project area. There is limited areas of potential suitable remnant woodlands and non-remnant patches of native vegetation habitat, within the Project Area. *Potentially present - not detected during ground truthing*.	No direct dependence
Satin Flycatcher	*Myiagra cyanoleuca*	Migratory	Inhabit heavily vegetated gullies in Eucalypt-dominated forests and taller woodlands, and on migration, occur in drier woodlands and open forests. There is some limited potential habitat present in the form of remnant and non-remnant woodlands within the Project Area. *Potentially present - not detected during ground truthing*.	No direct dependence
Rufous Fantail	*Rhipidura rufifrons*	Migratory	When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, including spotted gum (*E. maculata*), yellow box (*E. melliodora*), ironbarks or stringybarks, often with a shrubby or heath understorey. There is some limited potential habitat present in the form of remnant and non-remnant woodlands within the Project Area. *Potentially present - not detected during ground truthing*.	No direct dependence
Common Sandpiper	*Actitis hypoleucos*	Migratory	Small areas of foraging habitat present within small ephemeral wetlands, which may provide temporary refuge for the species, within the Project Area. *Potentially present - not detected during ground truthing*.	Potential dependence where wetlands are associated with TGDEs. Individuals may sometimes occur in the Project Area. However, there is very limited suitable habitat in the Project Area (ephemeral wetlands on drainage lines and farm dams), and this would only support occasional transient visitors.
Sharp tailed Sandpiper	*Calidris acuminata*	Migratory	The species prefers habitat on muddy edges of freshwater wetlands or brackish wetlands. Can be found at dams inland. Will often occupy coastal mudflats when ephemeral terrestrial wetlands have dried out. *Potentially present - not detected during ground truthing*.	Potential dependence where wetlands are associated with TGDEs. Individuals may sometimes occur in the Project Area. However, there is very limited suitable habitat in the Project Area (ephemeral

Common Name	Scientific Name	EPBC Act Status	Habitat	Dependence on Water
				wetlands on drainage lines and farm dams), and this would only support occasional transient visitors.
Latham's Snipe	*Gallinago hardwickii*	Migratory	They usually occur in open, freshwater wetlands that have some form of shelter (usually low and dense vegetation) nearby. They generally occupy flooded meadows, seasonal or semi-permanent swamps, or open waters, but various other freshwater habitats can be used including bogs, waterholes, billabongs, lagoons, lakes, creek or river margins, river pools and floodplains. *Potentially present - not detected during ground truthing*.	Potential dependence where wetlands are associated with TGDEs. Individuals may sometimes occur in the Project Area. However, there is very limited suitable habitat in the Project Area (ephemeral wetlands on drainage lines and farm dams), and this would only support occasional transient visitors.

3.2.3 Migratory Species

The White-throated Needletail (listed as vulnerable and migratory under the *EPBC Act*), is known to occur in the Project area.

The Fork-tailed Swift (*Apus pacificus*) is considered likely to occur in the Project area.

It is noted that an additional six *EPBC Act* migratory species potentially occur*,* including *s*everal migratory waders, in small wetland areas associated with drainage features and may use the margins of farm dams while some woodland species may have habitat available in woodland and open and closed forest communities.

3.3 Water Resources

Information related to water resources within the vicinity of the Project has been sourced from the EPBC Referral Water Resources Impact Assessment Report (KCB 2022).

3.3.1 Surface Water

The Project area is located within the Upper Dawson River sub-basin, which is part of the Fitzroy River Basin. The Fitzroy River Basin is the second largest externally drained basin in Australia and the largest on the eastern coast of the continent. Covering an area of 150,000 km^2, the basin contains several significant tributaries, including the Nogoa, Comet, Mackenzie and Dawson Rivers. The basin discharges into the Coral Sea east of Rockhampton.

Key watercourses within the vicinity of the Project include (Figure 3.1, :

- Woleebee Creek, which flows north from its headwaters flanking the south-eastern boundary of the Project to join Juandah Creek to the northeast. Smaller headwater tributaries of Woleebee Creek, present within ATP 2059, include Wandoan Creek.
- Conloi Creek, a tributary to Woleebee Creek, which flows west across the central portion of PL 209.
- Hellhole Creek, a tributary to Woleebee Creek which flows north-west into Woleebee Creek across the southern portion of PL 209.
- Juandah Creek, which flows towards the north to join the Dawson River, 3 km south of Taroom. Juandah Creek is joined by Woleebee Creek, Horse Creek (from the south) and Bungaban Creek from the east before joining the Dawson River.

Watercourses within the Project area are classified as Stream Orders 1 to 5 using the Strahler method, with the majority being Stream Order 1 (minor streams) (DNRM 2010). Reaches of Stream Order 5 (major streams) are associated with Woleebee Creek in the west.

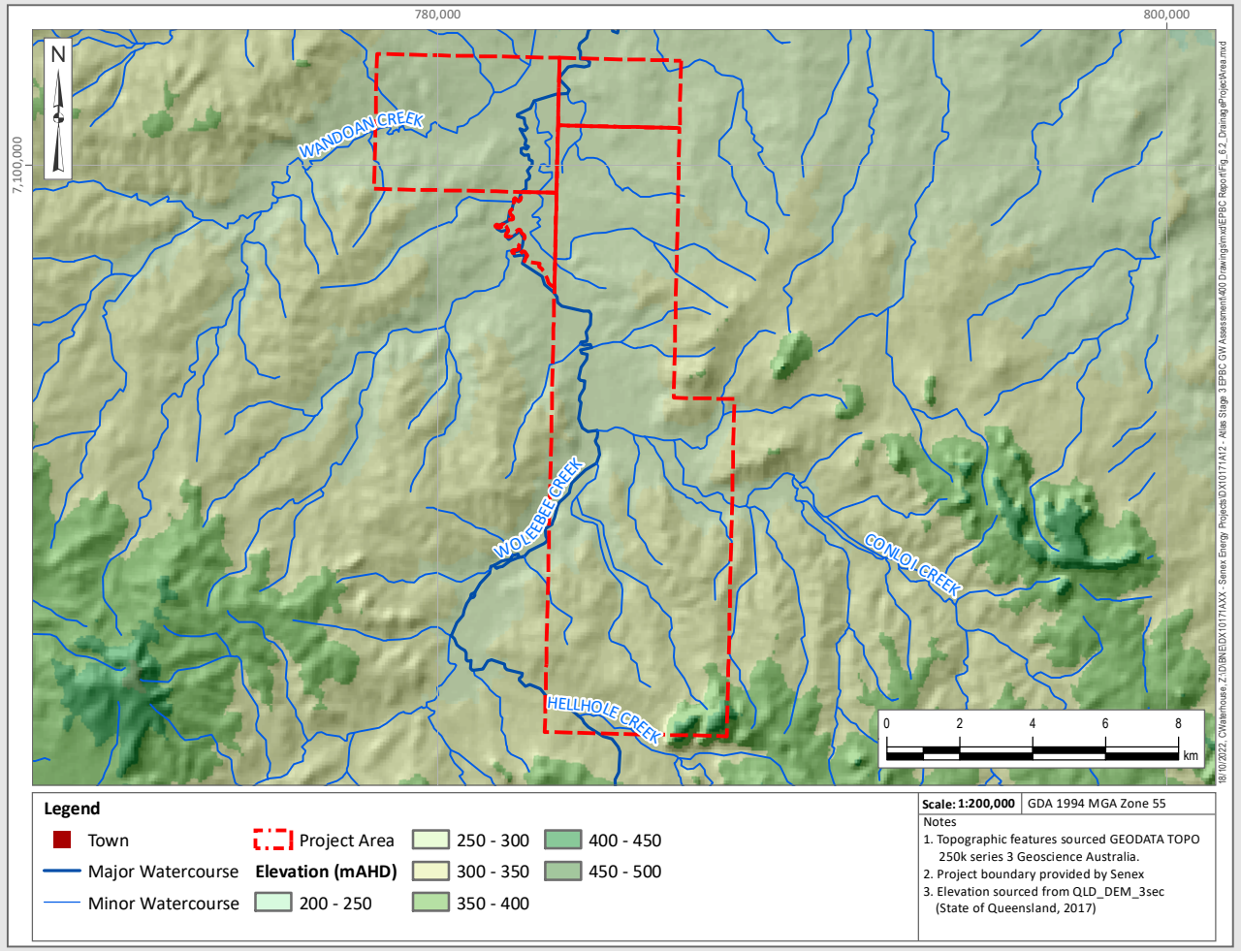

Figure 3.1 Drainage within the Project Area

Aquatic Ecosystems

Watercourses across the Project area are ephemeral, with most waterways anecdotally drying completely in dry periods and few waterways retaining refugial pools (Freshwater Ecology 2022).

The Project area supports aquatic features including wetlands (such as dams and intermittent swamps) and watercourses (including creeks, drainage features and floodplains) and were ground- truthed using the presence of water, or indicators of water such as riparian vegetation, and the wetland indicator species (e.g. *Eucalyptus camaldulensis)* ERM 2018; 2022). Due to the ephemeral nature of the watercourses, there are limited aquatic ecosystems in the watercourses.

The watercourses may act as refuges and provide drainage paths and intermittent habitats for aquatic species (Hydrobiology 2018; Freshwater Ecology 2022). At the time of the Aquatic Ecology assessment (Freshwater Ecology 2022), most waterways had already ceased surface flows with disconnected pools noted along the watercourses, although subsurface flow was apparent at sites along most creeks with sandy substrates. Along areas with clayey substrates, the disconnected area between pools was often separated by open grassland and poorly defined channels. The riparian vegetation density along the sites varied from moderate to non-existent, with most sites having a relatively low coverage of riparian vegetation.

Instream habitat, using habitat bioassessment, was mostly found to be in 'fair' condition across 24 sites sampled (70%) while 30% were determined to be in 'poor' condition.

The following species were recorded during the Aquatic Ecology assessment (Freshwater Ecology 2022) performed in March 2022:

- Nineteen aquatic macrophyte species;
- Three families of macro-crustaceans;
- Eight species of fish; and
- A single specimen of the Eastern Long-necked Turtle.

A desktop review was undertaken on available existing information for the potentially threatened aquatic flora known, or with potential, to be present in proximity to the Project area. Following the field surveys an assessment of the likelihood of occurrence for aquatic Endangered, Vulnerable and Near Threatened (EVNT) species was undertaken. All EVNT species identified in the desktop assessment were considered unlikely to occur within the Project area.

Third-Party Surface Water Users

Under the Fitzroy Basin Resource Operations Plan (ROP) (State of Queensland 2015), creeks within the Project area are within the Dawson Valley Water Management Area. Within this management area Woleebee, Horse and Juandah Creeks are a tributary of the Dawson N Zone, along the adopted middle thread distance (AMTD) reach 356.5 to 428.0 (km); and, is described as 'Upstream limit of Glebe Weir and Eurombah Creek Junction'.

There are no resource operations licence holders in the Dawson N Zone of the Dawson Valley Water Management Area (State of Queensland 2021). No other surface water users have been identified within the vicinity of the Project.

3.3.2 Groundwater

Regional Overview

The Project is located within the geographical extent of the Surat Basin, a basin of Jurassic-Cretaceous age, which is underlain by the Permo-Triassic Bowen Basin. Cenozoic-age formations are present overlying the Surat Basin sediments. The surface geological map within the vicinity of the Project area is shown in Figure 3.2.

Local Hydrogeology

The coal seams of the WCM sub-group, which is part of the Surat Basin are the target for gas production for the Project.

The Surat Basin forms part of the GAB, which comprises several aquifers and confining aquitards. Aquifers of the Surat Basin are a significant source of water used for stock, public water and domestic supply. The Office of Groundwater Impact Assessment (OGIA) (2021) presents the hydrostratigraphy of the Surat and underlying Bowen Basin, which is included as Figure 3.3. The main aquifers within the Surat Basin, from the deepest to the shallowest, are the Clematis Sandstone, Precipice Sandstone, Hutton Sandstone, Springbok Sandstone, Gubberamunda Sandstone, Mooga Sandstone and Bungil Formation. These aquifers are typically laterally

continu(OGIA 2016). Minor discontinuous aquifers include the Orallo Formation. The major aquitards are the Evergreen Formation, Eurombah Formation, WCM and Westbourne Formation (Figure 3.3). Key formations of the Surat Basin relevant to this assessment are highlighted on Figure 3.3. The formations overlying the target coal seams will be intersected during the drilling of CSG wells for the Project.

Quaternary-age alluvium has been mapped as occurring within the northern portion of the Project area and is mainly associated with Woleebee, Conloi and Wandoan Creeks, as shown on Figure 3.2. The lateral extent of the alluvium increases towards the north as the Wandoan Creek flows into the Woleebee Creek.

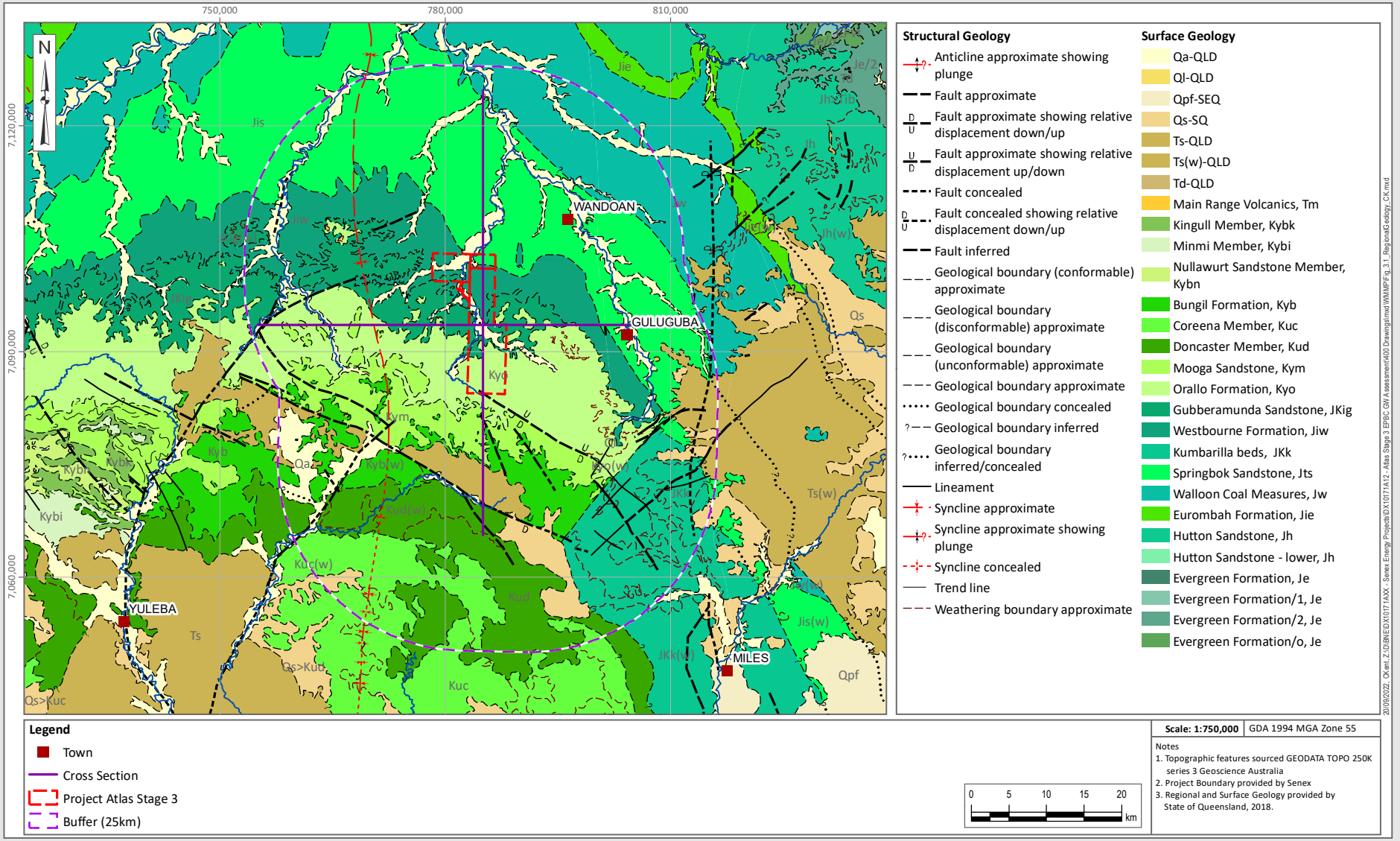

Figure 3.2 Regional Geological Map

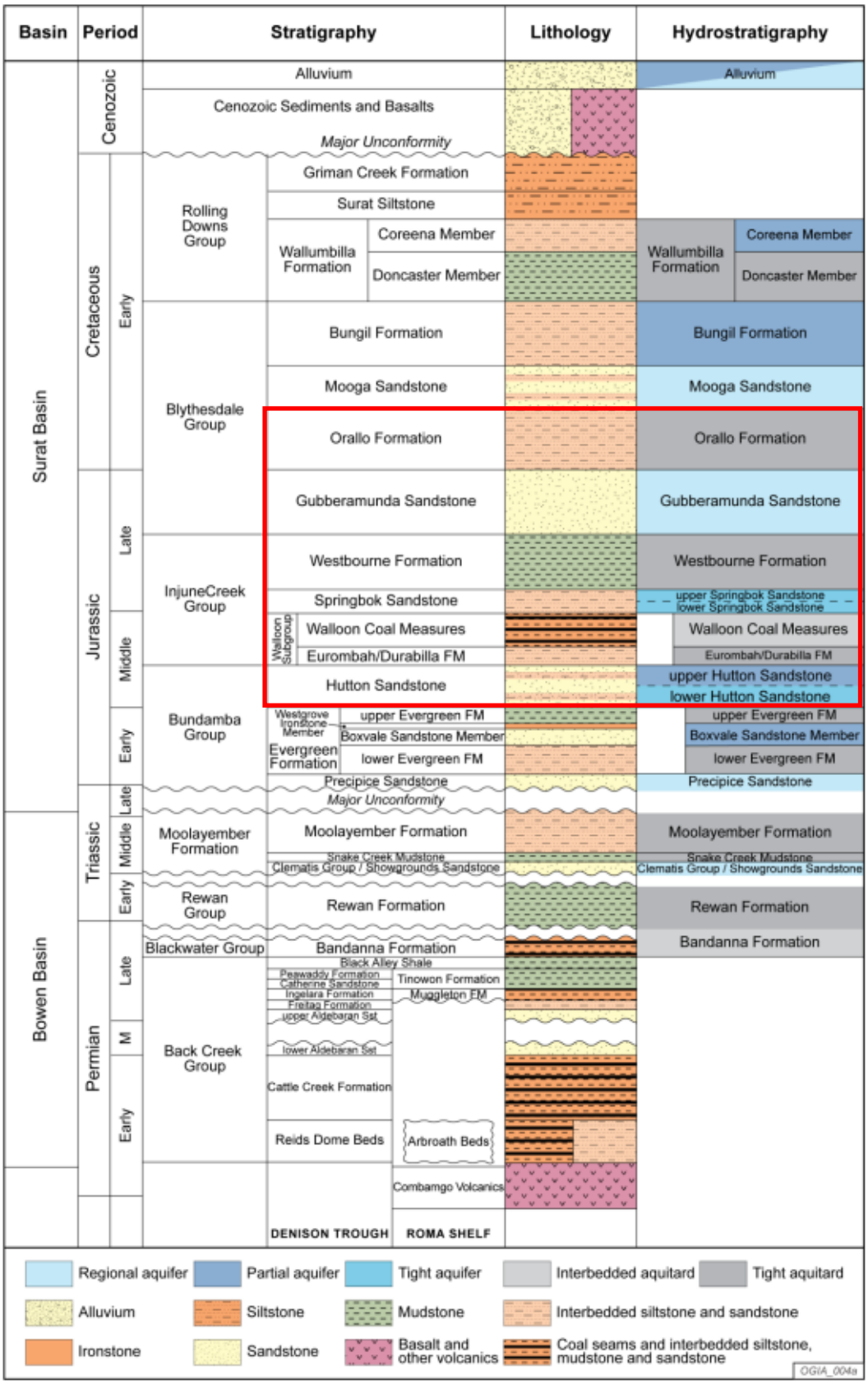

Figure 3.3 Regional Hydrostratigraphy (after OGIA 2021b) (Red Box are Key Geological Units)

Groundwater Dependent Ecosystems (GDEs) and Species

Groundwater dependent ecosystems (GDEs) are defined as 'Natural ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements to maintain their communities of plants and animals, ecological processes and ecosystem services' (Richardson et al. 2011).

The broad types of GDE are (Eamus et al. 2006):

- Ecosystems dependent on surface expression of groundwater;
- Ecosystems dependent on subsurface presence of groundwater; and
- Subterranean ecosystems.

Potential surface expression GDEs and subsurface GDEs are mapped by the Queensland Department of Environment and Science (DES) (State of Queensland 2018a) as potentially being present in the vicinity of the Project (Figure 3.4). These generally correspond with the location of the mapped alluvium associated with Woleebee Creek within the Project area and Wandoan Creek, Horse Creek and Juandah Creek further afield.

There are no spring vents or complexes within the vicinity of the Project.

Potential Aquatic GDEs

Baseflow fed reaches of watercourses, or watercourse springs, are sections of a watercourse where groundwater from an aquifer enters the stream through the streambed (OGIA 2021c). A report published by OGIA in 2017 re-maps potential gaining streams (or baseflow fed reaches, watercourse springs) within the Surat Cumulative Management Area (CMA) (OGIA 2017). This report identified sections of Woleebee Creek as a potentially gaining stream. OGIA have re-mapped watercourse springs within the Surat CMA for the 2021 UWIR report (OGIA 2021c), these are shown on Figure 3.4 with the details of the springs summarised in Table 3.4.

There are three mapped watercourse springs potentially present within the Project area associated with Woleebee Creek. These watercourse springs are identified as being associated with the alluvium, Gubberamunda Sandstone and the Orallo Formation. These are noted as springs of interest but not currently affected or listed as a mitigation site (OGIA 2021c).

Table 3.4 UWIR Watercourse Spring Details

Site Number	Name	Source Aquifer
W279	Woleebee Creek	Alluvium
W280	Woleebee Creek	Alluvium/Gubberamunda
W281	Woleebee Creek	Alluvium/Orallo Formation

Reaches of Woleebee Creek within PL 1037 were assessed during field verification in 2018 (KCB 2018). The assessment was conducted during the dry season and no flow was observed within the area surveyed. Pools of water were encountered in the lower reaches of Woleebee Creek, which were considered to be rainfall-derived surface water, based on their non-clear appearance and field water quality (547 µS/cm). The verification program considered it unlikely that Woleebee Creek is a baseflow fed reach.

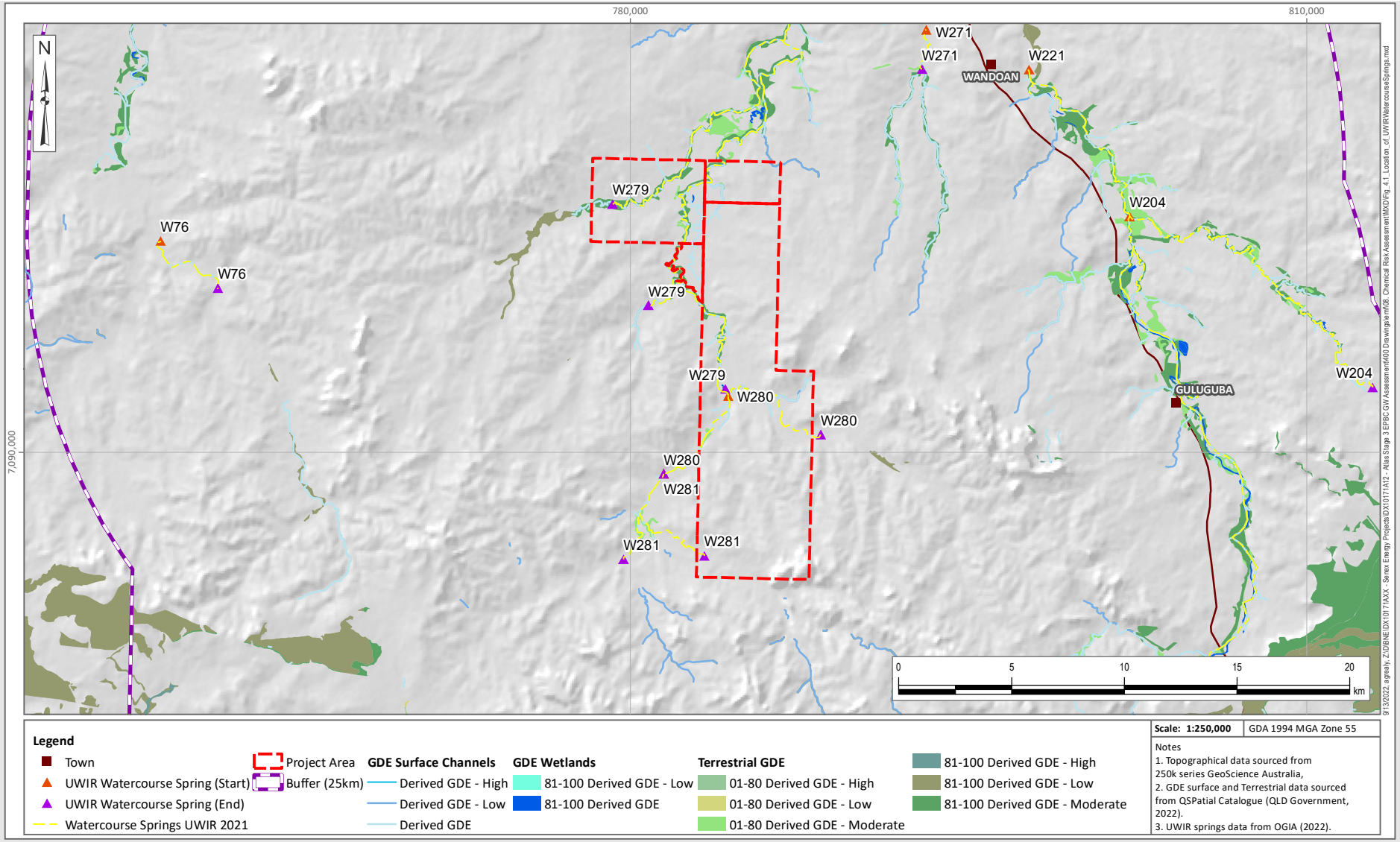

Figure 3.4 Location of UWIR Watercourse Springs and Mapped Potential GDEs

Potential Terrestrial GDEs

Terrestrial GDE mapping has identified potential terrestrial GDEs within the Project area (State of Queensland 2018a). Terrestrial GDEs through the Project area are associated with Wandoan Creek, Woleebee Creek, Conloi Creek and Hellhole Creek. An assessment of these GDEs has been undertaken by ERM (ERM 2022a).

Using the terminology developed as part of the DES GDE mapping, the following potential terrestrial and aquatic GDE types have been identified as occurring within the Project area are:

- Riverine wetlands on alluvia overlying sandstone ranges with fresh, intermittent flow.
- Treed regional ecosystems on alluvia overlying sandstone ranges with fresh, intermittent flow.

These potential GDE types correspond with regional ecosystems (REs) that occur on alluvial landscapes, associated with watercourses and the adjacent floodplain areas. Based on the DES GDE mapping rule sets, these vegetation communities rely on alluvial aquifers that form from particles such as gravel, sand, silt and/or clay deposited by fluvial processes in river channels or on floodplains (ERM 2022a).

RE 11.3.25 (Forest Red Gum *Eucalyptus tereticornis* or River Red Gum *Eucalytpus camaldulensis* woodland fringing drainage lines) is the most widely abundant vegetation community identified with the potential to be a GDE, however, interconnected patches of other REs are present (RE 11.3.2 Poplar Box *Eucalyptus populnea* woodland on alluvial plains and RE 11.3.27 freshwater wetlands: Coolabha *Eucalyptus populnea* woodland on alluvial plains) (ERM 2022a). Historic land clearing is known to have occurred throughout the Project area that has impacted the condition of terrestrial GDEs, particularly along creek lines and water courses. Grazing pressure is also likely to influence the ecological condition of RE patches and their value for maintaining biodiversity levels.

Average root depth for species of Eucalyptus present is known, based on literature reviews, to range from 9 m to 22.6 m, depending on the species and the interactions between geomorphology and plant physiological traits.

A review of available literature on tree rooting depth for those dominant species present in each of the ground-truthed REs has been completed to understand how dependent these species may be on groundwater (Table 3.5) (From ERM 2022a)).

Table 3.5 Potential GDEs, Vegetation Description and Tree Rooting Depth (ERM 2022a)

Regional Ecosystem Code and name	GDE Type	Dominant Flora Species	Field Verified Condition	Groundwater Dependence and Rooting Depth
11.3.2 *Eucalyptus populnea* woodland on alluvial plains	Treed regional ecosystems on alluvial overlying sandstone ranges with fresh, intermittent flow	Poplar Box *Eucalyptus populnea*	Majority of this RE and potential GDE is in a remnant condition. Occurs on alluvial plains adjacent to riparian vegetation.	12.6 - 22.6 m (Kath et al. 2014) for Poplar Box
11.3.17 *Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plain	Treed regional ecosystems on alluvia overlying sandstone ranges with fresh, intermittent flow	Poplar Box Brigalow *Acacia harpophylla* Belah *Casuarina*	Identified as majority remnant vegetation and occurs on adjacent alluvial floodplains, usually connected to the adjacent riparian zone.	Poplar Box- 12.6-22.6 m (Kath, et al. 2014) Brigalow - Unknown Belah - Unknown

Regional Ecosystem Code and name	GDE Type	Dominant Flora Species	Field Verified Condition	Groundwater Dependence and Rooting Depth
		cristata		
11.3.19 *Callitris glaucophylla*, *Corymbia spp.* and/or *Eucalyptus melanophloia* woodland on Cainozoic alluvial plains	Treed regional ecosystems on alluvia overlying sandstone ranges with fresh, intermittent flow	White Cypress Pine *Callitris glaucophylla*; *Corymbia spp*. And/or Silver-leaved Ironbark *Eucalypus melanophloia*	Occurs on alluvial floodplains adjacent to riparian zone.	Up to 6 m (*Callitris glaucophylla*) (Eberbach, 2003) Silver-leaved Ironbark - Unknown but likely potential to be similar to Forest Red Gum
11.3.25 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Riverine wetlands on alluvia overlying sandstone ranges with fresh, intermittent flow	Forest Red Gum	Largely confined to fringing riparian vegetation along watercourse and is the most common RE and GDE type within the Project area. Varying conditions, ranging from advanced regrowth to remnant.	At least 9 m and assumed to reach groundwater reservoirs (Forest Red Gum) (Ausecology Pty Ltd, 2018) 12.1 - 22.6 m (*E. camaldulensis*) (Jones et al. 2020)
11.3.27 Freshwater Wetlands	Riverine wetlands on alluvia overlying sandstone ranges with fresh, intermittent flow	Variable freshwater vegetation ranging from open water to fringing sedgelands and eucalypt woodlands. Forest Red Gum	Occurs largely in closed depressions or oxbows adjacent to watercourses or on adjacent alluvial plains.	*Eucalyptus camaldulensis*- 12.1- 22.6 m (Jones, et al., 2020) Forest Red Gum- at least 9 m (Ausecology Pty Ltd, 2018) *Eucalyptus coolabah* possibly at least 7-8 m (Costelloe, J. F. 2016)

Third-Party Groundwater Users

Groundwater in the GAB is managed within the *Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017* (State of Queensland 2017b) under the *Water Act 2000* (State of Queensland 2018b).

Within a 25 km boundary of the lease boundaries of the Project, there are 810 groundwater bores present. Aquifer attributions have been provided by OGIA (OGIA 2022). Of these 810, 79 bores are not recorded in the registered groundwater bore database (GWDB) (State of Queensland 2022).

Of the 731 registered bores, 590 are existing, 12 are proposed and the remainder are abandoned but usable or decommissioned. Of the 669 existing and unknown status bores (OGIA 2022):

- 410 bores have been identified as being used for water supply purposes (WS).
- 32 are potential water supply bores (PWS);219 are not used for water supply, they may be monitoring bores or not currently used for water supply (NWS); and

- eight are recent drills and the purpose is unknown.

Groundwater abstraction for stock and domestic (S&D) use is the dominant water use purpose within the vicinity of the Project. There are five bores noted as town water supply and ten for intensive stock use. The locations of existing bores are shown on Figure 3.5.

Baseline assessment programs were undertaken by Senex as follows:

- ATP 2059 – April 2022 – two registered bores;
- PL 445 – June 2022 – one registered bore; and
- PL 209 – June 2022 and March 2023 – 27 registered bores and one unregistered bore.

In summary, 17 bores assessed as part of the baseline assessment were used for stock and domestic on private land. Seven bores are not in use. Groundwater levels ranged from artesian (0.4 m above ground), to ~37 mbGL. 17 existing bores were screened in the Gubberamunda Sandstone with only two in the Upper Springbok Sandstone and one in the Orallo Formation.

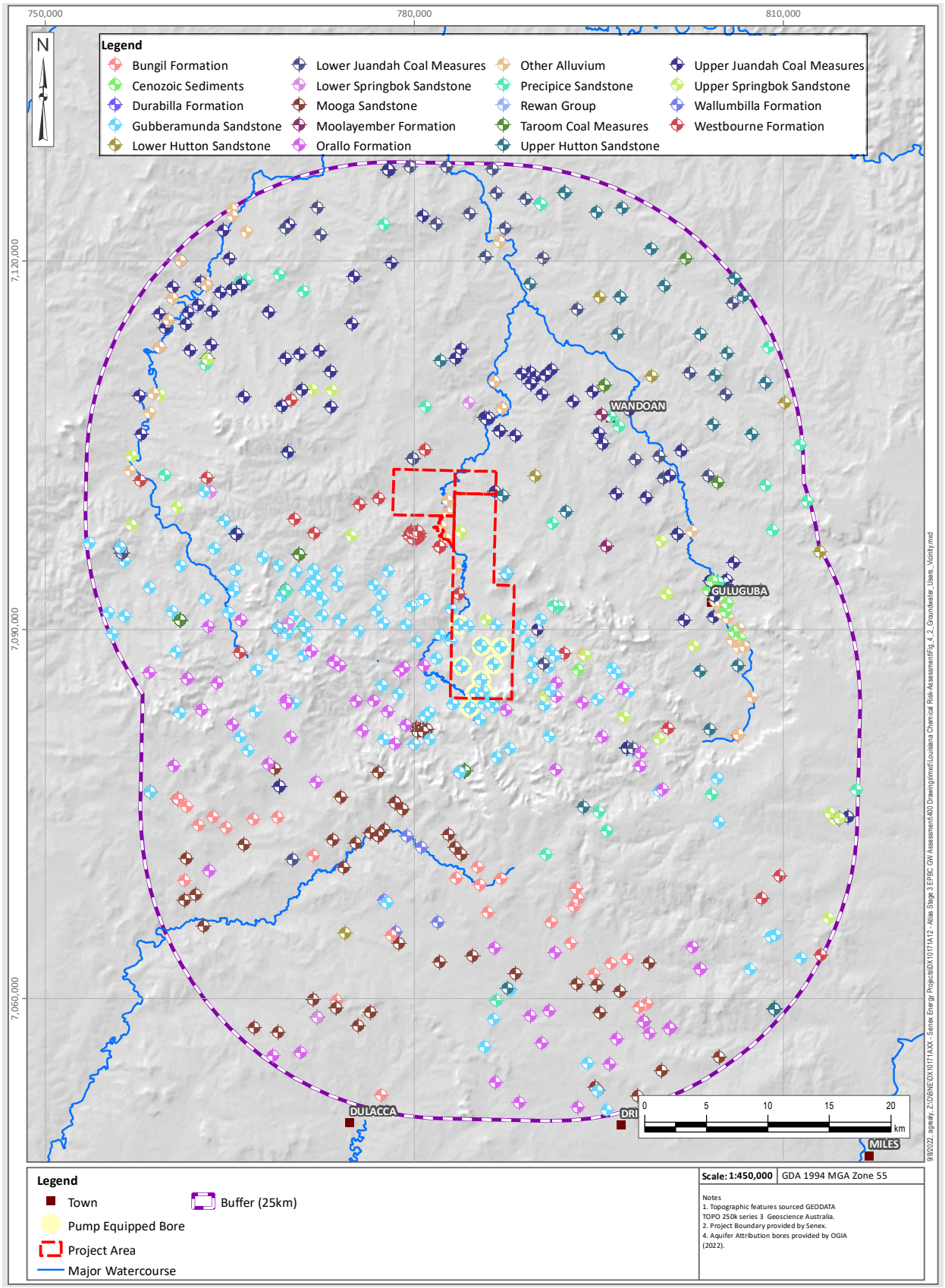

Figure 3.5 Registered and Pump-Equipped Groundwater Bores in the Vicinity of the Project

3.4 Summary of MNES Receptors

The potential MNES receptors known or with a high likelihood of occurrence within the Project area are summarised in Table 3.6.

Table 3.6 Summary of Potential MNES Receptors in the Project area

MNES	Type	Name	Notes
Nationally Threatened Species and Ecological Communities	Threatened Ecological Communities	Brigalow	Analogous type descriptions do not suggest reliance on groundwater; unknown.
		Poplar Box Grassy Woodland on Alluvial Plains	Potential dependence on groundwater at depth.
	Threatened Species	Flora ▪ Ooline ▪ Belson's panic ▪ Slender Tylophora	No direct dependence on groundwater.
		Fauna ▪ Koala ▪ Central greater glider ▪ Squatter pigeon ▪ Yellow-bellied glider ▪ Australian painted-snipe ▪ Dulacca woodland snail ▪ South-eastern glossy black cockatoo ▪ Corben's long-eared bat ▪ Collared delma ▪ Yakka skink ▪ Dunmall's snake ▪ Southern Whiteface ▪ Brown treecreeper ▪ Painted Honeyeater ▪ Diamond Firetail ▪ Northern Quoll ▪ Grey snake ▪ Five-clawed worm-skink ▪ White-throated Needletail ▪ Fork-tailed swift ▪ Oriental cuckoo ▪ Satin flycatcher ▪ Rufous fantail ▪ Common sandpiper ▪ Sharp tailed sandpiper ▪ Latham's snipe ▪ Yellow-bellied Glider (south-eastern)	Koala - Indirectly dependent on groundwater Painted-snipe – potential dependence, however, limited suitable habitat indicates occasional transient visitation. Others – no direct groundwater dependence on groundwater
Water Resources	Surface Water	The following creeks on tenement and their tributaries: ▪ Woleebee Creek ▪ Wandoan Creek	These creek systems are ephemeral systems and no surface water users have been identified within the vicinity of the Project area. ▪ Surface water dependent ecosystems and species – Aquatic biota is lacking due to the ephemeral nature of the water courses. RE communities are present in association with watercourses. ▪ Surface water users – None identified ephemeral systems.

MNES	Type	Name	Notes
	Groundwater	Walloon Coal Measures	Productive coal seam; Supports third-party groundwater abstraction off tenement.
		Springbok Sandstone	Aquifer; Supports limited third-party groundwater abstraction off tenement.
		Gubberamunda Sandstone	Aquifer; Supports spring complexes and watercourse springs; Moderate third-party groundwater abstraction off tenement.
		Orallo Formation	Minor discontinuous aquifer; Supports limited third-party groundwater abstraction off tenement.
		Superficial deposits	Aquifer; Not utilised for groundwater abstraction.
		GDE and species	Field verified terrestrial GDEs have been identified in the Project area.
		Groundwater users	Nine confirmed operational bores sourcing groundwater from the Gubberamunda Formation.

3.5 Exposure Pathways

The assessment identified risk events ('source'), the potential pathways, and the resulting MNES receptors. This is summarised in Table 3.7.

The main pathways for contaminants from drilling fluids are:

- Overland flow – chemicals spilled at the surface (including flow back produced water), if not contained, may travel via overland flow into nearby surface water systems. This could result in degradation of surface water quality in the local creek systems and may have potential health impacts on dependent threatened or migratory species if this water is consumed. As the surface water systems in the Project area are mainly ephemeral drainages, the risk of contaminants reaching this system will be higher during periods of rainfall. Contaminant concentrations at the receptor may be significantly lower than at the source due to dilution in the surface water system.
- Soaking into the ground – chemicals spilled at surface may soak into the ground. This could impact the water quality of the shallow groundwater system (and subsequently the surface water system if there is a connection).
- Groundwater flow – chemicals may be lost from the well (invasion risks) into the Surat Basin units and WCM degrading the groundwater quality in these sediments. Contaminated groundwater may then flow through the coal measures and be subsequently extracted from landholder bores or discharged to surface at a groundwater dependent ecosystem or a watercourse spring (if present). If a connection between the WCM and other aquifers exists, either through connections at the CSG well (if well integrity is compromised) or through fractures, there may be potential for contaminant migration and subsequent pollution of these aquifers. Contaminant concentrations at receptors are likely to be much lower than those at source due to dilution, dispersion, sorption and degradation of the contaminant prior to reaching the receptor.
- Leaching through the soil – in most cases, drilling mud will be disposed off-site at the end of its lifecycle. However, in some cases drilling muds will be disposed using mix-bury-cover methods, if the residual drilling material meets the approved quality criteria. Land application of residual drilling material may also be considered once it has been assessed and certified by a suitable qualified third-party. If disposed of incorrectly, chemicals from

the drilling mud may leach from the muds into the soil. This leachate may enter the groundwater system, moving along groundwater flow pathways as explained above.

The exposure assessment predicts direct impacts for water MNES. TECs and species are unlikely to be directly impacted using drilling additives during drilling, workover or completions. Threatened fauna and flora could hypothetically be indirectly affected through drinking contaminated surface water if a spill at surface occurred.

The distance of these pathways is currently unknown and has been estimated, as drilling locations have not been confirmed.

Chemicals are generally at their largest volumes and highest concentration during transport and storage. Concentrations are generally lower for intentional repeated releases, such as in the use of chemicals in drilling. Risks to the receiving environment are likely to be higher at the surface where chemicals are more concentrated and unlikely to disperse or be diluted immediately following release (DoEE 2017).

Table 3.7 Exposure Assessment, Source-Pathway-Receptor

Risk Type	Source/Risk Event	Pathway	Direct MNES Impact	Indirect MNES Impact
Above ground chemical spills and leaks	Chemical onsite storage in containers or tanks; Transfer of chemicals during use or mixing; Transportation of chemicals (e.g. trucks, pipelines); Management of flowback water and produced water, drilling method, well siting.	Overland flow to surface water systems	Surface water contamination	Potential reduction in water quality in the creek system. Potential health impacts to fauna species accessing contaminated surface water.
		Soak into the ground	Groundwater contamination, soil contamination	Potential reduction in water quality in shallow aquifer system; Springbok Sandstone, Gubberamunda Sandstone, Orallo Formation, Mooga Sandstone and impacts on water users. Potential health impacts to ecological communities and flora, and fauna accessing contaminated groundwater (plants). Potential reduction in water quality at GDEs and watercourse springs.
Below ground chemical spills and leaks	Inadequate well closure and plugging; Loss of well integrity, well siting.	Connections between aquifers (due to bore integrity)	Groundwater contamination	Potential reduction in water quality in aquifer systems; WCM; Springbok Sandstone, Gubberamunda Sandstone, Orallo Formation, Mooga Sandstone and impacts on water users. Potential reduction in water quality at GDEs and watercourse springs.
Other	Inappropriate reuse / disposal of drill cuttings and fluids.	Leaching through soil	Potential soil, water contamination	Potential reduction in water quality in shallow aquifer system; Springbok Sandstone, Gubberamunda Sandstone, Orallo Formation, Mooga Sandstone. Potential health impacts to ecological species and communities accessing contaminated groundwater (plants).

4 SCREENING ASSESSMENT FINDINGS

4.1 Chemical Classification and Risk Assessment

The Chemical Risk Assessment (CRA) and the CRAF were undertaken in accordance with leading industry practice risk assessment methodologies both internationally and domestically, which meets the DCCEEW "best practice" requirement.

A total of 59 chemicals in 47 drilling fluids were assessed (Table 4.1) using the CRAF, provided in Appendix I. The CRAF for review of chemicals to be used in CSG operations follows a two-step process:

- Step 1: Classification
- Step 2: Assessment

Classification involved identifying products and chemicals to be used during the drilling process. It details how the products will be used and assesses the hazardous nature of the products and the chemicals within them.

Table 4.1 Drilling Fluids and Chemicals Assessed

Drilling Fluid	Chemicals Contained in the Fluid	Product Function
ALDACIDE G	Glutaraldehyde, CAS 111-30-8: 10-30%; Methanol, CAS 67-56-1: 0.1-1%;	Biocide – Glutaraldehyde based
BARACARB 1200	Crystalline silica, quartz CAS 14808-60-7: 0.1 - 1%;	Bridging agent
BARAZAN D	Xanthan gum polymer	Viscosifier
Caustic Soda	Sodium Hydroxide, CAS 1310-73-2	pH control, Alkaline source
Duo-Vis	Glyoxal 107-22-2	Viscosifier
DBNPA	2,2-Dibromo-3-nitrilopropionamide, CAS 10222-01-2: 20%; Dipropylene glycol, CAS 25265-71-8: 60%; water, CAS 7732-18-5: 20%	Biocide
FORM-A-BLOK	Wollastonite (Ca(SiO3)), CAS 13983-17-0: 30-60%; Cellulose, CAS 9004-34-6: 10-30%; Kaolin, CAS 1332-58-7: 5-10%; Polyvinyl alcohol 9002-89-5	Lost circulation material; wellbore conditioning
COHO AUS DEX	Starch CAS 9005-25-8 >60%	Avoid excess filter cake in the bore
Glutaraldehyde 25%	glutaraldehyde, CAS 111-30-8: 25% water, CAS 7732-18-5: Balance	Biocide
IDCIDE-20	TETRAKIS(HYDROXYMETHYL)PHOSPHONIUM SULFATE, CAS 55566-30-8: 18-25%, Water, CAS 7732-18-5: Remainder; Biocide	Biocide – THPS based
Nuosept 78	2,2',2"-(Hexahydro- CAS: 4719-04-4: 78%; 1,3,5-triazine-1,3,5- CAS: 141-43-5: 1-3%. Biocide	Biocide
Potassium Chloride (KCl)	Potassium Chloride (KCl)	Clay control and weight agent
Safe-Carb 250	Calcium Carbonate, CAS 471-34-1: 60-100%; Crystalline silica (impurity), CAS 14808-60-7: less than 1%;	Bridging and weighting agent
Soda Ash	CAS: 497-19-8 Sodium carbonate	pH control
STOPPIT	Crystalline silica, quartz CAS 14808-60-7: 0.1 - 1%;	Lost Circulation Material - Course Granular Material

Drilling Fluid	Chemicals Contained in the Fluid	Product Function
THPS 50%	Tetrakis(hydroxymethyl)phosphonium sulfate, CAS 55566-30-8: 50%; triethylamine, CAS 121-44-8: 1-10%;	Biocide
COHO F2V N12	CAS 3323-53-3; main component assessed by KCB	Clay inhibition
COHO F2V CS	Nitrogen containing Polysaccharide, CAS: 56780-58-6 (95-99%)	Clay inhibition
COHO Floc C	CAS 3323-53-3; main component assessed by KCB	Clay inhibition and encapsulation
Fiber (F/M/C).	Organic fibrous material mixture > 60% Crystalline silica (impurity) <5%.	Loss control; bridge microfractures and stabilise geological formations.
FOAM-X ACB-143	Triethanolamine, CAS 102-71-6: 30 to 60% Diethanolamine, CAS 111-42-2: 5 to 10% Potassium hydroxide, CAS 1310-58-3: 10 to 30%	Accelerator
FOAM-X ACB-144	Ammonium Persulfate, CAS 7727-54-0: 60 to 100%	Accelerator
FOAM-X ACF-144	Ethoxylated C6-C10 Alcohol, CAS 68037-05-8; 30 to 60% Ammonium Sulfate 2-(2-butoxyethoxy)ethanol, CAS 112-34-5: 10 to 30%	Water foamer
FOAM-X ACG-1412	This product is not regulated. None of the substances in this product are hazardous	Viscosifier
FOAM-X ACS-141	Polyethylene glycol diacrylate, CAS 26570-48-9: 3 to 7% N,N'-methylenediacrylamide	Viscosifier
FOAM-X ACX-145	Potassium Carbonate, CAS 584-08-7: 10 to 30% Boric Acid, CAS 10043-35-3: 7 to 13% Potassium Hydroxide, CAS 1310-58-3: 7 to 13%	Enhancer
Foam-X ACF-147	2-Butoxyethanol, CAS 111-76-2 Cocoamidopropyl betaine, CAS 61789-40-0	Foamier
COHO Glute 9	Gluteraldehyde, CAS 111-30-8	Biocide
COHO Defoam	2-Ethyl-1-hexanol, CAS 104-76-7	Drilling fluid additive
COHO SAPP	Sodium acid pyrophosphate, CAS 7758-16-9	Cleaners, drilling mud, metal cleaning and phosphatising, detergents, ceramics, paint, paper, cement, water treatment, Acting as pH-buffering agent, chelating agent and stabiliser, raising agent, food additive, sequestrant.
COHO Quickseal FMC	NA: Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Lost Circulation Material – fibrous material made of coconut fibers, mixture of natural and polymer fibers
Blended Cement	Hydraulic Silicate Cement, CAS 65997-15-1 Granulated Blast Furnace Slag, CAS 65996-69-2 Coal Fly Ash, CAS 68131-74-8 Quartz, CAS 14808-60-7 Calcium Sulfate Dihydrate (Gypsum), CAS 10101-41-4 Calcium Oxide, CAS 1305-78-8 Limestone, CAS 1317-65-3 Chromium (6+), CAS 18540-29-9 (<10ppm)	Set and develop compressive strength
CM102	Ethylenediaminetetra (methylenephosphonic acid), CAS 1429-50-1	Extend cement slurry pumping time
CM200	Polycarboxylic acid, sodium salt, CAS 62601-60-9 (40%)	Improve cement slurry mixability
CM300	Bentonite CAS 1302-78-9 (>98%)	Absorb water allowing lower cement densities
CM301	Sodium Silicate solution, CAS 1344-09-8	Absorb water allowing lower cement densities
CM401	Petroleum Gas Oil, CAS 64741-44-2, 30 to 60 % Hydrotreated Light Distillate, CAS 64742-47-8,10 to 30 % Polypropylene Glycol, CAS 25322-69-4 Stearic Acid, CAS 57-11-4 1-Octanol, CAS 111-87-5	Reduce foam in cement slurry

Drilling Fluid	Chemicals Contained in the Fluid	Product Function
	Ethoxylate Tall Oil, CAS 61791-00-2 1-Decanol, CAS 112-30-1 Paraffin (hard), CAS 8002-74-2	
CM500	Ethylene Glycol, CAS 107-21-1 (antifreeze)	Control cement slurry fluid loss
CM502	2-Acrylamido-2-methyl-1-propanesulfonic acid, CAS 15214-89-8	Control cement slurry fluid loss
CM600	Calcium chloride, CAS 10043-52-4	Reduce cement slurry pumping time
CM601	Triethanolamine, CAS 102-71-6 <=100% Diethanolamine, CAS 111-42-2, <=100%	Reduce cement slurry pumping time
Drilling fluids not assessed due to inert constituents		
LCM/Kwikseal Fine	No chemicals, this contains: Granular, Flake and Fibrous Materials. Nut Shell, Woodfibers, Cellulose, Synthetic Fiber and Synthetic Flakes;	Lost Circulation Material
LCM/Kwikseal Med	No chemicals, this contains: Granular, Flake and Fibrous Materials. Nut Shell, Woodfibers, Cellulose, Synthetic Fiber and Synthetic Flakes;	Lost Circulation Material
PAC	Polyanionic Cellulose	Lost Circulation Material
Poly-Plus RD	PHPA acrylic copolymer	Lost Circulation Material

Each chemical was placed into a tier through the screening assessment (persistence, bioaccumulative and toxic (PBT) assessment). A summary of the number of chemicals for each tier is provided in Table 4.2. The following are reviewed within the screening assessment to determine the appropriate chemical tier level:

- Persistence:
  - Persistence refers to whether, and how fast, a chemical degrades in the environment over time. Chemicals that are persistent in the environment may cause chronic health problems, particularly in humans and animals that are high in the food chain.
  - The Stockholm Convention provides scientifically based criteria for identifying persistent organic pollutants and is used in this assessment to define a chemical's persistence in water soil and air and has been adopted in the *Environmental Risk Assessment Guidance Manual: for industrial chemicals* (EPHC 2009b).
- Bioaccumulation:
  - Bioaccumulation is the general term describing a process by which chemicals are taken up by a plant or animal either directly through exposure to a contaminated medium (soil, sediment, water) or by eating food containing the chemical (DoEE 2017).
  - The criteria for bioaccumulation used in the assessment has been taken from the *Exposure draft: Chemical risk assessment guidance manual: for chemicals associated with coal seam gas extraction* (DoEE 2017), which adopts the criteria from the *Environmental Risk Assessment Guidance Manuals* (EPHC 2009b; 2009a).
- Toxicity:
  - Ecotoxicity data are used to determine the toxic hazards posed by a chemical to terrestrial and aquatic organisms. The assessment process involves collecting all

available acute and chronic data and considering how this data can inform the assessment (DoEE 2017).

- The minimum data set for quantitative CSG chemical risk assessments comprises acute toxicity tests for fish and invertebrates and a chronic test for algae, however chronic data for fish and invertebrates are preferable if it is available.
- Acute and chronic toxicity are assessed against criteria from the *Exposure draft: Chemical risk assessment guidance manual: for chemicals associated with coal seam gas extraction* (DoEE 2017).

The overall tier level is determined by the highest tier value assigned for each criteria (for example, a chemical which is determined to be Tier 1 for toxicity but Tier 2 for persistence is assigned as a Tier 2 chemical).

The findings of the Chemical Risk Assessment are included in:

- The Register of Assessed Chemicals, with links to the individual assessments, available via the Senex website.
- Appendix II Chemical Register.
- Appendix III Toxicological profiles for each Tier 1 chemical.
- Appendix IV Toxicological profiles and qualitative risk assessment for each Tier 2 chemical.
- Appendix V SDS for each drilling fluid.

Table 4.2 Summary of Results of the Assessment

Tier	General Description	Category	Assessment	Number of Chemicals Assigned in Each Tier in this Assessment
Pre-screen	Previously assessed by national or international regulators and considered to be of low hazard	Chemicals of low concern	None	6
Tier 1	Not persistent, no potential concerns with bioaccumulation in soil or impacts on flora and fauna. Toxicity: harmful		Screening only	37
Tier 2	Persistent Does not bioaccumulate Acute toxicity: toxic, long-term toxicity – toxic with long lasting effects.	Chemicals of potential concern	Screening and qualitative risk assessment	16
Tier 3	Persistent Does bioaccumulate. Acute toxicity – very toxic, long-term toxicity – very toxic with long lasting effects	Chemicals of Potentially High Concern	Screening, qualitative risk assessment, quantitative risk assessment	0

4.2 Qualitative Risk Assessment

A qualitative risk assessment was completed for 16 chemicals as listed in Table 4.3. The chemicals were assessed based on their persistence, bioaccumulation or toxicity (both acute and chronic considered). Most of the chemicals had only had one of the three categories triggered as a Tier 2 chemical. Paraffin and 1-Decano triggered the Tier 2 assessment for two out of the three categories.

The qualitative risk assessment expanded on the characterisation of the chemical to understand how it may react in the receiving environment. The qualitative risk assessment included:

- Further hazard characterisation;
- Determination of pathways to identified receptors; and
- A risk assessment which examines the likelihood, consequence and subsequent magnitude to MNES from the chemical. This is undertaken both with and without management and mitigation measures in place.

The chemical assessed under the framework were generally defined as low to moderate risk to water related MNES with consideration to likelihood of an event occurring and the consequence to water MNES from each individual chemical. After mitigation measures have been put in place, which reduces the likelihood of an event occurring, all these chemicals are considered to have a low or insignificant risk to water related MNES.

Table 4.3 Tier 2 Listed Chemicals

Chemical Name	CAS No.	Listed as a Contaminant of Concern (COC) on Relevant Databases?	Persistence Tier	Bioaccumulation Tier	Acute Toxicity Tier	Chronic Toxicity Tier
N,N'-methylenediacrylamide	110-26-9	No	1	1	2	-
Gluteraldehyde	111-30-8	No	1	1	2	1
1-Decanol	112-30-1	No	1	2	2	2
Ethylenediaminetetra (methylenephosphonic acid)	1429-50-1	No	2	1	1	-
2-Acrylamido-2-methyl-1-propanesulfonic acid	15214-89-8	No	2	-	1	-
Nitrogen containing Polysaccharide	56780-58-6	No	-	-	-	-
Stearic Acid	57-11-4	No	1	2	1	1
Polycarboxylic acid, sodium salt	62601-60-9	No	-	-	-	-
Granulated Blast Furnace Slag	65996-69-2	No	2	1	1	1
Ethoxylated C6-C10 Alcohol	68037-05-8	No	-	1	-	-
Coal Fly Ash	68131-74-8	No	2	1	1	1
Paraffin (hard)	8002-74-2	No	2	2	1	1
Cellulose	9004-34-6	No	2	1	1	1

Chemical Name	CAS No.	Listed as a Contaminant of Concern (COC) on Relevant Databases?	Persistence Tier	Bioaccumulation Tier	Acute Toxicity Tier	Chronic Toxicity Tier
2,2-dibromo-3-nitrilopropionamide*	10222-01-2	No	1	1	3	3
Chromium (6+)*	18540-29-9	No	2	2	3	-
Petroleum Gas Oil*	64741-44-2	No	2	-	2	3

* These chemicals were initially identified as Tier 3, however the qualitative risk assessment confirmed that these chemicals will only be used for plug and abandonment and production. There is no pathway from the coal measures to aquatic organisms and so they have been downgraded to a Tier 2 chemicals.

4.3 Quantitative Risk Assessment

A quantitative risk assessment was initially undertaken for the following three chemicals:

- 2,2-dibromo-3-nitrilopropionamide;
- Chromium (6+); and
- Petroleum gas oil.

However, on further review of the qualitative assessments of these chemicals, including a review of their proposed use, they were downgraded to Tier 2 chemicals. These chemicals are proposed for use during production and plug and abandonment (if no suitable alternatives are identified), the chemicals will be exposed to the WCM only. There is no direct pathway from the WCM to surface water systems or their aquatic ecosystems within at least 1 km of the proposed CSG wells. There is no direct pathway to third-party bores in the Surat Basin aquifer units such as the Gubberamunda Sandstone. Vertical separation due to the presence of the WCM upper non-productive zone and the Westbourne Formation aquitard prevents connection.

4.4 Cumulative Impacts

The likelihood of chemical migration away from the bore or seepage are considered highly unlikely due to the following:

- Drilling and construction and well maintenance activities are short term where the contaminant source does not persist;
- Quantities are restricted to maintain optimal conditions;
- Drilling chemicals are designed to maintain bore integrity and limit fluid losses;
- Cleaning/treatment chemicals are designed to improve flow which will enhance removal from the formation during pumping;
- Operational groundwater pumping will develop a low groundwater pressure gradient towards the well, inducing groundwater flow towards the well where migration would need to move in the opposite direction to groundwater flow.
- Tight aquitard sediments of the Westbourne Formation acts as a barrier to mitigate migration pathways.

Potential for cumulative impacts is limited due to distance between well pads. Well pads are 500 to 750 m apart; the geochemical modelling suggests that at this distance concentrations of chemicals from single wells will be negligible.

Produced water is transferred to infrastructure on neighbouring Project Atlas (PL 1037). Additional storage facilities will be constructed if/when required. The use of existing infrastructure reduces the risk of spills or seepages from additional structures and any cumulative impacts that may occur because of this.

The evaluation of the chemicals indicates that there is negligible incremental risk posed by their use and the proposed management and monitoring controls are appropriate to ensure that the risk to MNES (and non-MNES) receptors remains low.

All the compounds utilised in drilling fluids are not considered to be persistent and bioaccumulative and toxic (PBT) in the environment. As such, the compounds are expected to degrade in the subsurface, or where these compounds are present in drilling waste, they will subsequently readily degrade or dissociate in the environment and will not bioaccumulate in terrestrial or aquatic species. Hence the presence of these constituents in the drilling fluid does not warrant a combined /cumulative evaluation in this risk assessment.

5 GEOGENIC SCREENING RISK ASSESSMENT

In accordance with the CRAF, a screening level assessment has been conducted on geogenic constituents recovered in produced water and drill cuttings. This assessment takes into account results of eight samples of drill cuttings and results for 1,495 produced water samples from CSG production wells that have been provided by Senex. The data is considered representative of geogenic chemicals in drill cuttings and produced water which may be stored. The drilling cutting samples were sourced from (GDA 2020):

- Atlas-84: -26.233995, 149.822147
- Atlas-165: -26.230379, 149.842089

The screening assessment evaluated the produced water results against:

- Environmental and Ecological:
  - Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018).
  - ANZECC 2000 Trigger Levels for Irrigation Use Short Term Up to 20 Years (ANZECC 2000).
  - ANZECC 2000 Trigger Levels for Livestock Watering (ANZECC 2000)

The screening criteria hierarchy utilised the following for solid residual drilling material includes:

- Environmental and ecological (including phytotoxicity):
  - Risk-Based Screening Levels for the Protection of Livestock Exposed to Petroleum Hydrocarbons, Publication Number 4733 (API 2004).
  - NEMP Schedule B5a – areas of Ecological Significance and Urban Residential and Open Public Space for ecological screening levels (ESLs) (NEMP 2011).

5.1.1 Geogenic Chemicals Within Produced Water

The laboratory data from Senex were assessed to identify potential hazards associated with the geogenic chemicals in the produced water. Maximum recorded concentrations of each constituent in the dataset were compared to the guidelines (ANZG 2018; ANZECC 2000) (Table 5.1). The maximum concentration of all the data was below the available guidelines except for copper. The maximum concentration for copper was 0.223 mg/L with the standards for ANZG (2018) being 0.0014 mg/L. Of the 48 analyses of copper, only eight were above the detection limit with the remaining results being 0.001 or 0.002 mg/L. It is possible that the result of 0.223 mg/L is an outlier or an erroneous result.

Based on the available data the potential hazard associated with the produced water is low.

Table 5.1 Maximum Concentration Compared to Available Water Quality Guidelines

Analyte		Limit of Reporting	ANZECC 2000 Trigger Levels for Irrigation Use Short Term Up to 20 Years (mg/L)	ANZECC 2000 Trigger Levels for Livestock Watering (mg/L)	ANZG 2018 Freshwater 95% Percentile (mg/L)	Maximum Produced Water Concentration (mg/L)
Anions	Fluoride	0.1 mg/L	2	2		**1.8**
Total Metals	Arsenic	0.01 mg/L	2	0.5 – 5	0.024	**0.002**
	Barium	0.001 mg/L	ND	ND		**1.68**
	Boron	0.05 mg/L		5	0.94	**0.42**
	Cadmium	0.0001 mg/L	0.05	0.01	0.0002	**<0.0001**
	Chromium	0.001 mg/L	1	1		**0.004**
	Chromium - Hexavalent (Total)				0.001	
	Cobalt	0.001 mg/L	0.1	1		**<0.001**
	Copper	0.001 mg/L	5	0.4 – 5	0.0014	**0.223**
	Iron	0.05 mg/L	10	Not sufficiently toxic		**3.11**
	Lead	0.001 mg/L	5	0.1	0.0034	**0.003**
	Manganese	0.001 mg/L	10	Not sufficiently toxic	1.9	**0.059**
	Nickel	0.001 mg/L	2	1	0.011	**<0.001**
	Selenium	0.01 mg/L	0.05	0.02	0.0006	**<0.01**
	Zinc	0.005 mg/L	5	20	0.008	**0.0280**
Mercury	Total Recoverable Mercury by FIMS	0.0001 mg/L	0.002	0.002		**<0.0001**

1234 – result below standard
1234 – result above standard

5.1.2 Geogenic Chemicals in Residual Drilling Materials

Residual drilling materials are a combination of fluids (drilling mud and water from the formation) and solids (drill cuttings and solid portions of the drilling mud). Testing of the solid components has been conducted by Senex. There were eight available sets of test results that were compared to the National Park & areas with high ecological value and Beef Cattle guidelines (API 2004; NEMP 2011).

The assessment indicates that there are no parameters that are above the available guidelines. It must be noted that there is only a limited amount of guideline values that could be used.

The risk assessment completed for the chemicals indicated that the likelihood that the drilling material will migrate to sensitive areas is unlikely. Furthermore, in terms of an accidental release to surface water or groundwater the risk is considered low. Due to these aspects, the risk related to the residual drilling material is considered to be low.

Table 5.2 Comparison of Drilling Muds to Available Guidelines

	Unit	Atlas-165-RDM-01	Atlas-165-RDM-02	Atlas-165-RDM-03	Atlas-165-RDM-04	Atlas-165-RDM-05	Atlas-84-RDM-01	Atlas-84-RDM-02	Atlas-84-RDM-03	Atlas-84-RDM-04	Atlas-84-RDM-05	National parks & areas with high ecological value	Beef Cattle
Arsenic	mg/kg	<5	<5	6	6	11	<5	<5	<5	<5	<5	20	
Chromium	mg/kg	2	4	6	4	4	5	4	5	4	6	25 – 50	
Copper	mg/kg	44	29	16	14	30	15	12	20	16	22	15 – 60	
Lead	mg/kg	10	9	8	8	10	10	6	11	8	11	110	
Nickel	mg/kg	4	7	8	6	8	7	4	10	6	7	1 – 25	
Zinc	mg/kg	34	46	56	54	76	59	48	51	46	62	7 – 130	
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	----	<0.5	----	----	----		37.1
Ethylbenzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	----	<0.5	----	----	----		4.86
meta- & para-Xylene	mg/kg	<0.5	<0.5	<0.5	<0.5	1.1	----	<0.5	----	----	----		29.8
Naphthalene	mg/kg	<0.5	<0.5	<0.5	<0.5	0.5	----	<0.5	----	----	----	10	
Sum of PAHs	mg/kg	<0.5	<0.5	<0.5	<0.5	0.5	----	<0.5	----	----	----		0.167
4.4`-DDT	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	----	<1.0	----	----	----	3	
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		5.95

1234 – result below standard
1234 – result above standard

6 RISK MANAGEMENT

6.1 Existing Management Controls

The key risks to MNES from drilling fluids are identified as:

- Above ground chemical spills and leaks to surface water systems through:
  - Transportation of chemicals;
  - Chemical and fuel storage;
  - Emergency and incident support;
  - Well siting (proximity to watercourses);
  - Well construction (methods used to drill and construct the wells); and
  - Management of produced water/flow back water (which may contain drilling chemicals initially). Flowback water is treated the same as produced water as the CSG production wells are immediately connected to the main gathering system.
- CSG production well construction / design/ drilling / integrity results in contamination of aquifers:
  - Well construction;
  - Drilling fluid losses; and
  - Well siting.
- Inappropriate reuse/disposal of drill cuttings and additives.

Key Senex management documents in relation to the mitigation and management of the use of chemicals include:

- Environmental Protocol for Field Development and Constraints Analysis (SENEX-CORP-EN-PRC-019).
- Environmental Management Plan (SENEX-ATLS-EN-PLN-001).
- Contingency Procedures for Emergency Environmental Incidents (SENEX-QLDS-EN-PRC-024)
- Spill Response Plan (SENEX-CORP-ER-PLN-006).
- Incident Management Procedure (SENEX-CORP-HS-PRC-004).
- Senex Hazardous Substances and Dangerous Goods Procedure (SENEX-CORP-HS-PRC-010).
- Atlas Stage 3 Water Monitoring and Management Plan (SENEX-ATLS-EN-PLN-017)

Additionally, for flowback/produced water:

- Atlas Project – Operation Management Plan for Regulated Structures (OPS-QLDS-OP-PLN-008)

The CRAF (Appendix I) details the mitigation and management controls to be implemented to ensure the potential risks associated with the use of chemicals to MNES have been eliminated or reduced to as low as reasonably practicable.

A groundwater quality trigger, action response plan (TARP) will be developed for the Senex groundwater monitoring network, which currently includes 12 monitoring bores. The use of the TARP will assist with understanding changes to groundwater quality that may be related to the drilling fluids. The chemical composition of drilling fluids to be used across Atlas Stage 3 were reviewed and key water quality indicators identified. The key indicator parameters will be assessed after each quarterly monitoring round to identify any trends or changes to groundwater quality. These key indicators include primary indicators of pH, Total Dissolved Solids (TDS), and Total Organic Carbon (TOC). Secondary indicators, which would be reviewed following identification of upward trend development of primary indicators, include a wide range of dissolved metals, salts, ions, and total petroleum hydrocarbons (TPH). Further information on the groundwater trigger methodology, action plan, and corrective actions are discussed in the WMMP.

6.1.1 Spill Response

The Spill Response Plan (SENEX-CORP-ER-PLN-006; Senex 2017) provides the response protocols that must be utilised in order for Senex to respond in an appropriate and timely manner in the event of a spill. The procedure provides a common system and focus for spill response support and response hierarchy, which includes preserving life, ensuring the safety of people, and minimising the impact on the environment. This includes mitigation of possible spills, leaks, and fluid losses at the drill sites (hydraulic hose bursts, leaks below the drill rig, refuelling spills, etc.). The environmental emergency activation pathway as presented by the Spill Response Plan is shown in Figure 6.1.

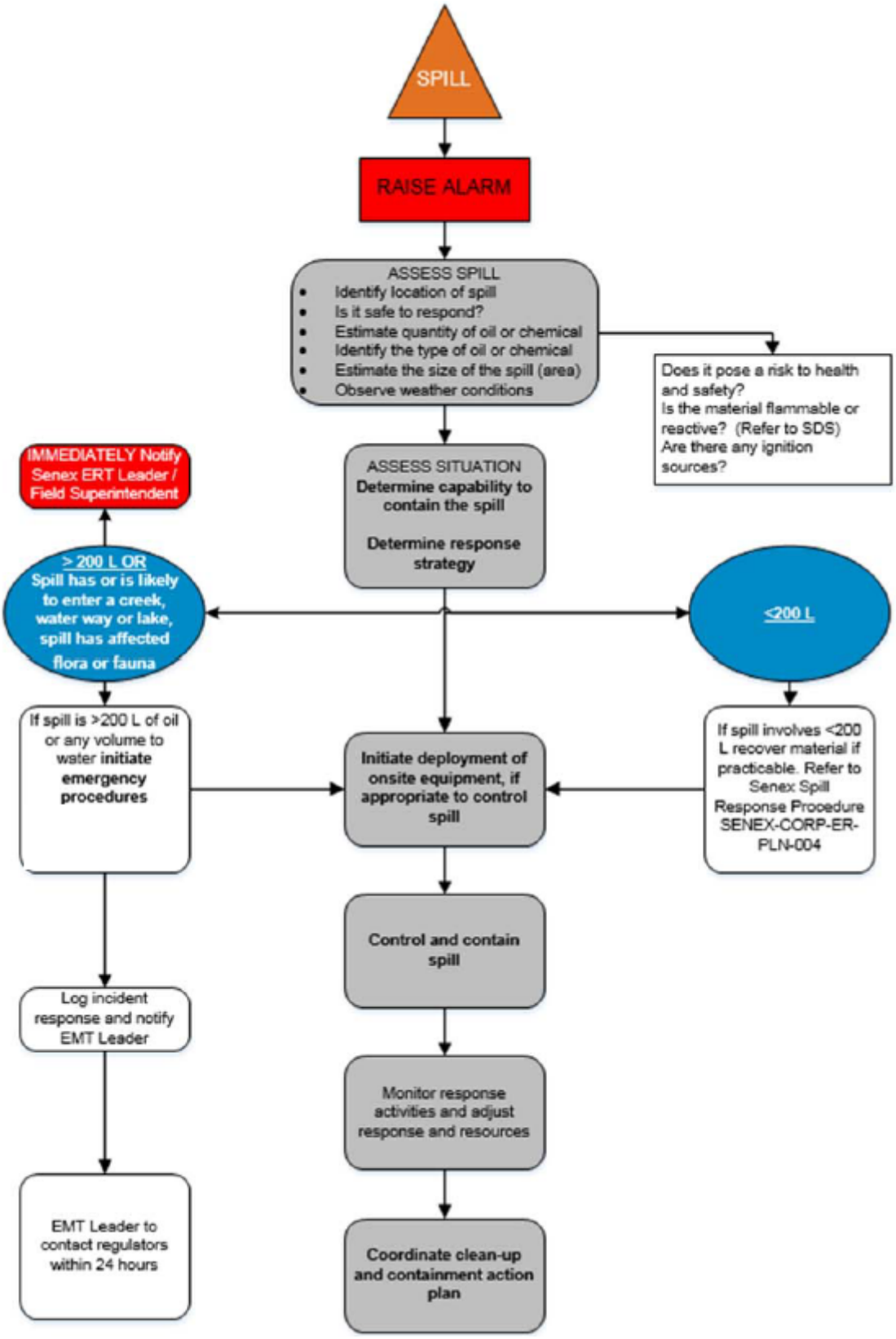

Figure 6.1 Senex Environmental Emergency Activation Pathway

Senex has adopted internationally accepted 'Tiered Response' classifications to describe different categories of spill events, based on severity and location. Tier classifications are determined based

on spill volume, environmental sensitivity, potential social impacts and other factors specific to the event. The Spill Response Plan details tier event trigger limits and the appropriate response required to assist with effective mitigation and management of associated risk due to accidental spill events.

The chemical risk assessment and associated SDS will be adaptively used to inform the spill response associated with accidental release of a chemical to prevent adverse impacts to protected matters. The spill response plan uses information from the CRA and SDS throughout the response process (see Table 6.1).

Table 6.1 Spill Response Plan (Adapted from the Spill Response Procedure (SENEX-CORP-ER-PLN-006; Senex 2017)

Step	Assess the Spill
Assess the Spill	Use the SDS and CRA to: ▪ Inform personnel training requirements. ▪ Inform the selection of appropriate spill response kits and PPE located at chemical storage / handling locations. ▪ Identify the risk to personal health and safety by the type of pollutant. Determine whether the chemical is flammable or reactive. ▪ Determine whether the spill poses a threat to personnel, people, or the environment. ▪ Inform the severity assessment and assign the spill classification (Tier 1: emergency/crisis to Tier 3: minor event). ▪ The potential for impacts to nearby sensitive environmental areas.
Control the Spill	Use the SDS and CRA to inform spill containment and management. The documents can be consulted for advice on accidental release measures, personal precautions, protective equipment, and emergency procedures.
Clean-up Action Plan	Use the SDS and CRA to inform decisions on clean up and rehabilitation, including protective equipment, dependent on the type and nature of the chemical (as documented in the CRA). For chemicals the SDS is to be referred to for information on appropriate handling and transport.

6.2 Recommendations for Mitigation, Management, Monitoring and Reporting

The assessment did not identify any additional mitigation, management or monitoring requirements above those already identified in the CRAF.

Should any future CRA's identify additional risk management requirements, as per the procedures detailed in the CRAF, they will be considered for incorporation into the Constraints Protocol, if/when required.

7 SUMMARY

The goal of the risk assessment was to demonstrate that the potential risks to MNES associated with the chemicals used in CSG operations have been eliminated or reduced as much as practically possible.

The life cycle of the drilling, stimulation and completion was assessed specifically for the proposed operations and included:

- Storage, usage (e.g., blending, injection), and recovery of chemicals throughout operations;
- Beneficial reuse of recovered drilling fluids and cuttings for well lease rehabilitation; and
- Storage of produced water.

A total of 59 chemicals in 47 drilling fluids were assessed. The majority of chemicals are classed as Tier 1 (low risk).

Overall, the risk assessment of the chemicals Senex proposes to use is low after mitigation measures have been implemented.

The management and mitigation practices adopted and implemented by Senex assist with eliminating or reducing the risk to water MNES from the use of chemicals associated with CSG extraction as is reasonably practicable.

8 CLOSING

We would like to thank you for the opportunity to work on this assignment. Should you have any questions, please do not hesitate to contact the undersigned.

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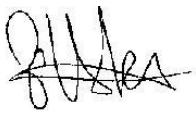

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APPENDIX I

Chemical Risk Assessment Framework (CRAF)

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Senex Energy Ltd

Atlas Stage 3 DCCEEW PD Response

Chemical Risk Assessment Framework

Final

Revision 1

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CLARIFICATIONS REGARDING THIS REPORT

This report is an instrument of service of KCB Australia Pty Ltd (KCB). The report has been prepared for the exclusive use of Senex Energy (Client) for the specific application to the Atlas Stage 3 Project, and it may not be relied upon by any other party without KCB's written consent.

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1 INTRODUCTION

1.1 Background

Senex Energy Pty Ltd (Senex), on behalf of its subsidiaries Senex Assets Pty Ltd and Senex Assets 2 Pty Ltd, is proposing to develop, operate, decommission and rehabilitate new coal seam gas (CSG) wells and associated infrastructure on Authority to Prospect (ATP) 2059, Petroleum Lease (PL) 445, the northern portion of PL 209 and parts of PL 1037 in the central part of the Surat Basin, Queensland (the proposed action).

The proposed action is referred to as the Atlas Stage 3 Gas Project (referred to herein as 'the Project'). KCB Australia Pty (KCB) has been commissioned by Senex Energy Ltd (Senex) to undertake a chemical risk assessment for chemicals to be used in CSG extraction as part of the Project.

The Chemical Risk Assessment Framework (CRAF) has been developed to assess the risk of chemicals used in CSG operations (drilling and completion and water treatment) within the Atlas Stage 3 Project area. The CRAF incorporates current leading industry practice risk assessment methodology for the assessment of the potential impacts of the chemicals proposed to be used in or arising from CSG operations on water-related matters, particularly for matters of national environmental significance (MNES).

Drilling additives containing chemicals, may be used during the following activities:

- The drilling of exploration and appraisal wells / core holes (some of these bores will subsequently be converted to CSG production wells);
- The drilling and completion of CSG production wells;
- Completion and workover of the CSG production wells typically on a three to five-year frequency; and
- Decommissioning of the CSG production wells. This is not expected to occur until at least 15 years (or more) after commencement of CSG production from a well.

1.2 Statement of Aim

The aim of the CRAF is to:

- Evaluate the potential risks and effects of chemicals used during CSG operations (drilling and completions and water treatment) to water-related MNES.
- Evaluate the potential risks and effects of geogenic chemicals to water-related MNES that may be present in recovered drilling fluids and produced waters during CSG operations.

1.3 Objective of the Risk Assessment

The objective of the risk assessment framework is to:

- Demonstrate that the potential risks to water-related MNES associated with the chemicals used in CSG operations have been eliminated or reduced as far as practically possible.

2 GOVERNANCE

2.1 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (State of Queensland 2023) is an Act with the objective to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

This Act states that 'to carry out an Environmentally Relevant Activity (ERA) an environmental authority (EA) is required'. A resource activity, specifically a petroleum activity, is defined as an ERA.

2.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* (Commonwealth of Australia 2022b) is the central piece of environmental legislation at the Commonwealth level. It provides for the protection of environmental values, including MNES. Actions that are likely to have a significant impact on MNES are subject to the assessment and approval process under this Act. Water resources in relation to large coal mining and CSG development projects are a MNES.

2.2.1 Significant Impact Guidelines 1.3: Coal Seam Gas and Large Coal Mining Developments

The *'Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources'* (Commonwealth of Australia 2022a) identify a 'significant impact' as *'an impact which is important, notable, or of consequence, having regard to its context or intensity'.*

Section 5.2 and 5.3 of the guidelines, identify that for a water resource a 'significant impact' may occur where, as a result of the action, one of the following changes to the hydrological characteristics of a water resource are of a sufficient scale or intensity to significantly reduce the current or future utility of the water resource for third-party users, including environmental and other public benefit outcomes:

a. Changes in the water quantity, including the timing of variations in water quantity;
b. Changes in the integrity of hydrological or hydrogeological connections, including substantial structural damage (e.g. Large-scale subsidence); and
c. Changes in the area or extent of a water resource.

The Department of Climate Change, Energy, the Environment and Water (DCCEEW) have identified the following aspects that may need to be considered when assessing the above hydrological characteristics:

- Flow regimes (volume, timing, duration and frequency of surface water flows);
- Recharge rates to groundwater;
- Aquifer pressure or pressure relationships between aquifers;
- Groundwater table and potentiometric surface levels;

- Groundwater-surface water interactions;
- River-floodplain connectivity;
- Inter-aquifer connectivity; and
- Coastal processes including changes to sediment movement or accretion, water circulation patterns, permanent alterations in tidal patterns, or substantial changes to water flows or water quality in estuaries.

The Significant Impact Guidelines 1.3, section 5.4, provide guidance on changes to water quality stating that a significant impact on a water resource may occur where, as a result of the action:

- There is a risk that the ability to achieve relevant local or regional water quality objectives would be materially compromised, and as a result the action:
  - Creates risks to human or animal health or to the condition of the natural environment as a result of the change in water quality;
  - Substantially reduces the amount of water available for human consumptive uses or for other uses, including environmental uses, which are dependent on water of the appropriate quality;
  - Causes persistent organic chemicals, heavy metals, salt or other potentially harmful substances to accumulate in the environment;
  - Seriously affects the habitat or lifecycle of a native species dependent on a water resource; or
  - Causes the establishment of an invasive species (or the spread of an existing invasive species) that is harmful to the ecosystem function of the water resource.
- There is a significant worsening of local water quality (where current local water quality is superior to local or regional water quality objectives); or
- High quality water is released into an ecosystem which is adapted to a lower quality of water.

Changes to water quality, that may occur from the use of additives used in drilling fluids, have been assessed for the identification of potential impacts.

For purposes of this assessment, a water resource is defined as:

> "Being surface or groundwater, or a watercourse, lake, wetland (whether or not it currently has water in it) or aquifer and including all aspects of the water resources including water, organisms and other components and ecosystems that contribute to the physical state and environmental value of the water resource" (Commonwealth of Australia 2007).

2.2.2 Matters of National Significance: Significant Impact Guidelines 1.1

The Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013) identify a 'significant impact' as an "impact which is important, notable, or of consequence, having regard to its context or intensity". A 'significant impact' on a critically endangered and endangered species, may occur where, as a result of the action, there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of a population;
- Reduce the area of occupancy of the species;
- Fragment an existing population into two or more populations;
- Adversely affect habitat critical to the survival of a species;
- Disrupt the breeding cycle of a population;
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- Introduce disease that may cause the species to decline; or
- Interfere with the recovery of the species.

For ecological communities, a 'significant impact' may occur, where, as a result of the action, there is a real chance or possibility that it will:

- Reduce the extent of an ecological community;
- Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- Adversely affect habitat critical to the survival of an ecological community;
- Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;
- Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
  - Assisting invasive species, that are harmful to the listed ecological community, to become established, or
  - Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or
- Interfere with the recovery of an ecological community.

For an action to have a significant impact on a migratory species there must be a real chance or possibility that it will:

- Substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;

- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

2.3 Independent Expert Scientific Committee (IESC) on Coal Seam Gas and Large Coal Mining Development Checklist

The IESC is a statutory body under the EPBC Act (Commonwealth of Australia 2016). The IESC's key function in relation to this Project is to provide scientific advice to the Commonwealth Environment Minister and relevant state ministers in relation to CSG or large coal mining development proposals that are likely to have a significant impact on water resources.

To allow the IESC to provide robust scientific advice to government regulators on potential water-related impacts of CSG, an information guideline (IESC 2018) has been developed outlining the information considered necessary for the IESC to undertake the relevant assessment. Table 2.1 provides the information checklist that in places relate to a chemical risk assessment.

It should be noted that hydraulic stimulation is not proposed for the Project, and therefore checklist items related to hydraulic stimulation are not applicable or addressed.

Table 2.1 IESC Checklist for CSG Well Construction and Operation

Checklist Title	Checklist Item	Applicable (Y/N)
CSG well construction and operation	Describe the scale of fracturing (number of wells, number of fracturing events per well), types of wells to be stimulated (vertical versus horizontal), and other forms of well stimulation (cavitation, acid flushing).	N
	Describe proposed measuring and monitoring of fracture propagation.	N
	Identify water source for drilling and hydraulic stimulation and outline the volume of fluid and mass balance (quantities/volumes).	N
	Describe the rules (e.g. water sharing plans) covering access to each water source used for drilling and hydraulic stimulation and how the Project proposes to comply with them.	Y (drilling only)
	Quantify and describe the quality and toxicity of flowback and produced water and how it will be treated and managed.	Y
	Assess the potential for inter-aquifer leakage or contamination.	Y
	The use of drilling and hydraulic fracturing chemicals should be informed by appropriately tiered deterministic and/or probabilistic hazard and risk assessments, based on ecotoxicological testing consistent with Australian Government testing guidelines (NRMMC-EPHC-NHMRC 2009; Commonwealth of Australia 2012).	Y (drilling only)
	Propose waste management measures (including salt and brines) during both operations and legacy after closure.	Y (drilling only)
	List the chemicals proposed for use in drilling and hydraulic stimulation including: ▪ Names of the companies producing fracturing additives and associated products; ▪ Proprietary names (trade names) of compounds (fracturing fluid additives) being produced; ▪ Chemical names of each additive used in each of the fluids; ▪ Chemical abstract service (CAS) numbers of each of the chemical components used in each of the fluids; ▪ General purpose and function of each of the chemicals used;	Y (drilling only)

Checklist Title	Checklist Item	Applicable (Y/N)
	▪ Mass or volume proposed for use; ▪ Maximum concentration (mg / l or g / kg) of the chemicals used; ▪ Chemical half-life data, partitioning data, and volatilisation data; ▪ Ecotoxicology; and ▪ Any material safety data sheets for the chemicals or chemical products used.	
	Chemicals for use in drilling and hydraulic fracturing must be identified as being approved for import, manufacture or use in Australia (that is, confirmed by National Industrial Chemicals Notifications and Assessment Scheme NICNAS as being listed in the Australian Inventory of Chemical Substances (Commonwealth of Australia 2017).	Y

3 CHEMICAL RISK ASSESSMENT FRAMEWORK

3.1 Leading Industry Practice

The chemical risk assessment is undertaken in accordance with leading industry practice risk assessment methodologies both internationally and domestically, which meets the DCCEEW "best practice" requirement. The leading industry national and international standards and guidelines include:

- The Organisation for Economic Co-operation and Development (OECD) Manual for Assessment Toolkit (OECD 2014).
- AS/NZS 4360:2004: Risk Management and AS/NZS ISO 31000:2009 Risk Management – Principals and Guidelines (AS/NZS 2004; 2009).

Leading industry guidance includes:

- Exposure Draft: Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction (DoEE 2017). This describes the assessment in terms of potential routes of environmental exposure and as well as receptors of the proposed chemical through the conceptual site modelling. The relative hazard profile of the chemical in relation to the environment is assessed with an ecotoxicity review, and environmental fate analysis.
- Australian Industrial Chemicals Introduction Scheme (AICIS) (formerly National Industrial Chemicals Notifications and Assessment Scheme (NICNAS), National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia, 2017.

The CSG Risk Assessment Guidance Manual (DoEE 2017) references the OECD toolbox in developing their CRAF and their tools to guide "best practice" for human health and environmental risk assessment. The OECD toolkit identifies that an environmental risk assessment should involve the following steps, which have been incorporated into this assessment:

- Hazard / chemical identification;
- Hazard characterisation;
- Exposure assessment; and
- Risk characterisation.

Relevant information on the chemicals was obtained from the following sources:

- Safety Data Sheets (SDS) provided by the drilling fluid supplier for the products proposed to be used in the drilling activities (Appendix I);
- Australian Inventory of Industrial Chemicals;
- OECD 'Global Portal to Information on Chemical Substances' (or eChemPortal) (OECD 2020);
- National Institutes of Health (NIH) PubChem chemistry database (NIH 2022); and
- Australian Inventory of Chemical Substances (Commonwealth of Australia 2017).

In assessing the environmental impact from drilling fluid chemicals, the following stages of the chemical lifecycle were considered:

- Transport and storage to and on the drilling site;
- Processing on site at the CSG production well head prior to use;
- During use down hole; and
- Disposal of the fluid (flowback/produced water).

3.2 Methodology

The CRAF for review of chemicals to be used in CSG operations follows a two-step process:

- Step 1: Classification
- Step 2: Assessment

This is summarised in Figure 3.1.

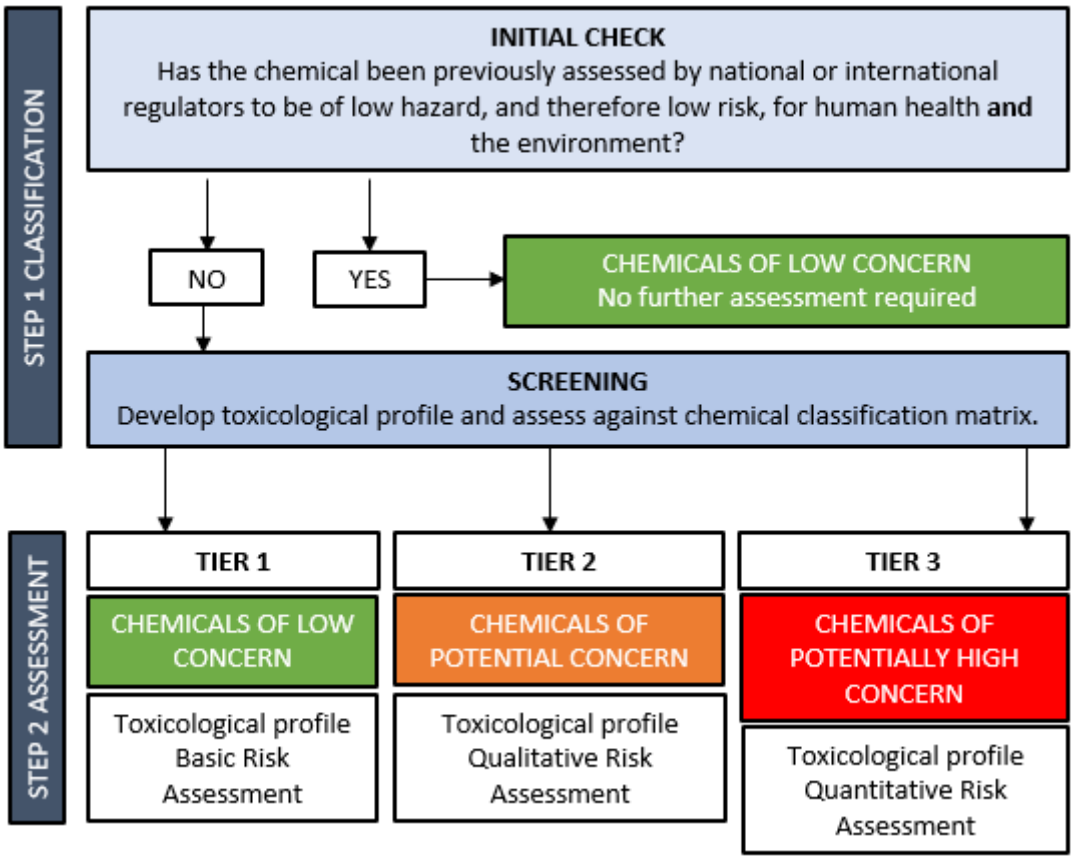

Figure 3.1 Schematic of Chemical Risk Framework (developed using DoEE 2017a)

Chemicals are classified into three tiers, a tiered approach is recommended by DCCEEW (formerly DoEE) (DoEE 2017). This approach entails increasing levels of complexity and a commensurate refinement of assumptions and the inclusion of additional, more site-specific data. Based on the classification category of the chemical (and its potential toxicity, persistence and bioaccumulation potential) different levels of assessment will be undertaken.

A general description of the chemical tiers, category and the assessment required is summarised in Table 3.1. The classification matrix used to categorise each chemical is provided in Appendix I.

Table 3.1 Description of Chemical Tiers

Tier	General Description	Category	Assessment Required
1	Not persistent, no potential concerns with bioaccumulation in soil or impacts on flora and fauna. Toxicity: harmful	Chemicals of low concern	Toxicological profile and screening assessment
2	Persistent Does not bioaccumulate Acute toxicity: toxic, long-term toxicity – toxic with long lasting effects.	Chemicals of potential concern	Toxicological profile Qualitative Risk Assessment
3	Persistent Does bioaccumulate. Acute toxicity – very toxic, long-term toxicity – very toxic with long lasting effects	Chemicals of Potentially High Concern	Toxicological Profile Qualitative and quantitative Risk Assessment

3.2.1 Step 1: Classification

Classification involves identifying products and chemicals to be used during the drilling process. It details how the products will be used and assesses the hazardous nature of the products and the chemicals within them.

A chemical register has been developed which summarises this initial classification and screening. A copy of the register is made available on the Senex website. A template of the register is provided in Appendix II.

Initial Check

This initial check identifies whether chemicals have been previously assessed by national or international regulators and considered to be of low hazard, and therefore low-risk, for human health and the environment. If a chemical has been previously assessed, it is assumed to be of low concern and is removed from the assessment.

Screening

The classification matrix used to categorise each chemical as part of the screening is provided in Appendix I. The following are reviewed within the screening assessment to determine the appropriate chemical tier level:

- Persistence
  - Persistence refers to whether, and how fast, a chemical degrades in the environment over time. Chemicals that are persistent in the environment may cause chronic health problems, particularly in humans and animals that are high in the food chain.
  - The Stockholm Convention provides scientifically based criteria for identifying persistent organic pollutants and is used in this assessment to define a chemical's persistence in water soil and air and has been adopted in the *Environmental Risk Assessment Guidance Manual: for industrial chemicals* (EPHC 2009b)
- Bioaccumulation

- Bioaccumulation is the general term describing a process by which chemicals are taken up by a plant or animal either directly through exposure to a contaminated medium (soil, sediment, water) or by eating food containing the chemical (DoEE 2017).
- The criteria for bioaccumulation used in the assessment has been taken from the *Exposure draft: Chemical risk assessment guidance manual: for chemicals associated with coal seam gas extraction* (DoEE 2017), which adopts the criteria from the *Environmental Risk Assessment Guidance Manuals* (EPHC 2009b; 2009a).

- Toxicity
  - Ecotoxicity data are used to determine the toxic hazards posed by a chemical to terrestrial and aquatic organisms. The assessment process involves collecting all available acute and chronic data and considering how this data can inform the assessment (DoEE 2017).
  - The minimum data set for quantitative CSG chemical risk assessments comprises acute toxicity tests for fish and invertebrates and a chronic test for algae, however chronic data for fish and invertebrates are preferable if it is available.
  - Acute and chronic toxicity are assessed against criteria from the *Exposure draft: Chemical risk assessment guidance manual: for chemicals associated with coal seam gas extraction* (DoEE 2017).

The overall tier level is determined by the highest tier value assigned for each criteria (for example, a chemical which is determined to be Tier 1 for toxicity but Tier 2 for persistence is assigned as a Tier 2 chemical).

3.2.2 Step 2: Assessment

All Tiers: Toxicological Assessment and Screening

Appendix III presents the template for the toxicological assessment for all Tier 1, 2 and 3 chemicals. The toxicological assessment includes a summary of the information collected in the screening exercise (above) and includes the following:

- Chemical synonyms and structure;
- Physico-chemical properties;
- Domestic and International Regulator Information;
- Environmental Fate Summary;
- Environmental Effects; and
- Categorisation and other Characteristics of Concern.

Tier 2 and 3: Qualitative Risk Assessment

A qualitative risk assessment is to be undertaken for all Tier 2 chemicals. This expands on the characterisation of the chemical to understand how it may react in the receiving environment. The qualitative risk assessment includes:

- Further hazard characterisation including consideration of the volume, concentration and use of chemical;
- Determination of pathways to identified receptors; and
- A risk assessment which examines the likelihood, consequence and subsequent magnitude to MNES from the chemical. This is undertaken both with and without management and mitigation measures in place.

Note that chemical volumes associated with drilling and/or well maintenance will vary depending on actual conditions encountered.

Hazard Characterisation

Where a drilling fluid was deemed to be potentially hazardous according to the criteria above, further hazard characterisation was undertaken. This characterisation further assessed the drilling additives and their chemical constituents to consider and occurred in the tiered approach, increasing complexity (as per DoEE 2017):

1. The nature and state of the chemicals at surface and their solubility, to determine the potential for chemicals to enter the environment;
2. The fate and transport of the chemical in the environment including an assessment of the mobility, potential for bioaccumulation and degradation; and
3. An assessment of the volumes of chemicals proposed to be used in the context of the environment, with a comparison against relevant environmental hazard criteria.

The fate of a chemical depends on its chemical and physical properties including its persistence, solubility, binding ability, volatility and how it reacts with the environment that it is released into.

Pathway Characterisation and Identification of Water MNES Receptors

The potential contaminant pathways and potential water MNES receptors are to be identified and documented.

For the purpose of the assessment the exposure pathways are categorised as complete, i.e. there is a source, pathway, mechanisms for exposure and potential receptor present.

The MNES values listed under the EPBC Act, including springs and groundwater dependent ecosystems (GDEs), comprise:

- Listed flora or fauna (terrestrial and aquatic);
- Threatened ecological communities; and
- Water resources.

The potential risks to both the MNES water resources and non-MNES receptors exposed to the water resource is evaluated. This may include human and livestock through the consumption of water containing chemicals. Accidental release scenarios are not included; however, the outcomes of the assessment should be used to inform emergency response actions. The chemical risk assessments will be limited to MNES receptors and those non-MNES receptors associated with the MNES water resources.

Risk Characterisation

The risk assessment considers the likelihood of exposure and a rating of the consequence of the exposure to understand the magnitude (significance) of the risk to MNES from drilling chemicals.

The likelihood of exposure was assessed by examining the likelihood that the chemical could reach the receptor based on known pathways (Table 3.2).

Table 3.2 Likelihood of Exposure Assessment

Rank	Descriptor	Likelihood of Exposure
1	Highly unlikely	There is no known connection between the source and receptor – there is no pathway. i.e. source is solid and not soluble – highly unlikely pathway to surface water system.
2	Unlikely	Unlikely connection between the source and the receiving environment. Unlikely for a surface spill to reach the receiving environment.
3	Possible	Possible connection between the source and the receptor (i.e. connection of coal seams with an aquifer being used for extraction). Possible that surface spills could reach the receiving environment.
4	Likely	Likely connection between the source and the receiving environment. Likely that spills could reach the receiving environment.
5	Very likely	Confirmed connection between the source and the receiving environment, with the receiving environment (aquifer) being used for drinking water or discharging to an ecosystem. Very likely that a surface spill will reach the receiving environment.

The consequence of each drilling fluid chemical was then assessed using the consequence levels in Table 3.3. The consequence of a chemical to MNES is based on the hazard characterisation of each chemical.

Table 3.3 Consequence Levels

Magnitude	Description	Example
Negligible	Negligible potential for adverse effects	▪ Low severity and short-term impacts restricted to the immediate area of an activity or footprint. ▪ Very minor chemical incident. ▪ Minimal environmental impacts. ▪ Insignificant departure from Federal or State policy or guidance.
Low	Results in some measurable changes in attributes quality or vulnerability	▪ Chemical incident. ▪ Impacts likely to persist for short duration only, with rapid recovery when the activity is completed. ▪ Impact is restricted to Walloon Coal Measures (WCM) only and other aquifers or users are not affected. ▪ Impact causes minor departure from Federal or State policy or guidance.
Moderate	Results in impact on the integrity of attribute or loss of part of attribute at a localised scale	▪ Significant chemical event. ▪ Minor, but manageable, environmental impacts. ▪ Rapid recovery upon activity completion. ▪ Potential health impacts. ▪ Impact may occur across aquifers and groundwater features or users may be affected. ▪ Moderate potential for adverse effects on aquatic ecosystems.

Magnitude	Description	Example
High	Results in impact on the integrity of attribute or loss of part of attribute at a regional scale	▪ Chemical pollution or contamination is likely. ▪ Significant environmental impacts. ▪ Significant health impacts. ▪ High potential for adverse effects on the aquatic ecosystems.
Severe	Results in loss of attribute	▪ Irreversible or persistent high severity impact likely. ▪ No recovery within the foreseeable future. ▪ Impacts are at a regional, national or international scale. ▪ Impacts to groundwater may include impacts across aquifers regionally. Groundwater discharge features and users are affected.

A final risk rating was determined for each risk by combining the consequence level with the likelihood level. The risk rating adopted is specific to this assessment and is consistent with AS/NZS 4360:2004: Risk Management and AS/NZS ISO 31000:2009 Risk Management – Principals and Guidelines (AS/NZS 2009; 2004).

The risk to water resources MNES from drilling additives was considered using the EPBC Significant Impact Guidelines 1.3 (Commonwealth of Australia 2022a), where a 'significant impact' is described as an impact which is important, notable or of consequence, having regard to its context or intensity.

The likelihood of a significant impact is defined by the Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013):

> *"To be likely, it is not necessary for a significant impact to have a greater than 50% chance of happening; it is sufficient if a significant impact on the environment is real or not remote chance or possibility".*

The subsequent risk rating was determined with regards to the Significant Impact Guidelines and MNES:

- **High significance:** Significant impact with high likelihood of impact to MNES. Levels of chemical risks are regarded as unacceptable or intolerable. Impact results may be irreversible or persistent high severity impact on the quality or availability of surface or groundwater;
- **Moderate significance:** Levels of chemical risks are regarded as unacceptable, moderate severity with impacts persisting over time. Impacts may be tolerable, but risk treatment and mitigation should apply where possible;
- **Low significance:** The MNES will be affected by low severity impact. Impacts are of short duration and the receptor will have a rapid recovery when the activity is complete; and
- **Insignificant:** An insignificant impact exists to an environmental value. Levels of chemical risks are regarded as acceptable, and no risk treatment is necessary. The impact is of low severity and restricted to the immediate area of activity. There are no medium or long-term impacts and recovery is rapid.

Table 3.4 Significance of Impact Adopted for this Chemical Risk Assessment

		Likelihood Level				
		Highly Unlikely (1)	Unlikely (2)	Possible (3)	Likely (4)	Highly Likely (5)
Consequence Level	Severe	Insignificant	Low	High	High	High
	High	Insignificant	Low	Moderate	High	High
	Moderate	Insignificant	Low	Moderate	Moderate	Moderate
	Low	Insignificant	Low	Low	Low	Low
	Negligible	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant

The significance of impact was determined for both with and without the application of management and mitigation measures.

Tier 3: Quantitative Risk Assessment

For Tier 3 chemicals, a quantitative risk assessment must be undertaken in addition to the qualitative risk assessment outlined above. This assessment examines the proposed quantities of the chemical to be applied to the environment versus the known acceptable levels of exposure. The potential for the chemical to degrade and dilute is considered using groundwater transport modelling. The results are used to inform the overall risk assessment and assignment of significance of impact.

This assessment is more site-specific and is tailored towards specific locations and distance to watercourses.

Contaminant Transport

An analytical 1D contaminant transport model, using industry-accepted contaminant transport equations, was used to determine what concentration of drilling chemicals could potentially reach any MNES receptors an arbitrary distance away, and how long would it take to reach this concentration at the receptor.

The model uses analytical equations based on the characteristics of the aquifer, the potential hydraulic gradient within that aquifer and the distance to the receptor. The adopted model uses the Domenico equation (Domenico 1987), which has been modified with the addition of stochastic modelling approaches to provide a range of results, based on the available data:

$$C_{ED} = \frac{C_0}{2} exp\left\{\frac{x}{2a_x}\left(1 - \sqrt{\left[1 + \frac{4\lambda a_x}{u}\right]}\right)\right\}.erfc\left\{\frac{1}{2\sqrt{a_x ut}}\left(x - ut\sqrt{\left[1 + \frac{4\lambda a_x}{u}\right]}\right)\right\}.erf\left\{\frac{S_y}{2\sqrt{a_y x}}\right\}.erf\left\{\frac{S_z}{4\sqrt{a_z x}}\right\}$$

Where:

C_{ED} = concentration of contaminant at point x and time t (mg/l)

C_o = initial contaminant concentration in groundwater (mg/l)

λ = decay constant

a_x, a_y, a_z = longitudinal, vertical and lateral dispersivity (m)

S_z, S_y = width and thickness of plume at source (in saturated zone) (m)

u = rate of contaminant movement due to retardation, where:

$$u = \frac{Ki}{nR_f}$$

R_f = retardation factor

n = effective porosity

i = hydraulic gradient

K = hydraulic conductivity (m/d)

x = distance to compliance point (m)

$erfc$ = complimentary error function

erf = error function

exp = exponential

t = time since contaminant entered groundwater (days)

The Domenico analytical equation is adopted for this assessment due to its versatility and widespread use in many attenuation assessment tools (Aziz et al. 2000) and the ability to incorporate degradation and retardation factors in the calculation.

Model Assumptions

The Domenico analytical equation assumes:

1. Fixed dimensions of a contaminant source;
2. Homogenous aquifer properties;
3. One dimensional groundwater flow;
4. First order degradation rate (where degradation is considered);
5. Contaminant concentration estimated at the centreline of the plume; and
6. Molecular diffusion based on concentration gradient is not considered.

No retardation (e.g. sorption) is considered in the transport process for the assessment of conservative contaminants (a retardation factor of 1 is applied). Where retardation is applied in the retardation simulation, there is an assumption that there are unlimited surfaces for sorption to occur.

3.3 Geogenic Screening Assessment

Geogenic chemicals mobilised and recovered during drilling activities or within produced water will be subject to a screening assessment, and if required qualitatively assessed against published or derived risk-based criteria depending on their end fate (i.e., use and/or disposal).

For aqueous residual drilling material, potentially applicable criteria may include:

- Human Health:

- National Water Quality Management Strategy (NRMMC) Australian Drinking Water Guidelines (2017).
- WHO Drinking water Quality, Fourth Edition (2017).
- USEPA Regional Screening Levels (RSLs) for tap water (November 2018 update) (2018).
- USEPA Maximum Contaminant Levels (MCLs, 2009).

- Environmental and Ecological:
  - Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018).
  - Risk-Based Screening Levels for the Protection of Livestock Exposed to Petroleum.
- Hydrocarbons, Publication Number 4733 (API, 2004):
  - Republic of South Africa (1993) South African Water Quality Guidelines
  - USEPA National Recommended Water Quality Criteria for Priority Pollutants (2009)
  - USEPA Region 3 Biological Technical Assistance Group Freshwater Screening Benchmarks (2011c).

The screening criteria hierarchy utilised the following for solid residual drilling material includes:

- Human Health Environmental and ecological (including phytotoxicity):
  - The National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013 (ASC NEPM).
  - CRC CARE Technical Report 10: Health screening levels for petroleum hydrocarbons in soil and groundwater (Friebel and Nadebaum, 2011, CRC CARE Technical Report no. 10).
  - USEPA May 2016 RSLs (RSL TR = 1.0, THQ = 0.1).
  - Risk-Based Screening Levels for the Protection of Livestock Exposed to Petroleum Hydrocarbons, Publication Number 4733 (API, 2004).

3.4 Cumulative Risk Assessment

The chemical risk assessment must qualitatively assess the potential for one or more hazards associated with the chemicals used in CSG operations to impact water resource MNES. The assessment must consider the potential for cumulative impacts to MNES for Tier 2 and Tier 3 chemicals (due to their persistence and/or potential to bioaccumulate). Should the chemical not meet the requirements for persistence or bioaccumulation, the potential for cumulative impacts is considered to be low.

4 CHEMICAL RISK ASSESSMENT APPROVAL PROCESS AND DOCUMENT CONTROL FOR DRILLING CHEMICALS

4.1 Register of Assessed Drilling Chemicals

A Register of Assessed Chemicals will be published and maintained on the Senex website.

The Register of Assessed Chemicals provides a summary, for each chemical, of the screening assessment and the Tier level assignment. The register also confirms the activities the chemical has been assessed for. The register includes a summary of document control including the date of the assessment for each chemical and the date of chemical re-evaluation (if chemical is still in use).

Toxicological profiles, risk assessments and a signed and dated statement from the independent chemical risk assessment expert for each chemical will be included in the Register of Assessed Chemicals and provided to the regulator.

The template for the Register of Assessed Chemicals is provided in Appendix I.

4.1.1 Peer Review

An independent chemical risk assessor will be appointed to peer review the toxicological profile of low-risk chemicals (Tier 1 and 2). This review will assess:

- Have the physical/chemical properties been documented?
- Was the chemical listed as a chemical of concern on any databases?
- Has the toxicity been assessed?
- Has the environmental fate (persistence, biodegradation and bioaccumulation) been assessed?
- Is the categorisation correct?

For Tier 2 chemicals the qualitative risk assessment will be assessed:

- Hazard characterisation;
- Pathway characterisation and identification of water MNES Receptors; and
- Risk characterisation including exposure assessment, assigned consequence levels and potential significance of impact, both with and without mitigation and management measures.

5-Year Peer Review

All chemicals listed in the register and still in use will be re-evaluated and a peer review conducted every 5-years. The peer review will include:

- Consideration of whether the individual chemical risk assessments listed on the chemical register are consistent with current scientific knowledge with regards to the toxicology and hazardous nature of the proposed chemicals;

- Consideration of whether the risk characterisation including exposure assessment, assigned consequence levels and potential significance of impact, both with and without mitigation and management measures remains unchanged;
- An evaluation of the adequacy of the current monitoring, mitigation and management measures in place; and,
- Following receipt of the peer review, if there are any concerns raised, Senex will provide an explanation to the peer reviewer on how items will be addressed and incorporated into the framework.

4.2 Review Process

Senex will review the chemical risk assessment should:

- New drilling additives and chemicals be proposed; and/or
- The advice with regards to toxicology and hazardous nature of the proposed chemicals change as advised by drilling contractors and /or regulatory authorities.

The SDS which include the name, type and quantity of each drilling fluid additive used on each well will be reviewed by Senex as they are updated by the manufacturer. Senex's contractor management systems and processes will ensure that any new drilling contractors or companies undertaking works on site involving the handling and use of drilling additives will be reviewed.

5 MITIGATION AND MANAGEMENT

Mitigation and management controls will be implemented to ensure the potential risks associated with the use of drilling additives to MNES have been eliminated or reduced to as low as reasonably practicable.

Key Senex management documents in relation to the mitigation and management of the use of chemicals include:

- Environmental Protocol for Field Development and Constraints Analysis (SENEX-CORP-EN-PRC-019)
- Environmental Management Plan (SENEX-ATLS-EN-PLN-001)
- Spill Response Plan (SENEX-CORP-ER-PLN-006)
- Incident Management Procedure (SENEX-CORP-HS-PRC-004)
- Senex Hazardous Substances and Dangerous Goods Procedure (SENEX-CORP-HS-PRC-010).
- Atlas Stage 3 Water Monitoring and Management Plan (SENEX-ATLS-EN-PLN-017)

Additionally for flowback/produced water:

- Atlas Project – Operation Management Plan for Regulated Structures (OPS-QLDS-OP-PLN-008)

The likelihood of chemical migration away from the bore or seepage are considered highly unlikely due to the following:

- drilling and construction and well maintenance activities are short term where the contaminant source does not persist;
- quantities are restricted to maintain optimal conditions;
- drilling chemicals are designed to maintain bore integrity and limit fluid losses;
- cleaning/treatment chemicals are designed to improve flow which will enhance removal from the formation during pumping;
- operational groundwater pumping will develop a low groundwater pressure gradient towards the well, inducing groundwater flow towards the well where migration would need to move in the opposite direction to groundwater flow; and
- Tight aquitard sediments of the Westbourne Formation acts as a barrier to mitigate migration pathways.

5.1 Management Documents

Key plans integral to the management of risk of impacts to MNES associated with the use of drilling chemicals and flowback, including processes to monitor and review controls are provided in the sections below. Flowback water is treated as produced water. On completion of the well, it is immediately connected to the main gathering system and is transported to the produced water facility at Lara where it is treated and stored.

5.1.1 Environmental Management Plan (SENEX-ATLS-EN-PLN-001)

The Environmental Management Plan describes how Senex will manage potential environmental impacts associated with conducting exploration, appraisal and production drilling activities in the Project area and ensure compliance with EA conditions, industry guidelines and regulatory requirements.

For Tier 2 or 3 chemicals, the outcome of the chemical risk assessment may inform the need for additional mitigation and management controls. These controls will include greater offsets from water-related MNES such as watercourses. Any additional controls identified through the chemical risk assessment process will be incorporated into the Environmental Management Plan.

5.1.2 Environmental Protocol for Field Development and Constraints Analysis (SENEX-CORP-EN-PRC-019)

To support CSG field layout for all infrastructure, including wells and gathering pipelines, Senex will implement their 'Environmental Protocol for field development and constraints analysis' (SENEX-QLDS-EN-PRC-019) (the Constraints Protocol) for all cases where construction will involve significant disturbance to land. The Constraints Protocol aims to limit impacts such that infrastructure siting:

- Considers biodiversity values and environmental constraints, such as sensitive receptors, when selecting preferential locations; and aligning with planning principles to avoid, minimise, mitigate and then manage potential environmental impacts;
- Is compliant with EA conditions and State and Federal regulatory requirements; and
- Identifies any additional external environmental approvals required and that those are secured prior to the commencement of construction activities.

With respect to environmental values, the Protocol addresses avoiding or minimising and managing potential impacts to:

- Biodiversity values contributing to MNES;
- Habitat for wildlife, including threatened MNES threatened communities, flora and fauna; and
- Wetlands, watercourses, springs and groundwater dependent ecosystems.

The Constraints Protocol also recognises that, in addition to environmental constraints, landholder, engineering and cultural heritage constraints must be considered during infrastructure siting. The Constraints Protocol is important in setting appropriate distances of infrastructure, including CSG wells, from MNES receptors. The recommendations from the chemical risk assessment (CRA) will be incorporated into the Constraints Protocol if/when required.

The process involves a desktop constraints analysis, site surveys, post-survey environmental constraints analysis and preparing a report that includes a list of site-specific environmental conditions and associated constraints maps. These are included in the final Access to Work (ATW) documentation, issued upon sign-off by the Project Manager to relevant staff and contractors prior to commencing construction.

5.1.3 Spill Response Plan (SENEX-CORP-ER-PLN-006; Senex 2017)

Provides the response protocols that must be utilised in order for Senex to respond in an appropriate and timely manner in the event of a spill. The procedure provides a common system and focus for spill response support and response hierarchy, which includes preserving life, ensuring the safety of people, and minimising the impact on the environment. This includes mitigation of possible spills, leaks, and fluid losses at the drill sites (hydraulic hose bursts, leaks below the drill rig, refuelling spills, etc.). The environmental emergency activation pathway as presented by the Spill Response Plan is shown in Figure 5.1.

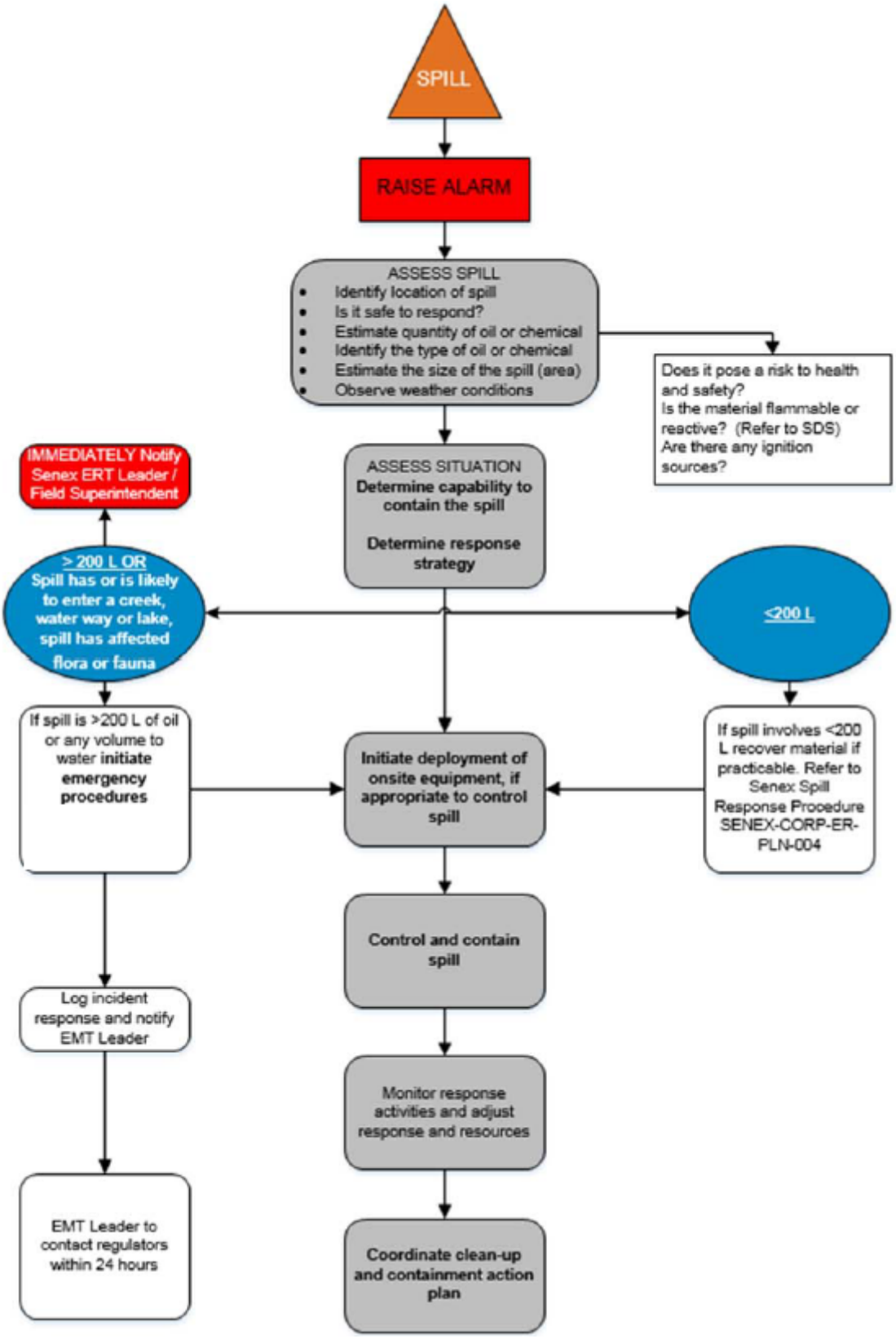

Figure 5.1 Senex Environmental Emergency Activation Pathway

Senex has adopted internationally accepted 'Tiered Response' classifications to describe different categories of spill events, based on severity and location. Tier classifications are determined based

on spill volume, environmental sensitivity, potential social impacts and other factors specific to the event. The Spill Response Plan details tier event trigger limits and the appropriate response required to assist with effective mitigation and management of associated risk due to accidental spill events.

The chemical risk assessment and associated SDS will be adaptively used to inform the spill response associated with accidental release of a chemical to prevent adverse impacts to protected matters. The spill response plan uses information from the CRA and SDS throughout the response process (see Table 5.1 below).

Table 5.1 Spill Response Plan (Adapted from the Spill Response Procedure (SENEX-CORP-ER-PLN-006; Senex 2017)

Step	Assess the Spill
Assess the Spill	Use the SDS and CRA to: ▪ Inform personnel training requirements. ▪ Inform the selection of appropriate spill response kits and PPE located at chemical storage / handling locations. ▪ Identify the risk to personal health and safety by the type of pollutant. Determine whether the chemical is flammable or reactive. ▪ Determine whether the spill poses a threat to personnel, people, or the environment. ▪ Inform the severity assessment and assign the spill classification (Tier 1: emergency/crisis to Tier 3: minor event). ▪ The potential for impacts to nearby sensitive environmental areas.
Control the Spill	Use the SDS and CRA to inform spill containment and management. The documents can be consulted for advice on accidental release measures, personal precautions, protective equipment, and emergency procedures.
Clean-up Action Plan	Use the SDS and CRA to inform decisions on clean up and rehabilitation, including protective equipment, dependent on the type and nature of the chemical (as documented in the CRA). For chemicals the SDS is to be referred to for information on appropriate handling and transport.

5.1.4 Code of Practice for Constructing and Abandoning Coal Seam Gas Wells and Associated Bores in Queensland

All CSG production wells will be designed, constructed, and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland Version 2" (State of Queensland 2019) and adherence to the API industry standards. The Code of Practice outlines mandatory requirements and good practice to reduce the risk of environmental harm. Senex will follow this Code of Practice as a minimum requirement for the CSG well design, construction and decommissioning of the wells.

CSG production wells will be designed to:

- Prevent any interconnection between target hydrocarbon bearing formations and aquifers.
- Ensure that gas is contained within the well and associated pipework and equipment without leakage.
- Ensure zonal isolation between different hydrostratigraphic units is achieved.
- Not introduce substances that may cause unlawful environmental harm.

In relation to drilling additives, the mandatory requirements include:

- Ensuring all drilling additives used during well procedures on CSG wells are selected and managed in accordance with the manufacturer's recommendations and relevant SDS.
- Recording the name, type and quantity of each chemical used on each well throughout the life of the well.

Good industry practice will be adopted and includes the following:

- Drilling fluid should be a carefully monitored and controlled mixture designed to:
  - Achieve best drilling results and ensure efficient removal of formation cuttings.
  - Control formation pressures.
  - Minimise damage to formations.
- Petroleum tenure holders should ensure that the drilling fluid selected is appropriate for the well design to manage any locally experienced drilling problems and the geological conditions likely to be encountered.
- The use of biodegradable substances in the drilling fluid is preferred.
- The source of water for all well procedures (drilling, completion, workover and abandonment) should be recorded for future well monitoring purposes.
- Products should be chosen, stored, and used at concentrations that minimise the risk of causing environmental harm.
- Personnel, including contractors, should be aware of the environmental impact and emergency spill procedures for the products and substances in use on site.
- Petroleum tenure holders should use established, effective drilling practices to achieve a stable, uniform and, as far as possible, in-gauge hole (i.e., a wellbore that is essentially the same diameter as the bit that was used to drill it).

5.2 Management and Mitigation Measures for Identified Risks

The key risks to water resource MNES from drilling fluids are identified as:

- Above ground chemical spills and leaks and total loss from above ground tanks to surface water systems through:
  - Transportation of chemicals to site;
  - During the mixing of drilling fluids on site;
  - Chemical and fuel storage loss of containment;
  - Flood events – loss of chemicals offsite;
  - Emergency and incident support;
  - Well siting (proximity to watercourses);
  - Well construction (methods used to drill and construct the wells); and

    - Management of produced water/flow back water (which may contain drilling chemicals initially) including secondary containment, flood berms, etc.
- CSG production well construction / design/ drilling / integrity results in contamination of aquifers:
    - Well construction;
    - Drilling fluid losses; and
    - Well siting.
- Inappropriate reuse/disposal of drill cuttings and additives and flowback water.

Appropriate management plans and documents, and planned mitigation and management measures for each of these risks is presented in Table 5.2. These mitigation and management controls are considered sufficient to address the risk of adverse impact to MNES.

Note that chemicals of potentially high concern (Tier 3), may have additional mitigation and management measures to assist with reducing the potential risks to MNES as much as is reasonably practicable. These additional controls will be documented into their risk assessments, and where required the Environmental Management Plan will be updated to include the relevant mitigation and management controls.

Table 5.2 Management and Mitigation Measures for Identified Risks

Risk	Key Reference Documents.	Mitigation or Management Measure
	▪ Environmental Management Plan (SENEX-ATLS-EN-PLN-001); ▪ Spill Response Plan (SENEX-ATLS-EN-PLN-001); ▪ AS 3780:2008 – The storage and handling of corrosive substances; ▪ AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers; and ▪ Senex Hazardous Substances and Dangerous Goods Procedure (SENEX-CORP-HS-PRC-010).	**Transportation of chemicals** ▪ In order to minimise the risk of spillage Senex will ensure that all hazardous materials are transported, stored and handled in accordance with AS1940, Australian Dangerous good Code and Environmental Protection Agency (EPA) guidelines. ▪ Bulk fuel tanks stored outside bunded areas must be contained within a self-bunded (double-skinned) tank with safety valves. ▪ The requirements for managing hazardous substance and dangerous goods at Senex sites are outlined in Senex Hazardous Substances and Dangerous Goods Procedure (SENEX-CORP-HS-PRC-010).
	▪ AS 3780:2008 – The storage and handling of corrosive substances; ▪ AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers; and ▪ Environmental Management Plan (SENEX-ATLS-EN-PLN-001).	**Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Substances not in use are to be sealed and safely stored in a secure area. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. ▪ All chemical, oil and fuel storage areas are to be inspected at least monthly for temporary storage, and quarterly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. ▪ An inventory of all chemicals maintained on each site is to be maintained by the Senex Site Supervisor. ▪ Safety Data Sheets (SDS) are to be maintained on site at all times and for all chemicals. ▪ Minimise inventory volumes stored on site.
Above ground chemical spills and leaks	▪ Incident Management Procedure (SENEX-CORP-PLN-006). ▪ Spill Response Plan (SENEX-ATLS-EN-PLN-001). ▪ Environmental Management Plan (SENEX-ATLS-EN-PLN-001).	**Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports must contain information required by the Senex Environment Manager and any relevant plans and procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex requires that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ▪ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.
	▪ Environmental Protocol for Field Development and Constraints Analysis (SENEX-ATLS-EN-PRC-019).	**Well Siting** The Environmental Protocol for field development and constraints analysis prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. Petroleum activities must not occur in or within 200 m of a wetland of high ecological significance or a Great Artesian Basin Spring (DES 2016). This includes watercourse springs identified on the tenement.
	▪ Code of practice for Constructing and Abandoning Coal Seam Gas Wells and Associated.	**Well Construction** Standard Operating Procedures will be followed for sumpless drilling and mud mixing during the drilling process. These procedures will include the following: ▪ Sumpless drilling – drilling additives and mud are stored in portable, temporary tanks (no earthen pits); ▪ The use of bunds at surface;

Risk	Key Reference Documents.	Mitigation or Management Measure
		▪ Regular site inspections, monitoring and recording mud returns, monitoring and recording mud volumes in tanks daily; and ▪ Undertaking daily drillers instructions.
	▪ Environmental Management Plan (SENEX-ATLS-EN-PLN-001). ▪ Atlas Stage 3 Water Monitoring and Management Plan (SENEX-ATLS-EN-PLN-017).	**Management of produced water/flow back water** Produced water will generally be collected from the water gathering systems into lined aggregation dam/s. Water for beneficial use, where treatment is not required, will be drawn from the aggregation dams. Where practical, Senex will use untreated CSG produced water to support ongoing development / construction activities such as dust suppression, drilling, construction and hydro-testing. Any untreated produced water used as part of Project activities will be undertaken in accordance with the End of Waste Codes (ENEW07546918 and ENEW07547018) produced water with moderately low salinities (<4 dS/m) will generally be processed by calcium addition and pH amendment only, however for higher salinities treatment by reverse osmosis (RO) or blending with available fresh water will be undertaken as required. Where suitable, water use options to be considered include stock watering and irrigation. Produced water may be used for dust suppression and construction purposes provided the use: ▪ Does not result in negative impacts on the composition and structure of soil or subsoils; ▪ Is not directly or indirectly released to waters; ▪ Does not result in runoff from the construction site; and ▪ Does not harm vegetation surrounding the construction site. Produced water may be disposed of for domestic purposes or stock purposes and must meet the irrigation or livestock watering criteria as relevant to those purposes in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018 revision; online resource). It must be disposed of in accordance with the BUAs where approved by Senex Site Supervisor having consulted with the Senex Environment Manager. All dams must be constructed, operated and maintained n accordance with accepted engineering standards; and be lined within impermeable geomembranes that will contain the wetting front and any entrained contaminants within the bounds of the containment system during both its operational life and including any period of decommissioning. Dams will be subject to a separate risk assessment. ▪ Visual inspection of areas where produced water is used will be undertaken during and post-application daily to ensure conditions are being met. ▪ Monitoring and inspections including of water levels, water quality and early signs of loss of structural or hydraulic integrity will be undertaken by a suitably qualified and experienced person to ensure conditions are being met. ▪ Dams and regulated structures must be monitored for early signs of loss of structural or hydraulic integrity as specified in the initial hazard assessment. ▪ Monitoring and reporting of groundwater to be undertaken as per the Atlas Stage 3 Water Monitoring and Management Plan [SENEX-ATLS-EN-PLN-017].
CSG production well construction / design / drilling / integrity results in contamination of aquifers	▪ Code of Practice for Constructing and Abandoning CSG Wells and Associated Bores in Queensland (DNRME 2019). ▪ Operations Geologist Standard Operating Procedure (OPS-QLDS-SB-PRC-001). ▪ CSG Basis of Well Design (SENEX-QLDS-DR-BOD-001).	**Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.
	▪ Environmental Protocol for field development and constraints analysis (SENEX-ATLS-EN-PRC-019).	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Reference to the geological conditions encountered during the drilling of other nearby bores.
	▪ Environmental Protocol for Field Development and Constraints Analysis (SENEX-ATLS-EN-PRC-019).	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potential for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). Petroleum activities must not occur in or within 200 m of a wetland of high ecological significance or a Great Artesian Basin Spring (DES 2016). This includes watercourse springs identified on the tenement.
Inappropriate reuse / disposal of drill cuttings, additives and flowback water	▪ EA. ▪ Environmental Protection Act 1994 (State of Queensland 2022). ▪ the Waste Reduction and Recycling Act 2011 (WRR Act)(State of Queensland 2021); and ▪ Characterisation of Management of Drilling Fluids and Cuttings in the Petroleum Industry (DES 2019).	**Appropriate disposal of drilling additives** Waste solids will be disposed of to landfill. Drilling additives to be recycled where practicable. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per EA requirements. Disposed of on site by land application following assessment and certification (by a suitably qualified third-party) that the quality and proposed application methods will not result in environmental harm. Records must be kept to demonstrate compliance with Condition Waste 15 and Waste 16 of the EA.

Risk	Key Reference Documents.	Mitigation or Management Measure
		The Department of Environment and Science (DES) regulates the management and disposal of wastes in Queensland under the provisions of the Environmental Protection Act 1994 (State of Queensland 2022), the Waste Reduction and Recycling Act 2011 (WRR Act)(State of Queensland 2021) and subordinate legislation. Further information on these regulations and management of drilling waste materials is provided in the Characterisation of Management of Drilling Fluids and Cuttings in the Petroleum Industry (DES 2019). Where onsite management options are proposed, state approvals require that the quality of material meet approved quality criteria and / or are assessed and certified by a suitably qualified third-party as being suitable for the application to land. If these options are to be used, Senex will undertake the appropriate assessments and develop management plans as per the requirements of the relevant state approvals. All waste generated in construction, operations and decommissioning must be stored, handled and transported in accordance with the waste and resource management hierarchy, waste and resource management principles, appropriate standards and regulatory requirements as outlined in the Senex Waste Management Procedure – Qld Operations [SENEX-QLDS-EN-PRC-022]. Only licensed waste contractors may collect, transport and dispose of regulated waste from the site.

5.3 Monitoring

5.3.1 Groundwater

Groundwater monitoring will act as a key mechanism for the early identification of the response to CSG water production, within the WCM and other formations where groundwater receptors exist.

The groundwater monitoring requirements for CSG tenure holders within the Surat Cumulative Management Area (CMA) are provided as part of the underground water impact report (UWIR) water management strategy (WMS) (OGIA 2021), which establishes baseline trends, identifies any changes within or near CSG development areas or locations of interest and informs future improvement of groundwater modelling. Due to the relatively small scale of the Project, two existing WMS monitoring bores located within PL 209, its location in relation to existing tenure holders, and their monitoring infrastructure (required by the UWIR WMS), Senex are not currently required by OGIA to install any additional groundwater monitoring facilities within the Project area. Senex will comply with any updates to the WMS that may be required in any future updates of the UWIR. The Water Monitoring and Management Plan (WMMP) outlines all groundwater monitoring being undertaken by Senex (SENEX-ATLS-EN-PLN-017).

Bore baseline assessments have been completed for ATP 2059, PL 209 and PL 445. Seventeen bores were assessed as being used for stock and domestic use. The majority of these bores were screened in the Gubberamunda Sandstone, two were screened in the Upper Springbok Sandstone and one in the Orallo Formation.

Senex will comply with any updates to the bores required for baseline assessment as part of the UWIR WMS that may be required in any future updates of the UWIR. Any future baseline assessments will be conducted in accordance with the DES ‘Baseline Assessments Guideline’ (DES 2022).

A groundwater quality trigger, action response plan (TARP) will be developed for the Senex groundwater monitoring network, which currently includes 12 monitoring bores. The use of the TARP will assist with understanding changes to groundwater quality that may be related to the drilling fluids. The chemical composition of drilling fluids to be used across Atlas Stage 3 were reviewed and key water quality indicators identified. The key indicator parameters will be assessed after each quarterly monitoring round to identify any trends or changes to groundwater quality. These key indicators include primary indicators of pH, Total Dissolved Solids (TDS), and Total Organic Carbon (TOC). Secondary indicators, which would be reviewed following identification of upward trend development of primary indicators, include a wide range of dissolved metals, salts, ions, and total petroleum hydrocarbons (TPH). Further information on the groundwater trigger methodology, action plan, and corrective actions are discussed in the WMMP.

5.3.2 Produced Water Quality Monitoring

The water quality of the produced water needs to be understood in order to identify potential impacts to the receiving environment should seepage, overtopping or emergency discharge to the environment occur. Water quality testing of produced water from Atlas production wells has been

ongoing since 2018. Detailed chemical testing of produced water entering the Atlas Water Treatment plant has been occurring from October 2022. The quarterly analytical suite includes:

- Field parameters: pH, dissolved oxygen, temperature, oxidation reduction, EC, TDS
- Lab pH
- Lab Electrical conductivity
- Sodium adsorption ratio
- Suspended solids
- Alkalinity
- Major ions (sodium, calcium, magnesium, potassium, sulfate, chloride, and fluoride)
- Total metals: barium, boron, lithium

The full suite of total metals is undertaken annually, and dissolved metals are tested if total concentrations are of concern.

Total recoverable hydrocarbons (TRH) volatiles/BTEX and TRH semi-volatile fraction are currently tested quarterly until there are eight complete datasets.

5.3.3 Land and Soils

Under the CSG Water Management Plan (WMP) (SENEX-ATLS-EN-PLN-013 and SENEX-ATLS-EN-PLN-014), Senex will undertake land and soil monitoring where CSG water management activities have the potential to significantly impact on environmental values.

5.4 Reporting

Monitoring, auditing of, and reporting on, contractor and Senex on site activities provides a direct measure of Senex's compliance with environmental regulations and EA conditions, together with an indication of the effectiveness of the HSEMS, EMP and supporting procedures and plans.

Environmental inspections, monitoring and auditing will be undertaken in terms of the Atlas Environmental Management Plan by the Senex Site Supervisor and Senex Environmental representatives periodically (in compliance with approval conditions) to assess whether activities comply with the requirements of these systems and documents (SENEX-ATLS-EN-PLN-001; Senex 2022).

5.4.1 Data Management and Reporting

Data collected as part of any monitoring will be collated and stored in the Senex database system, which will include any groundwater quality sampling results (SENEX-ATLS-EN-REP-006; Senex 2018). Senex will undertake all reporting as per the requirements under the State and Federal legislation, including to:

- OGIA as part of the UWIR requirements and in accordance with the Project's EA conditions.
- DCCEEW as part of the Joint Industry Framework (JIF) annual compliance requirements.

Senex and its contractors will maintain an appropriate and auditable record system. Environmental reporting information will include as relevant:

- Inspection / monitoring reports;
- Photographic records;
- Training and induction attendance and associated dates;
- Incident reports;
- Remedial actions taken following incident reports;
- Records of waste removal including waste tracking certificates; and
- Audit reports.

If an adverse impact to MNES is detected during the use and handling of chemicals, the Department is to be notified in writing within 15 business days of detection. The notification must specify the location, date and time of the adverse impact and include a short description of the adverse impact and the MNES adversely impacted.

All records and data required to be maintained by EA conditions will be retained for a minimum of 5 years. SDS records are kept by drilling contractors on site during each stage of drilling.

Drilling additives are selected and managed to ensure all products are used in accordance with the manufacturer's recommendations and relevant SDS. The name, type and quantity of each drilling fluid additive used on each well are recorded by Senex (Senex 2022; KCB 2022).

6 CLOSING

We would like to thank you for the opportunity to work on this assignment. Should you have any questions, please do not hesitate to contact the undersigned.

KCB AUSTRALIA PTY LTD.

Carly Waterhouse, MSc, RPGeo
Senior Hydrogeologist

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APPENDIX I

Chemical Classification Matrix

Criteria		INITIAL CHECK	TIER 1	TIER 2	TIER 3	PROHIBITED FROM USE
Concern/Risk Level		**LOW CONCERN**	**LOW CONCERN**	**POTENTIAL CONCERN**	**POTENTIALLY HIGH CONCERN**	**VERY HIGH CONCERN**
Risk assessment level		Screening risk assessment	Screening risk assessment	Detailed risk assessment	Refined Risk assessment	Prohibited from use on project
Listed as chemical of concern (COC) on relevant databases		1. Initial check to identify chemicals previously assessed by national or international regulators and considered to be of low hazard, and therefore low risk, for human health and the environment.	Not listed as a chemical of potential concern on the following databases: - European Union Substance of Very High Concern (EU SVHC). - US National Toxicology Program (US NTP) Report on Carcinogens or International Agency Research on Cancer (IARC) Monographs. - European Commission Endocrine Disruptors Strategy - list of Category 1 substances with endocrine disrupting capacity. - Chemical Substances Control Law of Japan (CSCL) Class I and II Specified Chemical.	Listed as a chemical of concern on the following databases: - European Union Substance of Very High Concern (EU SVHC). - US National Toxicology Program (US NTP) Report on Carcinogens or International Agency Research on Cancer (IARC) Monographs. - European Commission Endocrine Disruptors Strategy - list of Category 1 substances with endocrine disrupting capacity. - Chemical Substances Control Law of Japan (CSCL) Class I and II Specified Chemical.	Listed as a chemical of concern on the following databases: - European Union Substance of Very High Concern (EU SVHC). - US National Toxicology Program (US NTP) Report on Carcinogens or International Agency Research on Cancer (IARC) Monographs. - European Commission Endocrine Disruptors Strategy - list of Category 1 substances with endocrine disrupting capacity. - Chemical Substances Control Law of Japan (CSCL) Class I and II Specified Chemical.	Chemicals noted in the Rotterdam Accord including: - octabromodiphenyl ether - pentabromodiphenyl ether - perfluorooctane sulfonic acid - perfluorooctane sulfonates - perfluorooctane sulfonamides - perfluorooctane sulfonyls - polybromated biphenyls - short chain chlorinated paraffins - tetramethyl lead - tributyl tin compounds Chemicals restricted in the State of Queensland including: - Benzene* - Toluene* - Ethylbenzene* - m-&p- and o-Xylene*
Persistence		N/A	Not persistent as defined by: Air - Half life < 2 days Water - Half life < 60 days Soil and Sediment - Half life < 6 months	Persistent as defined by: Air - Half life ≥ 2 days Water - Half life ≥ 60 days Soil and Sediment - Half life ≥ 6 months	Persistent as defined by: Air - Half life ≥ 2 days Water - Half life ≥ 60 days Soil and Sediment - Half life ≥ 6 months	N/A
Bioaccumulative		N/A	Does not Bioaccumulate as defined by: - Aquatic - BAF < 2000 or BCF < 2000 or log KoW < 4.2 (if BAF and BCF are not available) -Terrestrial - log Koa < 6 and log Kow < 2 - Food Chain Bioaccumulation Potential - BMF < 1	Does not Bioaccumulate as defined by: - Aquatic - BAF < 2000 or BCF < 2000 or log KoW < 4.2 (if BAF and BCF are not available) -Terrestrial - log Koa < 6 and log Kow < 2 - Food Chain Bioaccumulation Potential - BMF < 1	Does Bioaccumulate as defined by: - Aquatic - BAF ≥ 2000 or BCF ≥ 2000 or log KoW ≥ 4.2 (if BAF and BCF are not available) -Terrestrial - log Koa ≥ 6 and log Kow ≥ 2 - Food Chain Bioaccumulation Potential - BMF > 1	N/A
Toxicity	**Acute toxicity**	N/A	Fish -96h LC 50 > 10 mg/L Invertebrates - 48h EC50 > 10 mg/L Algae and other aquatic plants -72 or 96h ErC50 > 10 mg/L	Fish -96h LC 50 >1 to < 10 mg/L Invertebrates - 48h EC50 >1 to < 10 mg/L Algae and other aquatic plants -72 or 96h ErC50 >1 to < 10 mg/L	Fish -96h LC 50 ≤ 1 mg/L Invertebrates - 48h EC50 ≤ 1 mg/L Algae and other aquatic plants -72 or 96h ErC50 ≤ 1 mg/L	N/A
	Chronic toxicity	N/A	Fish NOEC or Ecx >1 mg/L Invertebrates NOEC or Ecx > 1 mg/L Algae and other aquatic plants - NOEC or Ecx > 1 mg/L	Fish NOEC or Ecx >0.1 to < 1 mg/L Invertebrates NOEC or Ecx >0.1 to < 1 mg/L Algae and other aquatic plants - NOEC or Ecx >0.1 to < 1 mg/L	Fish NOEC or Ecx ≤ 0.1 mg/L Invertebrates NOEC or Ecx ≤ 0.1 mg/L Algae and other aquatic plants - NOEC or Ecx ≤ 0.1 mg/L	N/A
Risk assessment action required		N/A	Toxicological profile	Toxicological profile Qualitative risk assessment	Toxicological profile Quantitative risk assessment	N/A

APPENDIX II

Register of Assessed Chemicals (Template)

			Document Control			Stage 1: Initial Check	Stage 2: Screening Assessment							RISK ASSESSMENT			ASSESSED DRILLING ACTVITY					
Chemical Name	CAS No.	Contained in the following drilling fluids:	Initial Chemical Assessment Date	Independent Peer Review	Chemical Re-evaluation Date	Previously Assessed as low hazard by NICNAS? Y/N	Listed as a COC on relevant databases?	Persistence Tier	Bioaccumulation Tier	Acute toxicity Tier	Chronic toxicity tier	Overall Tier	Concern/ Risk Level	Toxicological profile?	Qualitative risk assessment?	Quantitative risk assessment?	Drilling additive - CSG production well	Drilling additive - completion and workover	Drilling additive - exploration and core holes	Drilling additive for abandonment	Production Operations	Monitoring Wells
Example chemical			Dd/mm/yy		Dd/mm/yy	N	No	1	1	1	1	1	**Low**	YES	N/A	N/A	X	X	X			X

Notes:
COC = chemical of concern

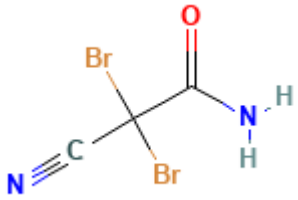
APPENDIX III

Example Toxicological Profiles

TOXICOLOGICAL PROFILE

1 2,2-DIBROMO-3-NITRILOPROPIONAMIDE

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	2,2-Dibromo-2-cyanoacetamide
CAS No.	10222-01-2
AICS name(s)	Acetamide, 2,2-dibromo-2-cyano-
Synonyms	Dibromocyanoacetamide, DBNPA, 2,2-Dibromo-3-nitrilopropionamide, 2,2-Dibromo-2-cyanoacetamide
Structural formula	
Molecular formula	$C_3H_2Br_2N_2O$
Molecular weight	241.87 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White to “off white” colour crystalline solid
SMILES notation	CC(=O)N(C(=N)Br)Br

1.2 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	123 – 125°C @ 101.3 kPa
Boiling point	Decomposes at 190°C @ 101.3 kPa
Density (relative to water)	934 -1,370 kg/m^3 (temperature not provided)
Water solubility	15 g/L @ 25°C
pKa	8.24
Log K_{ow}	0.80-0.88 L/kg (pH not provided)
Vapour pressure	0.120 Pa @ 25°C

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No

Convention, Protocol or other International Control	Listed yes or no?
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	DBNPA is highly soluble in water. Volatilisation from water surfaces or moist soil surfaces is not expected to be an important fate process based upon this compound's estimated Henry's Law constant (1.9 x 10-3 Pa m3/mol). It is also not expected to volatilise from dry soil surfaces based upon its vapor pressure (Pub Chem). Degradation of DBNPA is extremely pH dependent with increased degradation rates observed at higher pH's.
Degradation	The primary degradation pathway is through aerobic and anaerobic metabolism. In both anaerobic and aerobic metabolism studies, half-lives of less than 4 hours were measured for DBNPA; loss was due to both hydrolysis and biodegradation (EPA, 1994).
Persistence	While the rate of biodegradation in these tests does not satisfy the OECD criterion for readily biodegradability (60% in a 10-day window), the results do show that DBNPA is biodegradable at more realistic environmental exposure concentrations. If a chemical is found to be inherently biodegradable or readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).
Bioaccumulation	There are no reliable bioaccumulation studies on DBNPA. DBNPA is not expected to bioaccumulate based on a log Kow of 0.80 – 0.88 (PubChem).
Transport	If released to soil, based on this Koc value, the substance is expected to have high mobility. If released to water, based on the Koc value and its water solubility, DBNPA is not expected to adsorb to suspended solids and sediment.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

DBNPA is very toxic to aquatic organisms. DBNPA is also moderately acutely toxic to birds.

Acute Studies:

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Bluegill sunfish (Lepomis macrochirus)	96-hour LC_{50}	2.3	3	EPA, 2019
Bluegill sunfish (Lepomis macrochirus)	96-hour LC50	1.3	-	EPA, 2019
Rainbow Trout (Onchorhynchus mykiss)	96-hour LC50	1.0	-	EPA, 2019
Rainbow Trout (Onchorhynchus mykiss)	96-hour LC50	2.3	3	EPA, 2019
Fathead minnow (Pimephales promelas)	96-hour LC50	1.8	3	EPA, 2019
Fathead minnow (Pimephales promelas)	96-hour LC50	0.55	-	EPA, 2019
Sheepshead minnow (Cyprinodon variegatus)	96-hour LC50	3.3	-	EPA, 2019
Sheepshead minnow (Cyprinodon variegatus)	96-hour LC50	1.71	-	EPA, 2019
Daphnia magna	48-hour EC50	0.9	3	EPA, 2019
Daphnia magna	48-hour EC50	0.86	3	EPA, 2019
Green algae (Pseudokirchneriella subcapitata)	96-hour EC50	0.116		EPA, 2019

1.5.2 Chronic Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Rainbow Trout (Onchorhynchus mykiss)	85-d NOEC	0.47	2	EPA, 2019
Daphnia magna	28-d NOEC	0.05	3	EPA, 2019

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Green algae (Pseudokirchneriella subcapitata)	NOEC	0.058		EPA, 2019

1.5.3 Toxicity to Sediment Organisms

Acute Toxicity:

Test Species	% Active Ingredient (a.i)	Results (mg/kg-bw)	Reference
Mallard Duck (Anas platyrhynchos)	Technical Grade	205	EPA, 2019
Northern Bobwhite (Colinus virginianus)	Technical Grade	150	EPA, 2019
Northern Bobwhite (Colinus virginianus)	100	354	EPA, 2019

1.5.4 Terrestrial Toxicity

No data available.

1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

APPENDIX IV

Example Qualitative Risk Assessment

QUALITATIVE RISK ASSESSMENT

Petroleum Gas Oil

CAS Name	2,2-Dibromo-2-cyanoacetamide
CAS No.	10222-01-2
AICS name(s)	Acetamide, 2,2-dibromo-2-cyano-
Synonyms	Dibromocyanoacetamide, DBNPA, 2,2-Dibromo-3-nitrilopropionamide, 2,2-Dibromo-2-cyanoacetamide
Assigned Tier Level	Initially assigned Tier 3, downgraded to Tier 2
Relevant Drilling fluid	DNBPA 20%

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Well Volume Estimate (litres)	Wellbore Concentration Required (ppm)	Chemical Quantity per Well Treatment (mg)	General Purpose and Function
Biocide Well Treatment Nominated frequency: Annual. Note: Only 1 biocide would be used per application	Open Hole Section	DBNPA 20%	10,000 - 15,000	100	1.0 – 1.5	Biocide; Applied by injection into well annulus as shock treatment. Chemical quantity diluted with ~200 L of water onsite for application.

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to Matters of National Environmental Significance (MNES). The pathway assessment is being undertaken due to the chemical being a miscible liquid.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
2,2-dibromo-3-nitrilopropionamide	Liquid	Miscible	The soluble nature of this drilling chemical presents some risk that it could move off-site and will be considered further in this risk assessment

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
2,2-dibromo-3-nitrilopropionamide	2,2-dibromo-3-nitrilopropionamide, CAS 10222-01-2: 20%;	High persistence in water	Not considered as bioaccumulative	2,2-dibromo-3-nitrilopropionamide has a low mobility (KOC=8.978)

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling Fluid	Chemical Name	Maximum Chemical Concentration of Active Substance (mg/L)	Toxicity to Fish	Toxicity to Invertebrates	Toxicity to Algae	Comment
DBNPA 20%	2,2-dibromo-3-nitrilopropionamide	100	LC50 (96h) 0.55 mg/L (Fish)	EC50 (48h) 0.74 mg/L	Not available	Proposed chemical concentration is greater than environmental health hazard criteria, there is DBNPA 20% potential for environmental harm.

Quantitative Risk Assessment – Groundwater 1D Transport Modelling

Contaminant transport modelling was undertaken to assess the potential concentration of a drilling chemical at a receptor. Surface water spill modelling has not been undertaken, but the likelihood of a spill can be managed, and its impacts mitigated more readily than a groundwater impact. Senex has several standard procedures in place to facilitate appropriate materials and chemical handling practices and to effectively deal with surface spills.

Potential Receptors

As there are several potential receptors and the location of the wells has not been confirmed, indicative distances from a groundwater receptor to a CSG well were used in the modelling. Distances of 200 m and 50 m were modelled to provide an indication of sensitivity of the chemical to the receptor.

There is a Department of Environment, Science and Innovation (DESI) requirement that petroleum activities must not occur in or within 200 m of a wetland of high ecological significance or a Great Artesian Basin Spring (DES 2016). CSG wells may be located within 200 m of a water receptor should groundwater modelling and environmental risk assessment suggest that there are no potential impacts from drilling fluids and drill cuttings.

Wells will generally be spaced 500 to 750 m apart, therefore cumulative impact by more than one well on a receptor is unlikely.

Model Scenarios

The aquifer formations which supported groundwater abstraction and were potentially at risk, include the Walloon Coal Measures, the Westbourne Formation, the Springbok Sandstone and the Gubberamunda Sandstone. The model simulated the movement of a drilling chemical through the most permeable formation, the Gubberamunda Sandstone. Locally groundwater users abstract groundwater from the Gubberamunda Sandstone.

Model Parameters

The basic model parameters adopted in the analytical contaminant transport assessment are summarised below.

The adopted contaminant concentration input is 100 mg/L. Adoption of this concentration into the model facilitates calculation of indicative contaminant concentrations over time that may occur at a receptor (200 m or 50 m from the well).

Transport Model Parameters

Data Type	Parameter	Value			Source of Data
		Min	Max	Mean	
Receptor data	Distance to nearest receptor (m)	200			A 200 m conservative distance
Hydrogeology	Hydraulic conductivity (m/d)	1.9×10^{-2}	1.2×10^{-1}	5.2×10^{-2}	These values were taken from the UWIR to represent the most permeable formation – the Gubberamunda Sandstone
	Hydraulic gradient	0.0003	0.3	0.003	
	Effective porosity (%)	0.02	0.24	0.15	
Dispersion	Longitudinal Dispersivity	Dispersivity is calculated based on the distance to receptor and assuming 1/10th x plume length and 0.5 m for vertical dispersivity (Pickens and Grisak, 1981).			N/A
	Transverse Dispersivity				
	Vertical Dispersivity				
Adsorption	Retardation factor Soil Bulk density (f_{oc}) (K_{oc})	N/A			Adsorption not modelled for a conservative assessment
Contaminant source	Source thickness (m)	1,000			To represent 1,000 m deep well (overly conservative)
	Width (m)	0.5			Represents well width
	Length (m)	0.5			Represents well length
	Contaminant concentration (mg/L)	100			Representative drilling chemical concentration for illustrative purposes
Degradation	Rate of decay (1/day)	$1x10^{-10}$			A value as close to 0 as possible is used for conservative modelling.
Retardation	Bulk Density (g/cm^3)	Not applied			

[1] Note that cement and cement additive chemicals to be applied to a well will set and harden; only leachate concentrations of these chemicals will have the potential to impact on groundwater. Leachate concentrations were assumed to be 1% of the max. chemical concentration.

Model Sensitivity

Sensitivity in the model was assessed through stochastic simulation of selected parameters. The following parameters were considered for stochastic consideration of likely parameter bounds:

- Hydraulic conductivity;
- Effective porosity; and
- Hydraulic gradient.

Stochastic modelling follows a Monte Carlo simulation technique which allow multiple realisations of different "what if" cases where the ranges and distributions of the parameters are assessed. This allows the range of possible outcomes and their probability of occurring to be reported.

The Monte Carlo probability capability of GoldSim was used to assign distributions of the input parameters listed above. The approach allows the definition of the assumptions for each input and the 1-D contaminant transport equations to be assessed for multiple scenarios. This approach provides a broad understanding of the model variability, with results typically provided as ranges associated with a probability of occurrence.

Results

In summary:

- The 1D analytical model assumes that a constant source will be maintained at the well point. It is noted that most chemicals will not be applied consistently to the wells, and that concentrations will recede following chemical application. It is also noted that the lifetime of a CSG well is expected to be between 20 and 50 years. The model does not take into account retardation, degradation or sorption of the chemical contaminant and concentrations at the receptor. The model is therefore considered to represent an indicative scenario and is substantially conservative in nature; modelled concentrations at receptors are expected to be markedly lower than predicted.
- The 1D analytical model suggests that within 25 years there will be a concentration of 0.19 mg/L (mean) contaminant concentration at a receptor 50 m from a CSG well.
- The model was run for 400 years, at this time a mean maximum concentration at the receptor of 0.24 mg/L is predicted (50 m distance to receptor).

Chronic aquatic toxicity

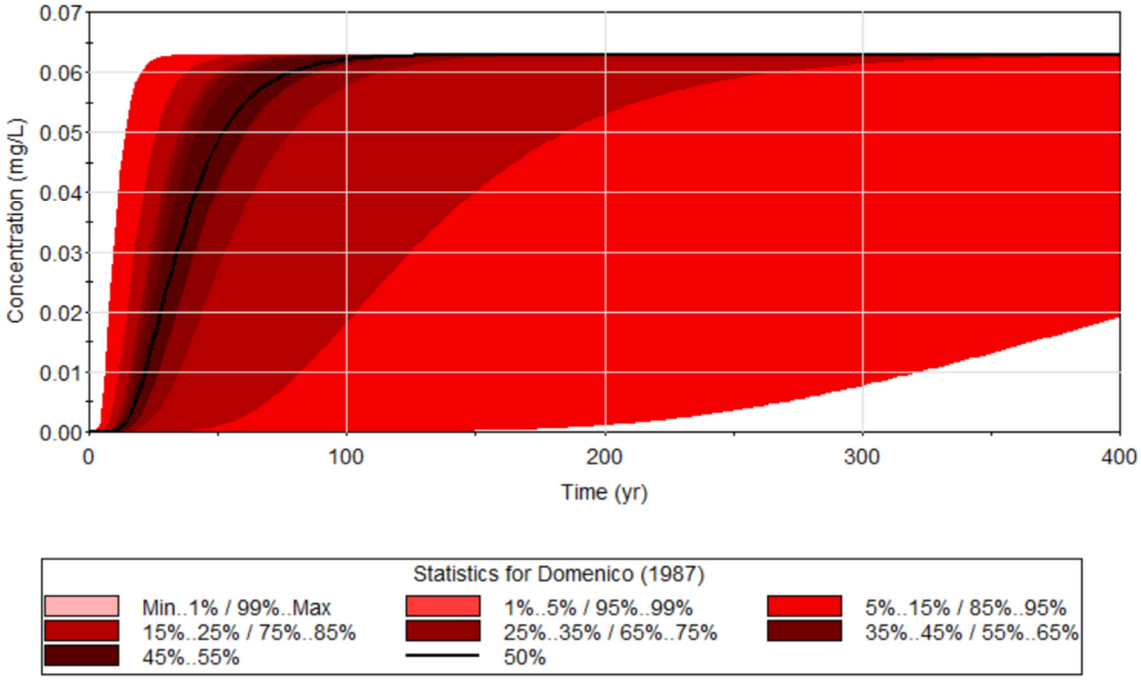
Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Rainbow Trout (*Onchorhynchus mykiss*)	85-d NOEC	0.47	2	EPA, 2019
Daphnia magna	28-d NOEC	0.05	3	EPA, 2019
Green algae (*Pseudokirchneriella subcapitata*)	NOEC	0.058		EPA, 2019

- Regardless of the results of the modelling, this chemical is only proposed to be used in plug and abandonment. During this time only the Walloon Coal Measures is open in the well, there is no pathway within 200 m from the Walloon Coal Measures to freshwater receptors in the surface water systems of Wandoan and Woleebee Creeks. The Walloon

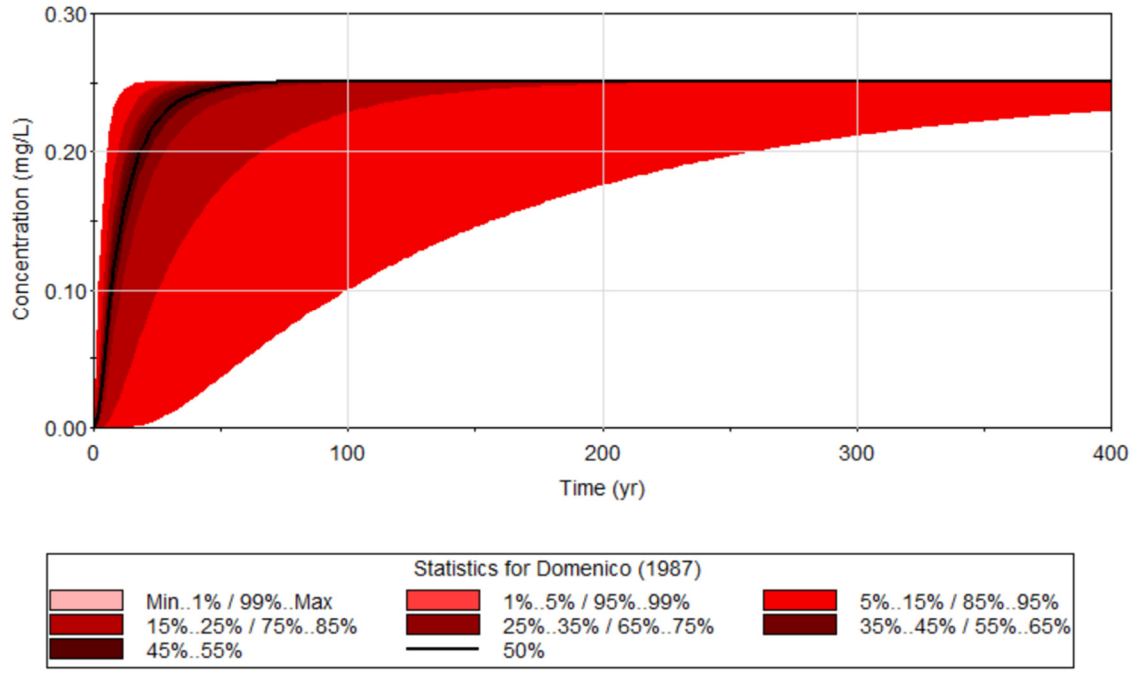
Coal Measures is at a significant depth below these systems. For this reason, this chemical has been downgraded to a Tier 2.

Mean Predicted Concentrations at Receptor

Formation	Distance to Receptor	Mean Potential Concentration at Receptor in 100 years (mg/L)	Time to Reach Maximum (Years)
Gubberamunda Sandstone	200	0.013	0.06 mg/L in 400 years
	50	0.21	0.24 mg/L in 400 years



Potential Contaminant Concentrations, based on Monte Carlo probability distribution at Receptor 200 m from CSG Well



Potential Contaminant Concentrations, based on Monte Carlo probability distribution at Receptor 50 m from CSG Well

Risk Assessment – Predicted Significance of Impact

The significance of impact on a MNES has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
CM401	Moderate to High	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	High potential for adverse effects on aquatic ecosystems and permanent human health effects through prolonged exposure

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	High	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ◆ Minimising release; ◆ Containing spilled material; ◆ Raising the alarm and response; ◆ Locations of spill kits; and ◆ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ◆ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	High	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low		1	High	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	High	Low			High	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Low			High	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	High	Low
	Wandoan Creek		4	High	High			High	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	High	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	High	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low		1	High	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Mod			High	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		High	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	High	Mod			High	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Mod			High	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Mod			High	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	High	Low		1	High	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependence on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	High	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	High	Low			High	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	High	Low			High	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Mod			High	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Mod			High	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	High		1	High	I
	Wandoan Creek		4	High	High			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

REFERENCES

DES. 2016. “Streamlined Model Conditions for Petroleum Activities: Guideline, Environmental Protection Act 1994.” State of Queensland, Department of Environment and Heritage Protection.

DNRME. 2019. “Code of Practice for the Construction and Abandonment of Petroleum Wells, and Associated Bores in Queensland - Version 2.” State of Queensland, Department of Natural Resources, Mines and Energy. https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0006/1461093/code-of-practice-petroleum-wells-bores.pdf.

APPENDIX II

Chemical Register

			Document Control			Stage 1: Initial Check	Stage 2: Screening Assessment							RISK ASSESSMENT			Assessed Drilling Activity					
Chemical Name	CAS No.	Contained in the following drilling fluids:	Initial Chemical Assessment Date	Independent Peer Review	Chemical Re-evaluation Date	Previously Assessed as low hazard by NICNAS? Y/N	Listed as a COC on relevant databases?	Persistence Tier	Bioaccumulation Tier	Acute toxicity Tier	Chronic toxicity tier	Overall Tier	Concern/Risk Level	Toxicological profile?	Qualitative risk assessment?	Quantitative risk assessment?	Drilling additive - CSG production well	Drilling additive - completion and workover	Drilling additive - exploration and core holes	Drilling additive for abandonment	Production Operations	Monitoring Wells
Boric Acid	10043-35-3	FOAM-X-ACX-145	25/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A	X	X	X			X
Calcium chloride	10043-52-4	CM600	23/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A				X		
Calcium Sulfate Dihydrate	10101-41-4	Blended cement	26/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A				X		
2,2-dibromo-3-nitrilopropionamide	10222-01-2	DNBPA 20%	15/11/2023			N	No	1	1	3	3	2	POTENTIAL	YES	YES	N/A					X	
Triethanolamine	102-71-6	FOAM-X-ACX-143, CM601	25/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A	X	X	X	X		X
2-Ethyl-1-hexanol	104-76-7	COHO Defoam, Foam-X ACB 143	25/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A	X	X	X			X
Ethylene Glycol	107-21-1	CM500	25/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A				X		
Glyoxal	107-22-2	Duo-Vis	26/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A	X	X	X			X
N,N'-methylenediacrylamide	110-26-9	FOAM-X- ACS-141	15/11/2023			N	No	1	1	2	-	2	POTENTIAL					X				
Gluteraldehyde	111-30-8	Glutaraldehyde 25%, ALDACIDE G, COHO Glute 9	16/11/2023			N	No	1	1	2	1	2	POTENTIAL	YES	YES	N/A	X	X	X	X	X	X
Diethanolamine,	111-42-2	CM601, FOAM-X ACB-143	26/10/2023			N	No	1				1	LOW	YES	N/A	N/A	X	X	X	X		X
2-Butoxyethanol	111-76-2	FOAM-X ACF-147	26/10/2023			N	No	1				1	LOW	YES	N/A	N/A		X				
1-Octanol	111-87-5	CM401	15/11/2023			N	No	1	1	1	-	1	LOW							X		
1-Decanol	112-30-1	CM401	15/11/2023			N	No	1	2	2	2	2	POTENTIAL							X		
Ammonium Sulfate 2-(2-butoxyethoxy)ethanol	112-34-5	Foam-X ACF-144	20/11/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A	X	X	X			X
Xanthan gum	11138-66-2	Duo-Vis	23/10/2023			Y (NICNAS 2017)	N/A	N/A	N/A	N/A	N/A	N/A	LOW	N/A	N/A	N/A	X	X	X			X
triethylamine	121-44-8	THPS 5-%	15/11/2023			N	No	1	1	1	1	1	LOW								X	
Bentonite	1302-78-9	CM300	23/10/2023			Y (NICNAS 2017)	N/A	N/A	N/A	N/A	N/A	N/A	LOW	N/A	N/A	N/A				X		
Calcium Oxide	1305-78-8	Blended cement	26/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A				X		
Potassium hydroxide	1310-58-3	Foam-X ACX-145, Foam-X ACB-143	26/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A	X	X	X			X
Sodium Hydroxide	1310-73-2	Caustic Soda	26/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A				X		
Limestone	1317-65-3	Blended cement	23/10/2023			Y (NICNAS 2017)	N/A	N/A	N/A	N/A	N/A	N/A	LOW	N/A	N/A	N/A				X		
Kaolin	1332-58-7	Contingency Program	15/11/2023			N	No	1	N/A	1	1	1	LOW				X		X			X
Sodium Silicate solution	1344-09-8	CM301	26/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A				X		

			Document Control			Stage 1: Initial Check	Stage 2: Screening Assessment							RISK ASSESSMENT			Assessed Drilling Activity					
Chemical Name	CAS No.	Contained in the following drilling fluids:	Initial Chemical Assessment Date	Independent Peer Review	Chemical Re-evaluation Date	Previously Assessed as low hazard by NICNAS? Y/N	Listed as a COC on relevant databases?	Persistence Tier	Bioaccumulation Tier	Acute toxicity Tier	Chronic toxicity tier	Overall Tier	Concern/Risk Level	Toxicological profile?	Qualitative risk assessment?	Quantitative risk assessment?	Drilling additive - CSG production well	Drilling additive - completion and workover	Drilling additive - exploration and core holes	Drilling additive for abandonment	Production Operations	Monitoring Wells
Wollastonite (Ca(Sio3))	13983-17-0	FORM-A-BLOK	15/11/2023			N	No	1	1	1	1	1	LOW				X		X			X
Monoethanolamine	141-43-5	Nuosept 78	26/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A	X		X			X
Ethylenediaminetetra (methylenephosphonic acid)	1429-50-1	CM102	17/11/2023			N	No	2	1	1	-	2	LOW							X		
Crystalline silica (impurity)	14808-60-7	BARACARB 1200, STOPPIT, Blended Cement, Safe-Carb 250, Fiber (F/M/C)	27/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A	X		X	X		X
2-Acrylamido-2-methyl-1-propanesulfonic acid	15214-89-8	CM502	15/11/2023			N	No	2	-	1	-	2	POTENTIAL							X		
Chromium (6+)	18540-29-9	Blended cement	16/11/2023			N	No	2	2	3	-	2	POTENTIAL							X		
Dipropylene glycol	25265-71-8	DNBPA 20%	15/11/2023			N	No	1	1	1	1	1	LOW								X	
Polypropylene Glycol	25322-69-4	CM401	15/11/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A				X		
Polyethylene glycol diacrylate	26570-48-9	Foam-X ACS-141	15/11/2023			N	No	1	-	1	-	1	LOW				X	X	X			X
Hexanedioic acid, compd. with 1,6-hexanediamine (1:1) Molecular Formula	3323-53-3	COHO F2V N12, COHO Floc C	14/11/2023			N	No	1	1	1	1	1	LOW				X		X			X
Calcium Carbonate	471-34-1	Safe-Carb 250	27/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A	X		X			X
s-Triazine-1,3,5-triethanol	4719-04-4	Nuosept 78	15/11/2023			N	No	1	1	1	-	1	LOW				X		X			X
Sodium Carbonate	497-19-8	Soda Ash	27/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A	X		X			X
Tetrakis (Hydroxymethyl)Phosphonium Sulfate	55566-30-8	THPS 50%, IDCIDE-20	27/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A		X			X	
Nitrogen containing Polysaccharide	56780-58-6	COHO F2V CS	17/11/2023			N	No	-	-	-	-	2	POTENTIAL				X		X			X
Stearic Acid	57-11-4	CM401	17/11/2023			N	No	1	2	1	1	2	POTENTIAL							X		
Potassium Carbonate	584-08-7	Foam-X ACX-145	15/11/2023			N	No	1	-	1	1	1	LOW				X	X	X			X
Cocoamidopropyl betaine	61789-40-0	Foam-X ACF-147	27/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A		X				
Polyethylene Glycol Monotallate	61791-00-2	CM401	20/11/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A				X		
Polycarboxylic acid, sodium salt	62601-60-9	CM200	14/11/2023			N	No	-	-	-	-	2	POTENTIAL							X		
Petroleum Gas Oil	64741-44-2	CM401	16/11/2023			N	No	2	-	2	3	2	POTENTIAL							X		
Hydrotreated Light Distillate	64742-47-8	CM401, FOAM-X ACG-1412	27/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A				X		

			Document Control			Stage 1: Initial Check	Stage 2: Screening Assessment							RISK ASSESSMENT			Assessed Drilling Activity					
Chemical Name	CAS No.	Contained in the following drilling fluids:	Initial Chemical Assessment Date	Independent Peer Review	Chemical Re-evaluation Date	Previously Assessed as low hazard by NICNAS? Y/N	Listed as a COC on relevant databases?	Persistence Tier	Bioaccumulation Tier	Acute toxicity Tier	Chronic toxicity tier	Overall Tier	Concern/Risk Level	Toxicological profile?	Qualitative risk assessment?	Quantitative risk assessment?	Drilling additive - CSG production well	Drilling additive - completion and workover	Drilling additive - exploration and core holes	Drilling additive for abandonment	Production Operations	Monitoring Wells
Granulated Blast Furnace Slag	65996-69-2	Blended cement	17/11/2023			N	No	2	1	1	1	2								X		
Hydraulic Silicate Cement	65997-15-1	Blended cement	31/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A				X		
Methanol	67-56-1	ALDACIDE G	31/10/2023			N	No	1	1	1	1	1	LOW	YES	N/A	N/A		X		X		
Ethoxylated C6-C10 Alcohol	68037-05-8	Foam-X ACF-144	14/11/2023			N	No	-	1	-	-	2	POTENTIAL				X	X	X			X
Coal Fly Ash	68131-74-8	Blended cement	17/11/2023			N	No	2	1	1	1	2	POTENTIAL							X		
Potassium Chloride	7447-40-7	Potassium Chloride	23/10/2023			Y (NICNAS 2017)	N/A	N/A	N/A	N/A	N/A	N/A	LOW	N/A	N/A	N/A	X	X	X			X
Ammonium Persulfate	7727-54-0	FOAM-X ACB-144	31/10/2023			N	No	1				1	LOW	YES	N/A	N/A	X	X	X			X
Water Ultrapur	7732-18-5	IDCIDE-20	23/10/2023			Y (NICNAS 2017)	N/A	N/A	N/A	N/A	N/A	N/A	LOW	N/A	N/A	N/A		X			X	
Sodium Acid Pyrophospate	7758-16-9	COHO SAPP	20/11/2023			N	No	1				1	LOW	YES	N/A	N/A		X		X		
Paraffin (hard)	8002-74-2	CM401	15/11/2023			N	No	2	2	1	1	2	POTENTIAL							X		
Polyacrylamide	9003-5-8	COHO Floc C	23/10/2023			Y (NICNAS 2017)	N/A	N/A	N/A	N/A	N/A	N/A	LOW	N/A	N/A	N/A	X					
Cellulose	9004-34-6	FORM-A-BLOK	15/11/2023			N	No	2	1	1	1	2	POTENTIAL				X		X			X
Corn Starch	9005-25-8	COHO AUS DEX	2/11/2023			N		1	1	1	1	1	LOW	Yes	N/A	N/A	X		X			X

Notes:
COC = chemical of concern

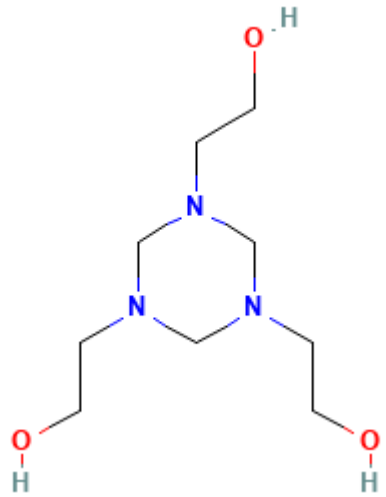
APPENDIX III

Toxicological Profiles for Each Tier 1 Chemical

TOXICOLOGICAL PROFILE

1 S-TRIAZINE-1,3,5-TRIETHANOL

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	1,3,5-Triazine-1,3,5(2H,4H,6H)-triethanol
CAS No.	4719-04-4
AICS name(s)	1,3,5-Triazine-1,3,5(2H,4H,6H)-triethanol
Synonyms	Actane Grotan 2,2',2''-(1,3,5-triazinane-1,3,5-triyl)triethanol Triazinetriethanol
Structural formula	
Molecular formula	C9H21N3O3
Molecular weight	219.28 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Colourless liquid
SMILES notation	C1N(CN(CN1CCO)CCO)CCO

1.2 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-79 °C
Boiling point	110.1 °C
Density (relative to water)	1155 kg/m³ at 20°C
Water solubility	Miscible at 20°C and at pH 5, 7, and 9
pKa	Not applicable. The substance is hydrolytically unstable.
Log K_{ow}	-2
Vapour pressure	0.000005 Pa at 25 °C

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Inventory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	The substance is readily biodegradable (cf. chapter 5.2). In Annex VIII of Regulation (EC) No 1907/2006, it is laid down that the study on hydrolysis does not need to be conducted if the substance is readily biodegradable. Nevertheless, hydrolysis was investigated according to OECD guideline 111 [BASF AG, 2002]. In this study the test item was completely hydrolyzed after 2 h at 50°C. Hydrolysis was detected by measuring the formaldehyde content of the test solution.
Degradation	The substance is readily biodegradable according to OECD criteria.
Persistence	Not persistent as substance is biodegradable.
Bioaccumulation	There are neither aquatic nor terrestrial studies for bioaccumulation of the substance available. The assessment of bioaccumulation is based on the 1-octanol/water partition coefficients of -2 [BASF AG, 2002]. Regarding the 1-octanol/water partition coefficient, accumulation in organisms is not to be expected.
Transport	Based upon a calculated log Koc adsorption to solid soil phase is not expected. The log Koc value was determined to be 1 and the Koc value was determined to be 10.

1.5 Environmental Effects

1.5.1 Acute and Chronic Aquatic Toxicity

Two OECD guideline studies were conducted for fish. The key study showed a LC50 of 16.07 mg/L, the supporting study showed no adverse effects. As a worst case the LC50 value of 16.07 mg/L was chosen as key value.

Two OECD guideline studies were conducted for invertebrates. The key study showed a EC50 of 11.9 mg/L, the supporting study showed a EC50 of 58 mg/L. As a worst case the EC50 value of 11.9 mg/L was chosen as key value.

1.5.2 Chronic Aquatic Toxicity

Long-term toxicity study in fish is not provided for fish.

Long-term toxicity study in aquatic invertebrates is not provided.

1.5.3 Toxicity to Sediment Organisms

Since the physicochemical data indicate that the substance is not very adsorptive or bioaccumulative, a relevant distribution into the sediment compartment and a considerable exposure of sediment organisms is not expected.

The sediment toxicity was tested in a short term sediment toxicity study according to US EPA 600/4-85/013. The test organisms Corophium volutator was collected from a site in the Bay of Suckquoy, near Sebay farm in Orkney and acclimated to laboratory conditions for seven days prior to testing. The exposure time was 10 days. The test substance exhibited a 10 day LC50 value of 875.47 mg/kg sediment dw.

1.5.4 Terrestrial Toxicity

Direct exposure to the terrestrial compartment is very unlikely. As direct exposure of the soil compartment is unlikely and because the substance is readily biodegradable, study on toxicity to terrestrial organisms is not mandatory.

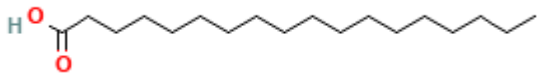
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern.

TOXICOLOGICAL PROFILE

1 STEARIC ACID

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Octadecanoic acid
CAS No.	57-11-4
AICS name(s)	Stearic acid
Synonyms	n-Octadecanoic acid Stearophanic acid
Structural formula	
Molecular formula	$C_{18}H_{36}O_2$
Molecular weight	284.5 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Stearic acid is a white solid with a mild odor. Floats on water.
SMILES notation	CCCCCCCCCCCCCCCCCC(=O)O

1.2 Physico-chemical Properties

Properties	
Physical form	The substance is a white solid.
Melting point	64.89 and 69.3 °C.
Boiling point	383 - 385.8 °C at 1013 mbar (DIN 51751).
Density (relative to water)	0.87 mg/cm3 at 20 °C.
Water solubility	< 0.05 mg/L.
pKa	4.75 at 25 °C
Log K_{ow}	8.23
Vapour pressure	< 8.54E-06 at 25 °C

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Inventory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	No experimental data are available on the hydrolytic stability of the category members Fatty Acids. Significant hydrolysis of the members of the category Fatty Acids is not expected based on the molecular structure (aliphatic and moistly saturated carbon chains). If fatty acids are released into aquatic environment, degradation will be dominated by biological degradation, which is determined to be rapid when in diluted form. Therefore no tests for the determination of hydrolysis as a function of pH have to be conducted.
Degradation	Biological degradation
Persistence	Readily biodegradable
Bioaccumulation	Bioaccumulation potential in fish tissues with an estimated BCF of 225 L/kg after 28 days exposure.
Transport	Based on the chemical structure, the estimated Koc values increase with increasing chain length from 10.57 for azelaic acid (C9) up to 51,050 for stearic acid (C18). Thus, remarkable adsorption potential is predicted for fatty acids starting at a chain length of 12 and higher. According to the Mackay Level I fugacity model fatty acids with a chain length of C8 and C9 partition mainly to the water phase, whereas with increasing chain length starting with C12 fatty acids partition, due to rising Koc values, to sediment and soil. Volatilisation is not expected to be a significant transport process or dissipation rout for fatty acids in the environment.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

All studies resulted in no toxicity up to the limit of water solubility of the test substance.

1.5.2 Chronic Aquatic Toxicity

A study on the chronic toxicity of stearic acid to fish is not available. However, since all other short-term and chronic toxicity tests yielded no evidence of toxic effects of stearic and palmatic acid to aquatic organisms, chronic toxicity to fish is not expected and the endpoint is waived.

1.5.3 Toxicity to Sediment Organisms

No available data.

1.5.4 Terrestrial Toxicity

Soluble fatty acids are readily biodegradable which was demonstrated in biodegradation tests according to OECD-guidelines. In addition degradation studies cited in the Draft Assessment Report (DAR) for Fatty Acids (C7-C20) (Volume1, 2008) DT50 values of 1.5 to – 3 days were reported, indicating rapid primary degradation of fatty acids by microbial organisms in the soil environment.

Further, in the same DAR low toxicity of a fatty acid formulation was demonstrated in several tests on soil macroorganisms, terrestrial non-target arthropods and terrestrial plants (DAR, Volume 1, 2008). These studies prove the negligible effects of fatty acids to terrestrial macroorganisms. Furthermore, fatty acids occur in soils naturally, are part of physiological

pathways and can be used as energy source. Thus, low toxicity is expected for terrestrial organisms exposed to the test substance.

In conclusion, due to a) the rapid degradation of fatty acids, b) the use as energy source, and c) tests available for a fatty acid formulation toxic effects to terrestrial organisms are not expected.

1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern.

TECHNICAL MEMORANDUM

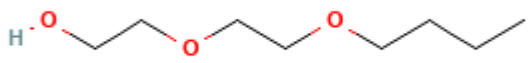
TO: Senex Energy **DATE:** November 20, 2023

FROM: KCB Australia **FILE NO:** DX10171A15

SUBJECT: Chemical Toxicological Profile

1 AMMONIUM SULFATE 2-(2-BUTOXYETHOXY)ETHANOL

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Ammonium Sulfate 2-(2-butoxyethoxy)ethanol
CAS No.	112-34-5
AICS name(s)	Ethanol, 2-(2-butoxyethoxy)
Synonyms	2-(2-Butoxyethoxy)ethanol 112-34-5 Butyldiglycol DIETHYLENE GLYCOL MONOBUTYL ETHER Diethylene glycol butyl ether
Structural formula	
Molecular formula	$C_8H_{18}O_3$
Molecular weight	162.23 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Liquid
SMILES notation	CCCCOCCOCCO

1.2 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-
Boiling point	-
Density (relative to water)	0.9536 g/cm^3 @ 25°C
Water solubility	-
pKa	14.8 pKa at 20°C:
Log K_{ow}	1 at the temperature of 20 °C
Vapour pressure	0.219mmHg @ 25C

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	The substance is not likely to be hydrolysed under normal environmental conditions but, as the substance is readily biodegradable, this is of no consequence..
Degradation	A number of guideline biodegradation studies have been carried out using unadapted innoculii in freshwater. These clearly indicate that 2 -(2 -butoxyethoxy)ethanol is readily biodegradable. There are multiple supporting inherent biodegradation studies that also support the conclusion of degradability.
Persistence	Not persistent
Bioaccumulation	As this substance has a low partition coefficient, bioaccumulation is not likely to be significant nor adsorption to soil or sediments
Transport	The complete miscibility of the substance in water suggests that volatilization from surface waters is not an important fate processes.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

Fish

A number of studies have been carried out using multiple species, both fresh and salt water. One study in two species is sufficiently well reported to judge it as reliable and this is used to derive the key parameters. All the other available experimental studies, whilst not individually robust, report data that is consistent with the key study and provide strong evidence that 2 -(2 -butoxyethoxy)ethanol is practically non-toxic to fish over the acute timeframe.

Leopomis macrochirus. 96hr LC50 =1300mg/l (protocol: no data)
Menidia beryllina. 96hr LC50 >2000mg/l (protocol: no data)
Leuciscus melanotus. 48hr LC50 1805mg/l (protocol: no data)
Leuciscus melanotus. 48hr LC50 2304mg/l (protocol: no data)
Poecilia reticulata. 7 day LC50 1150mg/l (protocol. no data)
Carassius auratus 24hr LC50 = 2700mg/l (protocol: APHA)

Pimephales promelas, 96hr ELC50=2400mg/l (protocal: APHA)

Invertebrates

A number of studies have been carried out however there is no single 48hr study that permits the determination of an actual EC50 value. The most reliable study result is a GLP protocol limit test where clearly no effects were observed at the highest tested concentration of 100mg/l. Other experimental studies are only for 24hr exposure periods. A QSAR predicts a 48hr EC50 for Daphnia magna of 2209mg/l. Clearly 2 -(2 -butoxyethoxy) ethanol is practically non-toxic to invertebrates. For the purposes of risk assessment, there is enough evidence to support a conclusion that the 48hr EC50 for daphnia is likely to be greater than 1101mg/l.

Daphnia magna. 48hr EC50 >100mg/l (OECD 202)
Daphnia magna. 24hr EC50 = 1750mg/l (protocol: no data)
Daphnia magna. 24hr EC50 = 3200mg/l (protocol: no data)
Dapnia magna 48hr LC50 >1000mg/l (protocol: US EPA)
Daphnia magna. 48hr EC50 = 2209mg/l (protocol: QSAR)

Algae

There sufficient data available on the toxicity of 2 -(2 -butoxyethoxy)ethanol to algae. There is a guideline and GLP limit test study available which confirms that the substance is of low toxicity. There is also a published study caried out to a modern guideline that contains a measured EC50 value (Aruoja, 2014). Whilst the GLP data is sufficient for classification and labelling, the published study is used as a based to derive the critical value for this end point, an EC50 of 1100mg/l.

Scenedesmus subspicatus. 96hr EC0>100mg/l (OECD201)
Pseudokirchneriella subcapitata: 72hr EC50=1101mg/l (similar to OECD201)
Scenedesmus quadricauda: 8 day EC3 =1000mg/l (protocol: no data)
Microcystis aeruginosa: 8 day EC3=53mg/l (protocol: no data)

1.5.2 Chronic Aquatic Toxicity

Fish

According to the conditions for adaptation listed in column 2 in Annex IX under section 9.1 of the regulation, long term aquatic toxicity testing shall be proposed if the chemical safety assessment indicates the need to investigate further the effects on aquatic organisms. In this case, the assessment does not indicate such a need therefore testing for this end point is not required.

QSAR predictions show that 2 -(2 -butoxethoxyethanol) is of low toxicity to fish at chronic levels of exposure with a predicted Chv (equivalent to a NOEC) value of 369mg/l.

Invertebrates

There is no experimental chronic invertebrate toxicity data available, but QSAR predictions show that 2 -(2 -butoxyethoxy)ethanol is of low toxicity to invertebrates at chronic levels of exposure. Acute data show that toxicity is so low that chronic toxicity information is in any case unlikely to

be required and should be sufficient to predict PEC:PNEC ratios are below one even with default assessment factors typical of acute data only.

1.5.3 Toxicity to Sediment Organisms

Based on the use pattern for this substance, direct and indirect exposure of sediment is unlikely. Fugacity level 1 modelling predicts that less than approximately 0.01% of released 2 -(2 -butoxyethoxy)ethanol hanol would theoretically partition to sediment. Level 3 fugacity modelling with realistic mass flow inputs indicate that sediment concentrations would be less than 1ppb. In reality, less than this would partition as the substance is readily biodegradable. On the basis that exposure is negligible and good aquatic toxicity information is available, no testing for sedimentary organism toxicity is therefore required.

1.5.4 Terrestrial Toxicity

No available data

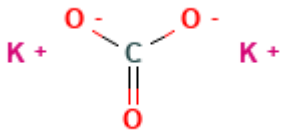
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other concerns identified.

TOXICOLOGICAL PROFILE

1 POTASSIUM CARBONATE

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Potassium Carbonate
CAS No.	584-08-7
AICS name(s)	Carbonic acid, dipotassium salt
Synonyms	Potassium carbonate
Structural formula	
Molecular formula	K_2CO_3
Molecular weight	138.205 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid white
SMILES notation	C(=O)([O-])[O-].[K+].[K+]

1.2 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	891 °C
Boiling point	-
Density (relative to water)	2.43 g/cm³ at 19°C
Water solubility	1,100 g/L
pKa	10.33 pHa at 20°C
Log K_{ow}	-
Vapour pressure	Vapour pressure is not necessary if the melting point is >300°C.

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Potassium carbonate dissociates completely in water to K+and inorganic carbon species. Both potassium and inorganic carbon are ubiquitously present in the environment.
Degradation	Biodegradation is not relevant because potassium carbonate is an inorganic substance.
Persistence	Not considered to be persistent.
Bioaccumulation	Potassium carbonate is very soluble in water. Therefore the substance does not accumulate in lipophilic tissues of living organisms. In aquatic and terrestrial ecosystems potassium carbonate will rapidly dissociate to potassium cation and inorganic carbon species. These are naturally-occurring ions in the environment. In animal and plant organisms, the mass balance of carbonate and potassium will be regulated by physiological mechanisms to ensure appropriate cell concentrations for natural life processes.
Transport	Due to the ionic character, potassium carbonate has a very low vapour pressure and very high water solubility.Therefore a very low Henry's Law constant can be assumed. Furthermore bio- and geoaccumulation are not to be expected. Based on this, potassium carbonate will remain predominantly in the water phase.In addition based on the ionic character and the physicochemical properties, no sorption onto soil and sediment organic matter occurs. Distribution modelling does not need to be conducted because the available data are sufficient for assessment.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

In a 96-h acute toxicity study according to national standard (US), comparable to international guideline FIFRA Guideline 72-1 the 96-h LC50 for Rainbow trouts (Oncorhynchus mykiss) was 68 mg a.i./L (95% CL: 61 - 75 mg a.i./L). The NOEC, based on mortality, was 33 mg a.i./L. In a second 96-h acute toxicity study according to national guideline FIFRA Guideline 72-1 the toxicity to Bluegill sunfish (Lepomis macrochirus) was considerably lower. The 96-h LC50 was determined to be 230 mg a.i./L (95% CL: 140 - 240 mg a.i./L). The NOEC, based on mortality, was 140 mg a.i./L.

In a 48-h acute toxicity study according to national standard (US), comparable to international guideline FIFRA 72 -1, the 48-h EC50 for Daphnia pulex and Daphnia magna were determined. Daphnia pulex was more sensitive than Daphnia magna. The 48-h EC50 was 200 mg a.i./L (95% CL: 120 - 310mg a.i./L) for Daphnia pulex, whereas the 48-h EC50 for Daphnia magna was 430 mg a.i./L (95% CL: 190 - 940 mg a.i./L). The NOEC, based on mortality, was 120 mg a.i./L and 190 mg a.i./L for Daphnia pulex and Daphnia magna, respectively.

1.5.2 Chronic Aquatic Toxicity

Potassium carbonate is an alkaline substance, which dissociates completely to form potassium cations (K+) and inorganic carbon species. Depending on pH of the receiving watersCO2is the predominant species at pH values below 6.35, while HCO3-is the predominant species at a pH in the range between 6.35 and 10.33 and CO32-is the predominant species at pH values above 10.33.

In the majority of the natural waters, pH levels are between 6 and 10. Thus HCO3-(pKa= 10.33) is the most important species for the buffer capacity. Therefore the pH is expected to remain within common environmentally expected ranges.

1.5.3 Toxicity to Sediment Organisms

Potassium carbonate is not expected to have an intrinsic toxic activity to sediment organisms.

1.5.4 Terrestrial Toxicity

Potassium carbonate is not expected to have an intrinsic toxic activity to soil macro-organisms, arthropods and terrestrial plants. Potassium carbonate and its abiotic dissociation products are common constituents of soil and not expected to have an intrinsic toxic activity to soil microorganisms.

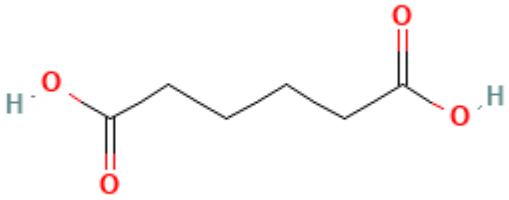
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern.

TOXICOLOGICAL PROFILE

1 HEXANEDIOIC ACID

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Hexanedioic acid, compound with 1,6-hexanediamine (1:1)
CAS No.	3323-53-3
AICS name(s)	Hexanedioic acid, compound with 1,6-hexanediamine (1:1)
Synonyms	Hexamethylenediamine adipate (1:1) Hexamethylenediammonium adipate Hexamethylenediamine monoadipate hexane-1,6-diamine;hexanedioic acid
Structural formula	
Molecular formula	$C_{12}H_{26}N_2O_4$
Molecular weight	262.35 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid white crystalline
SMILES notation	C(CCCN)CCN.C(CCC(=O)O)CC(=O)O

1.2 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	192.8 °C
Boiling point	-
Density (relative to water)	1.2 g/cm3 at 20 °C
Water solubility	467.9 g/l at 21 °C
pKa	The dissociation constant study does not need to be conducted as the substance is a salt. Salts are reaction products of acids and bases that retain their ionic character.
Log K_{ow}	-4.4 at 25 °C (pH = 7.7 - 7.8)
Vapour pressure	negligible at 20 °C

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Inventory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	According to structural properties, hydrolysis is not expected/probable. In the aqueous environment or with soil moisture, the substance dissociates rapidly to adipic acid (CAS No: 124-04-9) and 1,6-Hexametylenediamine, (CAS No: 124 -09 -4). Therefore, degradation by photolytic processes in soil or water are no expected to be of relevance.
Degradation	Readily biodegradable (according to OECD criteria). There is no study available that indicates ready biodegradation of AH-salt. However, since AH-salt rapidly dissociates in aqueous solution or with soil moisture to adipic acid (CAS No: 124-04-9) and 1,6-Hexametylenediamine, (CAS No: 124 -09 -4), the assessment of biodegradability is based on the products of dissociation. Both substances are readily biodegradable.
Persistence	Readily biodegradable
Bioaccumulation	Due to the low log Pow (-4.4, see chapter 4.7), bioaccumulation is not to be expected. Furthermore, in water or with soil moisture AH-salt is rapidly dissociating to Hexamethylendiamine (CAS: 124 -09 -4) and Adipic acid (CAS: 124 -04 -9). Both substances are not considered as bioaccumulative.
Transport	Due to the salt-character and physico-chemical properties, volatilization from surface waters and sewage treatment plants is not expected. The mobility in soil is expected to be high based on the log Kow (log Kow = -4.4). However, the soil adsorption can be only roughly estimated because of possible ionic interactions of the cations with negatively charged particles in the soil that may reduce their mobility. Due to the salt-character of the substance the calculation of a fugacity model is not appropriate. Based on the physico-chemical properties of AH-salt, water is expected to be the main target compartment.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

In aqueous solution, AH-salt rapidly dissociates to Adipic acid (CAS: 124 -04 -9) and 1.6 Hexamethylenediamine (CAS: 124 -09 -4). Both dissociation products are acute harmful to aquatic organisms with effect concentrations ranging from approximately 10 to 100 mg/l, respectively. For AH-salt, acute toxicity studies are available for fish, daphnia and algae and by thereby comprising three trophic levels. The less sensitive organism group is fish with an LC50 (96h) > 470 mg/l as reported for Rainbow trout and Bluegill (ABC Laboratories 1981). For the green alga Scenedesmus subspicatus a EμC50 (72h) of 537.8 mg/l and a NOEC (72h) of 125 mg/l were determined (BASF AG 1987; ECT 2010). The most sensitive organism is Daphnia magna, exhibiting an EC50 (48h) of 90 mg/l (ABC Laboratories 1981). Therefore AH-salt can be considered as acutely harmful to aquatic organisms underlining the observations on dissociation products.

1.5.2 Chronic Aquatic Toxicity

There are no chronic studies for fish and aquatic invertebrates available for AH-salt, however, in two reproduction tests, performed according to OECD guideline 211, no effect concentrations (NOEC) of 6.3 and 4.2 mg/l for Adipic acid (CAS: 124 -04 -9) and 1.6 Hexamethylenediamine (CAS: 124 -09 -4) were observed, clearly underlining the little hazard potential of AH-salt (MOE 1997, 2002). The lower NOEC of 4.2 mg/l for Hexamethylendiamine was used for the derivation of PNECaqua.

1.5.3 Toxicity to Sediment Organisms

No data on sediment toxicity are available. However, the substance is not persistent in the sediment compartment. The equilibrium partitioning method has been used for assessing the hazard to sediment organisms.

1.5.4 Terrestrial Toxicity

For AH-salt there are no appropriate data on terrestrial toxicity available for a derivation of PNECsoil. The substance however, exhibits little potential for adsorption , is not bioaccumulative and readily biodegradable. In contact with water or soil moisture, the salt will rapidly dissociate to adipic acid (CAS No: 124-04-9) and 1,6-Hexametylenediamine, (CAS No: 124 -09 -4). Furthermore, results of aquatic tests revealed little hazard potential of AH-salt, and by thereby suggesting little hazardous potential towards soil organisms. Therefore, the equilibrium partitioning method has been used to assess the hazard potential of AH-salt for soil organisms.

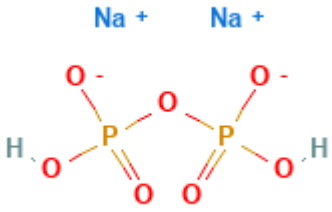
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern.

TOXICOLOGICAL PROFILE

1 SODIUM ACID PYROPHOSPATE

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Sodium Acid Pyrophospate
CAS No.	7758-16-9
AICS name(s)	Diphosphoric acid, disodium salt
Synonyms	Disodium diphosphate Sodium acid pyrophosphate Disodium dihydrogen pyrophosphate DISODIUM PYROPHOSPHATE
Structural formula	
Molecular formula	$H_4O_7P_2.2Na$
Molecular weight	221.94 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid
SMILES notation	OP(=O)([O-])OP(=O)(O)[O-].[Na+].[Na+]

1.2 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	> 723 K
Boiling point	-
Density (relative to water)	2.63
Water solubility	-
pKa	0.9
Log K_{ow}	The study does not need to be conducted because the substance is inorganic
Vapour pressure	-

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No

Convention, Protocol or other International Control	Listed yes or no?
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	The key study reports the estimated half-life's at 25°C of the test material were determined to be; 527 days at pH 4 and > 1 year at pH 7 and 9. Under the physiologically relevant conditions of pH 1.2, 37.0 ± 0.5°C, the half-life of the test material was determined to be 26.1 hours. The substance was shown to following the following mechanism of hydrolysis: Pyrophosphate anion + water → 2 x orthophosphate anion In reality and due to the pKa's of orthophosphoric acid and the nature of the phosphate ion it is likely that in natural waters the hydrolysis product will be either orthophosphoric acid and monopotassium dihydrogen orthophosphate (which may also dissociate to phosphate ions and sodium ions). Results for the preliminary test indicate that the rate of hydrolysis increases with a decrease in pH.
Degradation	Disodium dihydrogenpyrophosphate is an inorganic substance, biodegradation studies are not applicable. There are a number of studies indicating that under natural conditions hydrolysis to orthophosphate is the primary route of degradation (see IUCLID section 5.1.2). No further testing is deemed to be necessary.
Persistence	Pyrophosphates will not persist in natural waters. Biotic degradation and assimilation by algae and/or microorganisms will occur at a faster rate than hydrolysis in distilled water. The breakdown products of such reactions are the ubiquitous orthophosphate anion.
Bioaccumulation	Disodium dihydrogenpyrophosphate is hydrolysed to orthophosphate in aqueous and biological systems. The degradation products of disodium dihydrogenpyrophosphate are essential nutrients (food elements) for plants, and stimulate the growth of water plants (macrophytes) and/or algae (phytoplankton) and are ubiquitous in the environment. The potential for bioaccumulation is therefore considered to be minimal.
Transport	A key study for the endpoint 'adsorption/desorption' has not been performed for disodium dihydrogenpyrophosphate. An adaptation from the standard testing regime is justified on the following basis: In accordance with Section 2 of Annex XI of Regulation (EC) No 1907/2006 (REACH), testing is technically not possible as the relevant guideline for a screening study (OECD 121) is not validated for this type of substance and the batch equilibrium method (OECD 106) is not considered to be applicable (see 'discussion'). The literature data provided are not sufficient to determine a Kd value for risk assessment and are therefore provided as supporting information only.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

One key study to assess the short-term toxicity of disodium dihydrogenpyrophosphate exists, this study is conducted on an analogous substance (see justification below). On this basis sodium and potassium pyrophosphates are not considered to be toxic to fish. This conclusion is supported by

the additional literature provided and no further testing is justified. In addition, this read-across value is considered to be conservative (in comparison to the additional data provided) for the purposes of hazard assessment.

1.5.2 Chronic Aquatic Toxicity

No available data

1.5.3 Toxicity to Sediment Organisms

No available data

1.5.4 Terrestrial Toxicity

Sodium and potassium pyrophosphates are ionic in nature and therefore dissociate readily into cations and anions in water, sediment and soils. The toxicity of the both the cation and the anion must be addressed. Potassium and sodium cations are essential micronutrients that are ubiquitous in the environment. As such, their uptake is tightly regulated and is therefore not considered to pose a risk for ecotoxicity. The pyrophosphate anion is unstable in aqueous solutions with the degree of instability varying according to pH. In distilled water pyrophosphates will hydrolyse slowly via abiotic mechanisms to inorganic phosphate. In soils a number of different processes can occur; abiotic hydrolysis, biotic degradation (as a result of the action of phosphatases which cleave pyrophosphate into orthophosphate subunits) and assimilation by organisms in the media all resulting in an ultimate breakdown product of orthophosphate.

Furthermore inorganic phosphate fertilizers (containing Na+, K+ and PO43 - ions) are often added to soils to improve soil quality. Given the extensive use of inorganic phosphates as soil fertilizers and the natural occurrence of the ions in the environment it is unlikely that inorganic phosphates of this nature would have a detrimental effect on soil invertebrates and hence toxicity studies are scientifically unjustified.

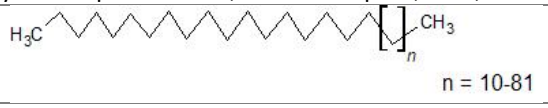
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other concerns identified.

TOXICOLOGICAL PROFILE

1 PARAFFIN (HARD)

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Paraffin (hard)
CAS No.	8002-74-2
AICS name(s)	Paraffin waxes and hydrocarbon waxes
Synonyms	SYNTHETIC WAX; Fischer-Tropsch wax; Paraffin wax; Paraffin wax, petroleum; Poly(methylene) wax; Synthetic paraffin wax, Fischer-Tropsch; Wax, extract
Structural formula	
Molecular formula	Unspecified
Molecular weight	-
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid
SMILES notation	-

1.2 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	43 to 68°C (typically around 55°C)
Boiling point	300°C to 800°C
Density (relative to water)	0.79 to 0.94 g/cm3 at 15°C.
Water solubility	Calculated water solubility for constituents of this substance range between 2.69E-12 and 142.1 mg/L.
pKa	Due to the non-polar character of hydrocarbon constituents in waxes, these molecules will not dissociate, and ionized species of these constituents are not expected to form.
Log K_{ow}	Calculated log Pow for constituents of this substance range between 3.17 and 18.02.
Vapour pressure	Negligible at 20°C, and ranges from 0 to 20 Pa at 80°C.

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No

Convention, Protocol or other International Control	Listed yes or no?
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Potentially hydrolyzable groups include alkyl halides, amides, carbamates, carboxylic acid esters and lactones, epoxides, phosphate esters, and sulfonic acid esters (Neely and Blau, 1985). The lack of a suitable leaving group renders compounds resistant to hydrolysis.
Degradation	Not degradable through hydrolysis. The substance was determined to be inherently biodegradable but not readily biodegradable with a mean degradation of 31.13% by day 28.
Persistence	Persistent in environment
Bioaccumulation	Standard bioaccumulation studies are not applicable to petroleum UVCB substances, therefore in accordance with Annex XI Section 1.3 testing is not scientifically necessary and the endpoint has been fulfilled using QSAR calculations for relevant constituents. Calculated BCF for constituents of this substance range between 0.42 and 25700 L/kg.
Transport	Calculated log Koc for constituents of this substance range between 2.67 and 14.70. It should be borne in mind that this is the full range of predicted values, and that this may be misleading or unrepresentative of the properties of the UVCB substance as a whole.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

The LL50 was > 100 mg/L and the NOEL was ≥100 mg/L (Exxon, 1995b).This study is scientifically sound and satisfies the guideline requirement for short-term toxicity to fish.

The EL50 was >10,000 mg/L and the NOEL was ≥ 1000 mg/L (Shell, 1988).

1.5.2 Chronic Aquatic Toxicity

Results of computer modelling to estimate aquatic chronic toxicity in a 28-day freshwater fish study show no chronic toxicity of paraffin and hydrocarbon wax to freshwater fish at or below its maximum attainable water solubility (Redman et al., 2010b). This supports the applied interspecies read across.

1.5.3 Toxicity to Sediment Organisms

Substance is a hydrocarbon UVCB. Standard tests for this endpoint are intended for single substances and are not appropriate for the risk assessment of this complex substance.PNEC derivation is not scientifically justified based on water solubility limitations.

1.5.4 Terrestrial Toxicity

Substance is a hydrocarbon UVCB. Standard tests for this endpoint are intended for single substances and are not appropriate for the risk assessment of this complex substance. PNEC derivation is not scientifically justified based on water solubility limitations.

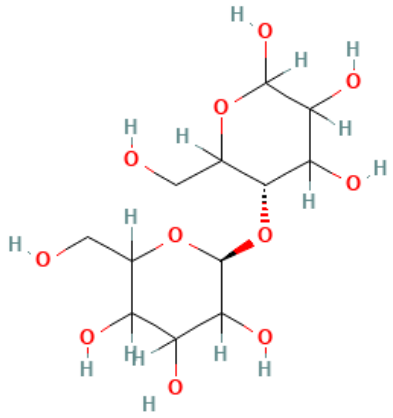
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern.

TOXICOLOGICAL PROFILE

1 CELLULOSE

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Cellulose
CAS No.	9004-34-6
AICS name(s)	Cellulose
Synonyms	DEAE-CELLULOSE (6S)-2-(hydroxymethyl)-6-[(3S)-4,5,6-trihydroxy-2-(hydroxymethyl)oxan-3-yl]oxyoxane-3,4,5-triol Diethylaminoethyl cellulose; Cellulose crystalline; Cellulose gel; Hydroxycellulose; Microcrystalline cellulose; Plastics, cellulosic; Sulfite cellulose
Structural formula	
Molecular formula	Unspecified
Molecular weight	342.30 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Cellulose is an odorless, white powdery fibers.
SMILES notation	C(C1C(C(C(C(O1)OC2C(OC(C(C2O)O)O)CO)O)O)O)O

1.2 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	-
Boiling point	-
Density (relative to water)	1.5 g/cm3
Water solubility	-
pKa	-
Log K_{ow}	-
Vapour pressure	-

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Insoluble in water.
Degradation	Not readily biodegradable.
Persistence	No available data
Bioaccumulation	Does not bioaccumulate.
Transport	No available data

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

The product component(s) are 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.

1.5.2 Chronic Aquatic Toxicity

No available data

1.5.3 Toxicity to Sediment Organisms

No available data

1.5.4 Terrestrial Toxicity

No available data

1.6 Categorisation and other Characteristics of Concern

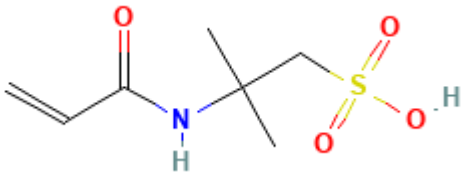
	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not classified as PBT/

	Comment
Other characteristics of concern	The lack of information is the main concern for this substance.

TOXICOLOGICAL PROFILE

1 2-ACRYLAMIDO-2-METHYL-1-PROPANESULFONIC ACID

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	2-Acrylamido-2-methyl-1-propanesulfonic acid
CAS No.	15214-89-8
AICS name(s)	2-Acrylamido-2-methyl-1-propanesulfonic acid
Synonyms	2-Acrylamido-2-methyl-1-propanesulfonic acid 2-Acrylamido-2-methylpropanesulfonic acid 2-Acrylamide-2-methylpropanesulfonic acid
Structural formula	
Molecular formula	$C_7H_{13}NO_4S$
Molecular weight	207.25
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid white powder.
SMILES notation	CC(C)(CS(=O)(=O)O)NC(=O)C=C

1.2 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	190 °C
Boiling point	The boiling point of ATBS cannot be determined since it decomposes on melting.
Density (relative to water)	1360 kg/m3 @ 20°C
Water solubility	> 500 mg/L @ 20°C
pKa	2.4
Log K_{ow}	-3.7
Vapour pressure	Negligible

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No

Convention, Protocol or other International Control	Listed yes or no?
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Not specified
Degradation	Low biodegradation rate of less than 10% after 44 days.
Persistence	Not specified
Bioaccumulation	Not specified
Transport	Not specified

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

The LC0 at 96 hours for fish of ATBS was 130 mg/L and the LC50 at both 72 and 96 hours was calculated as 170 mg/L.

The EC50 for acute toxicty at 48 hours on Daphnia magna of ATBS was shown to be 340 mg/mL (CI95% 280 - 430 mg/L). The No Observed Effect Concentration (NOEC) was 78 mg/l at 48 hours.

1.5.2 Chronic Aquatic Toxicity

No studies available.

1.5.3 Toxicity to Sediment Organisms

No studies available.

1.5.4 Terrestrial Toxicity

No studies available.

1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not specified
Other characteristics of concern	No other characteristics of concern

TOXICOLOGICAL PROFILE

1 CHROMIUM (6+)

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Chromium (6+)
CAS No.	18540-29-9
AICS name(s)	Chromium (6+)
Synonyms	Chromium(VI) Chromium hexavalent ion Chromium(6+) ion
Structural formula	Cr^{6+}
Molecular formula	Cr^{6+}
Molecular weight	51.996 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Chromium (6+) is unstable and can only be stable in a aqueous solution.
SMILES notation	[Cr+6]

1.2 Physico-chemical Properties

Properties	
Physical form	Within solusion
Melting point	-
Boiling point	-
Density (relative to water)	-
Water solubility	1680 g/L
pKa	-
Log K_{ow}	-
Vapour pressure	-

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Soluble in water.
Degradation	Not readily biodegradable/degradable.
Persistence	Persists in environment
Bioaccumulation	Does bioaccumulate.
Transport	No available data

1.5 Environmental Effects

1.5.1 Acute and Chronic Aquatic Toxicity

Freshwater algae and invertebrates are more sensitive to chromium (VI) than fish, with Cr (VI) being the most toxic species. Crustaceans are particularly sensitive to Cr (VI), with 3-day LC50 values for D. magna between 30 and 81 µg/L, nd chronic values from 2.5 to 40.0 µg/L (Trabalika & Gehrs 1977).

1.5.2 Toxicity to Sediment Organisms

No available data

1.5.3 Terrestrial Toxicity

No available data

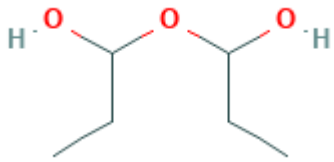
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Is PBT.
Other characteristics of concern	No other characteristics of concern.

TOXICOLOGICAL PROFILE

1 DIPROPYLENE GLYCOL

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	1-(1-Hydroxypropoxy)propan-1-ol
CAS No.	25265-71-8
AICS name(s)	-
Synonyms	1-(1-hydroxypropoxy)propan-1-ol DSSTox_CID_5186 DSSTox_RID_78591 DSSTox_GSID_27856 Oxydipropanol
Structural formula	
Molecular formula	$C_6H_{14}O_3$
Molecular weight	134.17 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Clear colourless liquid.
SMILES notation	CCC(O)OC(CC)O

1.2 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-20 °C
Boiling point	227°C
Density (relative to water)	1.02 at 20 °C
Water solubility	Miscible with water at 20 °C
pKa	Not availableas the substance has no ionic structure
Log K_{ow}	-0.46 @ 20 °C
Vapour pressure	1.3 Pa at 25 °C

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No

Convention, Protocol or other International Control	Listed yes or no?
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	The calculated half life of dipropylene glycol is 0.341 days with a OH radical concentration of 1.5E6 OH/cm3 (Aopwin, 2000). In accordance with column 2 of REACH Annex VIII, the hydrolysis test does not need to be conducted as the substance is readily biodegradable. Furthermore, ethers and glycols are generally known to be resistant to hydrolysis (Harris, J.C., 1990). Therefore, dipropylene glycol is not expected to undergo hydrolysis under environmentally relevant conditions.
Degradation	Dipropylene glycol is capable of being degraded under aerobic conditions by bacteria in water. Results from biodegradation screening tests show that dipropylene glycol is readily biodegradable in water (>80% after 28 days) (West et al., 2007). Significant biodegradation (>20%) was found in a simulation test with natural seawater after 64 days (West et al., 2007).
Persistence	Dipropylene glycol is not expected to persist in water or marine environments. Simulation studies with sediment and/or soil are not available.
Bioaccumulation	In accordance with column 2 of REACH Annex IX, the bioaccumulation study does not need to be conducted as the substance can be expected to have a low potential for bioaccumulation (log Kow = -0.46). This is supported by results from the Japanese NITE database (MITI, 1992).
Transport	Based on the result of the octanol/water partition coefficient (Log Kow of -0.64) dipropylene glycol is expected to have a low potential for adsorption/desorption. The Koc value calculated from the octanol-water partition coefficient (log Kow = -0.64) using the equation from the TGD (non-hydrophobics) is 4.87 (log value = 0.69). The Henry's law constant at environmental relevant temperature is 9.07E-04 Pa.m3/mol using EUSES calculation. If released into the environment, dipropylene glycol will preferentially partition into water (46.1%) and soil (53.7%) (Mackay, 1999). Volatility is not expected to be a significant fate process due to its low vapor pressure and high water solubility.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

The 96-h LC50 of the structurally related analogue monopropylene glycol (CAS number 57-55-6) to Fathead minnow is 46500 mg/L.

The 96-h LC50 of the structurally related analogue tripropylene glycol (CAS number 24800-44-0) to is > 1000 mg/L.

Furthermore, calculated effect concentrations are available for freshwater fish (96-h LC50 15167 mg/l).

Based on this information it can be assumed that the 96-h LC50 of dipropylene glycol can assumed to be > 1000 mg/L

1.5.2 Chronic Aquatic Toxicity

Long-term exposure of fish is not considered relevant as the substance is readily biodegradable. Furthermore, the short-term toxicity test indicate a very low toxicity to fish. As the QSAR for long-term toxicity to fish is high (30-d ChV is 1340 mg/l) chronic toxicity to fish is not expected. Therefore, a long-term toxicity test with fish is not considered necessary.

1.5.3 Toxicity to Sediment Organisms

No studies available.

1.5.4 Terrestrial Toxicity

The LD50 was > 2,000 mg/kg in Northern bobwhite (Colinus virginianus) (Wildlife International, 1995)

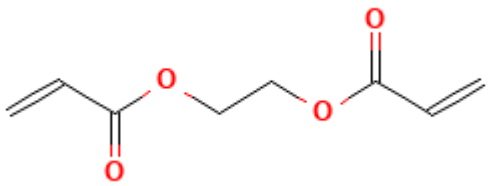
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern.

TOXICOLOGICAL PROFILE

1 PLYETHYLENE GLYCOL DIACRYLATE

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Ethylene glycol diacrylate
CAS No.	26570-48-9
AICS name(s)	Poly(oxy-1,2-ethanediyl), .alpha.-(1-oxo-2-propenyl)-.omega.-[(1-oxo-2-propenyl)oxy]-
Synonyms	Ethylene diacrylate Ethylene glycol diacrylate Ethylene acrylate Acrylic acid, ethylene ester
Structural formula	
Molecular formula	$(C_2H_4O)nC_6H_6O_3$
Molecular weight	170.16 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Orange liquid
SMILES notation	C=CC(=O)OCCOC(=O)C=C

1.2 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	
Boiling point	>100°C
Density (relative to water)	
Water solubility	Soluble
pKa	
Log K_{ow}	
Vapour pressure	2.3 kPA at 20°C

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No

Convention, Protocol or other International Control	Listed yes or no?
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	-
Degradation	Substance is biodegradable
Persistence	
Bioaccumulation	
Transport	

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

Ingredients	Ecotoxicity –Fish Species Data	Acute Crustaceans Toxicity	Ecotoxicity –Fresh water Algae
Polyethylene glycol diacrylate	LC50 > 100 mg/L 96 h (Fish)	EC50 > 100 mg/L 48 h (Daphnia)	EC50 1-10 mg/L 72 h (Algae)

1.5.2 Chronic Aquatic Toxicity

No data available

1.5.3 Toxicity to Sediment Organisms

No data available

1.5.4 Terrestrial Toxicity

No data available

1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not PBT
Other characteristics of concern	No other characteristics of concern known.

TOXICOLOGICAL PROFILE

1 NITROGEN CONTAINING POLYSACCHARIDE

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Starch, 2-hydroxy-3-(trimethylammonio)propyl ether, chloride
CAS No.	56780-58-6
AICS name(s)	Starch, 2-hydroxy-3-(trimethylammonio)propyl ether, chloride
Synonyms	2-Hydroxy-3-(trimethylammonio)propyl starch chloride; Starch, 2-hydroxy-3-(trimethylammonio)propyl ether, hydrochloride; Starch, N,N,N-trimethyl-2-hydroxypropanaminium chloride ether
Structural formula	-
Molecular formula	$C_6H_{16}NO_2.xCl.x$
Molecular weight	-
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	-
SMILES notation	-

1.2 Physico-chemical Properties

Properties	
Physical form	-
Melting point	-
Boiling point	Decomposes
Density (relative to water)	1.5 g/cm^3 (at 20°C)
Water solubility	Soluble
pKa	-
Log K_{ow}	No data available. Based on water solubility it is expected that the log P_{ow} would be very low.
Vapour pressure	-

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No

Convention, Protocol or other International Control	Listed yes or no?
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	No data available
Degradation	No data available
Persistence	No data available
Bioaccumulation	No data available
Transport	No data available

1.5 Environmental Effects

1.5.1 Acute and Chronic Aquatic Toxicity

Harmful to aquatic life with long lasting effects.

1.5.2 Toxicity to Sediment Organisms

No data available

1.5.3 Terrestrial Toxicity

No data available

1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	No data available
Other characteristics of concern	The lack of data is the main concern for this substance.

TOXICOLOGICAL PROFILE

1 POLYETHYLENE GLYCOL MONOTALLATE

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Polyethylene Glycol Monotallate
CAS No.	61791-00-2
AICS name(s)	-
Synonyms	Fatty acids, tall-oil, ethoxylated
Structural formula	-
Molecular formula	-
Molecular weight	-
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	-
SMILES notation	-

1.2 Physico-chemical Properties

Properties	
Physical form	-
Melting point	-
Boiling point	-
Density (relative to water)	-
Water solubility	-
pKa	-
Log K_{ow}	-
Vapour pressure	-

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	No
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	-
Degradation	-
Persistence	-
Bioaccumulation	-
Transport	-

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

No data available

1.5.2 Chronic Aquatic Toxicity

No data available

1.5.3 Toxicity to Sediment Organisms

No data available

1.5.4 Terrestrial Toxicity

No data available

1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Unknown
Other characteristics of concern	Lack of data is the main concern.

TOXICOLOGICAL PROFILE

1 POLYCARBOXYLIC ACID, SODIUM SALT

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	POC-OS-2020
CAS No.	62601-60-9
AICS name(s)	OS 2020
Synonyms	POLYCARBOXYLIC ACID, SODIUM SALT
Structural formula	-
Molecular formula	Unspecified
Molecular weight	-
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Slightly yellow liquid
SMILES notation	-

1.2 Physico-chemical Properties

Properties	
Physical form	Slightly yellow liquid
Melting point	-
Boiling point	-
Density (relative to water)	-
Water solubility	-
pKa	-
Log K_{ow}	-
Vapour pressure	-

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	No data available
Degradation	No data available
Persistence	No data available
Bioaccumulation	No data available
Transport	No data available

1.5 Environmental Effects

No data available

1.5.1 Acute Aquatic Toxicity

No data available

1.5.2 Chronic Aquatic Toxicity

No data available

1.5.3 Toxicity to Sediment Organisms

No data available

1.5.4 Terrestrial Toxicity

No data available

1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	No data available
Other characteristics of concern	The lack of data is the main concern

TOXICOLOGICAL PROFILE

1 PETROLEUM GAS OIL

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Petroleum Gas oil
CAS No.	64741-44-2
AICS name(s)	Distillates (petroleum), straight-run middle
Synonyms	Distillate, petroleum, hydrotreated middle; Gas oil
Structural formula	-
Molecular formula	Unspecified
Molecular weight	-
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Liquid
SMILES notation	-

1.2 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-21°C to +6°C
Boiling point	150°C to 399°C
Density (relative to water)	0.8 to 0.9 g/cm3 at 15°C
Water solubility	Calculated water solubility for constituents of this substance range between 2.69E-12 and 2000 mg/L.
pKa	NA
Log K_{ow}	Calculated log Pow for constituents of this substance range between 1.99 and 18.02.
Vapour pressure	0.4 kPa at 40°C

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Inventory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Potentially hydrolyzable groups include alkyl halides, amides, carbamates, carboxylic acid esters and lactones, epoxides, phosphate esters, and sulfonic acid esters (Neely and Blau, 1985). The lack of a suitable leaving group renders compounds resistant to hydrolysis. The available data and available weight of evidence demonstrate that straight run gas oils are resistant to hydrolysis because they lack a functional group that is hydrolytically reactive. Therefore, this fate process will not contribute to a measurable degradative loss of these substances from the environment
Degradation	Resistant to hydrolysis degradation however it is biodegradable. Calculated degradation half-lives for constituents of this substance range between 1.02 - 661986 days.
Persistence	Substance is moderately persistent however still biodegradable.
Bioaccumulation	Standard tests for this endpoint are intended for single substances and are not appropriate for this complex substance.
Transport	Standard adsorption/desorption studies are not applicable to petroleum UVCB substances.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

Short term toxicity to fish is calculated to be LL50 is 1.301 mg/L.

Short term toxicity to aquatic invertebrates is calculated to be LL50 is 9.983 mg/L.

Toxicity to aquatic algae and cyanobacteria is estimated to be 2.079 mg/L.

1.5.2 Chronic Aquatic Toxicity

Long term toxicity to fish is estimated for freshwater fish NOEL (No Observed Effect Level) value is 0.068 mg/l based on mortality.

Long term toxicity to aquatic invertebrates is estimated freshwater invertebrate NOEL (No Observed Effect Level) value is0.167mg/l based on immobility and numbers of live young produced per adult by Day 21.

1.5.3 Toxicity to Sediment Organisms

Substance is a hydrocarbon UVCB. Standard tests for this endpoint are intended for single substances and are not appropriate for the risk assessment of this complex substance. For the purpose of risk assessment, sediment PNECs for hydrocarbon blocks have been derived using aquatic PNECs and the equilibrium partitioning method (EqP) using representative structures.

1.5.4 Terrestrial Toxicity

Long-term toxicity to soil microorganisms except arthropods:

Substance is a hydrocarbon UVCB. Standard tests for this endpoint are intended for single substances and are not appropriate for the risk assessment of this complex substance. For the purpose of risk assessment, soil PNECs for hydrocarbon blocks have been derived using aquatic PNECs and the equilibrium partitioning method (EqP) using representative structures.

Long-term toxicity to terrestrial arthropods:

Substance is a hydrocarbon UVCB. Standard tests for this endpoint are intended for single substances and are not appropriate for the risk assessment of this complex substance. For the purpose of risk assessment, soil PNECs for hydrocarbon blocks have been derived using aquatic PNECs and the equilibrium partitioning method (EqP) using representative structures.

Long-term toxicity to terrestrial plants:

Substance is a hydrocarbon UVCB. Standard tests for this endpoint are intended for single substances and are not appropriate for the risk assessment of this complex substance. For the purpose of risk assessment, soil PNECs for hydrocarbon blocks have been derived using aquatic PNECs and the equilibrium partitioning method (EqP) using representative structures.

Short- and long-term toxicity to soil microorganisms:

Substance is a hydrocarbon UVCB. Standard tests for this endpoint are intended for single substances and are not appropriate for the risk assessment of this complex substance. For the purpose of risk assessment, soil PNECs for hydrocarbon blocks have been derived using aquatic PNECs and the equilibrium partitioning method (EqP) using representative structures

Long term toxicity to birds:

In accordance with Column 2 of REACH Annex X, studies on long-term or reproductive toxicity to birds studies do not need to be conducted due to the existence of a large mammalian dataset demonstrating low toxicity to higher organisms.

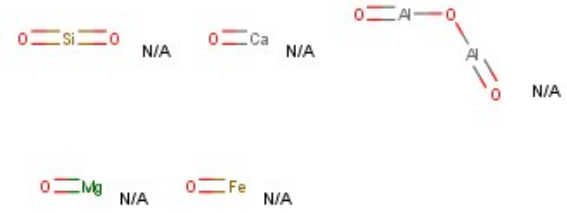
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern.

TOXICOLOGICAL PROFILE

1 GRANULATED BLAST FURNACE SLAG

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Blast furnace slag
CAS No.	65996-69-2
AICS name(s)	Slags, ferrous metal, blast furnace
Synonyms	-
Structural formula	
Molecular formula	~ Al(n)Ca(m)Mg(o)Si(p)O(3n/2+m+o+2p)
Molecular weight	-
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Grey, inorganic solids
SMILES notation	-

1.2 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	1100 - 1400 °C.
Boiling point	> 2000 °C
Density (relative to water)	0.7 - 1.4 g/cm³
Water solubility	Slags are inorganic solid UVCB. Consequently, single data cannot represent the complex and varying processes leading to the release of traces of analytes from the solid material. The key values for release of ions from ferrous slags are estimated to be heavy metals: insoluble 0.01 mg/l calcium: moderately soluble (0.1-600 mg/L) other alkaline and alkaline earth elements, aluminium: slightly soluble (0.1-100 mg/L) Sulfate and thiosulfate: slightly to moderately soluble (0.1-1000 mg/L) The solubility of slag analytes decreases during aging of slag.
pKa	Ferrous slags do not dissociate in water
Log K_{ow}	The partition coefficient is expected to be too low to be measured
Vapour pressure	Extremely low vapour pressure at ambient temperature (20 °C)

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Ferrous slags are inorganic UVCB similar to natural rock, with a very low solubility, and very high stability in water rendering slags suited for hydraulic engineering e.g. as a rock material in waterway construction and for coastal protection..
Degradation	No degradation was observed even after more than 10 years of use in waterway construction
Persistence	Persistent
Bioaccumulation	Ferrous slags are inorganic UVCB similar to natural rock. These materials contain trace elements of toxicological or environmental relevance. The accumulation of these elements was tested in field studies. For several elements tested, there was a high scattering of their concentrations in animals and algae, but it could not be shown that a significant accumulation of these trace elements occurred however it does occur.
Transport	Ferrous slags are inert inorganic UVCB similar to natural rock. Ferrous slags contain tightly bound heavy metals of low solubility resulting in high kd values for the distribution of these metals in the solid/liquid phase.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

As there is ample evidence from different slags and independent slag samples, the concentration of LC50 = 100 g/L is used for PNEC derivation for fish.

Although some 48 h-IC50were below 50 g/L, it is suggested to use the concentration of 50 - 100 g/L for PNEC deriviation for invertebrates.

1.5.2 Chronic Aquatic Toxicity

Slag stones do not exhibit any hazardous effect on any stage of early fish development e.g. fertilization of eggs, egg number, egg distribution, development of larvae.

Daphnia magna OECD 211: 21d-EC10 = 5000 mg/L

1.5.3 Toxicity to Sediment Organisms

In a field study it has been shown that benthic organisms growing on slags (BOS) exhibited even greater species diversity and population density than on natural rock. So, no negative influence of slags on benthic organisms could be detected. Therefore, a NOEC = 100 g/kg was taken as a default value for calculations.

1.5.4 Terrestrial Toxicity

In an earthworm acute toxicity test performed according to OECD 207 and GLP, powdered air-cooled blast furnace slag (ABS) did not affect survival or body fresh weight of the earthworm Eisenia fetida during 2 weeks incubation in soil with a maximum concentration of 100 g of the slag per kg of artificial OECD soil (highest concentration tested, NERI 2008).

The effects of slags on earthworms were measured in a 14 d test according to ISO 11268-1 (Effects of Pollutants on Earthworms. 1. Determination of Acute Toxicity Using Artificial Soil Substrate). ABS was not toxic against Eisenia fetida within 14 days. The LC50 was 770 g/kg (highest concentration tested, LECES 1999).

1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern.

TOXICOLOGICAL PROFILE

1 ETHOXYLATED C6-C10 ALCOHOL

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Polyethylene glycol
CAS No.	68037-05-8
AICS name(s)	Poly(oxy-1,2-ethanediyl), .alpha.-sulfo-.omega.-hydroxy-, C6-10-alkyl ethers, ammonium salts
Synonyms	C6-10-alkyl ether, sulfate, ammonium salt
Structural formula	-
Molecular formula	Unspecified
Molecular weight	-
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	-
SMILES notation	-

1.2 Physico-chemical Properties

Properties	
Physical form	-
Melting point	-
Boiling point	-
Density (relative to water)	-
Water solubility	-
pKa	-
Log K_{ow}	-
Vapour pressure	-

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	No data available
Degradation	No data available
Persistence	No data available
Bioaccumulation	This preparation or material is not expected to bioaccumulate.
Transport	No data available

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

No data available

1.5.2 Chronic Aquatic Toxicity

No data available

1.5.3 Toxicity to Sediment Organisms

No data available

1.5.4 Terrestrial Toxicity

No data available

1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	The lack of information about this substance is the main other concern.

TOXICOLOGICAL PROFILE

1 COAL FLY ASH

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	COAL FLY ASH
CAS No.	68131-74-8
AICS name(s)	Ashes, residues
Synonyms	By products fuel oil ash; Cinders; Electric utility boiler, bottom ash; High carbon rice hull ash; Power house, by product coal ash; Wood char
Structural formula	-
Molecular formula	Unspecified
Molecular weight	-
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid greyish black powder
SMILES notation	-

1.2 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	> 640 °C
Boiling point	The study does not need to be conducted because the substance is a solid which melts above 300°C
Density (relative to water)	1.94
Water solubility	In 100 g of the substance 743 mg to 1.944 g is soluble in 1L of water at pH 10.12 to 11.87.
pKa	The dissociation constant does not need to be measured as the substance is a mixture containing substances that are not soluble in water.
Log K_{ow}	The partition coefficient does not need to be measured as the substance is inorganic.
Vapour pressure	The vapour pressure does not need to be measured, as the melting point is > 300 °C.

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No

Convention, Protocol or other International Control	Listed yes or no?
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	The substance is an inorganic UVCB mixture of poorly water soluble inorganic constituents. Testing the hydrolysis by the recommended standard test method (OECD 111/EU C.7.) is therefore not relevant and technically and scientifically unjustified. Inorganic constituents and metals contained in ashes can undergo inorganic hydrolysis processes, which are diverse dependent on the metal and highly determined by pH and other environmental conditions.
Degradation	Log degradation due to low solubility.
Persistence	Persistent in environment due to low solubility.
Bioaccumulation	Bioavailability and consequently bioaccumulation of ash-related metals is complex and dependent on multiple factors like pH, redox potential, geochemical interactions etc. Bioaccumulation of ash associated metals is generally very low and not of concern for any compartment.
Transport	No available studies.

1.5 Environmental Effects

1.5.1 Acute and Chronic Aquatic Toxicity

The ashes (residues), coal with higher content of free lime indicated slightly harmful effects to aquatic organisms whereas other ashes (residues), coal are not harmful to aquatic organisms. The heavy metal content of the tested substance had no influence on toxic effects on aquatic organisms.

1.5.2 Toxicity to Sediment Organisms

Toxicity to sediment organisms is considered to be low.

1.5.3 Terrestrial Toxicity

Terrestrial studies with earthworm, plants and microorganisms are available and show only low toxicity at high test concentrations.

The test substance is not classified as toxic or harmful. Furthermore the bioaccumulation potential is low and thus the test substance is considered to cause low hazard to predators.

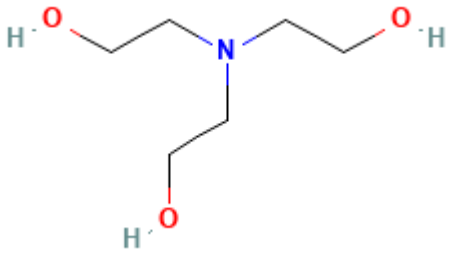
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern.

TOXICOLOGICAL PROFILE

1.1 TRIETHANOLAMINE

1.2 Chemical Synonyms and Structure

	Chemical
CAS Name	2,2’,2”-nitrilotriethanol
CAS No.	102-71-6
AICS name(s)	Ethanol, 2,2',2''-nitrilotris-
Synonyms	Triethanolamine; 2,2’,2”-nitrilotriethanol; 2,2’,2”nitrilotris[ethanol]; ethanol, 2,2’,2”-nitrilotri- (8Cl); ethanol, 2,2’,2”-nitrilotris- (9Cl); nitrilotriethanol; TEA; tris(beta-hydroxyethyl)amine; tris(2-hydroxyethyl)amine
Structural formula	
Molecular formula	C6H15NO3
Molecular weight	149.19 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Colourless to pale-yellow liquid with an amine-like odour.
SMILES notation	CC(O)N(CCO)CCO

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	20.5°C @ 101.3 kPa
Boiling point	336.1°C @ 101.3 kPa
Density (relative to water)	1120 kg/m^3 @ 20°C
Water solubility	>1,000 g/L @ 20°C
pKa	7.86 @ 25°C
Log K_{ow}	-1.9 @ 25°C [Experimental]
Vapour pressure	Negligible

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No

Convention, Protocol or other International Control	Listed yes or no?
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Triethanolamine is readily biodegradable, and it has a low potential to bioaccumulate. Triethanolamine will not adsorb significantly to suspended solids and sediments in water and would be highly mobile in soil.
Degradation	Triethanolamine is readily biodegradable. In an OECD 301E test, there was 96% degradation after 19 days (ECHA). [Kl. score = 2]
Persistence	Triethanolamine is considered to be readily biodegradable, therefore categorising it as Not Persistent.
Bioaccumulation	Based on the log Kow (-2.48) and the calculated BCF, bioaccumulation is not to be expected.
Transport	If released to water, based on its low Koc and high water solubility values, triethanolamine is likely to remain in water and not adsorb to sediment. It is also not expected to adsorb to soil, and, has the potential to be highly mobile.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

DBNPA is very toxic to aquatic organisms. DBNPA is also moderately acutely toxic to birds.

Acute Studies:

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Pimephales promelas	96-hour LC_{50}	11,800	2	ECHA
Ceriodaphnia dubia	48-hour EC_{50}	610	2	Warne and Schifko, 1999
Desmodesmus subspicatus	74-hour EC_{50}	512 (neutralised) 216 (un-neutralised)	2	ECHA

1.6.2 Chronic Aquatic Toxicity

In a 21-day Daphnia reproduction test, the NOEC for mortality is 16 mg/L, the NOEC for reproduction rate was 125 mg/L, and the NOEC for reproduction on the appearance of first offspring was 250 mg/L (Kuehn et al., 1989). [Kl. score = 2].

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

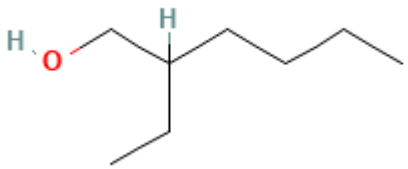
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 2-ETHYL-1-HEXANOL

1.2 Chemical Synonyms and Structure

	Chemical
CAS Name	2-Ethylhexan-1-ol
CAS No.	104-76-7
AICS name(s)	1-Hexanol, 2-ethyl-
Synonyms	2-Ethylhexanol, 2-ethylhexan-1-ol, 2-ethyl-n-hexyl alcohol, Ethyl Hexanol
Structural formula	
Molecular formula	C8H18O
Molecular weight	130.23 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Clear and colourless liquid
SMILES notation	CCCCCCC(C)O

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-89oC @ 101.kPa
Boiling point	185oC @ 101.3 kPa
Density (relative to water)	833 kg/m3 @ 20oC
Water solubility	0.9 g/L @ 20oC
pKa	15.75@ 25oC
Log K_{ow}	2.9 @ 25oC
Vapour pressure	93 Pa @ 20oC 120 Pa @ 25oC

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No

Convention, Protocol or other International Control	Listed yes or no?
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	2-Ethylhexanol is slightly soluble in water. However, it is not expected to volatilise from dry soil surfaces based upon its vapour pressure. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions (pH 5 to 9) (PubChem).
Degradation	2-Ethylhexanol was considered readily biodegradable in an OECD TG 301C test.
Persistence	As chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days.
Bioaccumulation	Chemical is not expected to bioaccumulate.
Transport	Expected to be high mobility if released in soil. Not expected to adsorb to suspended solids and sediment.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Fathead minnow	96-hour LC_{50}	28.2	1	ECHA
Golden Orfe	96-hour LC50	17.1	1	ECHA
Daphnia magna	48-hour EC_{50}	39	2	ECHA
Scenedesmus subspicatus	72-hour EC50 EC10	11.5 (biomass) 16.6 (growth rate) 3.2 (biomass) 5.3 (growth rate)	2	ECHA

1.6.2 Chronic Aquatic Toxicity

The 72-hour EC10 from an algal study using Scenedesmus subspicatus was 3.2 and 5.3 mg/L, based onbiomass and growth rate, respectively (ECHA).

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 ETHYLENE GLYCOL

1.2 Chemical Synonyms and Structure

CAS Name	Ethane-1,2-diol
CAS No.	107-21-1
AICS name(s)	1,2-Ethanediol
Synonyms	Ethylene glycol; ethane-1,2-diol; 1,2-ethanediol, 2-hydroxyethanol; monoethylene glycol; MEG; glycol alcohol; EG
Structural formula	
Molecular formula	C2H6O2
Molecular weight	62.07 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Colourless and odourless syrupy liquid
SMILES notation	CCO

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-13°C @ 101.3 kPa
Boiling point	197.4°C @ 101.3 kPa
Density (relative to water)	1110 kg/m^3@ 20°C
Water solubility	1000 g/L @ 20°C
pKa	N/A
Log K_{ow}	-1.36 (calculated) @ 25°C
Vapour pressure	12.3 Pa @ 25°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Ethylene glycol is readily biodegradable, and it is not expected to bioaccumulate. Ethylene glycol has low potential to adsorb to soil and sediment.
Degradation	Ethylene glycol was readily biodegradable in an OECD 301A test. After 10 days, degradation was 90-100% (ECHA).
Persistence	Categorised as Not persistent since its half-life is substantially less than 60 days.
Bioaccumulation	Bioaccumulation is not to be expected.
Transport	If released to soil, ethylene glycol is expected to have low potential for adsorption and a high potential for mobility. If released to water, based on its Koc and high water solubility values, ethylene glycol is likely to remain in water and not adsorb to sediment.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Pimephales promelas	96-hour LC_{50}	>72,860	1	Pillard (1995)
Oncorhynchus mykiss	96-hour LC_{50}	22,810 24,591	2	OECD (2004a,b)
Daphnia magna	48-hour EC_{50}	>100	1	ECHA
Daphnia magna	48-hour EC_{50}	46,300	2	Gersich et al. (1986)
Ceriodaphnia dubia-affinis	48-hour EC_{50}	25,800 (20oC) 10,000 (24oC)	2	Cowgill et al. (1995)
Daphnia magna	48-hour EC_{50}	46,300 (20oC) 51,000 (24oC)	2	Cowgill et al. (1995)

1.6.2 Chronic Aquatic Toxicity

The 72-hour EC10 from an algal study using Scenedesmus subspicatus was 3.2 and 5.3 mg/L, based onbiomass and growth rate, respectively (ECHA).

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

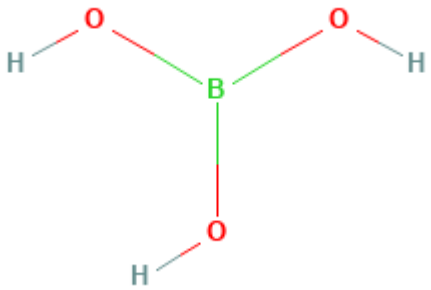
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1 BORIC ACID

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Boric Acid
CAS No.	10043-35-3
AICS name(s)	Boric Acid
Synonyms	Orthoboric acid; boracic acid; borofax; boron hydroxide; boron trihydroxide
Structural formula	
Molecular formula	BH3O3
Molecular weight	61.84 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White, odorless, crystalline solid
SMILES notation	B(O)(O)O

1.2 Physico-chemical Properties

Properties	
Physical form	
Melting point	>100°C (decomposes)
Boiling point	N/A
Density (relative to water)	1489 kg/m^3 @ 20°C
Water solubility	48.8 g/L @ 20°C
pKa	8.94 @ 20°C
Log K_{ow}	Not Applicable, substance is inorganic
Vapour pressure	0 Pa @ 25°C

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No

Convention, Protocol or other International Control	Listed yes or no?
Stockholm Convention	No
Reach (Substances of Very High Concerns)	See Below
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Borax will transform into boric acid in the aquatic environment. In the environment boric acid is in equilibrium with borate anions. Both species are very stable as they do not undergo biotransformation or redox reactions under normal environmental conditions. Boric acid is highly water soluble and it tends to remain in surface waters. Although some partitioning from water to soil and sediment does occur, the adsorption is pH dependent with the greatest adsorption occurring under alkaline conditions (pH 7.5 to 9.0) (NICNAS, 2019).
Degradation	Degradation is not applicable to inorganic borates.
Persistence	Under certain conditions, Boric acid may break down over time, but it can remain effective for extended periods.
Bioaccumulation	The WHO review of boron (WHO, 1998) noted that “highly water soluble materials are unlikely to bioaccumulate to any significant degree and that borate species are all present essentially as undissociated and highly soluble boric acid at neutral pH” (Hamilton and Wiedmeyer, 1990; Thompson et al. 1976).
Transport	Undissociated Boric acid is transported in soil with little adsorption.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

- The oral LD50 of borax in rats is > 2,500 mg/kg (ECHA) [Kl. score = 1]. The oral LD50 of boric acid in rats is 3,450 mg/kg (ECHA) [Kl. score = 1].
- There are no acute inhalation studies on borax. In a read-across study for borax, the 4-hour inhalation LC50 value for disodium tetraborate pentahydrate in rats is >2.04 mg/L (ECHA) [Kl. score = 1].
- The mass median aerodynamic diameter (MMAD) was 2.8 µm (ECHA) [Kl. score = 1]. In another study, the 4-hour inhalation LC50 value for boric acid in rats was >2.03 mg/L (ECHA) [Kl. score = 1].
- The dermal LD50 of borax in rabbits is >2,000 mg/kg (ECHA) [Kl. score = 2]. The dermal LD50 of boric acid in rabbits is >2,000 mg/kg (ECHA) [Kl. score = 1].

1.5.2 Chronic Aquatic Toxicity

- Long-term effects (LC10) on freshwater fish ranged from 3.5 to 47 mg B/L. Adequate long-term LC10 of 21.6 mg B/L was found for the fresh water fish P. promelas in a study according to EPA OPPTS 850.1400 (ECHA) [Kl. Score = 2].
- Long-term effects (LC10/NOEC) on reproduction on freshwater vertebrates ranged from 6.6 to 32 mg B/L based on several well-accepted guideline studies (ECHA) [Kl. Scores =1 or 2].

- Boric acid has been evaluated for its toxicity towards the fresh water alga Pseudokirchneriella subcapitata (formerly Selenastrum capricornutum) in an Alga growth inhibition test according to OECD 201 under GLP requirements. The exposure duration was 72 hours under static conditions. The NOEC growth rate determined from the study was 17.5 mg B/L (ECHA) [Kl. Score = 1].
- The ANZG water quality guideline (2021) derived a very high reliability default guideline value (DGVs) for (dissolved) boron in freshwater from 22 chronic (long-term) toxicity data, comprising eight fish, two amphibians, three crustaceans, one bivalve, three macrophytes, one green microalga, three diatoms and one blue–green alga.

1.5.3 Toxicity to Sediment Organisms

- Limited sediment toxicity data are available for boric acid and boron containing compounds in general (NICNAS, 2019).
- Chronic toxicity values for the effects of boric acid on sediment-dwelling invertebrates have been obtained for a freshwater midge (Chironomus riparius, harlequin fly), a freshwater bivalve (Lampsilis siliquoidea, fatmucket clam), and the aquatic worm (Lumbriculus variegatus, California blackworm). The respective toxicity values for these species are as follows: 28 d NOEC = 37.8 mg B/kg; 21 d LC25 (survival) = 363.1 mg B/kg; and 28 d NOEC = 100.8 mg B/kg (NICNAS, 2019).
- Due to the high water solubility of boron and its low partitioning to sediment, sediment toxicity testing for boron is particularly challenging as it is difficult to ensure that exposure is through the solid phase (i.e., sediment) and not from the aqueous boric acid in the overlying water (NICNAS, 2019).

1.5.4 Terrestrial Toxicity

Ecotoxicological tests with plants and soil invertebrates have recorded modest chronic toxicity values (NOECs/ECs) in the range of 15.3 to 84.0 and 5.2 to 315 mg total B/kg, respectively (ECHA, 2008). However, to predict the potential toxicity of boron to plants and soil organisms, measuring the total boron concentration may be unsuitable. Instead, potential toxicity is better predicted using boron concentrations in the soil solution (extractable boron) (Mertens, et al., 2011). In Australia, it is generally accepted that boron toxicity will pose a risk to terrestrial plants when soil concentrations exceed 15 mg/kg of extractable boron (NICNAS, 2019).

1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	The overall conclusion is that borax and boric acid are not PBT substances.
Other characteristics of concern	No other characteristics of concern were identified for borax or boric acid.

TOXICOLOGICAL PROFILE

1 CALCIUM CHLORIDE

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Calcium dichloride
CAS No.	10043-52-4
AICS name(s)	Calcium Chloride
Synonyms	Calcium chloride; calcium dichloride; calcium chloride anhydrous
Structural formula	
Molecular formula	$CaCl_2$
Molecular weight	110.98 gm/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White odourless solid; crystals; powder; or granules
SMILES notation	[Ca+2].[Cl-].[Cl-]

1.2 Physico-chemical Properties

Properties	
Physical form	White solid, powder or granules
Melting point	782°C
Boiling point	>1,600 °C
Density (relative to water)	2150 kg/m^3 @ 25°C
Water solubility	745 g/L @ 20°C (very soluble)
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Calcium chloride dissociates completely in aqueous solutions to calcium (Ca2+) and chloride (Cl-) ions. Calcium chloride and its dissociated ions are ubiquitous in the environment.
Degradation	Because of its dissociation properties and high water solubility, calcium chloride is not expected to be adsorbed to soil. The calcium ion may bind to soil particulate or may form stable inorganic salts with sulfate and carbonate ions.
Persistence	Not persistent long term due to it's solubility in water and mobility in an environmental setting.
Bioaccumulation	Neither CaCl2 or its disassociated ions are expected to Bioaccumulate.
Transport	Mobile in soil and eventually drains to surface water, where it is readily dissolved.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Pimephales promelas	96-hour LC_{50}	4,630	2	OECD, 2002; ECHA
Lepomis macrochirus	96-hour LC_{50}	9500 – 11, 300	2	OECD, 2002; ECHA
Gambusia affinis	96-hour LC_{50}	13,400	2	OECD, 2002; ECHA
Lepomis macrochirus	96-hour LC_{50}	10,650	2	OECD, 2002; ECHA
Daphnia magna	48-hour EC_{50}	2,400	1	OECD, 2002; ECHA
Daphnia magna	48-hour EC_{50}	2,770	2	OECD, 2002; ECHA
Ceriodaphnia dubia	48-hour EC_{50}	1,830	2	OECD, 2002; ECHA
Daphnia magna	48-hour EC_{50}	1,062	2	OECD, 2002; ECHA
Pseudokirchneriella subcapitata	72-hour EC_{50}	2,900 (Biomass)	1	OECD, 2002; ECHA

1.5.2 Chronic Aquatic Toxicity

- The 21-day EC50 and EC16 values for calcium chloride in a chronic Daphnia reproduction study were 610 and 320 mg/L, respectively (OECD, 2002).

1.5.3 Toxicity to Sediment Organisms

1.5.4 Terrestrial Toxicity

- No studies available.

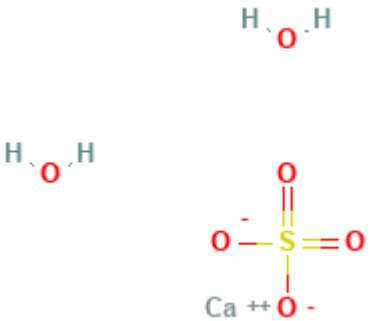
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified for calcium chloride.

TOXICOLOGICAL PROFILE

1 CALCIUM SULFATE DIHYDRATE

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	Calcium Sulfate Dihydrate
CAS No.	10101-41-4
AICS name(s)	Sulfuric Acid, Calcium Salt, Dihydrate
Synonyms	Calcium sulphate dihydrate; calcium sulfate—water (1/1/2); sulfuric acid, calcium salt, dihydrate; phosphogypsum; Landplaster; GIPS; Alabaster Annaline; C.I. Pigment white 25; gypsum; gypsum stone land and plaster; light spar; magnesia white; mineral white; native calcium sulfate; precipitated calcium sulfate ; Sainite; Satin spar; sulfuric acid, calcium(2+) salt, dihydrate ;terra alba
Structural formula	
Molecular formula	CaH_4O_6S
Molecular weight	172.17 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White, odorless crystalline solid
SMILES notation	[Ca+2].[O-]S(=O)(=O)[O-].[H]O[H]

1.2 Physico-chemical Properties

Properties	
Physical form	White, odorless crystalline solid
Melting point	100-150 oC pressure not provided
Boiling point	No data available
Density (relative to water)	2320 kg/m3, temperature not indicated
Water solubility	2.05 g/L @ 20°C
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Calcium sulphate, dihydrate is a colourless solid inorganic substance with monoclinic and hygroscopic properties (OECD, 2003). In aqueous solutions, the substance is moderately soluble, dissociating into calcium (Ca2+) and sulphate (SO42-) ions that are ubiquitous in the environment.
Degradation	Biodegradation is not applicable (inorganic compound).
Persistence	Long term persistence in the environment due to assimilation with species present in water and it's role in the chemical balance in soils.
Bioaccumulation	Not expected to bioaccumulate.
Transport	Soluble; can be transported in water/soil – sulphate will either become part of the sulphur cycle or be assimilated by microorganisms and plants (ECHA).

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

Calcium sulphate dihydrate is of low acute toxicity to aquatic organisms.

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oryzias latipes	96-hour LC_{50}	>100	1	OECD, 2003
Daphnia magna	48-hour EC_{50}	>100	1	OECD, 2003
Selenastrum capricornutum	72-hour EC_{50}	>100	1	OECD, 2003

1.5.2 Chronic Aquatic Toxicity

- No chronic studies are available.

1.5.3 Toxicity to Sediment Organisms

- No studies are available.

1.5.4 Terrestrial Toxicity

- No studies available.

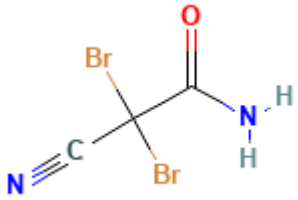
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1 2,2-DIBROMO-3-NITRILOPROPIONAMIDE

1.1 Chemical Synonyms and Structure

	Chemical
CAS Name	2,2-Dibromo-2-cyanoacetamide
CAS No.	10222-01-2
AICS name(s)	Acetamide, 2,2-dibromo-2-cyano-
Synonyms	Dibromocyanoacetamide, DBNPA, 2,2-Dibromo-3-nitrilopropionamide, 2,2-Dibromo-2-cyanoacetamide
Structural formula	
Molecular formula	$C_3H_2Br_2N_2O$
Molecular weight	241.87 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White to “off white” colour crystalline solid
SMILES notation	CC(=O)N(C(=N)Br)Br

1.2 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	123 – 125°C @ 101.3 kPa
Boiling point	Decomposes at 190°C @ 101.3 kPa
Density (relative to water)	934 -1,370 kg/m^3 (temperature not provided)
Water solubility	15 g/L @ 25°C
pKa	8.24
Log K_{ow}	0.80-0.88 L/kg (pH not provided)
Vapour pressure	0.120 Pa @ 25°C

1.3 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No

Convention, Protocol or other International Control	Listed yes or no?
European Commission Endocrine Disruptors Strategy	No

1.4 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	DBNPA is highly soluble in water. Volatilisation from water surfaces or moist soil surfaces is not expected to be an important fate process based upon this compound's estimated Henry's Law constant (1.9 x 10-3 Pa m3/mol). It is also not expected to volatilise from dry soil surfaces based upon its vapor pressure (Pub Chem). Degradation of DBNPA is extremely pH dependent with increased degradation rates observed at higher pH's.
Degradation	The primary degradation pathway is through aerobic and anaerobic metabolism. In both anaerobic and aerobic metabolism studies, half-lives of less than 4 hours were measured for DBNPA; loss was due to both hydrolysis and biodegradation (EPA, 1994).
Persistence	While the rate of biodegradation in these tests does not satisfy the OECD criterion for readily biodegradability (60% in a 10-day window), the results do show that DBNPA is biodegradable at more realistic environmental exposure concentrations. If a chemical is found to be inherently biodegradable or readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).
Bioaccumulation	There are no reliable bioaccumulation studies on DBNPA. DBNPA is not expected to bioaccumulate based on a log Kow of 0.80 – 0.88 (PubChem).
Transport	If released to soil, based on this Koc value, the substance is expected to have high mobility. If released to water, based on the Koc value and its water solubility, DBNPA is not expected to adsorb to suspended solids and sediment.

1.5 Environmental Effects

1.5.1 Acute Aquatic Toxicity

DBNPA is very toxic to aquatic organisms. DBNPA is also moderately acutely toxic to birds.

Acute Studies:

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Bluegill sunfish (Lepomis macrochirus)	96-hour LC_{50}	2.3	3	EPA, 2019
Bluegill sunfish (Lepomis macrochirus)	96-hour LC50	1.3	-	EPA, 2019
Rainbow Trout (Onchorhynchus mykiss)	96-hour LC50	1.0	-	EPA, 2019
Rainbow Trout (Onchorhynchus mykiss)	96-hour LC50	2.3	3	EPA, 2019
Fathead minnow (Pimephales promelas)	96-hour LC50	1.8	3	EPA, 2019
Fathead minnow (Pimephales promelas)	96-hour LC50	0.55	-	EPA, 2019
Sheepshead minnow (Cyprinodon variegatus)	96-hour LC50	3.3	-	EPA, 2019
Sheepshead minnow (Cyprinodon variegatus)	96-hour LC50	1.71	-	EPA, 2019
Daphnia magna	48-hour EC50	0.9	3	EPA, 2019
Daphnia magna	48-hour EC50	0.86	3	EPA, 2019
Green algae (Pseudokirchneriella subcapitata)	96-hour EC50	0.116		EPA, 2019

1.5.2 Chronic Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Rainbow Trout (Onchorhynchus mykiss)	85-d NOEC	0.47	2	EPA, 2019
Daphnia magna	28-d NOEC	0.05	3	EPA, 2019

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Green algae (Pseudokirchneriella subcapitata)	NOEC	0.058		EPA, 2019

1.5.3 Toxicity to Sediment Organisms

Acute Toxicity:

Test Species	% Active Ingredient (a.i)	Results (mg/kg-bw)	Reference
Mallard Duck (Anas platyrhynchos)	Technical Grade	205	EPA, 2019
Northern Bobwhite (Colinus virginianus)	Technical Grade	150	EPA, 2019
Northern Bobwhite (Colinus virginianus)	100	354	EPA, 2019

1.5.4 Terrestrial Toxicity

No data available.

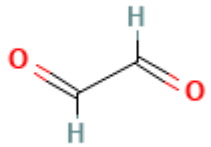
1.6 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 GLYOXAL

1.2 Chemical Synonyms and Structure

CAS Name	Oxalaldehyde
CAS No.	107-22-2
AICS name(s)	Ethanedial
Synonyms	1,2-ethanedial, biforrmal, biformyl, ethandedial (9CI), ethandione, glyoxal, glyoxal aldehyde, oxal,
Structural formula	
Molecular formula	$C_2H_2O_2$
Molecular weight	58.04 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Clear, slightly viscous liquid
SMILES notation	O=CO

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-25°C @ 101.3 kPa
Boiling point	103.6°C @ 101.3 kPa
Density (relative to water)	1270 kg/m^3 @ 20°C
Water solubility	Miscible (20°C, pH 5-9)
pKa	N/A
Log K_{ow}	-1.15 @ 23°C (pH 7) -1 @ 23°C (pH 5) -1.62 @ 23°C (pH 9)
Vapour pressure	2020 Pa @ 20°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No

Convention, Protocol or other International Control	Listed yes or no?
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	If released to air, glyoxal would rapidly partition to soil and water; if released to soil and water, glyoxal would mostly remain in those compartments and degradation would prevent partitioning from one compartment to the other (OECD, 2005).
Degradation	Glyoxal is readily biodegradable.
Persistence	Chemical has low potential for accumulation therefore it has low persistence.
Bioaccumulation	No experimental studies on glyoxal were identified. The octanol-water partition coefficient is -1.15 at pH 7 (ECHA), indicating a low potential for bioaccumulation.
Transport	Glyoxal is mobile in soil and has low potential for accumulation in soil.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Golden Orfe	96-hour LC_{50}	186-272	2	ECHA
Common Carp	96-hour LC_{50}	>200	2	ECHA
Pimephales promelas	96-hour LC_{50}	215	2	ECHA
Daphnia magna	48-hour EC_{50}	101	2	ECHA
Scenedesmus subspicatus	72-hour EC_{50} 72-hour NOEC	>200 >100	2	ECHA
Scenedesmus subspicatus	72-hour EC50 72-hour NOEC	>100 3.13	1	ECHA

1.6.2 Chronic Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Fathead Minnow	34-Day NOEC	112	1	ECHA
Daphnia magna	21-day NOEC	3.19	1	ECHA

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Earthworm Eisenia fetida (OECD 207)	14-day LC_{50}	> 398	1	ECHA
Soil microorganisms (OECD 216)*	28-day EC_{50} 28-day EC_{10}	>400 >400	1	ECHA
Soil microorganisms (OECD 217)*	28-day EC_{50} 28-day EC_{10}	>400 240	1	ECHA

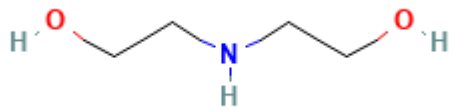
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 DIETHANOLAMINE

1.2 Chemical Synonyms and Structure

CAS Name	2,2'-iminodiethanol
CAS No.	111-42-2
AICS name(s)	Ethanol, 2,2'-iminobis-
Synonyms	Diethanolamine; 2,2'-iminodiethanol; 2,2'-dihydroxydiethylamine; 2-[(2-hydroxyethyl)amino]ethanol; bis(2-hydroxyethyl)amine; DEA; di(2-hydroxyethyl)amine; ethanol, 2,2'-iminobis-(9Cl); ethanol, 2,2'iminodi-(8Cl)
Structural formula	
Molecular formula	$C_4H_{11}NO_2$
Molecular weight	105.14 gm/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid Crystals (prisms) or syrupy liquid
SMILES notation	CCOCCNCCO

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	27°C @ 101.3 kPa
Boiling point	268.9°C (decomposition occurs >200°C)@ 101.3 kPa
Density (relative to water)	1100 kg/m^3 @ 20°C
Water solubility	1000 g/L @ 20°C (miscible)
pKa	8.99 @ 20°C
Log K_{ow}	-2.46 @ 25°C
Vapour pressure	0 Pa @ 20°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Inventory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No

Convention, Protocol or other International Control	Listed yes or no?
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Diethanolamine is highly soluble in water. Based on its Henry's Law Constant is not expected to evaporate into the atmosphere from the water surface. However, the substance will be rapidly degraded by photochemical processes (half-life = 4.2 h).
Degradation	Diethanolamine is readily biodegradable.
Persistence	Diethanolamine is categorised as not persistent (half life substantially less than 60 days).
Bioaccumulation	There are no bioaccumulation studies on diethanolamine. The BCF was estimated to be 2.3 based on calculations from OASIS Catalogic v.5.11.15 [BCF base-line model v.0208] (Dimitrov et al., 2005; ECHA). Based on the log Kow (-2.46) and the calculated BCF, bioaccumulation is not to be expected.
Transport	If released to water, based on its low Koc and high water solubility values, diethanolamine is likely to remain in water and not adsorb to sediment. It is also not expected to adsorb to soil, and, has the potential to be highly mobile.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss	96-hour LC_{50}	460	2	ECHA
Pimephales promelas	96-hour LC_{50}	1,460	2	Mayes, et al (1983)
Pimephales promelas	96-hour LC_{50}	1,664	2	ECHA
Lepomis macrochirus	48-hour LC_{50}	1,850	2	Turnbull, et al (1954)
Carassius auratus	24-hour LC_{50}	>5,000 (neutralised) 800 (non-neutralised)	2	Bridie, et all (1979)
Ceriodaphnia dubia	48-hour EC_{50}	30.1 (24oC) 89.9 (20oC)	2	Cowgill, et al. (1985)
Daphnia magna	48-hour EC_{50}	55	2	ECHA
Daphnia magna	48-hour EC_{50}	171	2	ECHA
Pseudokirchneriella subcapitata	72-hour EC_{50} (growth rate)	9.5 (Test 1) 19 (Test 2)	2	ECHA
Desmodesmus subspicatus	72-hour EC_{50}	14.9 (growth rate) 6.2 (biomass)	2	ECHA
Desmodesmus subspicatus	72-hour EC_{50}	107.3 (growth rate) 74.5 (biomass)	2	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Chorella vulgaris	72-hour EC_{50}	778 (growth rate)	2	ECHA

1.6.2 Chronic Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Daphnia magna	EC_{10} NOEC	1.05 0.76	1	ECHA
Pseudokirchneriella subcapitata	EC_{10} (growth rate)	1.4 (test 1) 1.1 (test 2)	2	ECHA
Desmodesmus subspicatus	EC_{10} (neutralised)	2.4 (growth rate) 2.0 (biomass)	2	ECHA
Desmodesmus subspicatus	EC_{10} (non-neutralised)	85.7 (growth rate) 41.3 (biomass)	2	ECHA
Pseudokirchneriella subcapitata	7-day NOEC	10	2	ECHA

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

In an earthworm (Eisenia Andrei, Eisenia fetida, or Lumbricus terrestris) study, the 35-day LC50 was4,141 mg/kg soil dry weight (mortality); the 63-day EC50 was 776 mg/kg soil dry weight (reproduction); and the 63-day EC25 was 171 mg/kg soil dry weight (reproduction) (ECHA). [Kl. score = 2].

In a springtails (Folsomia candida) study, the 28-day LC50 was 8,301 mg/kg soil dry weight (mortality); the 28-day EC50 was 4,205 mg/kg soil dry weight (reproduction); and the 28-day EC25 was 2,102 mg/kg soil dry weight (reproduction) (ECHA). [Kl. score = 2]

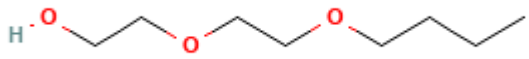
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 AMMONIUM SULFATE 2-(2-BUTOXYETHOXY)ETHANOL

1.2 Chemical Synonyms and Structure

CAS Name	2-(2-butoxyethoxy)ethanol
CAS No.	112-34-5
AICS name(s)	2-(2-butoxyethoxy)ethanol
Synonyms	DGBE, Diethylene glycol monobutyl ether; 2-(2-butoxyethoxy)ethanol; diethylene glycol butyl ether; ethanol, 2-(2-butoxy)-; butyldiglycol ether; butyl dioxitol
Structural formula	
Molecular formula	$C_8H_{18}O_3$
Molecular weight	162.23 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Colourless liquid with a faint, butyl odour.
SMILES notation	CCOCCOCCO

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	<-70°C @ 101.3 kPa
Boiling point	231°C @ 101.3 kPa
Density (relative to water)	955 kg/m^3 @ 20°C
Water solubility	955 g/L @ 20°C
pKa	14.8 @ 20°C
Log K_{ow}	1.0 @ 20°C
Vapour pressure	2.9 Pa @ 25°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Inventory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	-
Degradation	DGBE is readily biodegradable. In an OECD TG 301C test, there was approximately 85% degradation after 28 days as measured by O2 consumption (ECHA) [Kl. score = 1].
Persistence	Categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).
Bioaccumulation	No bioconcentration studies have been conducted on DGBE. DGBE is not expected to bioaccumulate based on the experimental log Kow of 1.0 (ECHA).
Transport	If released to soil, DGBE is expected to have low potential for adsorption and a high potential for mobility. If released to water, based on its Koc and high water solubility values, DGBE is likely to remain in water and not adsorb to sediment.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Lepomis machrochirus	96-hour LC_{50}	1,300	2	ECHA
Pimephales promelas	96-hour LC_{50}	2,500	2	ECHA
Daphnia magna	48-hour EC_{50}	>100	1	ECHA
Daphnia magna	48-hour EC_{50}	2,850	2	ECHA
Daphnia magna	24-hour EC_{50}	3,200	2	ECHA
Daphnia magna	48-hour EC_{50}	4,950	2	ECHA
Daphnia magna	48-hour EC_{50}	>1,000	2	ECHA
Scenedesmus subspicatus	96-hour EC_{50}	>100 (growth rate) >100 (biomass)	1	ECHA
Scenedesmus subspicatus	72-hour EC_{50}	1,101 (growth rate)	2	ECHA

1.6.2 Chronic Aquatic Toxicity

The 96-hour NOEC from an algal study using Scenedesmus subspicatus were >100 mg/L for growth rate and biomass (ECHA). [Kl. score = 1]

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

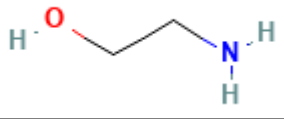
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 MONOETHANOLAMINE

1.2 Chemical Synonyms and Structure

CAS Name	Monoethanolamine
CAS No.	141-43-5
AICS name(s)	2-amino-ethanol
Synonyms	2-Aminoethanol; Monoethanolamine
Structural formula	
Molecular formula	C_2H_7NO
Molecular weight	61.08
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Clear liquid with fish odour
SMILES notation	C(CO)N

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	4°C
Boiling point	167°C @ 101.3 kPa
Density (relative to water)	1016 kg/m^3 @ 20°C
Water solubility	>1000 g/L @ 20°C (pH 12.1)
pKa	9.5 @ 25°C
Log K_{ow}	-2.3 @ 25°C
Vapour pressure	50 Pa @ 20°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Monoethanolamine is highly soluble in water. A pKa of 9.5 indicates monoethanolamine will exist almost entirely in the cation form at pH values of 5 to 9 and, therefore, volatilization from water surfaces is not expected to be an important fate process. Likewise, volatilization from moist soil is not expected because cations do not volatilize. Monoethanolamine is not expected to volatilize from dry soil surfaces based upon its vapor pressure.
Degradation	Monoethanolamine is considered readily biodegradable.
Persistence	As it is readily biodegradable, this categorises the chemical as not persistent.
Bioaccumulation	Not expected to bioaccumulate.
Transport	Based upon these Koc values, if released to soil, monoethanolamine is not expected to adsorb to soiland has a potential for high mobility. If released into water, monoethanolamine is also not expected to adsorb to suspended solids and sediment. However, absorption is affected by the acidity of the substrate (PubChem).

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Brachydanio rerio	96-hour LC_{50}	1, 180	2	OECD, 2004, ECHA
Oncorhynchus mykiss	96-hour LC_{50}	260-310	2	ECHA
Daphnia magna	48-hour EC_{50}	1,700	2	OECD, 2004; ECHA

*Highest attainable test concentration.

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

There are no studies on sodium silicate. A honeybee acute contact toxicity study according to (USEPA, 2012) has been conducted on AgSil™ 25 potassium silicate solution (29.1% potassium silicate in water). The 48-hr LD0 was 25 µg/animal and the 48-hr LD50 was 25 µg/animal (ECHA).

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 CALCIUM OXIDE

1.2 Chemical Synonyms and Structure

CAS Name	Calcium Oxide
CAS No.	1305-78-8
AICS name(s)	Calcium Oxide
Synonyms	Lime; Quicklime; Burnt lime; Calcia; Calxyl; Gebrannter kalk; Unslaked lime; Calcium monoxide
Structural formula	
Molecular formula	CaO
Molecular weight	56.08 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid powder - Beige
SMILES notation	[O-2].[Ca+2]

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	> 450°C (pressure not provided)
Boiling point	2,850°C @ 101.3 kPa
Density (relative to water)	3310 kg/m^3 @ 22°C
Water solubility	1.338 g/L @ 20 °C
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	The pH buffer capacity is controlled by a whole range of processes (mineral dissolution/precipitation,protonation/deprotonation of pH dependent charge sites, reaction with CO2, biological processes, etc.) and as such, partition coefficients are not relevant for the fate and behaviour of OH- in soils or sediment.
Degradation	Does not biodegrade as it is an inorganic substance.
Persistence	Calcium oxide is expected to disassociate in the environment to its respective cation and anion as limited by its aqueous solubility and pH.
Bioaccumulation	Not expected to bioaccumulate in the environment.
Transport	In soil as well as in sediment-water systems, calcium oxide will react and release calcium ions and hydroxyl ions. Therefore, relevant information on adsorption/desorption of calcium oxide can be broadened to data on adsorption/desorption of calcium and magnesium.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss	96-hour LC_{50}	50.6	1	ECHA
Daphnia magna	48-hour EC_{50}	49.1	1	ECHA
Pseudokirchneriella subcapitata	72-hour EC_{10}	79.22	1	ECHA

1.6.2 Chronic Aquatic Toxicity

A 42-day Oncorhynchus mykiss test showed that enhanced Ca2+ diets (60 mg Ca2+) had no effects on survival. Mean fish weights remained constant across all treatments (ECHA) [Kl Score = 4]. A 14-day Crangon septemspinosa test showed an EC10 of 32 mg/L (ECHA) [Kl Score = 2].

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Eisenia foetida	14-Day LC_{50} NOEC	>5,000	1	ECHA

1.7 Categorisation and other Characteristics of Concern

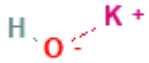
	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT

	Comment
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 POTASSIUM HYDROXIDE

1.2 Chemical Synonyms and Structure

CAS Name	Potassium Hydroxide
CAS No.	1310-58-3
AICS name(s)	Potassium Hydroxide
Synonyms	Potassium hydroxide; caustic potash; potash lye; potassium hydrate
Structural formula	
Molecular formula	KOH
Molecular weight	56.1 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White, crystalline solid
SMILES notation	[OH-].[K+]

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	406°C (pressure not provided) 250°C
Boiling point	1,327°C @ 1013 hPa
Density (relative to water)	2044 kg/m^3 @ 20°C
Water solubility	Very soluble
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Potassium hydroxide is an inorganic salt that dissociates completely to potassium and hydroxide ions in aqueous solutions.
Degradation	Biodegradation is not applicable to Inorganic Ions of KOH.
Persistence	Criteria for Persistence not applicable for this substance.
Bioaccumulation	Not expected to bioaccumulate.
Transport	Expected to be transported in water and soil as it is very soluble; ions (K and H) are ubiquitous and found present in most soil, water, and sediment.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

KOH: The 96-hour LC50 to Gambusia affinis (mosquito fish) is 80 mg/L. At 56 mg/L, no mortality was observed.

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies were identified.

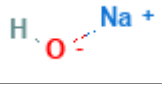
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 SODIUM HYDROXIDE

1.2 Chemical Synonyms and Structure

CAS Name	Sodium Hydroxide
CAS No.	1310-73-2
AICS name(s)	Sodium Hydroxide
Synonyms	Caustic soda, soda lye, NaOH
Structural formula	
Molecular formula	HNaO
Molecular weight	40 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid
SMILES notation	[OH-].[Na+]

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	318°C (solid, 100%); 52°C (60% solution)
Boiling point	1,388°C @ 101.3 kPa
Density (relative to water)	2130 kg/m3, 20°C (100%) 1430 kg/m3, 20°C (40%)
Water solubility	Very soluble (>10 g/L @ 25°C)
pKa	14.8 @ 25°C
Log K_{ow}	N/A
Vapour pressure	1 Pa @ 513°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Due to its high water solubility and low vapour pressure, sodium hydroxide will be found predominantly in the aquatic environment where it dissociates completely to sodium (Na+) andhydroxyl (OH-) ions.
Degradation	Biodegradation is not applicable to these inorganic ions.
Persistence	Persistence Criteria not applicable.
Bioaccumulation	Bioaccumulation criteria not applicable
Transport	Both sodium and hydroxide ions are also ubiquitous and are present in most water, soil and sediment.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

The 24-hour LC50 to Carassius auratus (goldfish) is 160 mg/L. At 100 mg/L, which was equivalent to a pH of 9.8, no mortality was observed. The 48-hour LC50 to Leuciscus idus melanotus, is 189 mg/L. The 96-hour LC50 of Gambusia affinis (mosquitofish) is 125 mg/L. At 84 mg/L, no effects on the fish were observed. The pH was 9 at 100 mg/L.

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies were identified.

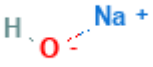
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 SODIUM HYDROXIDE

1.2 Chemical Synonyms and Structure

CAS Name	Sodium Hydroxide
CAS No.	1310-73-2
AICS name(s)	Sodium Hydroxide
Synonyms	Caustic soda, soda lye, NaOH
Structural formula	
Molecular formula	HNaO
Molecular weight	40 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid
SMILES notation	N/A

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	318°C (solid, 100%) 52°C (60% solution)
Boiling point	1,388°C @ 101.3 kPa
Density (relative to water)	2130 kg/m^3, 20°C (100%) 1430 kg/m^3, 20°C (40%)
Water solubility	Very soluble (>10 g/L @ 25°C)
pKa	14.8 @ 25°C
Log K_{ow}	N/A
Vapour pressure	1 Pa @ 513°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Due to its high water solubility and low vapour pressure, sodium hydroxide will be found predominantly in the aquatic environment where it dissociates completely to sodium (Na+) and hydroxyl (OH-) ions.
Degradation	Biodegradation is not applicable to these inorganic ions.
Persistence	Considered N/A
Bioaccumulation	Sodium hydroxide is not expected to bioaccumulate and does not meet the screening criteria for bioaccumulation.
Transport	Both sodium and hydroxide ions are also ubiquitous and are present in most water, soil and sediment.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

1.6.2 Chronic Aquatic Toxicity

The 24-hour LC50 to Carassius auratus (goldfish) is 160 mg/L. At 100 mg/L, which was equivalent to a pH of 9.8, no mortality was observed. The 48-hour LC50 to Leuciscus idus melanotus, is 189 mg/L. The 96-hour LC50 of Gambusia affinis (mosquitofish) is 125 mg/L. At 84 mg/L, no effects on the fish were observed. The pH was 9 at 100 mg/L.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies were identified.

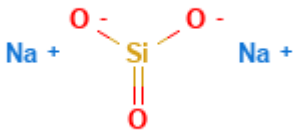
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 SODIUM SILLICATE

1.2 Chemical Synonyms and Structure

CAS Name	Sodium hydroxysilanoylolate
CAS No.	1344-09-8
AICS name(s)	Silicic acid, sodium salt
Synonyms	Water glass; soluble glass; silicate of soda; sodium orthosilicate; sodium silicate glass
Structural formula	
Molecular formula	$Na_2O \times nO_2Si$
Molecular weight	184.04 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Amorphous glass melt (lumps); aqueous solution or spray-dried powder with ~20% residual water
SMILES notation	N/A

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	Slightly lower than that of water
Boiling point	730-870°C (Flow point)
Density (relative to water)	1260 – 1710 kg/m^3 (solutions)
Water solubility	Solution: infinitely miscible; spray-dried solution: readily dissolvable
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	Negligible at ambient temperature

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No

Convention, Protocol or other International Control	Listed yes or no?
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Sodium silicate is an inorganic compound that dissociates completely to sodium and silicate ions in aqueous solutions.
Degradation	Not applicable.
Persistence	Not applicable.
Bioaccumulation	Not expected to accumulate.
Transport	

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Brachydanio rerio	96-hour LC_{50}	1, 180	2	OECD, 2004, ECHA
Oncorhynchus mykiss	96-hour LC_{50}	260-310	2	ECHA
Daphnia magna	48-hour EC_{50}	1,700	2	OECD, 2004; ECHA

*Highest attainable test concentration.

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

There are no studies on sodium silicate. A honeybee acute contact toxicity study according to (USEPA, 2012) has been conducted on AgSil™ 25 potassium silicate solution (29.1% potassium silicate in water). The 48-hr LD0 was 25 µg/animal and the 48-hr LD50 was 25 µg/animal (ECHA).

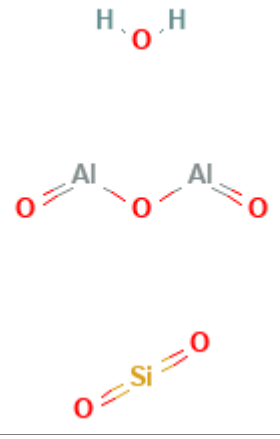
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 XANTHAN GUM

1.2 Chemical Synonyms and Structure

CAS Name	dialuminum;disodium;oxygen(2-);silicon(4+);hydrate
CAS No.	1302-78-9
AICS name(s)	Bentonite
Synonyms	Albagel Premium USP 4444, Bentonite magma, Bentonite 2073, Bentopharm, CI 77004, E558, HI-Gel, HI-Jel, Imvite I.G.B.A., Magbond, mineral sopa, Montmorillonite, Panther creek bentonite, soap clay, Southern bentonite, taylorite, Tixoton, Veegum HS, Volclay, Volclay Bentonite BC, and Wilkinite
Structural formula	
Molecular formula	$Al_2H_2Na_2O_{13}Si_4$
Molecular weight	422.29 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Powder or granular material.
SMILES notation	N/A

1.3 Physico-chemical Properties

Properties	
Physical form	Solid/Clay
Melting point	
Boiling point	
Density (relative to water)	
Water solubility	
pKa	
Log K_{ow}	
Vapour pressure	

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	As a naturally-occurring clay material biodegradation, bioaccumulation and absorption not relevant for this substance.
Degradation	As an inorganic substance, bentonite will not biodegrade.
Persistence	Persistent as the substance is not biodegradable.
Bioaccumulation	As a naturally occurring inorganic clay material, bentonite is not bioaccumulative.
Transport	Adsorption and desorption are not relevant for naturally occurring clay materials.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

As a naturally-occurring clay material, aquatic toxicity is not a relevant property. No data are available regarding the acute toxicity of this substance.

1.6.2 Chronic Aquatic Toxicity

No data are available regarding chronic toxicity of this substance.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

1.7 Categorisation and other Characteristics of Concern

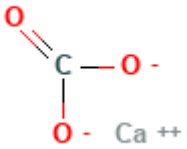
	Comment
Persistent, Bioaccumulative and	Not a PBT

	Comment
Toxic (PBT) Categorisation	
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 LIMESTONE

1.2 Chemical Synonyms and Structure

CAS Name	Calcium Carbonate
CAS No.	1317-65-3
AICS name(s)	Limestone
Synonyms	Calcium carbonate, precipitated; carbonic acid, calcium salt (1:1); aragonite; calcium monocarbonate; monocalcium carbonate
Structural formula	
Molecular formula	$CaCO_3$
Molecular weight	100.09 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White Powder
SMILES notation	O=C([O-])[O-].[Ca+2]

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	825°C (decomposes) @ 101.3 kPa
Boiling point	-
Density (relative to water)	2700 to 2950 kg/m^3 @ 20°C
Water solubility	0.0166 g/L @ 20°C (slightly soluble)
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No

Convention, Protocol or other International Control	Listed yes or no?
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Calcium carbonate is partially soluble in water, dissociating into calcium (Ca^{2+}) and carbonate (CO_3^{2-})ions. Both ions are ubiquitous in the environment.
Degradation	Not Applicable
Persistence	Not Applicable
Bioaccumulation	Not expected to bioaccumulate.
Transport	Transport expected within aquatic environments and in soils due to it's high solubility and availability of ions in natural environment.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss	96-hour LC_{50}	>100% (saturated solution)	1	OECD, 2003
Daphnia magna	48-hour EC_{50}	>100% (saturated solution)	1	OECD, 2003
Desmodescus subspicatus	72-hour EC_{50} 72-hour EC_{10}	>14 mg/L* >14 mg/L*	1	OECD, 2003

*Highest attainable test concentration.

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies were identified.

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 XANTHAN GUM

1.2 Chemical Synonyms and Structure

CAS Name	Xanthan Gum
CAS No.	11138-66-2
AICS name(s)	Xanthan Gum
Synonyms	Xanthan gum, gum xanthan, corn sugar gum
Structural formula	(C35H49O29)n
Molecular formula	C35H49O29 (as the monomer)
Molecular weight	2 x 106 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Xanthan gum is a cream-colored, odorless, free-flowing powder.
SMILES notation	N/A

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	Degrades >200°C
Boiling point	N/A
Density (relative to water)	1 g/cm^3
Water solubility	N/A
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	
Degradation	There are no biodegradation studies on xanthan gum. Xanthan gum is expected to be degradable but is unlikely to be readily biodegradable
Persistence	It is expected to meet criteria for persistence (low) due to perceived biodegradable contents.
Bioaccumulation	Xanthan gum is a high molecular weight polysaccharide (2,000,000 daltons), which due to its size, is not expected to be bioavailable. Therefore, xanthan gum is not expected to meet the criteria for bioaccumulation.
Transport	

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Limited acute studies are available on Xanthan gum. Xanthan gum is a high molecular weight polysaccharide (2,000,000 daltons), which due to its size, is not expected to be bioavailable. Hence, xanthan gum is expected to be non-toxic to aquatic organisms.

1.6.2 Chronic Aquatic Toxicity

A 96-hour LC50 value for fish (Rainbow Trout) has been reported to be 420 mg/ (DoEE, 2017).

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

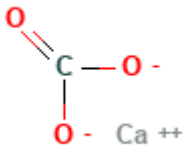
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 CALCIUM CARBONATE

1.2 Chemical Synonyms and Structure

CAS Name	Calcium Carbonate
CAS No.	471-34-1
AICS name(s)	Carbonic acid, calcium salt (1:1)
Synonyms	Carbonic acid, calcium salt (1:1); calcium monocarbonate; monocalcium carbonate
Structural formula	
Molecular formula	$CH_2O_3.Ca$ -
Molecular weight	100.09 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White powder
SMILES notation	[Ca+2].[O-]C([O-])=O

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	825oC (decomposes) @ 101.3 kPa
Boiling point	-
Density (relative to water)	2700 to 2950 kg/m^3 @ 20°C
Water solubility	0.0166 g/L @ 20°C (slightly soluble)
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No

Convention, Protocol or other International Control	Listed yes or no?
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Calcium carbonate is partially soluble in water, dissociating into calcium (Ca^{2+}) and carbonate (CO_3^{2-}) ions. Both ions are ubiquitous in the environment.
Degradation	Biodegradation is not applicable to these inorganic ions; both calcium and carbonate ions are also ubiquitous and are present in most water, soil, and sediment.
Persistence	Not Applicable for this substance.
Bioaccumulation	Calcium carbonate is not expected to bioaccumulate.
Transport	Naturally transported in water and soil due to it's solubility; sedimentation and erosion can accelerate process of transport through these mediums.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss	96-hour LC_{50}	>100% (saturated solution)	1	ECHA
Daphnia magna	48-hour EC_{50}	>100% (saturated solution)	1	ECHA
Desmodesmus subspicatus	72-hour EC_{50} 72-hour EC_{10}	>14* >14*	1	ECHA

*Highest attainable test concentration.

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Eisenia foetida	14-day LC_{50} NOEC	>1000 1000	1	ECHA
Nitrogen transformation	28-day EC_{50} NOEC	>1000 1000	1	ECHA

1.7 Categorisation and other Characteristics of Concern

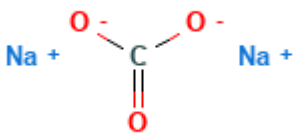
	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT

	Comment
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 SODIUM CARBONATE

1.2 Chemical Synonyms and Structure

CAS Name	Disodium Carbonate
CAS No.	497-19-8
AICS name(s)	Carbonic acid, disodium salt
Synonyms	sodium carbonate; disodium carbonate; carbonic acid, disodium salt; bisodium carbonate; soda ash, calcined soda
Structural formula	
Molecular formula	CH2O3.2Na
Molecular weight	106 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid; white powder
SMILES notation	[Na+].[Na+].[O-]C([O-])=O

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	851°C @ 101.3 kPa
Boiling point	Decomposes
Density (relative to water)	2520 kg/m^3 @ 20°C
Water solubility	212.5 g/L @ 20°C
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Due to its high water solubility and negligible vapour pressure, sodium carbonate will be found predominantly in the aquatic environment where it dissociates completely to sodium (Na+) and carbonate (CO_3^{2-}) ions. Both ions are ubiquitous in the environment (UNEP, 1995).
Degradation	Biodegration is not applicable.
Persistence	Persistence criteria is not applicable.
Bioaccumulation	Substance does not meet screening criteria for bioaccumulation.
Transport	Na+ and CO_3^{2-} ions will not adsorb on particulate matter or surfaces; both are ubiquitous and will allow transport through aquatic ecosystems and soil.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Bluegill Sunfish	96-hour LC_{50}	300	2	ECHA
Mosquitofish	96-hour LC_{50}	740	2	ECHA
Bluegill Sunfish	24-hour LC_{50}	385	4	ECHA
Molly	50-hour LC_{50}	297	4	ECHA
Cariodaphnia Dubia	48-hour EC_{50}	200-227	2	ECHA

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

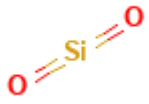
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 CRYSTALLINE SILICA (IMPURITY)

1.2 Chemical Synonyms and Structure

CAS Name	Dioxosilane
CAS No.	14808-60-7
AICS name(s)	Quartz (SiO2)
Synonyms	Crystalline Silica, Quartz, Cristobalite, Dioxide, Silicon
Structural formula	
Molecular formula	SiO_2
Molecular weight	60.084 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Off-white granule
SMILES notation	N/A

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	1400-2000°C
Boiling point	2230°C
Density (relative to water)	2500-2700 kg/m^3
Water solubility	6.4 mg/L
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Crystalline silica is characterised by silicon dioxide (SiO2) molecules oriented in fixed, periodic patterns to form stable crystals. The primary crystalline form of silica is quartz. It is a stable solid under typical environmental conditions.
Degradation	No data are available. Based on the crystalline form of the substance it in not expected to biodegrade.
Persistence	As it is not biodegradable, Crystalline silica is persistent in most aquatic and terrestrial environments.
Bioaccumulation	There are no bioaccumulation studies on crystalline silica.
Transport	No experimental data are available for crystalline silica. As a stable inorganic solid, it is not soluble in water and it will not sorb to soils or sediment.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Although no data are available, crystalline silica is expected to exhibit low acute toxicity to aquatic organisms.

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

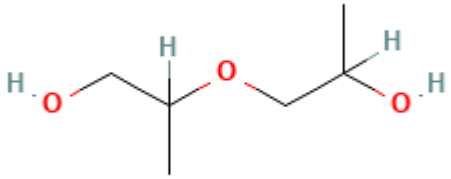
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 POLYPROPYLENE GLYCOL

1.2 Chemical Synonyms and Structure

CAS Name	2-(2-hydroxypropoxy)propan-1-ol
CAS No.	25322-69-4
AICS name(s)	Poly[oxy(methyl-1,2-ethanediyl)], .alpha.-hydro-.omega.-hydroxy-
Synonyms	2-(2-hydroxypropoxy)propan-1-ol, Polypropylene glycol, 2-(2-hydroxypropoxy)-1-propanol, polyoxypropylene glycol, methyloxirane homopolymer, polyoxypropylene
Structural formula	
Molecular formula	$C_6H_{14}O_3$
Molecular weight	134.17 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Viscous colourless liquid
SMILES notation	N/A

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	No freezing down to -150°C
Boiling point	287.6°C @101.3 kPa
Density (relative to water)	1012 kg/m^3@ 20oC
Water solubility	47 g/L at 22°C
pKa	N/A
Log K_{ow}	0.01 @ 25°C
Vapour pressure	0.0839 Pa @ 20°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No

Convention, Protocol or other International Control	Listed yes or no?
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	
Degradation	PPG has been determined to be readily biodegradable via an OECD Guideline 301 F test. After 28 days, 86.6% of the test substance had been degraded in a manometric respirometry test (ECHA) [KI Score = 2]
Persistence	Categorised as not persistent due to 'Readily Biodegradable' classification.
Bioaccumulation	Based on a log Kow of <=3 and relatively high water solubility, PPG is not expected to bioaccumulate.
Transport	Substance has a low affinity for adsorption to soils and activated sludge biosolids.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Danio rerio	96-hour LC_{50}	>100	2	ECHA
Daphnia magna	96-hour EC_{50}	105.8	2	ECHA
Desmodesmus subspicatus	72-hour EC_{50}	>100	2	ECHA

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

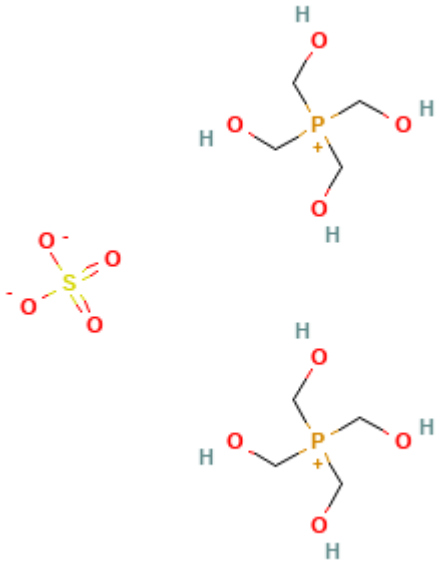
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 TETRAKIS (HYDROXYMETHYL)PHOSPHONIUM SULFATE

1.2 Chemical Synonyms and Structure

CAS Name	bis[tetrakis(hydroxymethyl)phosphonium] sulfate
CAS No.	55566-30-8
AICS name(s)	Phosphonium, tetrakis(hydroxymethyl)-, sulfate (2:1)(salt)
Synonyms	Tetrakis(hydroxymethyl)phosphonium sulfate; bis[tetrakis(hydroxymethyl)phosphonium] sulfate; Octakis (hydroxymethyl) phosphonium sulfate; Tolcide PS75; THPS
Structural formula	
Molecular formula	$C_8H_{24}O_8P_2O_4S$
Molecular weight	406.28 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Colourless liquid
SMILES notation	[O]S(=O)(=O)OP+(C)(C)COP+(C)(C)COP+(C)(C)COP+(C)(C)CO

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-
Boiling point	108.5°C @ 101.3 kPa
Density (relative to water)	1390 kg/m^3 @ 20°C
Water solubility	37,700 g/L @ 21°C
pKa	N/A
Log K_{ow}	-9.8 (calculated) (temperature not provided)
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	THPS is highly soluble in water. Volatilisation from water surfaces or moist soil surfaces is not expected, It is also not expected to volatilise from dry soil surfaces based upon its vapor pressure (Pub Chem).
Degradation	THPS is inherently biodegradable. In an OECD 302B study, >20% degradation occurred within a 28-day period (IPCS, 2000)
Persistence	It is categorised asNot Persistent since its half-life is substantially less than 60 days, and that it is found to be inherently biodegradable (DoEE, 2017) .
Bioaccumulation	There are no bioaccumulation studies on THPS. THPS is not expected to bioaccumulate based on a log Kow of -9.8 (IPCS, 2000).
Transport	THPS is expected to be mobile to moderately mobile in soil. If released to water, based on the K_{oc} value and its high water solubility, it is also not expected to adsorb to suspended solids and sediment.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss	96-hour LC_{50}	71	1	ECHA
Lepomis macrochirus	96-hour LC_{50}	74	1	ECHA
Cyprinodon variegatus	96-hour LC_{50}	72	1	ECHA
Daphnia magna	48-hour EC_{50}	11.3 14.3	1 2	ECHA
Lemna minor	7-day EC_{50}	200-227	1	ECHA

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

The LD50 to mallard duck (Anas platyryncus) is 311 mg/kg (IPCS, 2000). The dietary LC50 values to mallard ducks and bobwhite quail are 1,313 and 2,414 mg/kg diet, respectively (IPCS, 2000).

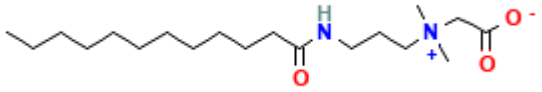
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 COCAMIDOPROPYL BETAINE

1.2 Chemical Synonyms and Structure

CAS Name	Cocamidopropyl betaine
CAS No.	61789-40-0
AICS name(s)	1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivs., inner salts
Synonyms	1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivs., hydroxides, inner salts; COCAMIDOPROPYL BETAINE; Cocoamidopropylbetaine; Coconut oil, amidopropyl betaine; N-(3-Cocoamidopropyl)-N,N-dimethyl-N-carboxymethyl betaine; N-(Cocoamidopropyl)-N,N-dimethyl-N-carboxymethyl ammonium, betaine; N-Cocamidopropyl-N,N-dimethylglycine, hydroxide, inner salt
Structural formula	
Molecular formula	$C_{12.8}H_{39.8}N2O_3$
Molecular weight	355 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid
SMILES notation	CCCCCCCCCCCCCCCC(=O)N+(C)C.[O-]S([O-])(=O)=O

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	283°C (calculated for C12 fatty acid; QSAR) (pressure not provided)
Boiling point	651oC for C12 fatty acid (calculated; QSAR) (pressure not provided)
Density (relative to water)	1,050 – 1,070 kg/m^3@ 20°C
Water solubility	0.00162 - 8.769 g/L @ 25°C (calc.) >10 g/L @ 25°C (aq. soln, measured)
pKa	N/A
Log K_{ow}	-1.28 to -3.63 @ 25°C*
Vapour pressure	0 Pa @ 25°C (calculated; QSAR)

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	
Degradation	Cocamidopropyl betaine is readily biodegradable. In an OECD 301 D test, degradation was 84% after 30 days (ECHA) [Kl. score = 2].
Persistence	Since the chemical is found to be inherently biodegradable or readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).
Bioaccumulation	Low potential for bioaccumulation.
Transport	Substance is expected to have low-to-moderate adsorption in soil and sediment, should transport easily through these mediums.

1.6 Environmental Effects

- The acute toxicity of cocamidopropyl betaine is low-to-moderate by the oral and dermal routes.
- Irritating to the skin in humans but is a potentially weak skin sensitizer
- Repeated dose toxicity studies in rats by the oral route have shown that cocamidopropyl betaine is irritating to the gastrointestinal tract

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Danio rerio	96-hour LC_{50}	2	2	ECHA
Daphnia magna	48-hour EC_{50}	6.4	2	ECHA
Desmodesmus subspicatus	72-hour EC_{50}	48 (growth)	4	ECHA

1.6.2 Chronic Aquatic Toxicity

The 28-day NOEC for cocamidopropyl betaine in Oncorhynchus mykiss is 0.16 mg/L (ECHA) [Kl. score = 4].

The 21-day NOEC for cocamidopropyl betaine in a Daphnia reproduction test is 0.9 mg/L (ECHA) [Kl. score = 2].

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 HYDROTREATED LIGHT DISTILLATE

1.2 Chemical Synonyms and Structure

CAS Name	1,4-bis(propan-2-yl)benzene; 7,7-dimethylhexadecane; octadecane
CAS No.	64742-47-8
AICS name(s)	Distillates (petroleum), hydrotreated light
Synonyms	Distillates, petroleum, hydrotreated light
Structural formula	Not available (UVCB substance)
Molecular formula	Not available (UVCB substance)
Molecular weight	Not available (UVCB substance)
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Liquid
SMILES notation	Not available (UVCB substance)

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-49°C (pour point) @ 101.3 kPa.
Boiling point	90 to 320°C @ 101.3 kPa
Density (relative to water)	770 to 850 kg/m3 @ 15°C
Water solubility	0.000009 – 0.00645 g/L @ 25°C
pKa	N/A
Log K_{ow}	1.99 – 18.02 @ 20°C
Vapour pressure	<1,000 to 37,000 Pa at 37.8°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	- Substance has the potential to volatilise from water or moist soil surfaces. - This substance/category is most likely to partition to the sediment and soil compartments rather that in the air when an equal emission rate to air, water and soil is assumed. - Low solubility raises the expectance of substance partitioning to soil.
Degradation	Substance is considered to be inherently biodegradable as it can be degraded by microorganisms.
Persistence	Considered to be not persistent (half-life less than 60 days).
Bioaccumulation	Substance is not considered to be bioaccumulative.
Transport	Most likely to be transported through soil – substance has low solubility and will not disperse as readily through aquatic means, though it is likely to partition as sediment in this region.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss	96-hour LL_{50}	2-5	1	ECHA
Daphnia magna	48-hour EL_{50}	1.4	1	ECHA
Raphidocelis `subcapitata	72-hour EC_{50}	<1-3 (average of 2)	1	ECHA
Selenastrum capricornutum	72-hour EC_{50}	3.7	2	ECHA

1.6.2 Chronic Aquatic Toxicity

No chronic data were available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

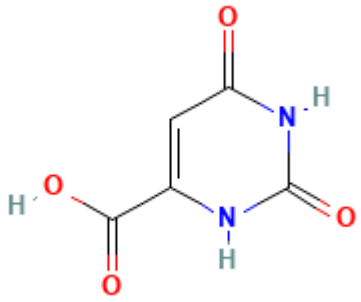
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 POLYETHYLENE GLYCOL MONOTALLATE

1.2 Chemical Synonyms and Structure

CAS Name	Fatty acids, tall-oil, ethoxylated
CAS No.	61791-00-2
AICS name(s)	Fatty acids, tall oil, ethoxylated
Synonyms	2-[(10Z,13Z)-nonadeca-10,13-dienoyloxy]ethyl (10Z,13Z)-nonadeca-10,13-dienoate 2-hydroxyethyl (5Z,9Z,12Z)-octadeca-5,9,12-trienoate 2-hydroxyethyl (9Z)-octadec-9-enoate 2-hydroxyethyl (9Z,12Z)-octadeca-9,12-dienoate, Polyethylene glycol, monotallate, PEG
Structural formula	
Molecular formula	C(18-50)H(34-98)O(3-8) (UVCB substance)
Molecular weight	(UCVB Substance) Variable
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Liquid
SMILES notation	OCCO

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-85°C @ 101.3 kPa
Boiling point	Not available. During the heating process the test item began to change its state at approximately 172°C from liquid to highly viscous. This indicates a thermally caused change of the test item.
Density (relative to water)	958 kg/m3 @ 20°C
Water solubility	The test item can be mixed with water up to a ratio of 3:7 (m (test item):m (water)).
pKa	N/A
Log K_{ow}	5.94 @ 25°C
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	-
Degradation	Substance is considered to be readily biodegradable.
Persistence	Considered to be not persistent (half-life less than 60 days).
Bioaccumulation	Substance is not considered to be bioaccumulative.
Transport	Adsorption of fatty acids, tall-oil, ethoxylated to solid soil is expected with limited potential for mobility.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Danio rerio	96-hour LL_{50}	>100	1	ECHA
Daphnia magna	48-hour LL_{50}	12.41	1	ECHA
Pseudokirchnerella subcapitata	72-hour LL_{50}	39.7	1	ECHA

1.6.2 Chronic Aquatic Toxicity

No chronic data were available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available.

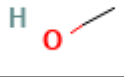
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 METHANOL

1.2 Chemical Synonyms and Structure

CAS Name	Methanol
CAS No.	67-56-1
AICS name(s)	Methanol
Synonyms	Methyl alcohol, carbinol, wood spirits, wood alcohol, methylol, wood, columbian spirits, colonial spirit, columbian spirit, methyl hydroxide, monohydroxymethane, pyroxylic spirit, wood naphtha.
Structural formula	
Molecular formula	CH_4O
Molecular weight	32.04 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Colourless Liquid
SMILES notation	CO

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	97.8°C @ 101.3 kPa
Boiling point	64.7°C @ 101.3 kPa
Density (relative to water)	790 Kg/m^3 @ 20°C
Water solubility	>1,000 g/L [miscible]
pKa	-
Log K_{ow}	-0.77 @ 20°C
Vapour pressure	16927 Pa @ 25°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	- Methanol is highly soluble in water - Expected to volatilise from water and moist soil surfaces - Expected to volatilise from dry soil surfaces based on vapour pressure - Vapour-phase methanol will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 17.2 days (ECHA)
Degradation	- Methanol is readily biodegradable. In a closed bottle test using seawater, there was 84% and 95% degradation after 10 and 20 days, respectively
Persistence	Found to be not persistent as half life is less than 60 days.
Bioaccumulation	Potential for bioaccumulation is low
Transport	- High mobility if released to soil - Highly soluble so not expected to adsorb to suspended solids and sediment in water

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Bluegill	96-hour LC_{50}	15,400	1	Poirer et al. 1986
Salmo Gairdneri	96-hour LC_{50}	20,100	1	Call et al., 1983
Pimphales Promelas	96-hour LC_{50}	28,100	1	Call et al., 1983
Daphnia Magna	96-hour EC_{50}	18,260	2	Dorn et al., 2012; ECHA
Daphnia Magna	48-hour EC_{50}	>10,000	2	Kuehn et al., 1989
Selenastrum Capricornutum	96-hour EC_{50}	~22,000	2	Cho et al., 2008; ECHA
Chlorella Pyrenoidosa	10-14 Day EC_{50}	28,400	2	Stratton and Smith, 1988

1.6.2 Chronic Aquatic Toxicity

No adequate chronic studies were identified. Reported studies were either invalid or their reliability was questionable. Methanol belongs to the category of organic chemicals exerting toxicity for aquatic organisms with a non-specific mode of action. The acute and chronic toxicity may be estimated for such kind of chemicals using QSAR methods. The ECOSAR model (version 1.11, US EPA, July 2012) predicts for methanol a chronic toxicity value of about 450 mg/L (equivalent to a NOEC) for Pimephales promelas and a value of 208 mg/L for Daphnia magna (REACH) [Kl. score = 1].

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Earthworm *Eisenia fetida (OECD 222)*	35-d EC_{50} 63-d EC_{50}	17,199 26,646	2	Poirer et al. 1986

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Folsomia candida (OECD 232)	28-d EC_{25} 28-d NOEC (reproduction)	2,842 1,000	1	Call et al., 1983
Hordeum Vulgare (OECD 208)	14-d EC_{50} 14-d NOEC (seedling emergence)	15,492 12,000	1	ECHA
	14-d EC_{25} 14-d NOEC (shoot dry mass)	2,538 1,555		
	14-d EC_{25} 14-d NOEC (root dry mass)	2,823 2,592		
	14-d EC_{25} 14-d NOEC (shoot length)	4,885 2,592		
	14-d EC_{25} 14-d NOEC (root length)	5,752 4,320		

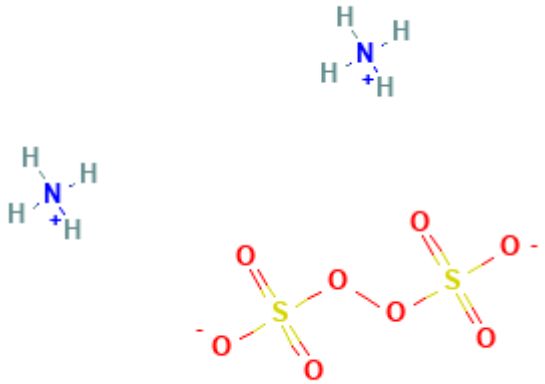
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 AMMONIUM PERSULFATE

1.2 Chemical Synonyms and Structure

CAS Name	Diammonium peroxodisulphate
CAS No.	7727-54-0
AICS name(s)	Peroxydisulfuric acid (((HO)S(O)2)2O2), diammonium salt
Synonyms	Diammonium peroxydisulfate; Diammonium peroxydisulphate; Diammonium persulfate; Peroxydisulfuric acid (((HO)S(O)2)2O2), ammonium salt (1:2); Peroxydisulfuric acid (((HO)S(O)2)2O2), diammonium salt; Peroxydisulfuric acid, diammonium salt; ammonium persulphate
Structural formula	
Molecular formula	$H_8N_2O_8S_2$
Molecular weight	228.21 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White, odourless, crystalline solid
SMILES notation	[NH4+].[NH4+].[O-]S(=O)(=O)OOS(=O)(=O)[O-]

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	ND. Decomposes at ca. 120°C at 100.66 kPa
Boiling point	ND. Decomposes at ca. 393 K (= 120°C) at 100.79 kPa
Density (relative to water)	1260 kg/m³ at 20°C
Water solubility	850 g/L @ 25°C
pKa	Diammonium persulfate dissociates completely to ammonium cation and persulfate anion when it is dissolved in water.
Log K_{ow}	Not applicable as substance is inorganic salt
Vapour pressure	0 Pa @ 25°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	- Persulfates dissociate in water to the corresponding cation and persulfate anion. - Hydrolysis is temperature and pH dependent. The persulfate anion, independent from the cation, undergoes decomposition in normal water or acid conditions, readily oxidizing water to oxygen, producing acid conditions. - All degradation products are ubiquitous to the environment (ECHA).
Degradation	Biodegradation is not applicable to inorganic compounds.
Persistence	Not expected to be persistent.
Bioaccumulation	There are no bioaccumulation studies on diammonium peroxodisulphate. Substances of the Persulfate Category are inorganic salts sharing the same anionic persulfate moiety. Persulfates are very soluble in water and are not expected to bioaccumulate in soil or aqueous solutions.
Transport	Persulfates are soluble in water and their vapour pressures are negligible. Thus, persulfates released into the environment are distributed into the water compartment in ionic form of the cation and persulfate ion. Persulfates are not expected to sorb to soil due to their dissociation properties, instability (hydrolysis) and high-water solubility. They behave as free ions and decompose into sulfate and bisulfate ions.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss	96-hour LC_{50}	76.3	1	ECHA
Daphnia Magna	48-hour EC_{50}	120	1	ECHA
Phaeodactylum tricornutum	72-hour EC_{50}	320	1	ECHA

1.6.2 Chronic Aquatic Toxicity

Long-term toxicity testing to fish was considered scientifically unjustified, due to the results obtained in the short-term toxicity to fish studies, the substance physical-chemical properties and hydrolysis behaviour

(ECHA). An OECD Guideline 211 (Daphnia magna Reproduction Test) was performed and yielded a 21-day NOEC of 20.8 mg/L based on reproduction (ECHA) [KI Score = 1

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies were identified.

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 HYDRAULIC SILICATE CEMENT

1.2 Chemical Synonyms and Structure

CAS Name	Portland Cement
CAS No.	65997-15-1
AICS name(s)	Cement, portland, chemicals
Synonyms	Portland cement, cement kiln dust; kiln baghouse dust; kiln precipitator catch; Portland cement kiln; waste kiln dust
Structural formula	N/A
Molecular formula	N/A
Molecular weight	N/A
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Fine, grey powder.
SMILES notation	N/A

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	>700°C
Boiling point	-
Density (relative to water)	2,800 kg/m^3 @ 20°C
Water solubility	-
pKa	-
Log K_{ow}	-
Vapour pressure	-

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	N/A: Portland Cement contains inorganic substances that are not applicable to biodegradation or bioaccumulation.
Degradation	N/A
Persistence	N/A
Bioaccumulation	N/A
Transport	N/A

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Danio rerio	96-hour LC_{50}	11.1	1	ECHA
Daphnia magna	48-hour EC_{50}	>100	1	ECHA
Desmodesmus subspicatus	72-hour EC_{50}	28.2	1	ECHA

1.6.2 Chronic Aquatic Toxicity

No chronic data were available. A study is available on flue dust, Portland cement (CAS No. 68475-76-3). The 21-day NOEC in a Daphnia reproduction test was 50 mg/L (ECHA) [Kl. Score = 1].

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available. The 14-day NOEC of flue dust, Portland cement (CAS No. 68475-76-3) to earthworms is 1,000 mg/kg. Since 1,000 mg/kg is the limit dose, it is assumed that the LC50 is >1,000 mg/kg (ECHA) [Kl. Score = 1].

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 POTASSIUM CHLORIDE

1.2 Chemical Synonyms and Structure

CAS Name	Potassium Chloride
CAS No.	7447-40-7
AICS name(s)	Potassium Chloride
Synonyms	Potassium Chloride
Structural formula	
Molecular formula	KCl
Molecular weight	74.55 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid; white crystals
SMILES notation	[K+][Cl-]

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	770oC @ 101.3 kPa
Boiling point	1,407oC (pressure not provided)
Density (relative to water)	1984 kg/m^3
Water solubility	255 g/L @ 25°C
pKa	-
Log K_{ow}	-
Vapour pressure	-

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	- Potassium chloride (KCl) dissociates completely in aqueous solutions to potassium (K+) and chloride (Cl-) ions. Potassium chloride and its dissociated ions are ubiquitous in the environment.
Degradation	Not applicable
Persistence	Does not meet criteria for persistence.
Bioaccumulation	Not expected to bioaccumulate.
Transport	The transport and/or leaching of potassium (K+) and chloride (Cl-) ions is affected by clay minerals (type and content), pH, and organic matter. Potassium ions are less mobile and less prone to leaching than anions in soil, such as chloride and nitrate (NO3 -). Chloride binds only weakly to soil particles, and therefore follows water movement (OECD, 2001b).

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Pimphales Promelas	96-hour LC_{50}	880	2	Mount et al., 1997; ECHA
Daphnia Magna	48-hour EC_{50}	660	2	Mount et al., 1997; ECHA
Ceriodaphnia dubia	48-hour EC_{50}	630	2	Mount et al., 1997; ECHA
Scenedesmus subspicatus	72-hour EC_{50}	>100 (growth rate)	1	ECHA

1.6.2 Chronic Aquatic Toxicity

In a fish early-life-stage test with the fathead minnow (Pimephales promelas), the 7-day NOEC was 500mg/L (ECHA).

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies were identified.

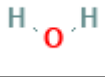
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 WATER ULTRAPUR

1.2 Chemical Synonyms and Structure

CAS Name	Oxidane, water
CAS No.	7732-18-5
AICS name(s)	Water
Synonyms	hydroxic acid, hydroxylic acid, and hydrogen hydroxide
Structural formula	
Molecular formula	H2O
Molecular weight	18.015 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Liquid
SMILES notation	O

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	0°C @ 101.3 kPa
Boiling point	100°C @ 101.3 kPa
Density (relative to water)	997 kg/m3 @ 20°C
Water solubility	N/A
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	-

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Water which evaporates from the surface of oceans, fresh watercourses, and vegetation is carried in the air to be precipitated as rainfall or snow. The molecules of water vapor in air are pure water; falling raindrops formed by their condensation are saturated with nitrogen, oxygen and other atmospheric gases (PubChem).
Degradation	N/A
Persistence	N/A
Bioaccumulation	N/A
Transport	High mobility through soil.

1.6 Environmental Effects

Water is essential for all life and is not considered to be an ecotoxicological hazard (DoEE, 2017b).

1.6.1 Acute Aquatic Toxicity

N/A

1.6.2 Chronic Aquatic Toxicity

N/A

1.6.3 Toxicity to Sediment Organisms

N/A

1.6.4 Terrestrial Toxicity

N/A

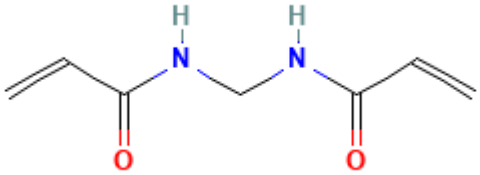
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 N,N'-METHYLENEDIACRYLAMIDE

1.2 Chemical Synonyms and Structure

	Chemical
CAS Name	N,N'-METHYLENEBISACRYLAMIDE
CAS No.	110-26-9
AICS name(s)	N,N'-methylenebis-2-Propenamide
Synonyms	N,N'-Methylenediacrylamide, N,N'-Methylene-bis-acrylamide, Methylenebisacrylamide, MDA
Structural formula	
Molecular formula	$C_7H_{10}N_2O_2$
Molecular weight	154.17 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White Crystalline powder with neutral odour.
SMILES notation	CC(=O)NCC(=O)C=CC

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	185°C (with decomposition)
Boiling point	Decomposes
Density (relative to water)	1.235 at 30°C
Water solubility	0.1 to 1 mg/mL at 18°C
pKa	N/A
Log K_{ow}	-0.08 @ 24°C
Vapour pressure	5.31

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	No data available.
Degradation	The test item, N,N'-Methylenediacrylamide was found to be not ready and completely biodegradable under the conditions applied in a manometric respirometry test.
Persistence	As it is completely biodegradable, substance does not meet criteria for persistence.
Bioaccumulation	The study does not need to be conducted because the substance has a low potential for bioaccumulation based on log Kow <=3
Transport	Substance has low water partition coefficient, thus adsorption in water is low.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Acute toxic

Ingredients	Ecotoxicity –Fish Species Data	Acute Crustaceans Toxicity	Ecotoxicity –Fresh water Algae
N,N'-dimethylenediacrylamide	LC50 > 100 mg/L 96 h (Fish)	EC50 > 100 mg/L 48 h (Daphnia)	EC50 1-10 mg/L 72 h (Algae)

1.6.2 Chronic Aquatic Toxicity

No chronic studies are available.

1.6.3 Toxicity to Sediment Organisms

No studies are available.

1.6.4 Terrestrial Toxicity

No studies available.

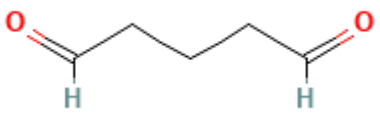
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified for N,N'-methylenediacrylamide

TOXICOLOGICAL PROFILE

1.1 GLUTERALDEHYDE

1.2 Chemical Synonyms and Structure

	Chemical
CAS Name	Gluteraldehyde
CAS No.	111-30-8
AICS name(s)	Pentanedial
Synonyms	Cidex, Diswart, Gludesin, Glutaral, Glutaraldehyde, Glutardialdehyde, Glutarol, Korsolex, Novaruca, Sekumatic, Sonacide
Structural formula	
Molecular formula	$C_5H_8O_2$
Molecular weight	100.12 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Clear viscous colourless liquid with pungent odour.
SMILES notation	C(CC=O)CC=O

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-33 °C (extrapolated onset temperature).
Boiling point	101.5 °C at 987.1 hPa
Density (relative to water)	1.33 g/cm³
Water solubility	miscible at 20.2 °C and pH 5 - 9
pKa	No dissociating properties.
Log K_{ow}	-0.36 at 23 °C and pH 7 and 20°C
Vapour pressure	20 hPa at 20.1 °C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Several studies showed that glutaraldehyde is stable against hydrolysis under environmental conditions. However, at pH 9 a condensation of aldehyde groups was reported. A half-life of 8.2 h indicates that by exposure to the atmosphere, the substance will be rapidly degraded by photochemical processes. Photolysis study in water showed that glutaraldehyde is photolytically stable in aqueous test solutions.
Degradation	Substance is readily biodegradable.
Persistence	Persistence unlikely due to a rapid degradation of substance in soil by microbial activity.
Bioaccumulation	Bioaccumulation is not expected.
Transport	- Low to moderate adsorption to different solid soils - High mobility in sediment - Over time, substance will distribute to water

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Key studies were undertaken to measure the acute toxicity of the substance to fish.

- The acute toxicity of glutaraldehyde 50% to rainbow trout (Salmo gairdneri) was tested according to U.S. EPA Guideline at 0, 1.7, 2.8, 4.6, 7.8, 13 and 22 mg a.i./l (EG & G, Bionomics BW-81-12-1055). The testing of the acute toxicity of glutaraldehyde to rainbow trout under static conditions resulted in a LC50 after 96 hours of 10 mg a.i./l.
- The acute toxicity of glutaraldehyde on Bluegill (Lepomis macrochirus) was investigated at nominal concentrations of 0, 7.8, 13, 22, 36, 60 and 100 mg a.i./l (EG & G, Bionomics BW-81-11-1047). The static testing of the acute toxicity of glutaraldehyde to Bluegill resulted in a LC50 after 96 hours of 13 mg a.i./l. Symptoms of toxicity occurred from 13 mg a.i./l.
- The acute toxicity of glutaraldehyde was also tested on the marine fish species, sheepshead minnows (Cyprinodon variegatus) according to an in-house Laboratory Test Protocol for Fishes (EG & G, Bionomics BP-81-11-178). The testing of the acute toxicity of glutaraldehyde under static conditions resulted in a LC50 after 96 hours of 39 mg a.i./l. Symptoms of toxicity occurred at 36 mg a.i./l. Acutely, substance is very toxic to aquatic invertebrates.
- Acute very toxic to aquatic invertebrates.

In summary, the substance is acutely toxic to fish.

1.6.2 Chronic Aquatic Toxicity

- The chronic treatment of early-life-stages of fish with glutaraldehyde resulted in a NOEC of 1.6 mg a.i./L.
- A NOAEL value of 10 mg/L was reported for the chronic toxicity of glutaraldehyde 50% to Daphnia magna.

1.6.3 Toxicity to Sediment Organisms

- No studies available.

1.6.4 Terrestrial Toxicity

- Glutaraldehyde revealed very low acute toxicity to earthworm indicated by a LC50 value of 170 mg a.i./kg dry weight soil. The result converted to wet weight by dividing with a factor of 1.13 (EUSES manual) results in a LC50 of 150 mg a.i./kg ww.
- Glutaraldehyde revealed very low acute toxicity to earthworm indicated by a LC50 value of 170 mg a.i./kg dry weight soil. The result converted to wet weight by dividing with a factor of 1.13 (EUSES manual) results in a LC50 of 150 mg a.i./kg ww.
- Glutaraldehyde showed no toxic effects to the plant Avena sativa. The sensitivity of the used plant species to the applied test material concentrations increased from Avena sativa, Brassica napus to Vicia sativa. Thus, Vicia sativa was the most sensitive species. The respective EC50 and NOEC converted to organic matter content of 3.4 % were 1219 mg a.i./kg dw and 169 mg a.i./kg dw. The results further converted from dry weight to wet weight soil are EC50 = 1079 mg a.i./kg ww and NOEC = 150 mg a.i./kg ww.
- The carbon transformation test with glutaraldehyde resulted in an EC10 after 28 days of 10.45 mg a.i./kg dry matter soil or 9.2 mg a.i./kg wet matter soil (converted to an organic matter content of 3.4 %); The nitrate transformation test resulted in an EC10 after 28 days of 17.5 mg a.i./kg dry matter soil and an EC50 after 28 days of 546 mg a.i./kg dry matter soil (converted to OM content of 3.4 %).

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified for N,N'-methylenediacrylamide

TOXICOLOGICAL PROFILE

1.1 1-OCTANOL

1.2 Chemical Synonyms and Structure

	Chemical
CAS Name	1-Octanol
CAS No.	111-87-5
AICS name(s)	1-Octanol
Synonyms	1 Octanol, 1-Octanol Alcohol, n-Octyl, n Octanol,n Octyl Alcohol, n-Octanol,n-Octyl Alcohol
Structural formula	
Molecular formula	$C_8H_{18}O$
Molecular weight	130.23 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Octanol appears as a clear colorless liquid with a penetrating aromatic odour
SMILES notation	CCCCCCCCO

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-13.5 °C
Boiling point	194.7 °C
Density (relative to water)	0.828 g/cm³
Water solubility	107 mg/L
pKa	15.76
Log K_{ow}	3.5
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally for hydrogen peroxide.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	- This substance has no hydrolysable structural features and would be expected to be stable in water. Oxidation would not be expected under normal environmental conditions. - A half-life of 26.7 h for photodegradation by hydroxyl radicals in the air is available from a recognised published source. - This substance, and its structural analogues in the C6 -24 Aliphatic Alcohols category, are readily biodegradable and there is consistent evidence of very rapid biotransformation in aquatic and terrestrial substrates.
Degradation	- Readily biodegradable. - Very short environmental half-life; biodegradable by a range of organism types
Persistence	- Does not meet the criteria for persistence as it is readily biodegradable
Bioaccumulation	BCF 9.1 l/kg ww in fish (estimated, CATALOGIC); extensive metabolismin vivois to be expected.
Transport	- Modelling predicts predominant compartments to be soil and water, but fate is highly dependent on the pathway of release. - Volatility: low, based on Henry's law constant of 1.1 Pa.m^3/mol at 12°C. - Adsorption: low, based on Koc of 123 l/kg.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

In the key acute oral toxicity study for octan-1-ol, conducted according to an appropriate OECD Test Guideline 401 but full details were not available, and in compliance with GLP, an LD50 value of >5000 mg/kg bw was reported when applied as an aqueous solution (Henkel, 1981; rel 2).

In the key acute dermal toxicity study for octan-1-ol, which was well-documented and meets generally accepted scientific principles, although conducted prior to GLP, an LD50 value of 2000-4000 mg/kg bw was reported (Scientific Associates 1976; rel 2).

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

- No studies available.

1.6.4 Terrestrial Toxicity

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified for 1-Octanol.

TOXICOLOGICAL PROFILE

1.1 CORN STARCH

1.2 Chemical Synonyms and Structure

CAS Name	Starch
CAS No.	9005-25-8
AICS name(s)	Starch
Synonyms	Starch, soluble; maltose; corn starch;rice starch; sorghum gum; starch gum' tapioca starch
Structural formula	(-C6H10O5-)n
Molecular formula	(C6H10O5)n
Molecular weight	Variable, UVCB
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Fine, white odorless powder
SMILES notation	N/A

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	240^{o}C (pressures not provided)
Boiling point	N/A (decomposes)
Density (relative to water)	1500 kg/m3(temperature not provided)
Water solubility	Insoluble
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Starch is a polysaccharide comprising glucose monomers joined in α-1,4 linkages. The simplest form of starch is the linear polymer amylose; amylopectin is the branched form. Starch is manufactured in the green leaves of plants from excess glucose produced during photosynthesis and serves the plant as a reserve food supply.
Degradation	Starch is expected to be biodegradable.
Persistence	As it is readily biodegradable, starch is not expected to be persistent.
Bioaccumulation	Does not bioaccumulate.
Transport	

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Orthopristis chrysoptera (pinfish)	96-hour LC_{50}	>5,000 (no mortality)	4	USEPA
Bairdiella chrysoura (silver perch)	96-hour LC_{50}	>5,000 (no mortality)	4	USEPA
Lagodon rhomboids (pinfish)	96-hour LC_{50}	>5,000 (no mortality)	4	USEPA

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies were identified.

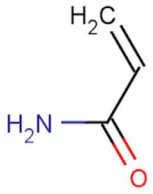
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 POLYACRYLAMIDE

1.2 Chemical Synonyms and Structure

CAS Name	Copolymer of polyacrylamide (poly(2-propenamide)] and polyacrylate [poly(2-propenoic acid)]
CAS No.	9003-5-8
AICS name(s)	2-Propenamide, homopolymer
Synonyms	Anionic polyacrylamide
Structural formula	
Molecular formula	$(C_3H_5NO)x$- and $(C_3H_3O_2)x$-
Molecular weight	1,000,000 to >50,000,000 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid powder or granules
SMILES notation	CH3COOH

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	N/A
Boiling point	N/A
Density (relative to water)	1.0 – 1.3 g/cm^3
Water solubility	N/A
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	No studies on the environmental fate of anionic polyacrylamide are available.
Degradation	Not expected to biodegrade.
Persistence	Does not meet criteria of persistence.
Bioaccumulation	Not expected to bioaccumulate.
Transport	The polyanions in this group are expected to partition onto natural colloids in surface waters and in soil and are not expected to undergo long-range transport in the environment.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Ionic Charge	LC_{50} (mg/L)	Reference
Fathead Minnow	-31	810	Betz Laboratories, Inc. (1991)
Rainbow Trout	-31	>100	Betz Laboratories, Inc. (1991)
Bluegill Sunfish	-31	>300	Betz Laboratories, Inc. (1991)
Rainbow Trout	-22	>100	Betz Laboratories, Inc. (1991)
Bluegill Sunfish	-22	>300	Betz Laboratories, Inc. (1991)
Rainbow Trout	-12	>100	Betz Laboratories, Inc. (1991)
Bluegill Sunfish	-12	>300	Betz Laboratories, Inc. (1991)
Daphnia Magna	-39	470	Betz Laboratories, Inc. (1991)

1.6.2 Chronic Aquatic Toxicity

No studies available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies were identified.

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT

	Comment
Other characteristics of concern	No other characteristics of concern were identified.

TOXICOLOGICAL PROFILE

1.1 1-DECANOL

1.2 Chemical Synonyms and Structure

	Chemical
CAS Name	1-Decanol
CAS No.	112-30-12
AICS name(s)	1-Decanol
Synonyms	1-decanol, n-decanol, n-decyl alcohol; n-decyl alcohol, aluminum salt; n-decyl alcohol, magnesium salt, n-decyl alcohol, sodium salt; n-decyl alcohol, titanium salt
Structural formula	
Molecular formula	$CH_3(CH_2)_9OH$
Molecular weight	158.28 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Decyl alcohol appears as a clear colorless liquid with a sweet fat-like odor
SMILES notation	CCCCCCCCCCO

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	6 °C
Boiling point	229 °C
Density (relative to water)	0.83 g/cm³
Water solubility	21.1 mg/L at 20°C
pKa	15.8
Log K_{ow}	4.5
Vapour pressure	< 5 Pa at 20 °C; 15 Pa at 40 °C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	The alcohols in this category undergo atmospheric photodegradation with half-lives in the range ca. 10-30 hours under typical European conditions associated with reaction with hydroxyl radicals based on measured and predicted results. Long chain alcohols have no hydrolysable structural features and would not be expected to be degraded by oxidation under normal environmental conditions.
Degradation	Rapid degradation in water is indicated by the difficulties encountered in aquatic toxicity tests (chronic Daphnia reproduction) for long chain aliphatic alcohols (Section 6.1.4). Alcohols in the range C10-C15 were found to be rapidly removed from the test medium.
Persistence	As it is readily biodegradable, substance does not meet criteria for persistence.
Bioaccumulation	Bioconcentration factor in fish: low (BCF = 26 L/kg), estimated using QSAR. The bioconcentration factor (adjusted for bioavailability limitations, rapid in vivo metabolism and transformation, and excretion processes) was estimated by CATALOGIC BCF base-line model (version 03.10). Based on this, the substance is non-bioaccumulative.
Transport	Modelling predicts predominant compartment to be soil, but fate is highly dependent on the pathway of release. Volatility: low, based on Henry's law constant of 2.2 Pa.m^3/mol at 12°C. Adsorption: moderate, based on Koc of 1490 l/kg.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Fish: weight of evidence: LC50 (120 h): 3.4 mg/l (OECD 236) and LC50 (96 h): 2.4 mg/l (OECD 203)

Invertebrates: EC50 (48 h): 3.1 mg/l

Algae: EC50 in the range 1 - 10 mg/l (estimated by read-across from other taxonomic levels; Fisk et al., 2009); ErC50 1.5 mg/l (Category QSAR, Fisk et al., 2015)

1.6.2 Chronic Aquatic Toxicity

Fish: EC10 (33-day) 0.43 mg/l (based on survival) and NOEC 0.26 mg/l (based on growth (total length)) (mean measured)

Invertebrates: EC10 (21-day): 0.21 mg/l and NOEC 0.11 mg/l (mean measured) for effects on reproduction

Algae: ErC10 0.7 mg/l (Category QSAR, Fisk et al., 2015)

1.6.3 Toxicity to Sediment Organisms

Short term sediment toxicity

A 6-d EC50 value of 150 mg/kg dw soil (1.3% organic carbon) has been determined for the effects of the test substance on population numbers of the ostracod H. incongruens. This is a reliable non-guidance study looking at the effects in a soil and water mixture.

The study reflects the lowest value that is available for this endpoint. However this study is shorter than the guidance short-term toxicity study and is not considered to be useful to assess the sediment compartment where longer-term exposure is more relevant.

Long term sediment toxicity

In accordance with Section 1.2 of REACH Annex XI (testing does not appear scientifically necessary (based on weight of evidence)), the toxicity to sediment organism study does not need to be conducted based on weight of evidence.

This is based on considerations relating to test design and feasibility and chemical safety assessment context.

1.6.4 Terrestrial Toxicity

Toxicity to soil macroorganisms except arthropods

A 72 h EC50 value of 98 mg/kg dw soil (1.3% organic carbon) has been determined for the effects of the test substance on population numbers of the nematode Caenorhabditis elegans.

A 7-day LD50 value of 170 mg/kg dw soil has been determined for the effects of the test substance on mortality in the earthworm Eisenia foetida.

Toxicity to terrestrial arthropods

A 72-h EC50 value of 320 mg/kg dw soil has been determined for the effects of the test substance on population numbers of the soil dwelling arthropod Folsomia candida.

Toxicity to soil microorganisms

An EC50 >1000 mg/kg dwt in soil based on effects on dehydrogenase activity (as an indirect indicator of microbial biomass) was observed in a non-standard study.

Toxicity to birds

A 5 day LC50 value equivalent to >10,000 ppm (expressed as nominal concentration in the diet) has been determined for the effects of the test substance on mortality of Anas platyrhynchos (mallard duck) and Colinus virginianus (bobwhite quail)

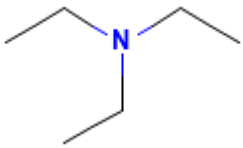
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified for 1-Decanol.

TOXICOLOGICAL PROFILE

1.1 TRIETHYLAMINE

1.2 Chemical Synonyms and Structure

	Chemical
CAS Name	N,N-diethyl-ethanamine
CAS No.	121-44-8
AICS name(s)	Triethylamine
Synonyms	(Diethylamino)ethane; Ethanamine, N,N-diethyl-; N,N-Diethylethanamine
Structural formula	
Molecular formula	$C_6H_{15}N$
Molecular weight	101.19 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Triethylamine is a colorless liquid with a strong ammoniacal odor.
SMILES notation	CCN(CC)CC

1.3 Physico-chemical Properties

Properties	
Physical form	Liquid
Melting point	-115 to - 114.7 °C.
Boiling point	90 °C
Density (relative to water)	0.73 g/cm3 at 20 °C.
Water solubility	112 400 mg/L @ 20°C
pKa	11.43 (0°C), pKa = 10.75 (25°C), and pKa = 10.45 at 35°C
Log K_{ow}	1.45
Vapour pressure	72 hPa @ 20°C

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Considering the hydrolytic stability of the test substance, it is not to be expected that hydrolytic processes will contribute to its degradation in the environment. This is based on the lack of functional groups that hydrolyze under environmental conditions.
Degradation	According to the decision of the EU Commission Working Group on the Classification and Labelling of dangerous substances (1995) the substance should be regarded as readily biodegradable.
Persistence	As substance is readily biodegradable, it does not meet the criteria for persistence.
Bioaccumulation	A bioconcentration factor lower than 0.5 was found in Cyprinus carpio by Chemical Industry Ecology – Toxicology & Information Center (CSCL Japan) in 1992 - ten years before a BCF of 7.45 was calculated by Lyman et al. (1982). Due to these results no bioaccumulation of triethylamine is to be expected.
Transport	Soil adsorption is not expected to be an important environmental fate for the test substance. Neutral molecules will not adsorb in such a strong intend to organic carbon in soil as their cationic counterparts.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

The toxicity of triethylamine towards the freshwater fish Oryzias latipes was investigated in accordance with OECD Guideline 203 (Ministry of the Environment in Japan. 1999a). As final result of this key study, a LC50(96h) value of 24 mg/L is reported.

1.6.2 Chronic Aquatic Toxicity

Fish embryos of Salmo gairdneri (new name: Oncorhynchus mykiss) were used to investigate the chronic toxicity of triethylamine in a semi-static freshwater experiment (van Leeuwen et al., 1990). This early life stage test was conducted for 60 days. Test concentrations are not specified. Based on mortality the following nominal results are reported: LC50 (60d) = 137 mg/L, EC50 (60d) = 130 mg/L, and LOEC (60d) > 100 mg/L, respectively. Taking the body length into account a LOEC (60d) of 100 mg/L is given. A LOEC (60d) of 3.2 mg/L is the result concerning weight of the test organisms as basis for effect.

Furthermore, the long-term toxicity of the test substance was determined by evaluating fertilized eggs of Danio rerio, which were observed for 7 days (van Leeuwen et al., 1990). Test concentrations are not specified. Effects such as mortality rate, developmental changes and multiple effects(integrated) were investigated at different mean test temperatures and pH values. The LC50 (7d) was determined as 180 mg/L. Based on the total embryotoxicity, the EC50 (7d) amounts to 53 mg/L while the LOEC (7d) is reported as 100 mg/L. Based on mortality, the LOEC (7d) amounts to 320 mg/L.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

The test substance triethylamine is not supposed to be directly applied to soil. Therefore soil is no compartment of concern for the test substance. In case of indirect exposure, the substance will rapidly degrade. The risk to soil organisms is therefore negligible. Testing the toxicity to birds is scientifically unjustified. The substance is not bioaccumulative and because of reasons of animal welfare, no study in this context has to be performed. As conclusion the topic terrestrial toxicity can be waived.

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified for 1-Decanol.

TECHNICAL MEMORANDUM

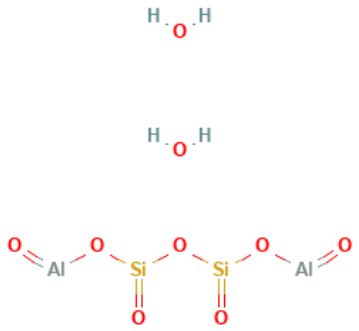
TO: Senex Energy **DATE:** November 15, 2023

FROM: KCB Australia **FILE NO:** DX10171A15

SUBJECT: Chemical Toxicological Profile

1.1 KAOLIN

1.2 Chemical Synonyms and Structure

	Chemical
CAS Name	Kaolin
CAS No.	1332-58-7
AICS name(s)	Kaolin
Synonyms	China Clay, Argilla, Porcelain Clay, Kaolinite
Structural formula	
Molecular formula	$Al_2H_4O_9Si_2$
Molecular weight	258.16 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Kaolin appears as odorless white to yellowish or grayish powder.
SMILES notation	O.O.O=[Al]O[Si](=O)O[Si](=O)O[Al]=O

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	>1100 °C
Boiling point	N/A
Density (relative to water)	2.3987 g/cm³
Water solubility	1.15 ± 0.19 mg/L at 20.2 ± 2.1 °C
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Kaolin, calcined is an inorganic solid and poorly soluble in water. Due to its chemical nature and stability, hydrolysis is not expected. However, ion exchange processes are possible depending on the surrounding environment to transfer the substance in another, as very limited, not quantifiable hydrolysis is involved in the dissolution of silicates in water.
Degradation	Not applicable as Kaolin is an inorganic substance
Persistence	If released into the environment, the substance is expected to combine indistinguishably with the soil or sediment due to its similarity with inorganic soil/sediment matter and will be subjected to natural processes under environmental conditions (cation exchange, dissolution, sedimentation). Due to low water solubility and extremely low vapour pressure, it is expected to distribute mainly into soils and sediments, weakly into water and probably not at all into the air.
Bioaccumulation	Kaolin, calcined is an inorganic solid insoluble in n-octanol. Due to its inherent chemico-physical properties, bioaccumulation is not to be expected.
Transport	Kaolin, calcined, if released into the environment, is expected to combine indistinguishably with the soil or sediment due to its similarity with inorganic soil/sediment matter and will be subjected to natural processes under environmental conditions (cation exchange, dissolution, sedimentation). Due to low water solubility and extremely low vapour pressure, it is expected to distribute mainly into soils and sediments, weakly into water and probably not at all into the air.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Concerning aquatic short-term toxicity effects, tests for representatives of each trophic level (fish, Daphnia, algae) are available. The test results with structurally related compounds presented hereby confirmed that the toxicity profile of silicic acid, aluminium salt for aquatic species is of low concern. The most sensitive species were the algae. However, the EC50 values of all species are above 410 mg/L, which is far higher than the solubility of the substance in water.

1.6.2 Chronic Aquatic Toxicity

Long-term toxicity data are available for daphnids and algae in tests with structurally related compounds. The most sensitive species were algae with an EC10 value of 41 mg/L (growth rate). A study on chronic toxicity to fish has not been conducted due to the low acute toxicity and animal welfare reasons.

1.6.3 Toxicity to Sediment Organisms

No data are available for sediment toxicity. If released to the environment, kaolin, calcined is expected to combine indistinguishably with the soil or sediment due to its similarity with inorganic soil/sediment matter and will be subjected to natural processes under environmental conditions (cation exchange, dissolution, sedimentation). Furthermore the amounts released are negligible in comparison to the release by natural deposit or alteration. Therefore, further testing is not required.

1.6.4 Terrestrial Toxicity

No studies available.

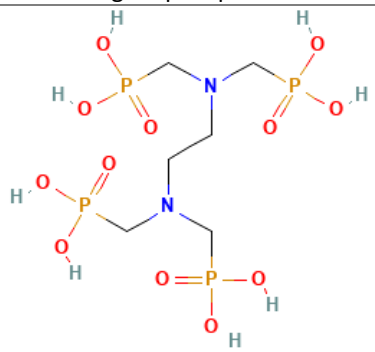
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified for Kaolin.

TOXICOLOGICAL PROFILE

1.1 ETHYLENEDIAMINETETRA (METHYLENEPHOSPHONIC ACID)

1.2 Chemical Synonyms and Structure

	Chemical
CAS Name	[2-[bis(phosphonomethyl)amino]ethyl-(phosphonomethyl)amino]methylphosphonic acid
CAS No.	1429-50-1
AICS name(s)	Phosphonic acid, [1,2-ethanediylbis [nitrilobis(methylene)]]tetrakis-
Synonyms	EDTMP, Ethylenebis(nitrilodimethylene)tetraphosphonic acid, Lexidronam, Ethylenediaminetetra(methylenephosphonic acid), Organophosphates
Structural formula	
Molecular formula	$C_6H_{20}N_2O_{12}P_4$
Molecular weight	436.12 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	Solid
SMILES notation	C(CN(CP(=O)(O)O)CP(=O)(O)O)N(CP(=O)(O)O)CP(=O)(O)O

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	>400°C
Boiling point	EDTMP will undergo thermal decomposition without boiling.
Density (relative to water)	1760 kg/m3 @ 22.2 ± 0.5 °C
Water solubility	253 g/l at 20°C
pKa	The dissociation constant of EDTMP-xCaNa is read across from its parent acid. Eight dissociation constants as listed below were obtained for the acid using an appropriate estimation method. pKa1 = 1.3 pKa2 = 2.7 pKa3 = 4.2 pKa4 = 5.7 pKa5 = 5.9 pKa6 = 7.3 pKa7 = 8.8

Properties	
	pKa8 = >10
Log K_{ow}	-4.1
Vapour pressure	<2.7E-09 Pa at 25 °C (QSAR)

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Hydrolosis: Not hydrolytically unstable Direct photolysis of EDTMP is not significant in the absence of sensitisers. Sensitised photolysis was observed in the presence of ferric nitrate.
Degradation	A degradation rate in river and lake waters of ca. 2 - 7% after 60 days was determined in a reliable study conducted according to generally accepted scientific principles. In the presence of natural light, 11 - 20% degradation was observed over the same time period. Soil biodegradation rate of 68-73% over 148d in two active soils was determined in a reliable study conducted according to generally accepted scientific principles. EDTMP acid and its salts are considered not readily biodegradable and not inherently biodegradable. Low but recordable levels of biodegradation were seen in two ready and two inherent tests. A high degree (75-90%) of removal was recorded in the longer term (extended SCAS test over 126 days; Horstmann and Grohmann, 1988).
Persistence	The requirement to test the substance for hydrolysis was waived as the substance is not susceptible to hydrolytic degradation. This is supported by a measured hydrolysis half-life of ca.50 days at 28°C and pH 6.8 in a secondary source to which no reliability could be assigned. Not biodegradable.
Bioaccumulation	No study of bioaccumulation conducted with EDTMP-xCaxNa is available. Given the very low estimated value of log Kow (-4), bioaccumulation is expected to be very low
Transport	EDTMP and its salts adsorb strongly to inorganic surfaces, soils and sediments High adsorption is consistent with similar behaviour seen for structural analogues, and other common complexing agents such as EDTA.

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Short-term toxicity of the test substance and degradation products to fish is low. See table below.

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss	96-hour LC_{50}	250	1	ABC, 1979
Oncorhynchus mykiss	14-Day LC_{50} NOEC	114	1	ABC, 1979
Cyprinodon Variergatus	96-hour LC_{50}	250	1	ABC, 1979

1.6.2 Chronic Aquatic Toxicity

No long term studies are available.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available – were not considered necessary as substance has a low log K_{ow}.

NECsoil has been calculated from PNECfreshwater on the basis of the equilibrium partitioning method and the risk characterisation ratio (RCR) based on PNECsoil is <1 (see Section 10 of the CSR).

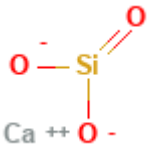
1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and Toxic (PBT) Categorisation	Not a PBT
Other characteristics of concern	No other characteristics of concern were identified for EDTMP.

TOXICOLOGICAL PROFILE

1.1 WOLLASTONITE

1.2 Chemical Synonyms and Structure

	Chemical
CAS Name	Calcium metasilicate
CAS No.	13983-17-0
AICS name(s)	Wollastonite
Synonyms	Ca2SiO4, calcium silicate, calcium silicate (CaSiO3), calcium silicate, CaH2SiO3 (1:1) salt, mesoporous amorphous calcium silicate, mineral wool, pseudowollastonite, xonotlite
Structural formula	
Molecular formula	CaO_3Si
Molecular weight	116.16 g/mol
Physical form, appearance and odour at 20 degrees C and 1.013 hPa	White or slightly cream-colored powder
SMILES notation	[O-][Si](=O)[O-].[Ca+2]

1.3 Physico-chemical Properties

Properties	
Physical form	Solid
Melting point	>300°C
Boiling point	N/A
Density (relative to water)	2.87 @ 20°C
Water solubility	4.7 mg/L
pKa	N/A
Log K_{ow}	N/A
Vapour pressure	N/A

1.4 Domestic and International Regulator Information

A review of international and national environmental regulatory information was undertaken. No specific environmental regulatory controls or concerns were identified within Australia and internationally.

Convention, Protocol or other International Control	Listed yes or no?
Australian Investory of Chemical Substances (AICS)	Yes
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
Reach (Substances of Very High Concerns)	No
United States Endocrine Disrupter Screening Program	No

Convention, Protocol or other International Control	Listed yes or no?
European Commission Endocrine Disruptors Strategy	No

1.5 Environmental Fate Summary

	Comment
Dissolution, speciation and partitioning	Synthetic wollastonite is an inorganic substance which contains both amorphous and crystalline silica. These substances are expected to combine indistinguishably with the soil layer or sediment due to their similarity with inorganic soil matter.
Degradation	Based on the chemical nature of the substance (inorganic structure and chemical stability) no degradation is expected to occur.
Persistence	Strong evidence that Wollastonite is not persistent in the environment (Maxim, Mcconnell. 2004).
Bioaccumulation	It Is not expected that bioaccumulation will occur.
Transport	Substance is poorly soluble in water No other studies conducted about substance mobility

1.6 Environmental Effects

1.6.1 Acute Aquatic Toxicity

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss	96-hour LC_{50}	>100% (saturated solution)	2	OECD Guideline 203
Oncorhynchus mykiss	96-hour LC_{50}	>100% (saturated solution)	1	OECD Guideline 203

1.6.2 Chronic Aquatic Toxicity

A long-term toxicity study to rainbow trout has not been carried out on Synthetic Wollastonite or the read-across material Soda-ash flux calcined kieselghur. Synthetic wollastonite is poorly soluble in water and consists of amorphous and crystalline silica which naturally occur in water bodies. Long-term toxic effects are not expected and therefore the study is considered to be scientifically unjustified.

1.6.3 Toxicity to Sediment Organisms

No studies available.

1.6.4 Terrestrial Toxicity

No studies available – were not conducted because direct and indirect exposure of the soil compartment is unlikely.

1.7 Categorisation and other Characteristics of Concern

	Comment
Persistent, Bioaccumulative and	Not a PBT

	Comment
Toxic (PBT) Categorisation	
Other characteristics of concern	No other characteristics of concern were identified for Wollastonite.

APPENDIX IV

Toxicological Profiles and Quantitative Risk Assessment for Each Tier 2 Chemical

QUALITATIVE RISK ASSESSMENT

1-Decanol

CAS Name	1-Decanol
CAS No.	112-30-12
AICS name(s)	1-Decanol
Synonyms	1-decanol, n-decanol, n-decyl alcohol; n-decyl alcohol, aluminum salt; n-decyl alcohol, magnesium salt, n-decyl alcohol, sodium salt; n-decyl alcohol, titanium salt
Assigned Tier Level	Tier 2
Relevant Drilling fluid	CM401

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m^3)	General Purpose and Function
Cement and additives. *Additives quantities are estimated and based on 100bbl of Cement Slurry. Concentrations may change depending on lab report.	Open Hole and Cased Hole Section	CM401	4.50	15,876.00		Reduce foam in cement slurry

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
1-Decanol	Clear Liquid	Immiscible in water	Slurry consisting of all chemicals to be formed and applied to well, this slurry will set and harden. Although there is little risk of movement of the material itself, there is a risk that leachate will be formed and therefore further assessment required

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
1-Decanol	1-Decanol, CAS 112-30-1	Readily biodegradable	Unknown	The portion in water is expected to be soluble or

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
				dispersible. (SDS)

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
CM401	1-Decanol	283	LC50 (Oncorhynchus mykiss) – 310 mg/L (96 h) LC50 (Pimephales promelas) – 190 mg/L (96 h) NOEC (Oncorhynchus mykiss (rainbow trout)) – <78 mg/L (96 h) NOEC (Pimephales promelas) – 100 mg/L (96 h)	LC50 (Daphnia magna) – 220 mg/L (48 h) LC50 (Ceriodaphnia dubia) – 4.32 mg/L (48 h) EC50 (Daphnia magna) – 130 mg/L (48 h) NOEC (Daphnia magna) – 16 mg/L (48 h) NOEC (Ceriodaphnia dubia) – 2.50 mg/L (48 h)	Hydrotreated Light Distillate (petroleum) EC50 – > 1,000 mg/L (72 h)	Proposed chemical concentration is greater than required to cause harm to some fish and invertebrates. Potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
CM401	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	High potential for adverse effects on aquatic ecosystems and permanent human health effects through prolonged exposure.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	High	Low
	Wandoan Creek		4	High	High			High	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	Mod	Low		1	Mod	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	Mod	Mod		2	Mod	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low		1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).		Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	High		1	High	I
	Wandoan Creek		4	High	High			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

Cellulose

CAS Name	Cellulose
CAS No.	9004-34-6
AICS name(s)	Cellulose
Synonyms	DEAE-CELLULOSE (6S)-2-(hydroxymethyl)-6-[(3S)-4,5,6-trihydroxy-2-(hydroxymethyl)oxan-3-yl]oxyoxane-3,4,5-triol Diethylaminoethyl cellulose; Cellulose crystalline; Cellulose gel; Hydroxycellulose; Microcrystalline cellulose; Plastics, cellulosic; Sulfite cellulose
Assigned Tier Level	Tier 2
Relevant Drilling fluid	Form-A-Block

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m^3)	General Purpose and Function
Contingency Program2 (Estimate: Required on 5% of Wells Drilled)	All	FORM-A-BLOK	1,250.00	55,650	22.46	Lost Circulation Material Wellbore conditioning

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Cellulose	Solid	-	-

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Cellulose	Cellulose, CAS 9004-34-6: 10-30%;	Persistent	Does not bioaccumulate	Unknown

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
Form-A-Block	Cellulose	Unknown	Unknown	Unknown	Unknown	Not known to be environmentally hazardous.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

The risk assessment methodology is provided in the Chemical Risk Assessment Framework (KCB, 2023).

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
Form-A-Block	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	Lack of available information. Unknown potential for adverse effects on aquatic ecosystems and permanent human health.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	Mod	Mod		2	Mod	Low
	Wandoan Creek		4	Mod	Mod			Mod	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	Mod	Low		1	Mod	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	Mod	Mod		2	Mod	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	Mod	Mod		1	Mod	I
Surface Water	Wandoan Creek		3	Mod	Mod			Mod	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	Mod	Mod		1	Mod	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	Mod	Mod		1	Mod	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low		1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).		Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	Mod	Mod		1	Mod	I
	Wandoan Creek		4	Mod	Mod			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	Mod	Low		1	Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	Mod	Mod		1	Mod	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

Granulated Blast Furnace Slag

CAS Name	COAL FLY ASH
CAS No.	68131-74-8
AICS name(s)	Ashes, residues
Synonyms	By products fuel oil ash; Cinders; Electric utility boiler, bottom ash; High carbon rice hull ash; Power house, by product coal ash; Wood char
Assigned Tier Level	Tier 2
Relevant Drilling fluid	Blended Cement

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m^3)	General Purpose and Function
Cement and additives. *Additives quantities are estimated and based on 100bbl of Cement Slurry. Concentrations may change depending on lab report.	Open Hole and Cased Hole Section	Blended Cement	18,000.00	15,898.00	1737.48	Set and develop compressive strength

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Coal Fly Ash	Solid	Low solubility	Slurry consisting of all chemicals to be formed and applied to well, this slurry will set and harden. Although there is little risk of movement of the material itself, there is a risk that leachate will be formed and therefore further assessment required

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Coal Fly Ash	Coal Fly Ash: >99.0%, CAS 68131-74-8	Persistent	Unknown but unlikely	Low mobility

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
Blended Cement	Coal Fly Ash	1,737,480	None known; classification criteria not met	Unknown	Product forms an alkaline slurry when mixed with water that may be toxic to algea	Potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
Blended Cement	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	Lack of available information. Unknown potential for adverse effects on aquatic ecosystems and permanent human health.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	Mod	Low
	Wandoan Creek		4	High	High			Mod	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod		2	High	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	High	Mod		1	High	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low		1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).		Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	Mod		1	High	I
	Wandoan Creek		4	High	Mod			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

ETHOXYLATED C6-C10 ALCOHOL

CAS Name	Polyethylene glycol
CAS No.	68037-05-8
AICS name(s)	Poly(oxy-1,2-ethanediyl), .alpha.-sulfo-.omega.-hydroxy-, C6-10-alkyl ethers, ammonium salts
Synonyms	C6-10-alkyl ether, sulfate, ammonium salt
Assigned Tier Level	Tier 2
Relevant Drilling fluid	Foam-X ACF-144

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m^3)	General Purpose and Function
Solids Control / Mitigation	All	Foam-X ACF-144	70	87,450	0.8	Water foamer

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Ethoxylated C6-C10 Alcohol	Liquid	Miscible in water	The soluble nature of this drilling chemical presents some risk that it could move off-site and will be considered further in this risk assessment

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Ethoxylated C6-C10 Alcohol	Ethoxylated C6-C10 Alcohol, CAS 68037-05-8; 30 to 60%	Unknown	Not expected	Unknown

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
Foam-X ACF-144	Ethoxylated C6-C10 Alcohol	480	Unknown	Unknown	Unknown	There is minimal amount of information on the toxicity. There is potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
Foam-X ACF-144	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	Lack of available information. Unknown potential for adverse effects on aquatic ecosystems and permanent human health.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	Mod	Low
	Wandoan Creek		4	High	High			Mod	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod		2	High	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	High	Mod		1	High	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	Mod		1	High	I
	Wandoan Creek		4	High	Mod			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

Gluteraldehyde

CAS Name	Gluteraldehyde
CAS No.	111-30-8
AICS name(s)	Pentanedial
Synonyms	Cidex, Diswart, Gludesin, Glutaral, Glutaraldehyde, Glutardialdehyde, Glutarol, Korsolex, Novaruca, Sekumatic, Sonacide
Assigned Tier Level	Tier 2
Relevant Drilling fluid	Glutaraldehyde 25%, ALDACIDE G, COHO Glute 9

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m³)	General Purpose and Function
Base Fluid 100% of wells	Open Hole Section	ALDACIDE G	27.27	47,700	0.57	Biocide - Glutaraldehyde Based
Base Mud Program 100% of Wells Drilled	All	COHO Glute 9	76.00	103,350	0.7	Biocide

Application	Hole Section	Drilling Fluid	Well Volume Estimate (litres)	Wellbore Concentration required (ppm)	Chemical Qty per Well Treatment (mg)	General Purpose and Function
Biocide Well treatment Nominated frequency: Annual. Note: Only 1 biocide would be used per application	Open Hole Section	Glutaraldehyde 25%	10,000 - 15,000	100	1.0 - 1.5	Biocide; Applied by injection into well annulus as shock treatment. Chemical quantity diluted with ~200 L of water onsite for application.

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Gluteraldehyde	Viscous Liquid	Miscible	The soluble nature of this drilling chemical presents some risk that it could move off-site and will be considered further in this risk assessment

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Gluteraldehyde	Gluteraldehyde, CAS 111-30-8	Readily biodegradable (SDS)	Low bioaccumulation (SDS)	Unknown

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
COHO Glute 9	Gluteraldehyde	700 (0.7 kg/m^3)	LC50(96h): 10 mg/L (Lepomis macrochirus) NOEC(97d): 1.6 mg/L (Oncorhynchus mykiss) LC50(96h): 3.5 mg/L (Oncorhynchus mykiss) LC50(96h): 60 mg/L (Scophthalmus maximus)	EC50(48h): 0.35 mg/L (Daphnia magna) EC50(48h): 0.7 mg/L (Acartia tonsa) NOEC(21d): 0.13 mg/L (Daphnia magna) EC50(48h): 0.1 mg/L (Acartia tonsa)	EC50(72h): 0.61 mg/L (Desmodesmus subspicatus) EC50(72h): 0.5 mg/L (Skeletonema costatum)	Also toxic to micro-organisms (EC50 (17h) 6.65 mg/l (Pseudomonas putida)) Proposed chemical concentration is greater than environmental health hazard criteria; there is ALDACIDE G potential for environmental harm.
Gluteraldehyde 20%	Gluteraldehyde	100				
ALDACIDE G	Gluteraldehyde	172				

Risk Assessment – Predicted Significance of Impact

The significance of impact on an Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
COHO Glute 9	Moderate to High	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	High potential for adverse effects on aquatic ecosystems and permanent human health effects through prolonged exposure.
Gluteraldehyde 25%			
ALDACIDE G			

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	High	Low
	Wandoan Creek		4	High	High			High	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	High		1	High	I
	Wandoan Creek		4	High	High			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

Granulated Blast Furnace Slag

CAS Name	Blast furnace slag
CAS No.	65996-69-2
AICS name(s)	Slags, ferrous metal, blast furnace
Synonyms	-
Assigned Tier Level	Tier 2
Relevant Drilling fluid	Blended Cement

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m³)	General Purpose and Function
Cement and additives. *Additives quantities are estimated and based on 100bbl of Cement Slurry. Concentrations may change depending on lab report.	Open Hole and Cased Hole Section	Blended Cement	18,000.00	15,898.00	1737.48	Set and develop compressive strength

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Granulated Blast Furnace Slag	Solid	Insoluble	Slurry consisting of all chemicals to be formed and applied to well, this slurry will set and harden. Although there is little risk of movement of the material itself, there is a risk that leachate will be formed and therefore further assessment required

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Granulated Blast Furnace Slag	Granulated Blast Furnace Slag: >90%, CAS 65996-69-2	Persistent	Yes (Product forms an	Low mobility

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
			alkaline slurry when mixed with water)	

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
Blended Cement	Granulated Blast Furnace Slag	1,737,480	Daphnia magna OECD 211: 21d-EC10 = 5000 mg/L	Unknown	Unknown	There is minimal amount of information on the toxicity. There is potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
Blended Cement	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	Lack of available information. Unknown potential for adverse effects on aquatic ecosystems and permanent human health.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	Mod	Low
	Wandoan Creek		4	High	High			Mod	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod		2	High	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	High	Mod		1	High	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	Mod		1	High	I
	Wandoan Creek		4	High	Mod			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

N,N'-Methylenediacrylamide

CAS Name	N,N'-METHYLENEBISACRYLAMIDE
CAS No.	110-26-9
AICS name(s)	N,N'-methylenebis-2-Propenamide
Synonyms	N,N'-Methylenediacrylamide, N,N'-Methylene-bis-acrylamide, Methylenebisacrylamide, MDA
Assigned Tier Level	Tier 2
Relevant Drilling fluid	DNBPA 20%

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m³)	General Purpose and Function
Solids Control / Mitigation	Outer hole (annulus between preperforated casing and open hole)	Foam-X ACS-141	3,600	87,450	41.17	Viscosifier.

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
N,N'-Methylenediacrylamide	Solid	Soluble	The soluble nature of this drilling chemical presents some risk that it could move off-site and should be considered further in this risk assessment

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
N,N'-Methylenediacrylamide	N,N'-methylenediacrylamide, CAS 110-26-9 <1%	Low, Material is readily biodegradable	Unknown	Readily mobile

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
ACS-141	N,N'-Methylenediacrylamide	< 4,400 (after injection 145)	LC>100 mg/L (96 h) (Fish) estimated.	EC50> 100 mg/L (48 h) (Daphnia) estimated	EC50: 1 – 10 mg/L (72 hrs) (Algae) estimated	Proposed concentration is greater than environmental health hazard criteria. Potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
ACS-141	Moderate to High	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	High potential for adverse effects on aquatic ecosystems and permanent human health effects through prolonged exposure.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	High	Low
	Wandoan Creek		4	High	High			High	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	High	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	High	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Mod			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Mod			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Mod			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low		1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).		Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Mod			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	High		1	High	I
	Wandoan Creek		4	High	High			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

POLYCARBOXYLIC ACID, SODIUM SALT

CAS Name	Starch, 2-hydroxy-3-(trimethylammonio)propyl ether, chloride
CAS No.	56780-58-6
AICS name(s)	Starch, 2-hydroxy-3-(trimethylammonio)propyl ether, chloride
Synonyms	2-Hydroxy-3-(trimethylammonio)propyl starch chloride; Starch, 2-hydroxy-3-(trimethylammonio)propyl ether, hydrochloride; Starch, N,N,N-trimethyl-2-hydroxypropanaminium chloride ether
Assigned Tier Level	Tier 2
Relevant Drilling fluid	COHO F2V CS

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m^3)	General Purpose and Function
Base Mud Program 100% of Wells Drilled	All	COHO F2V CS	0.6	87,450	0.01	Clay inhibition

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Nitrogen containing Polysaccharide	Solid	Soluble	The soluble nature of this drilling chemical presents some risk that it could move off-site and will be considered further in this risk assessment

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Nitrogen containing Polysaccharide	Nitrogen containing Polysaccharide, CAS: 56780-58-6 (95-99%)	Unknown	Unknown	Unknown

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
COHO F2V CS	Nitrogen containing Polysaccharide	40	Unknown	Unknown	Unknown	There is minimal amount of information on the toxicity. There is potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
COHO F2V CS	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	Lack of available information. Unknown potential for adverse effects on aquatic ecosystems and permanent human health.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	Mod	Low
	Wandoan Creek		4	High	High			Mod	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod		2	High	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	High	Mod		1	High	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low		1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).		Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	Mod		1	High	I
	Wandoan Creek		4	High	Mod			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

Paraffin

CAS Name	Paraffin (hard)
CAS No.	8002-74-2
AICS name(s)	Paraffin waxes and hydrocarbon waxes
Synonyms	SYNTHETIC WAX; Fischer-Tropsch wax; Paraffin wax; Paraffin wax, petroleum; Poly(methylene) wax; Synthetic paraffin wax, Fischer-Tropsch; Wax, extract
Assigned Tier Level	Tier 2
Relevant Drilling fluid	CM401

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m^3)	General Purpose and Function
Cement and additives. *Additives quantities are estimated and based on 100bbl of Cement Slurry. Concentrations may change depending on lab report.	Open Hole and Cased Hole Section	CM401	4.50	15,876.00		Reduce foam in cement slurry

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Paraffin (hard)	Solid	Insoluble	Slurry consisting of all chemicals to be formed and applied to well, this slurry will set and harden. Although there is little risk of movement of the material itself, there is a risk that leachate will be formed and therefore further assessment required

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Paraffin (hard)	Paraffin (hard), CAS 8002-74-2	Unknown	Unknown	Unknown

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
CM401	Paraffin (hard)	283	The LL50 was > 100 mg/L and the NOEL was ≥100 mg/L The EL50 was >10,000 mg/L and the NOEL was ≥ 1000 mg/L	Unknown	Unknown	There is minimal amount of information on the toxicity. There is potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
CM401	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	Lack of available information. Unknown potential for adverse effects on aquatic ecosystems and permanent human health.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	Mod	Low
	Wandoan Creek		4	High	High			Mod	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod		2	High	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	High	Mod		1	High	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	Mod		1	High	I
	Wandoan Creek		4	High	Mod			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

POLYCARBOXYLIC ACID, SODIUM SALT

CAS Name	POC-OS-2020
CAS No.	62601-60-9
AICS name(s)	OS 2020
Synonyms	POLYCARBOXYLIC ACID, SODIUM SALT
Assigned Tier Level	Tier 2
Relevant Drilling fluid	CM200

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m³)	General Purpose and Function
Cement and additives. *Additives quantities are estimated and based on 100bbl of Cement Slurry. Concentrations may change depending on lab report.	Open Hole and Cased Hole Section	CM200	4.50	15,876.00		Improve cement slurry mixability

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Polycarboxylic acid	Liquid	Miscible in water	Slurry consisting of all chemicals to be formed and applied to well, this slurry will set and harden. Although there is little risk of movement of the material itself, there is a risk that leachate will be formed and therefore further assessment required

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Polycarboxylic acid	Polycarboxylic acid, sodium salt, CAS 62601-60-9 (40%)	Unknown	Unknown	Unknown

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
CM200	Polycarboxylic acid	283	Unknown	Unknown	Unknown	There is minimal amount of information on the toxicity. There is potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
CM200	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	Lack of available information. Unknown potential for adverse effects on aquatic ecosystems and permanent human health.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	Mod	Low
	Wandoan Creek		4	High	High			Mod	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod		2	High	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	High	Mod		1	High	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	Mod		1	High	I
	Wandoan Creek		4	High	Mod			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	High	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

Steric Acid

CAS Name	Octadecanoic acid
CAS No.	57-11-4
AICS name(s)	Stearic acid
Synonyms	n-Octadecanoic acid Stearophanic acid
Assigned Tier Level	Tier 2
Relevant Drilling fluid	CM401

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m^3)	General Purpose and Function
Cement and additives. *Additives quantities are estimated and based on 100bbl of Cement Slurry. Concentrations may change depending on lab report.	Open Hole and Cased Hole Section	CM401	4.50	15,876.00		Reduce foam in cement slurry

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Stearic Acid	Solid	Insoluble	Slurry consisting of all chemicals to be formed and applied to well, this slurry will set and harden. Although there is little risk of movement of the material itself, there is a risk that leachate will be formed and therefore further assessment required

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Stearic Acid	Stearic Acid, CAS 57-11-4	Unknown	Bioaccumulation potential in fish tissues with an estimated BCF of 225 L/kg after 28 days exposure.	Unknown

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
CM401	Stearic Acid	283	Studies resulted in no toxicity	Unknown	Unknown	There is minimal amount of information on the toxicity. There is potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
CM401	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	Lack of available information. Unknown potential for adverse effects on aquatic ecosystems and permanent human health.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	Mod	Mod		2	Mod	Low
	Wandoan Creek		4	Mod	Mod			Mod	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	Mod	Low		1	Mod	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	Mod	Mod		2	Mod	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	Mod	Mod		1	Mod	I
Surface Water	Wandoan Creek		3	Mod	Mod			Mod	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	Mod	Mod		1	Mod	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	Mod	Mod		1	Mod	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	Mod	Mod		1	Mod	I
	Wandoan Creek		4	Mod	Mod			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	Mod	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	Mod	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

2-Acrylamido-2-methyl-1-propanesulfonic acid

CAS Name	2-Acrylamido-2-methyl-1-propanesulfonic acid
CAS No.	15214-89-8
AICS name(s)	2-Acrylamido-2-methyl-1-propanesulfonic acid
Synonyms	2-Acrylamido-2-methyl-1-propanesulfonic acid 2-Acrylamido-2-methylpropanesulfonic acid 2-Acrylamide-2-methylpropanesulfonic acid
Assigned Tier Level	Tier 2
Relevant Drilling fluid	CM502

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m^3)	General Purpose and Function
Cement and additives. *Additives quantities are estimated and based on 100bbl of Cement Slurry. Concentrations may change depending on lab report.	Open Hole and Cased Hole Section	CM502	400	15,876.00		Control cement slurry fluid loss

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
2-Acrylamido-2-methyl-1-propanesulfonic acid	Solid	Soluble	Slurry consisting of all chemicals to be formed and applied to well, this slurry will set and harden. Although there is little risk of movement of the material itself, there is a risk that leachate will be formed and therefore further assessment required

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater

environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
2-Acrylamido-2-methyl-1-propanesulfonic acid	2-Acrylamido-2-methyl-1-propanesulfonic acid, CAS 15214-89-8	Not readily biodegradable	Unknown	Unknown

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
CM502	2-Acrylamido-2-methyl-1-propanesulfonic acid	25,160	LC0 at 96 hours for fish of ATBS was 130 mg/L LC50 at both 72 and 96 hours was calculated as 170 mg/L.	EC50 for acute toxicty at 48 hours on Daphnia magna of ATBS was shown to be 340 mg/mL	Unknown	There is minimal amount of information on the toxicity. There is potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
CM502	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	High potential for adverse effects on aquatic ecosystems and permanent human health effects through prolonged exposure.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	High	Low
	Wandoan Creek		4	High	High			High	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	Mod	Low		1	Mod	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	Mod	Mod		2	Mod	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low		1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).		Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	High		1	High	I
	Wandoan Creek		4	High	High			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

Ethylenediaminetetra (methylenephosphonic acid)

CAS Name	[2-[bis(phosphonomethyl)amino]ethyl-(phosphonomethyl)amino]methylphosphonic acid
CAS No.	1429-50-1
AICS name(s)	Phosphonic acid, [1,2-ethanediylbis [nitrilobis(methylene)]]tetrakis-
Synonyms	EDTMP, Ethylenebis(nitrilodimethylene)tetraphosphonic acid, Lexidronam, Ethylenediaminetetra(methylenephosphonic acid), Organophosphates
Assigned Tier Level	Tier 2
Relevant Drilling fluid	CM102

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m³)	General Purpose and Function
Cement and additives. *Additives quantities are estimated and based on 100bbl of Cement Slurry. Concentrations may change depending on lab report.	Open Hole and Cased Hole Section	CM102	4.50	15,876.00		Extend cement slurry pumping time

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to MNES.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Ethylenediaminetetra (methylenephosphonic acid)	Solid	Soluble	Slurry consisting of all chemicals to be formed and applied to well, this slurry will set and harden. Although there is little risk of movement of the material itself, there is a risk that leachate will be formed and therefore further assessment required

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Ethylenediaminetetra (methylenephosphonic acid)	Ethylenediaminetetra (methylenephosphonic acid), CAS 1429-50-1	Moderately persistent and moderately biodegradable	Unknown	Unknown

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling fluid	Chemical name	Maximum Chemical Concentration of Active Substance mg/L	Toxicity to fish*	Toxicity to invertebrates	Toxicity to algae	Comment
CM102	Ethylenediaminetetra (methylenephosphonic acid)	283	96-hour LC_{50}: 250 mg/L	Unknown	Unknown	There is minimal amount of information on the toxicity. There is potential for environmental harm.

Risk Assessment – Predicted Significance of Impact

The significance of impact on a Matters of National Environmental Significance (MNES) has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
CM102	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	High potential for adverse effects on aquatic ecosystems and permanent human health effects through prolonged exposure.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ♦ Minimising release; ♦ Containing spilled material; ♦ Raising the alarm and response; ♦ Locations of spill kits; and ♦ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ♦ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	High	Low
	Wandoan Creek		4	High	High			High	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	Mod	Low		1	Mod	I
								Mod	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	Mod	Mod		2	Mod	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	High		1	High	I
	Wandoan Creek		4	High	High			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

QUALITATIVE RISK ASSESSMENT

Petroleum Gas Oil

CAS Name	2,2-Dibromo-2-cyanoacetamide
CAS No.	10222-01-2
AICS name(s)	Acetamide, 2,2-dibromo-2-cyano-
Synonyms	Dibromocyanoacetamide, DBNPA, 2,2-Dibromo-3-nitrilopropionamide, 2,2-Dibromo-2-cyanoacetamide
Assigned Tier Level	Initially assigned Tier 3, downgraded to Tier 2
Relevant Drilling fluid	DNBPA 20%

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Well Volume Estimate (litres)	Wellbore Concentration Required (ppm)	Chemical Quantity per Well Treatment (mg)	General Purpose and Function
Biocide Well Treatment Nominated frequency: Annual. Note: Only 1 biocide would be used per application	Open Hole Section	DBNPA 20%	10,000 - 15,000	100	1.0 – 1.5	Biocide; Applied by injection into well annulus as shock treatment. Chemical quantity diluted with ~200 L of water onsite for application.

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to Matters of National Environmental Significance (MNES). The pathway assessment is being undertaken due to the chemical being a miscible liquid.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
2,2-dibromo-3-nitrilopropionamide	Liquid	Miscible	The soluble nature of this drilling chemical presents some risk that it could move off-site and will be considered further in this risk assessment

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
2,2-dibromo-3-nitrilopropionamide	2,2-dibromo-3-nitrilopropionamide, CAS 10222-01-2: 20%;	High persistence in water	Not considered as bioaccumulative	2,2-dibromo-3-nitrilopropionamide has a low mobility (KOC=8.978)

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling Fluid	Chemical Name	Maximum Chemical Concentration of Active Substance (mg/L)	Toxicity to Fish	Toxicity to Invertebrates	Toxicity to Algae	Comment
DBNPA 20%	2,2-dibromo-3-nitrilopropionamide	100	LC50 (96h) 0.55 mg/L (Fish)	EC50 (48h) 0.74 mg/L	Not available	Proposed chemical concentration is greater than environmental health hazard criteria, there is DBNPA 20% potential for environmental harm.

Quantitative Risk Assessment – Groundwater 1D Transport Modelling

Contaminant transport modelling was undertaken to assess the potential concentration of a drilling chemical at a receptor. Surface water spill modelling has not been undertaken, but the likelihood of a spill can be managed, and its impacts mitigated more readily than a groundwater impact. Senex has several standard procedures in place to facilitate appropriate materials and chemical handling practices and to effectively deal with surface spills.

Potential Receptors

As there are several potential receptors and the location of the wells has not been confirmed, indicative distances from a groundwater receptor to a CSG well were used in the modelling. Distances of 200 m and 50 m were modelled to provide an indication of sensitivity of the chemical to the receptor.

There is a Department of Environment, Science and Innovation (DESI) requirement that petroleum activities must not occur in or within 200 m of a wetland of high ecological significance or a Great Artesian Basin Spring (DES 2016). CSG wells may be located within 200 m of a water receptor should groundwater modelling and environmental risk assessment suggest that there are no potential impacts from drilling fluids and drill cuttings.

Wells will generally be spaced 500 to 750 m apart, therefore cumulative impact by more than one well on a receptor is unlikely.

Model Scenarios

The aquifer formations which supported groundwater abstraction and were potentially at risk, include the Walloon Coal Measures, the Westbourne Formation, the Springbok Sandstone and the Gubberamunda Sandstone. The model simulated the movement of a drilling chemical through the most permeable formation, the Gubberamunda Sandstone. Locally groundwater users abstract groundwater from the Gubberamunda Sandstone.

Model Parameters

The basic model parameters adopted in the analytical contaminant transport assessment are summarised below.

The adopted contaminant concentration input is 100 mg/L. Adoption of this concentration into the model facilitates calculation of indicative contaminant concentrations over time that may occur at a receptor (200 m or 50 m from the well).

Transport Model Parameters

Data Type	Parameter	Value			Source of Data
		Min	Max	Mean	
Receptor data	Distance to nearest receptor (m)	200			A 200 m conservative distance
Hydrogeology	Hydraulic conductivity (m/d)	1.9×10^{-2}	1.2×10^{-1}	5.2×10^{-2}	These values were taken from the UWIR to represent the most permeable formation – the Gubberamunda Sandstone
	Hydraulic gradient	0.0003	0.3	0.003	
	Effective porosity (%)	0.02	0.24	0.15	
Dispersion	Longitudinal Dispersivity	Dispersivity is calculated based on the distance to receptor and assuming 1/10th x plume length and 0.5 m for vertical dispersivity (Pickens and Grisak, 1981).			N/A
	Transverse Dispersivity				
	Vertical Dispersivity				
Adsorption	Retardation factor Soil Bulk density (f_{oc}) (K_{oc})	N/A			Adsorption not modelled for a conservative assessment
Contaminant source	Source thickness (m)	1,000			To represent 1,000 m deep well (overly conservative)
	Width (m)	0.5			Represents well width
	Length (m)	0.5			Represents well length
	Contaminant concentration (mg/L)	100			Representative drilling chemical concentration for illustrative purposes
Degradation	Rate of decay (1/day)	$1x10^{-10}$			A value as close to 0 as possible is used for conservative modelling.
Retardation	Bulk Density (g/cm^3)	Not applied			

[1] Note that cement and cement additive chemicals to be applied to a well will set and harden; only leachate concentrations of these chemicals will have the potential to impact on groundwater. Leachate concentrations were assumed to be 1% of the max. chemical concentration.

Model Sensitivity

Sensitivity in the model was assessed through stochastic simulation of selected parameters. The following parameters were considered for stochastic consideration of likely parameter bounds:

- Hydraulic conductivity;
- Effective porosity; and
- Hydraulic gradient.

Stochastic modelling follows a Monte Carlo simulation technique which allow multiple realisations of different "what if" cases where the ranges and distributions of the parameters are assessed. This allows the range of possible outcomes and their probability of occurring to be reported.

The Monte Carlo probability capability of GoldSim was used to assign distributions of the input parameters listed above. The approach allows the definition of the assumptions for each input and the 1-D contaminant transport equations to be assessed for multiple scenarios. This approach provides a broad understanding of the model variability, with results typically provided as ranges associated with a probability of occurrence.

Results

In summary:

- The 1D analytical model assumes that a constant source will be maintained at the well point. It is noted that most chemicals will not be applied consistently to the wells, and that concentrations will recede following chemical application. It is also noted that the lifetime of a CSG well is expected to be between 20 and 50 years. The model does not take into account retardation, degradation or sorption of the chemical contaminant and concentrations at the receptor. The model is therefore considered to represent an indicative scenario and is substantially conservative in nature; modelled concentrations at receptors are expected to be markedly lower than predicted.
- The 1D analytical model suggests that within 25 years there will be a concentration of 0.19 mg/L (mean) contaminant concentration at a receptor 50 m from a CSG well.
- The model was run for 400 years, at this time a mean maximum concentration at the receptor of 0.24 mg/L is predicted (50 m distance to receptor).

Chronic aquatic toxicity

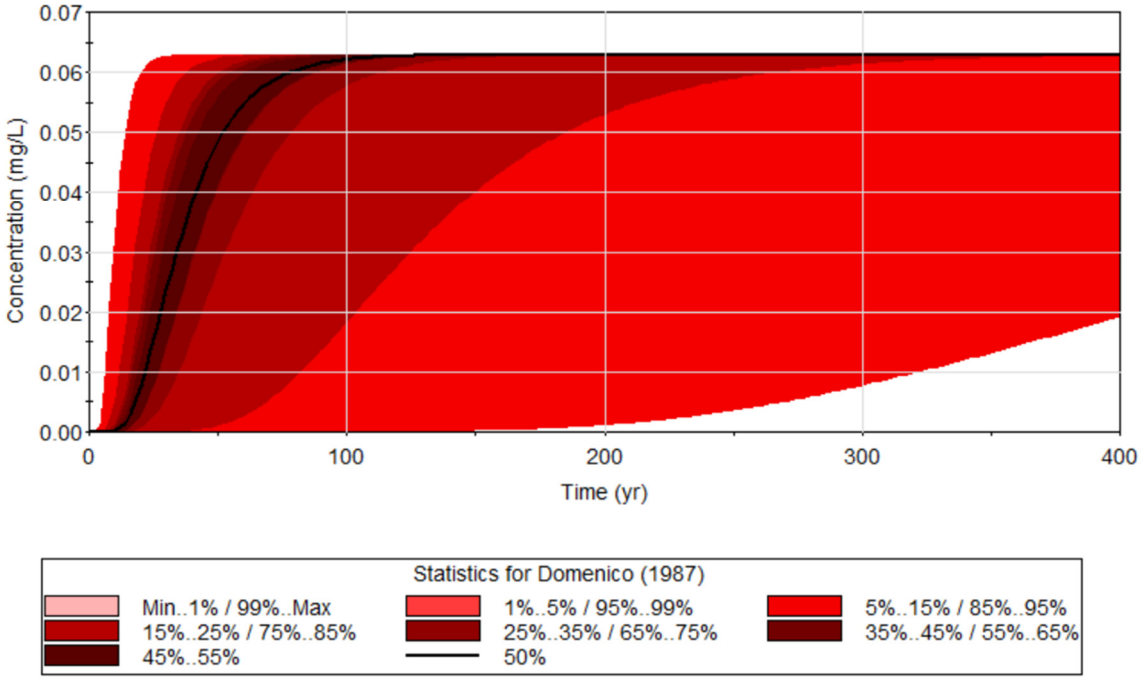
Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Rainbow Trout (*Onchorhynchus mykiss*)	85-d NOEC	0.47	2	EPA, 2019
Daphnia magna	28-d NOEC	0.05	3	EPA, 2019
Green algae (*Pseudokirchneriella subcapitata*)	NOEC	0.058		EPA, 2019

- Regardless of the results of the modelling, this chemical is only proposed to be used in plug and abandonment. During this time only the Walloon Coal Measures is open in the well, there is no pathway within 200 m from the Walloon Coal Measures to freshwater receptors in the surface water systems of Wandoan and Woleebee Creeks. The Walloon

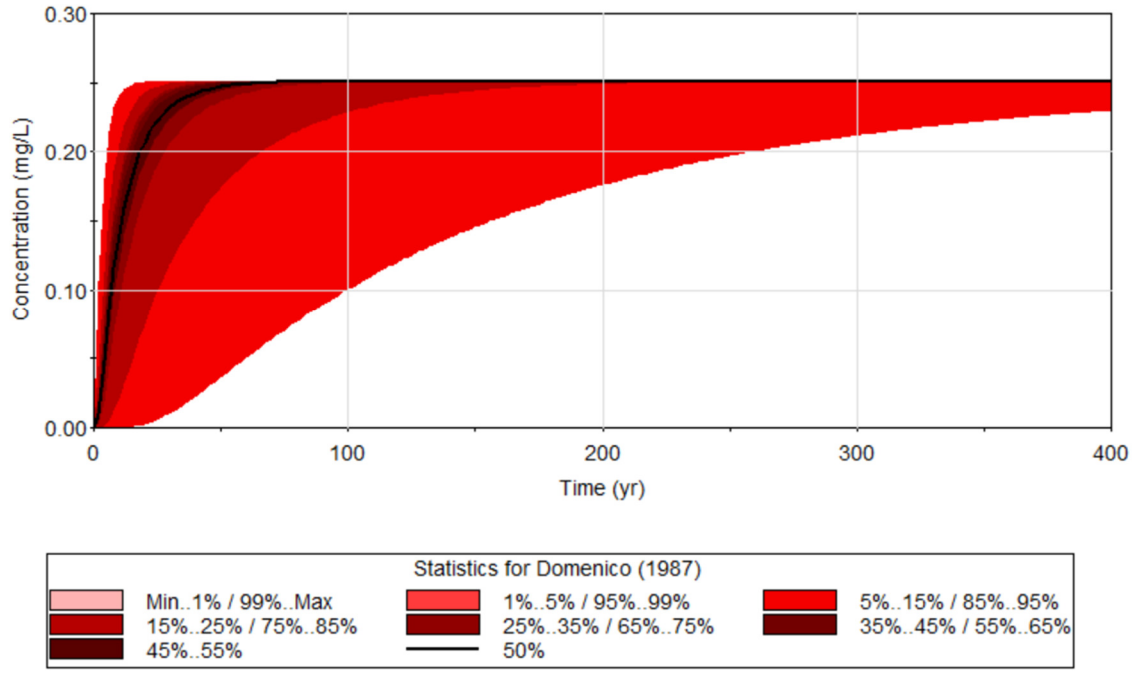
Coal Measures is at a significant depth below these systems. For this reason, this chemical has been downgraded to a Tier 2.

Mean Predicted Concentrations at Receptor

Formation	Distance to Receptor	Mean Potential Concentration at Receptor in 100 years (mg/L)	Time to Reach Maximum (Years)
Gubberamunda Sandstone	200	0.013	0.06 mg/L in 400 years
	50	0.21	0.24 mg/L in 400 years



Potential Contaminant Concentrations, based on Monte Carlo probability distribution at Receptor 200 m from CSG Well



Potential Contaminant Concentrations, based on Monte Carlo probability distribution at Receptor 50 m from CSG Well

Risk Assessment – Predicted Significance of Impact

The significance of impact on a MNES has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
CM401	Moderate to High	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	High potential for adverse effects on aquatic ecosystems and permanent human health effects through prolonged exposure

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	High	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ◆ Minimising release; ◆ Containing spilled material; ◆ Raising the alarm and response; ◆ Locations of spill kits; and ◆ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ◆ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	High	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low		1	High	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	High	Low			High	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Low			High	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	High	Low
	Wandoan Creek		4	High	High			High	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	High	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and ▪ Not introduce substances that may cause unlawful environmental harm.	1	High	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low		1	High	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Mod			High	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low	**Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		High	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	High	Mod			High	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Mod			High	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Mod			High	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	High	Low		1	High	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependence on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	High	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	High	Low			High	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	High	Low			High	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Mod			High	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	High	Mod			High	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	High	Low			High	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	High		1	High	I
	Wandoan Creek		4	High	High			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

REFERENCES

DES. 2016. “Streamlined Model Conditions for Petroleum Activities: Guideline, Environmental Protection Act 1994.” State of Queensland, Department of Environment and Heritage Protection.

DNRME. 2019. “Code of Practice for the Construction and Abandonment of Petroleum Wells, and Associated Bores in Queensland - Version 2.” State of Queensland, Department of Natural Resources, Mines and Energy. https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0006/1461093/code-of-practice-petroleum-wells-bores.pdf.

QUALITATIVE RISK ASSESSMENT

Chromium (6+)

CAS Name	Chromium (6+)
CAS No.	18540-29-9
AICS name(s)	Chromium (6+)
Synonyms	Chromium(VI) Chromium hexavalent ion Chromium(6+) ion
Assigned Tier Level	Initially assigned Tier 3, downgraded to Tier 2
Relevant Drilling fluid	Blended Cement

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m³)	General Purpose and Function
Used as grout in 100% of Wells Drilled	All	Blended Cement	18,000.00	15,898.00	1737.48	Set and develop compressive strength

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to Matters of National Environmental Significance (MNES). The pathway assessment is being undertaken due to the chemical being soluble in water.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Chromium (6+)	Element in water	Soluble	Slurry consisting of all chemicals to be formed and applied to well, this slurry will set and harden. Although there is little risk of movement of the material itself, there is a risk that leachate will be formed and therefore further assessment required.

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Chromium (6+)	Hexavalent Chromium (VI), <10 ppm, 18540-29-9	Unknown	Unknown	Unknown

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling Fluid	Chemical Name	Maximum Chemical Concentration of Active Substance (mg/L)	Toxicity to Fish*	Toxicity to Invertebrates	Toxicity to Algae	Comment
Blended Cement	Hexavalent Chromium (VI), <10 ppm, 18540-29-9	10	3-day LC50 values for D. magna between 30 and 81 µg/L	Not listed	Not listed	Proposed chemical concentration is greater than environmental health hazard criteria; there is potential for environmental harm.

Quantitative Risk Assessment – Groundwater 1D Transport Modelling

Contaminant transport modelling was undertaken to assess the potential concentration of a drilling chemical at a receptor. Surface water spill modelling has not been undertaken, but the likelihood of a spill can be managed, and its impacts mitigated more readily than a groundwater impact. Senex has several standard procedures in place to facilitate appropriate materials and chemical handling practices and to effectively deal with surface spills.

Potential Receptors

As there are several potential receptors and the location of the wells has not been confirmed, indicative distances from a groundwater receptor to a CSG well were used in the modelling. Distances of 200 m and 50 m were modelled to provide an indication of sensitivity of the receptor to the chemical.

There is a Department of Environment, Science, and Innovation (DESI) requirement that petroleum activities must not occur in or within 200 m of a wetland of high ecological significance or a Great Artesian Basin Spring (DES 2016). CSG wells may be located within 200 m of a water receptor should the groundwater modelling and environmental risk assessment suggest that there are no potential impacts from drilling fluids and drill cuttings.

Wells will generally be spaced 500 – 750 m apart, therefore cumulative impact by more than one well on a receptor is unlikely.

Model Scenarios

The aquifer formations which supported groundwater abstraction and were potentially at risk, include the Walloon Coal Measures, the Westbourne Formation and the Gubberamunda Sandstone. The model simulated the movement of a drilling chemical through the most permeable formation, the Gubberamunda Sandstone. Locally groundwater users abstract groundwater from the Gubberamunda Sandstone.

Model Parameters

The basic model parameters adopted in the analytical contaminant transport assessment are summarised below. The adopted contaminant concentration is input is 10 mg/L.

Adoption of this concentration into the model facilitates calculation of indicative contaminant concentrations over time that may occur at a receptor (200 m or 50 m from the well).

Transport Model Parameters

Data Type	Parameter	Value			Source of Data
		Min	Max	Mean	
Receptor data	Distance to nearest receptor (m)	200			A 200 m conservative distance
Hydrogeology	Hydraulic conductivity (m/d)	1.9×10^{-2}	1.2×10^{-1}	5.2×10^{-2}	These values were taken from the UWIR to represent the most permeable formation – the Gubberamunda Sandstone
	Hydraulic gradient	0.0003	0.3	0.003	
	Effective porosity (%)	0.02	0.24	0.15	
Dispersion	Longitudinal Dispersivity	Dispersivity is calculated based on the distance to receptor and assuming 1/10th x plume length and 0.5 m for vertical dispersivity (Pickens and Grisak, 1981).			N/A
	Transverse Dispersivity				
	Vertical Dispersivity				
Adsorption	Retardation factor Soil Bulk density (f_{oc}) (K_{oc})	N/A			Adsorption not modelled for a conservative assessment
Contaminant source	Source thickness (m)	1000			To represent 1000 m deep well (overly conservative)
	Width (m)	0.5			Represents well width
	Length (m)	0.5			Represents well length
	Contaminant concentration (mg/L)	6.5			Representative drilling chemical concentration for illustrative purposes
Degradation	Rate of decay (1/day)	$1e^{-10}$			A value as close to 0 as possible is used for conservative modelling.
Retardation	Bulk Density (g/cm^3)	Not applied			

[1] Note that cement and cement additive chemicals to be applied to a well will set and harden; only leachate concentrations of these chemicals will have the potential to impact on groundwater. Leachate concentrations were assumed to be 1% of the max. chemical concentration.

Model Sensitivity

Sensitivity in the model was assessed through stochastic simulation of selected parameters. The following parameters were considered for stochastic consideration of likely parameter bounds:

- Hydraulic conductivity;
- Effective porosity; and
- Hydraulic gradient.

Stochastic modelling follows a Monte Carlo simulation technique which allow multiple realisations of different "what if" cases where the ranges and distributions of the parameters are assessed. This allows the range of possible outcomes and their probability of occurring to be reported.

The Monte Carlo probability capability of GoldSim was used to assign distributions of the input parameters listed above. The approach allows the definition of the assumptions for each input and the 1-D contaminant transport equations to be assessed for multiple scenarios. This approach provides a broad understanding of the model variability, with results typically provided as ranges associated with a probability of occurrence.

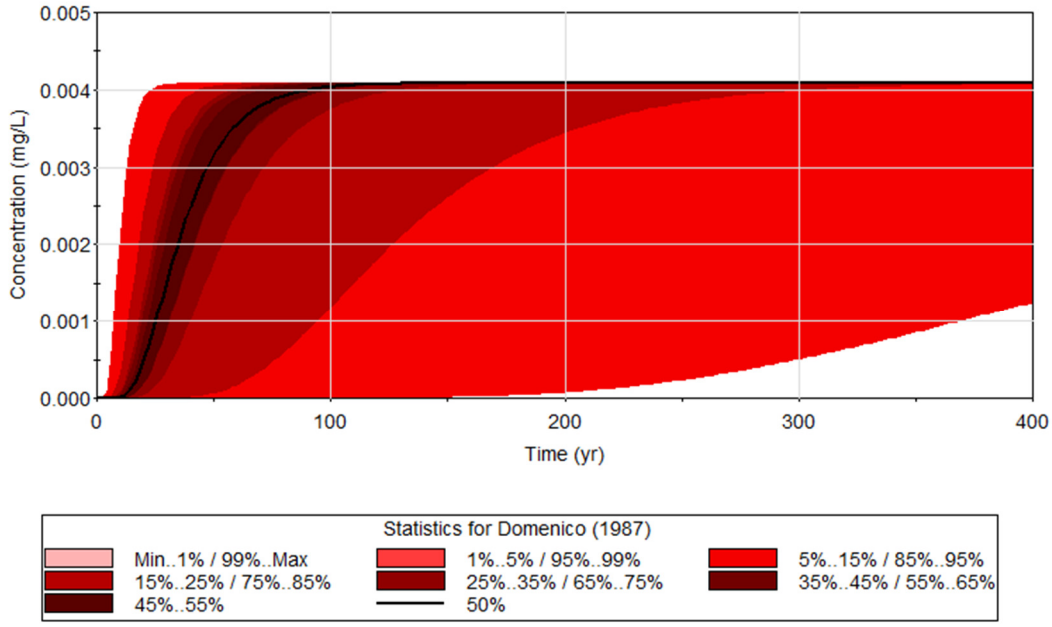
Results

In summary:

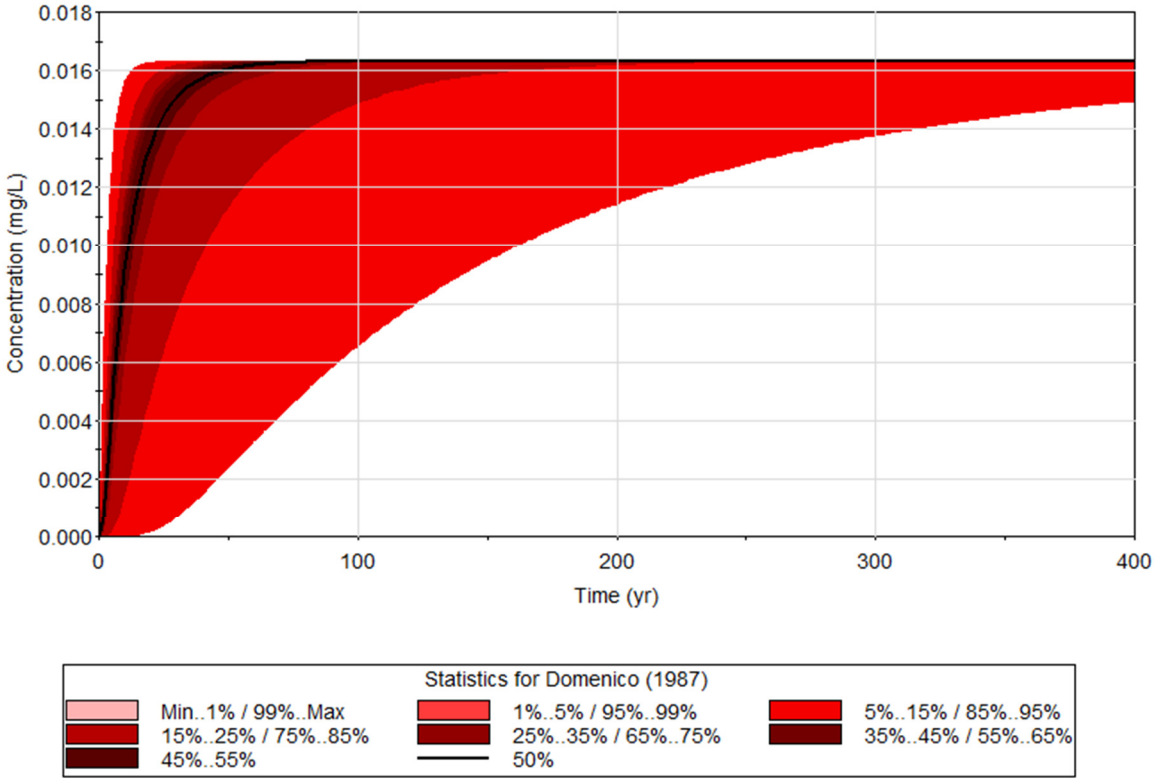
- The 1D analytical model assumes that a constant source will be maintained at the well point. It is noted that most chemicals will not be applied consistently to the wells, and that concentrations will recede following chemical application. It is also noted that the lifetime of a CSG well is expected to be between 20 – 50 years. The model does not take into account retardation, degradation or sorption of the chemical contaminant and concentrations at the receptor. The model is therefore considered to represent an indicative scenario and is substantially conservative in nature; modelled concentrations at receptors are expected to be markedly lower than predicted.
- The 1D analytical model suggests that within 25 years there will be a concentration of 0.014 mg/L (mean) contaminant concentration at a receptor 50 m from a CSG well.
- The model was run for 400 years, at this time a mean maximum concentration at the receptor of 0.016 mg/L is predicted (50 m distance to receptor).
- Freshwater algae and invertebrates are more sensitive to chromium (VI) than fish, with Cr (VI) being the most toxic species. Crustaceans are particularly sensitive to Cr (VI), with 3-day LC50 values for D. magna between 30 and 81 µg/L, and chronic values from 2.5 to 40.0 µg/L (Trabalika & Gehrs 1977).
- Regardless of the results of the modelling, this chemical will only be used during plug and abandonment. During plug and abandonment there is no immediate pathway from the bore to freshwater receptors, the well is only open in the coal seam which is at significant depth below the surface water systems such as Woleebee and Wandoan Creeks. For this reason, this chemical has been downgraded to a Tier 2.

Mean Predicted Concentrations at Receptor

Formation	Distance to Receptor	Mean Potential Concentration at Receptor in 100 years (mg/L)	Time to Reach Maximum (Years)
Gubberamunda Sandstone	200	0.004	0.004 mg/L in 400 years
	50	0.016	0.016 mg/L in 400 years



Potential Contaminant Concentrations, based on Monte Carlo probability distribution at Receptor 200 m from CSG Well



Potential Contaminant Concentrations, based on Monte Carlo probability distribution at Receptor 50 m from CSG Well

Risk Assessment – Predicted Significance of Impact

The significance of impact on a MNES has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
Blended Cement	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale	High potential for adverse effects on aquatic ecosystems and permanent human health effects through prolonged exposure.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ◆ Minimising release; ◆ Containing spilled material; ◆ Raising the alarm and response; ◆ Locations of spill kits; and ◆ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ◆ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	High	Low
	Wandoan Creek		4	High	High			High	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	▪ Not introduce substances that may cause unlawful environmental harm. **Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low		1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	High		1	High	I
	Wandoan Creek		4	High	High			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

REFERENCES

DES. 2016. “Streamlined Model Conditions for Petroleum Activities: Guideline, Environmental Protection Act 1994.” State of Queensland, Department of Environment and Heritage Protection.

DNRME. 2019. “Code of Practice for the Construction and Abandonment of Petroleum Wells, and Associated Bores in Queensland - Version 2.” State of Queensland, Department of Natural Resources, Mines and Energy. https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0006/1461093/code-of-practice-petroleum-wells-bores.pdf.

QUALITATIVE RISK ASSESSMENT

Petroleum Gas Oil

CAS Name	Petroleum Gas Oil
CAS No.	64741-44-2
AICS name(s)	Distillates (petroleum), straight-run middle
Synonyms	Distillate, petroleum, hydrotreated middle; Gas oil
Assigned Tier Level	Initially assigned Tier 3, downgraded to Tier 2
Relevant Drilling fluid	CM401

Proposed Chemical Use

Application	Hole Section	Drilling Fluid	Quantity Per Well (kg)	System Volume (litres)	Concentration (kg/m³)	General Purpose and Function
Used in grout in 100% of Wells Drilled	All	CM401	4.50	15,876.00		Reduce foam in cement slurry

Drilling Fluid Surface State and Pathway Assessment

The nature and state of the chemicals at surface and their solubility was assessed to determine the potential for the chemical to enter the environment. Where a chemical is a solid at surface and is insoluble in water, it is assumed that the chemical is unlikely to be mobilised away from the drill pad, and if present down a well is unlikely to mobilise through an aquifer. It is assumed that there is little to no risk that the chemical will migrate off-site, and these chemicals are not considered to present a risk to Matters of National Environmental Significance (MNES). This chemical was assessed due to the potential leachate which could be formed from the cement.

Chemical Name	Physical State at surface (as manufactured and pre-mixing)	Solubility	Comment
Petroleum Gas Oil	Liquid	Insoluble with water 2.69E-12 and 2000 mg/L.	Slurry consisting of all chemicals to be formed and applied to well, this slurry will set and harden. Although there is little risk of movement of the material itself, there is a risk that leachate will be formed and therefore further assessment required.

Chemical Fate and Transport

The behaviour of the chemical in the surface and subsurface was considered further to determine how the chemicals would behave should they be released to the surface water or groundwater environment. The chemical fate and transport informed the potential consequence of a release of the chemical into the environment.

Chemical Name	CAS Registry Number - From SDS	Persistence / Degradation	Potential for Bioaccumulation	Mobility
Petroleum Gas Oil	Petroleum Gas Oil, 64741-44-2, 30 – 60 % by weight	Unknown	Unknown	The portion in water is expected to be soluble or dispersible.

Environmental Hazard

The proposed chemical concentrations to be used have been evaluated against environmental health hazard criteria. Note that the concentration of additives stated would be diluted upon entering the receiving environment. The predicted environmental concentrations (PEC) have not been calculated, making this assessment overly conservative.

Drilling Fluid	Chemical Name	Maximum Chemical Concentration of Active Substance (mg/L)	Toxicity to Fish	Toxicity to Invertebrates	Toxicity to Algae	Comment
CM401	Petroleum Gas Oil, 64741-44-2, 30 – 60 % by weight	0.52	LC50 (Oncorhynchus mykiss) – 310 mg/L (96 h) LC50 (Pimephales promelas) – 190 mg/L (96 h) NOEC (Oncorhynchus mykiss (rainbow trout)) –<78 mg/L (96 h) NOEC (Pimephales promelas) – 100 mg/L (96 h)	LC50 (Daphnia magna) – 220 mg/L (48 h) LC50 (Ceriodaphnia dubia) – 4.32 mg/L (48 h) EC50 (Daphnia magna) – 130 mg/L (48 h) NOEC (Daphnia magna) – 16 mg/L (48 h) NOEC (Ceriodaphnia dubia) – 2.50 mg/L (48h)	Hydrotreated Light Distillate (petroleum) EC50 – > 1,000 mg/L (72 h)	Proposed chemical concentration is greater than required to cause harm to some fish and invertebrates. Potential for environmental harm.

Quantitative Risk Assessment – Groundwater 1D Transport Modelling

Contaminant transport modelling was undertaken to assess the potential concentration of a drilling chemical at a receptor. Surface water spill modelling has not been undertaken, but the likelihood of a spill can be managed, and its impacts mitigated more readily than a groundwater impact. Senex has several standard procedures in place to facilitate appropriate materials and chemical handling practices and to effectively deal with surface spills.

Potential Receptors

As there are several potential receptors and the location of the wells has not been confirmed, indicative distances from a groundwater receptor to a CSG well were used in the modelling. Distances of 200 m and 50 m were modelled to provide an indication of sensitivity of the receptor to the chemical.

There is a Department of Environment, Science, and Innovation (DESI) requirement that petroleum activities must not occur in or within 200 m of a wetland of high ecological significance or a Great Artesian Basin Spring (DES 2016). CSG wells may be located within 200 m of a water receptor should the groundwater modelling and environmental risk assessment suggest that there are no potential impacts from drilling fluids and drill cuttings.

Wells will generally be spaced 500 – 750 m apart, therefore cumulative impact by more than one well on a receptor is unlikely.

Model Scenarios

The aquifer formations which supported groundwater abstraction and were potentially at risk, include the Walloon Coal Measures, the Westbourne Formation, the Springbok Sandstone, and the Gubberamunda Sandstone. The model simulated the movement of a drilling chemical through the most permeable formation, the Gubberamunda Sandstone. Locally groundwater users abstract groundwater from the Gubberamunda Sandstone.

Model Parameters

The basic model parameters adopted in the analytical contaminant transport assessment are summarised below. The adopted contaminant concentration input is 283 mg/L.

Adoption of this concentration into the model facilitates calculation of indicative contaminant concentrations over time that may occur at a receptor (200 m or 50 m from the well).

Transport Model Parameters

Data Type	Parameter	Value			Source of Data
		Min	Max	Mean	
Receptor data	Distance to nearest receptor (m)	200			A 200 m conservative distance
Hydrogeology	Hydraulic conductivity (m/d)	1.9×10^{-2}	1.2×10^{-1}	5.2×10^{-2}	These values were taken from the UWIR to represent the most permeable formation – the Gubberamunda Sandstone
	Hydraulic gradient	0.0003	0.3	0.003	
	Effective porosity (%)	0.02	0.24	0.15	
Dispersion	Longitudinal Dispersivity	Dispersivity is calculated based on the distance to receptor and assuming 1/10th x plume length and 0.5 m for vertical dispersivity (Pickens and Grisak, 1981).			N/A
	Transverse Dispersivity				
	Vertical Dispersivity				
Adsorption	Retardation factor Soil Bulk density (f_{oc}) (K_{oc})	N/A			Adsorption not modelled for a conservative assessment
Contaminant source	Source thickness (m)	1000			To represent 1000 m deep well (overly conservative)
	Width (m)	0.5			Represents well width
	Length (m)	0.5			Represents well length
	Contaminant concentration (mg/L)	0.52			Representative drilling chemical concentration for illustrative purposes
Degradation	Rate of decay (1/day)	$1e^{-10}$			A value as close to 0 as possible is used for conservative modelling.
Retardation	Bulk Density (g/cm^3)	Not applied			

[1] Note that cement and cement additive chemicals to be applied to a well will set and harden; only leachate concentrations of these chemicals will have the potential to impact on groundwater. Leachate concentrations were assumed to be 1% of the max. chemical concentration.

Model Sensitivity

Sensitivity in the model was assessed through stochastic simulation of selected parameters. The following parameters were considered for stochastic consideration of likely parameter bounds:

- Hydraulic conductivity;
- Effective porosity; and
- Hydraulic gradient.

Stochastic modelling follows a Monte Carlo simulation technique which allow multiple realisations of different "what if" cases where the ranges and distributions of the parameters are assessed. This allows the range of possible outcomes and their probability of occurring to be reported.

The Monte Carlo probability capability of GoldSim was used to assign distributions of the input parameters listed above. The approach allows the definition of the assumptions for each input and the 1-D contaminant transport equations to be assessed for multiple scenarios. This approach provides a broad understanding of the model variability, with results typically provided as ranges associated with a probability of occurrence.

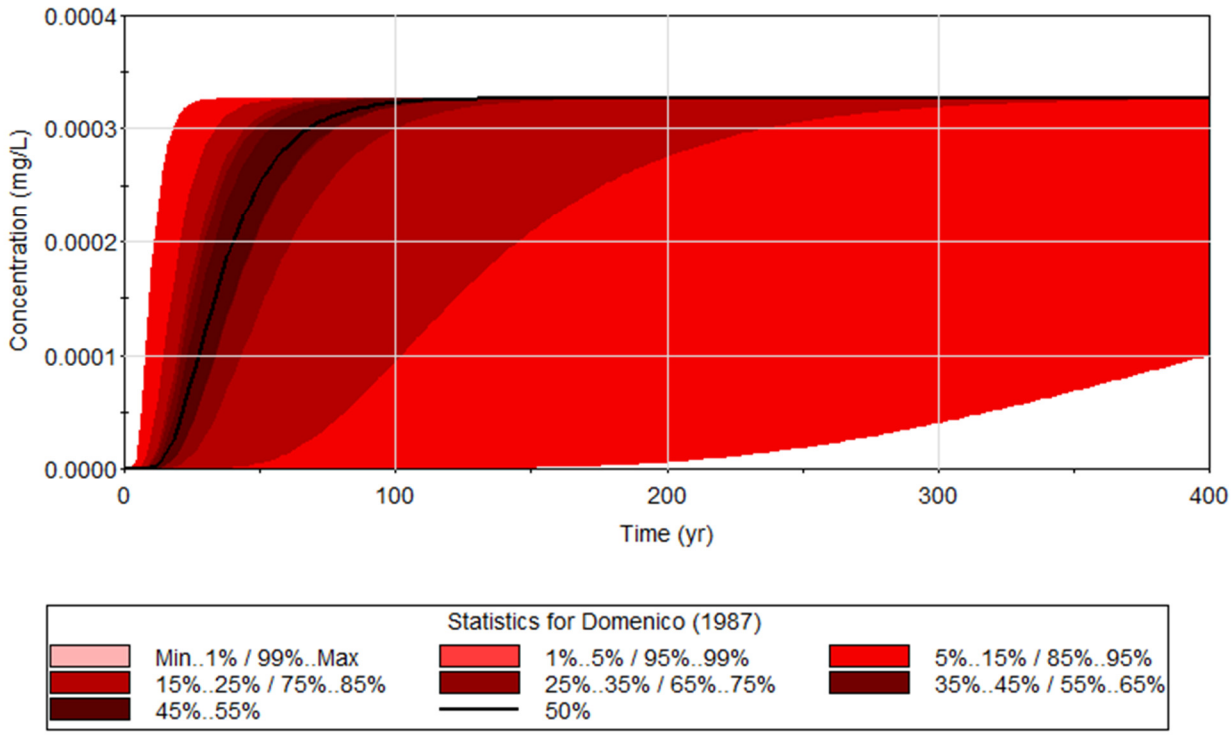
Results

In summary:

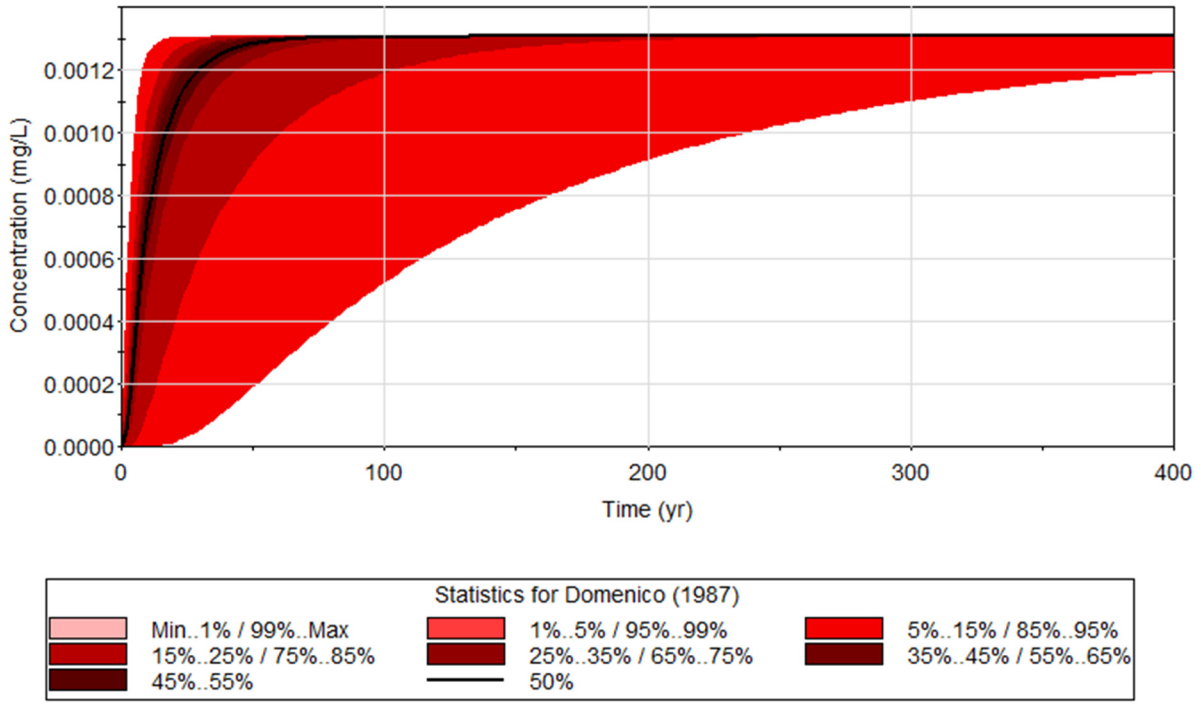
- The 1D analytical model assumes that a constant source will be maintained at the well point. It is noted that most chemicals will not be applied consistently to the wells, and that concentrations will recede following chemical application. It is also noted that the lifetime of a CSG well is expected to be between 20 – 50 years. The model does not take into account retardation, degradation or sorption of the chemical contaminant and concentrations at the receptor. The model is therefore considered to represent an indicative scenario and is substantially conservative in nature; modelled concentrations at receptors are expected to be markedly lower than predicted.
- The 1D analytical model suggests that within 25 years there will be a concentration of 0.001mg/L (mean) contaminant concentration at a receptor 50 m from a CSG well.
- The model was run for 400 years, at this time a mean maximum concentration at the receptor 50m from the well of 0.001 mg/L is predicted.
- Long term toxicity to fish is estimated for freshwater fish NOEL (No Observed Effect Level) value is 0.068 mg/l based on mortality. Long term toxicity to aquatic invertebrates is estimated freshwater invertebrate NOEL (No Observed Effect Level) value is 0.167mg/l.
- Regardless of the results of the modelling, this chemical will only be used during plug and abandonment. During plug and abandonment there is no immediate pathway from the bore to freshwater receptors, the well is only open in the coal seam which is at significant depth below the surface water systems such as Woleebee and Wandoan Creeks. For this reason, this chemical has been downgraded to a Tier 2.

Mean Predicted Concentrations at Receptor

Formation	Distance to Receptor	Mean Potential Concentration at Receptor in 100 years (mg/L)	Time to Reach Maximum (Years)
Gubberamunda Sandstone	200	0.0003	0.0003 mg/L in 400 years
	50	0.001	0.001 mg/L in 400 years



Potential Contaminant Concentrations, based on Monte Carlo probability distribution at Receptor 200 m from CSG Well



Potential Contaminant Concentrations, based on Monte Carlo probability distribution at Receptor 50 m from CSG Well

Risk Assessment – Predicted Significance of Impact

The significance of impact on a MNES has been assessed based on:

- The likelihood of an impact reaching an MNES receptor; and
- The environmental consequence on the MNES receptor.

The risk assessment methodology is provided in the Chemical Risk Assessment Framework (KCB, 2023).

Environmental Consequence

Drilling Fluid	Magnitude Assigned	Description	Reasoning
CM401	Moderate	Can result in impact on the integrity of attribute or loss of part of attribute at a local to regional scale,	High potential for adverse effects on aquatic ecosystems and permanent human health effects through prolonged exposure.

Significance of Impacts

The significance of an impact is assessed prior to and following the application of management and mitigation measures.

The full assessment is provided in the tables below.

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Above Ground Chemical Spills and Leaks

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** The Atlas Stage 3 Environmental Protocol for Planning and Field Development prevents the siting of any CSG wells in locations which may result in the degradation of an environmental value. The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Chemical and fuel storage** ▪ All fuel, oil and chemicals are to be stored, transported and handled in accordance with appropriate standards including AS 3780:2008 – The storage and handling of corrosive substances, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers. ▪ Storage areas must be sealed, bunded, and adequately ventilated. ▪ Storage and refuelling areas will be preferentially located away from watercourses, sensitive areas and any source of ignition as determined by the Senex Site Supervisor. ▪ Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. All chemical, oil and fuel storage areas are to be inspected at least weekly for temporary storage, and monthly for permanent storage areas during the operating phase by the Contractor Site Supervisor and/or the Senex Site Supervisor. **Emergency and Incident Support** ▪ In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up as outlined in the Senex Spill Response Plan. ▪ Contractors must have in place procedures for spill response which are in accordance with the Senex Spill Response Plan and will include details requirements for: ◆ Minimising release; ◆ Containing spilled material; ◆ Raising the alarm and response; ◆ Locations of spill kits; and ◆ Management of contaminated material if necessary. ▪ Any spills will be assessed by the Senex Site Supervisor supported by the Senex Environment Manager as required to determine appropriate remediation options such as the removal of contaminated material. ▪ Incident reports will contain information required by the Senex Environment Manager and any Incident Reporting and Investigation Procedures. ▪ Emergency Response drills will be performed to ensure readiness and identify opportunities for improvement. ▪ Senex will ensure that all incidents including spills are reported and fully investigated in accordance with their specific level of potential risk. ▪ Emergency events will be managed in accordance with the contingency procedures in the Project Atlas Emergency Response Plan. ◆ Personnel who observe an environmental incident including a spill must immediately notify the Contractor Site Supervisor who will then notify the Senex Site Supervisor.	1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been verified. Any impacts could be regional.	4	High	High		2	High	Low
	Wandoan Creek		4	High	High			High	Low
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Unlikely that a surface spill will reach this formation. Aquifer at depth.	2	High	Low		1	High	I
								High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		2	High	Low
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		2	Mod	Low

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: CSG Production Well Construction / Design / Drilling / Integrity Results in Contamination of Aquifers

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	This is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low	**Well Siting** Sites for CSG production wells will be selected based on a good understanding of the local conditions and geology to prevent any potentials for connections of target coal seam gas reservoirs and aquifers (i.e. avoiding the presence of known faults). The Constraints Protocol aims to avoid, minimise and mitigate disturbance to biodiversity values. Brigalow and Poplar Box Grassy Woodland will be avoided by project footprint. **Well Construction** CSG production wells will be designed, constructed and decommissioned in accordance with the "Code of Practice for the construction and abandonment of coal seam gas and petroleum wells and associated bores in Queensland (DNRME 2019)". This code outlines mandatory requirements and good practice to reduce the risk of environmental harm. CSG production wells will be designed to: ▪ Prevent any interconnection between target hydrocarbon bearing formations and aquifers; ▪ Ensure that gas is contained within the well and associated pipework and equipment without leakage; ▪ Ensure zonal isolation between different aquifers is achieved; and	1	Mod	I
Ecological Communities	Brigalow (Acacia harpophylla dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependence on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Analogous RE type descriptions suggest that this community is not reliant on groundwater or associated with wetlands.	1	Mod	Low		1	Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri (syn. Tylophora linearis) (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Geophaps scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	▪ Not introduce substances that may cause unlawful environmental harm. **Prevention of drilling fluid losses** Selecting the correct drilling additives based on the drilling conditions and formation to prevent excessive fluid losses in the well. Prior to drilling, reference to the geological conditions and fluid losses encountered during the drilling of other nearby bores to assist with selection of the most appropriate fluids. CSG production wells will be flushed with water until all traces of drilling additives are removed.		Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated.	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Anomalopus mackayi (Five-clawed worm-skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Grantiella picta (Painted Honeyeater)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Dasyurus hallucatus (Northern Quoll)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Migratory species	*Hirundapus caudacutus* (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.	3	High	Mod		1	High	I
Surface Water	Wandoan Creek		3	High	Mod			High	I
Groundwater	Walloon Coal Measures	Productive coal measure at depth. Supports some groundwater abstraction outside of the Project Area. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Gubberamunda Sandstone	High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
Groundwater	Superficial deposits	Supports some groundwater abstraction. Any impacts would be localised.	3	Mod	Mod		1	Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

Final Impact Assessment Before and Following Application of Management and Mitigation Measures: Inappropriate Reuse / Disposal of Drill Cuttings and Additives

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
Wetlands	RAMSAR wetlands (Great Sandy Strait)	The is located over 300 km from the project. This distance, together with the dilution effect, indicate that the wetlands will not be impacted.	1	Mod	Low		1	Mod	I
Ecological Communities	Brigalow (*Acacia harpophylla* dominant and codominant)	Analogous RE type descriptions do not suggest this community is reliant on groundwater or associated with wetlands.	2	Mod	Low		1	Mod	I
	Poplar Box Grassy Woodland on Alluvial Plains	Potential dependance on groundwater at 12 – 22m rooting depth.	3	Mod	Mod			Mod	I
Flora	*Cadellia pentastylis* (Ooline)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Homopholis belsonii (Belson's panic)		2	Mod	Low			Mod	I
	Vincetoxicum forsteri *(syn. Tylophora linearis)* (Slender Tylophora)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Fauna	*Phascolarctos cinereus* (Koala)	Habitat and resources unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low	**Appropriate disposal of drilling additives** Waste solids will be disposed of to an appropriately licenced facility. Drilling additives to be recycled where possible. Disposed of on site by mix-bury-cover method if the residual drilling material meets the approved quality criteria as per the EA (EA0001207).	1	Mod	I
	Petauroides volans (Greater Glider)	Habitat possibly affected where wetlands associated with GDEs.	2	Mod	Low			Mod	I
	Geophaps scripta scripta (Squatter Pigeon)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Petaurus australis (Yellow-bellied Glider)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Rostratula australis (Australian painted-snipe)	Habitat possibly affected where wetlands associated with GDEs. Only occasion transient presence anticipated	3	Mod	Low			Mod	I
	Adclarkia dulacca (Dulacca Woodland Snail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Calyptorhynchus lathami (Glossy Black Cockatoo)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Nyctophilus corbeni (Long-eared Bat)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Delma torquata (Collared Delma)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Egernia rugosa (Yakka Skink)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Furina dunmalli (Dunmall's Snake)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Hemiaspis damelii (Grey Snake)	Habitat possibly affected where wetlands associated with GDEs.	3	Mod	Low			Mod	I
	Climacteris picumnus victoriae (Brown Treecreeper (south-eastern))	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Stagonopleura guttata (Diamond Firetail)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
	Aphelocephala leucopsis (Southern whiteface)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low			Mod	I
Migratory species	Hirundapus caudacutus (White-throated Needletail) (both threatened and migratory)	Habitat unlikely to be affected, may be impacted by direct uptake of contaminated water.	2	Mod	Low		1	Mod	I
	Various migratory species (potential occurrence but no evidence)	Habitat and resources, especially for aerial species, unlikely to be affected; may be impacted by direct uptake of contaminated water.	1	Mod	Low		1	Mod	I
Surface Water	Woleebee Creek	All surface water sub-catchments present are vulnerable to above ground chemical spills should drilling activities be occurring within close proximity. Note, these systems	4	High	High		1	High	I
	Wandoan Creek		4	High	High			High	I

	MNES	Mitigating Factors	Inherent Risk Rating			Management Controls	Residual Risk Rating		
			Likelihood[1]	Consequence[2]	Risk Rating[3]		Likelihood[1]	Consequence[2]	Risk Rating[3]
		are ephemeral systems which are not utilised for abstraction and no freshwater MNES have been identified. Any impacts could be regional.							
Groundwater	Walloon Coal Measures	Productive coal measure at depth.	2	High	Low		1	High	I
	Gubberamunda Sandstone	Present at surface in some part of the Project. High groundwater abstraction. Supports spring complexes and watercourse springs regionally. Impacts could be at a regional scale.	3	High	Mod		1	High	I
	Superficial deposits	Present at surface in some parts of the Project area. Does not support groundwater abstraction. Any impacts would be localised.	3	Mod	Mod			Mod	I

1 Based on Table 3.2 Likelihood levels in the Chemical Risk Assessment Framework (KCB, 2023)
2 Based on Table 3.3 Consequence levels in the Chemical Risk Assessment Framework (KCB, 2023)
3 Based on Table 3.4 Significance of impact; I represents an 'insignificant impact' in the Chemical Risk Assessment Framework (KCB, 2023)

REFERENCES

DES. 2016. “Streamlined Model Conditions for Petroleum Activities: Guideline, Environmental Protection Act 1994.” State of Queensland, Department of Environment and Heritage Protection.

DNRME. 2019. “Code of Practice for the Construction and Abandonment of Petroleum Wells, and Associated Bores in Queensland - Version 2.” State of Queensland, Department of Natural Resources, Mines and Energy. https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0006/1461093/code-of-practice-petroleum-wells-bores.pdf.

APPENDIX V

SDS for Each Drilling Fluid

ACB-143

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: ACB-143 | Prepared by: HSE Dept
Date Issued: December 27, 2017 | # & Version: 167-2.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	ACB-143
Product Purpose:	Gelling catalyst
Supplier Identification:	Australian Coil Services Pty Ltd 283 McDougall Street Toowoomba, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Warning

Primary Routes of Exposure: Eyes and skin

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Skin corrosion/irritation (Category 2), H315
Serious eye damage/eye irritation (Category 1), H318
Specific target organ toxicity - repeated exposure (Category 2), H373

Acute aquatic toxicity (Category 3), H412
Chronic aquatic toxicity (Category 3), H412

Hazard Statements:

H302 - Harmful if swallowed
H315 - Causes skin irritation
H318 - Causes serious eye damage
H373 - May cause damage to organs through prolonged or repeated exposure
H412 - Harmful to aquatic life with long lasting effects

Precautionary Statements:

P260 - Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P273 - Avoid release to the environment. P280 Wear eye protection/ face protection.
P280 - Wear protective gloves.
P301 + P312 + P330 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
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 or doctor/ physician.
P314 - Get medical advice/ attention if you feel unwell.
P332 + P313 - If skin irritation occurs: Get medical advice/ attention.
P501 - Dispose of contents/ container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: Irritating, and may injure eye tissue if not removed promptly.
Skin: Can cause moderate irritation. Prolonged or frequently repeated skin contact may cause allergic reactions in some

individuals. Repeated exposures may cause local redness, swelling and tissue damage.
Ingestion: Not a likely route of exposure. Irritation of the gastro-intestinal tract possible. Harmful if swallowed.
Inhalation: May cause irritation with prolonged contact.
Chronic: No adverse effect expected other than those mentioned above.

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Triethanolamine	102-71-6	30 to 60
Diethanolamine	111-42-2	5 to 10
Potassium hydroxide	1310-58-3	10 to 30

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 20 minutes. If symptoms persist seek medical advice.

Skin Contact: Remove contaminated clothing and footwear. Immediately wash off all material with soap and copious amounts of water for at least 20 minutes.

Ingestion: Do not induce vomiting without medical advice. Seek medical advice.

Inhalation: Remove to fresh air, treat symptomatically. If symptoms persist, seek medical advice.

5. FIRE FIGHTING MEASURES

Flash Point:	194 ^{O}C
Lower explosion Limit (LEL):	Not available
Upper explosion Limit (UEL):	Not available
Auto ignition temperature:	Not available
Suitable Extinguishing Media:	Water fog or fine spray, carbon dioxide or dry chemical foam. Alcohol resistant foams are preferred. General purpose synthetic foams or protein foams may function but much less effectively. Water spray or fog for larger fires is acceptable.
Fire and explosion Hazard:	May evolve oxides of nitrogen and carbon under fire conditions.
Specific Methods:	Cool tanks and containers with water spray. Do not flush into surface water or sanitary sewer system. Keep product and empty containers away from heat and ignition sources.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.
Specific Hazards:	Heating can release hazardous gases.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Avoid contact with skin, eyes and clothing. Evacuate personnel to safe areas. Keep people away from and upwind of spill or leak. PPE: see section 8.

Environmental Precautions:	Do not contaminate surface water. Do not release into the environment. Prevent product from entering any drains. Do not flush product into surface water or sanitary sewer systems.
Methods For Cleaning Up:	Sweep up and shovel and then place into an appropriate waste container. Remove soiled refuse and place in a suitable disposal container.
Disposal:	Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions:	Handle wearing appropriate PPE as per section 8. Ensure adequate ventilation is available to avoid breathing vapors. Don't use sodium nitrite or other nitrosating agents in formulations containing this product. Suspected cancer-causing nitrosamines could be formed. Spills of these organic liquids on hot fibrous insulations may lead to lowering of the auto ignition temperature possibly resulting in spontaneous combustion.
Storage Precautions:	Store according to Provincial and Federal regulations. Do not freeze. Thaw and mix well before using. Keep in a dry place. Store in stainless steel or plastic. Do not store in zinc, copper, copper alloys or galvanized containers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits:	*This product does contain substances that have an established exposure limit.*
Engineering Measures:	General ventilation is recommended. Local Exhaust fan may be necessary when mist is generated.

CAS	Chemical Name	ACGIH*	OSHA	IDLH
102-71-6	Triethanolamine	5 mg/m3 TLV-TWA	Not Available	Not Available
111-42-2	Diethanolamine	1 mg/m3 TLV-TWA	3 ppm TWA 15 mg/m3 TWA	Not Available
1310-58-3	Potassium hydroxide	CEIL: 2 mg/m3	No available.	Nota available.

Hygiene Recommendations: Keep an eye wash fountain and safety shower available
Eye Protection: Wear safety glasses with side shields or chemical goggles.
Hand Protection: Wear polyethylene gloves, ethyl vinyl alcohol laminate, butyl rubber, natural rubber, polyvinyl, Viton, neoprene or nitrile gloves.
Respiratory Protection: If exposure exceeds occupational exposure limits, use an appropriate NIOSH-approved respirator. For most conditions, no respirator protection is needed; however, if handling at elevated temperatures without sufficient ventilation, use an approved air-purifying respirator. Organic vapor cartridge with a particulate pre-filter.
Skin and Body Protection: Wear standard protective clothing – consider to select type of protective clothing depending on quantity of chemical to be handled.

*ACGIH – Occupational exposure limits – TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Form: Liquid
Color: Colorless to yellow
Odor: Ammonia like
Boiling Point: 105 ^{O}C
Vapor Pressure: Not available.
Vapor Density: Not available.
pH: Not Available
Solubility: Soluble
Evaporation Rate: < 0.01

Flash Point:	Not available.
Freezing Point:	~ 5 ^{O}C
Specific Gravity:	1.14
Viscosity:	Not Available

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions. Hygroscopic (absorbs moisture from air)
Conditions to Avoid:	Temperature extremes and moisture.
Materials to Avoid:	Nitriles, strong acids and strong oxidizers. Product may react with various halogenated organic solvents, resulting in temperature and/or pressure increases. Corrosive when wet. Heating above 60 ^{O}C in the presence of aluminum can result in corrosion and generation of flammable hydrogen gas. Halogenated hydrocarbons.
Hazardous Polymerization:	Will not occur
Hazardous Decomposition Products:	Oxides of nitrogen and carbon.
Under Fire Conditions:	Heating can release hazardous gases
Incompatibility materials:	Acids, aluminum, copper, flammable liquids, magnesium, nitro compounds, nitromethane, organic materials, tin, trichloroethylene, zinc.

11. TOXICOLOGICAL INFORMATION

	Triethanolamine	Diethanolamine	Potassium hydroxide
Acute Oral Toxicity:	No data available	No data available	No data available
LD50/oral/rat:	4190 mg/kg	620 uL/kg	273 mg/kg
LC50/inhalation/4hr/rat:	No data available	No data available	No data available
LD50/dermal/4hr/rabbit:	>2,000 mg/kg	7,640 uL/kg	No data available

Sensitization:	Possible and may cause allergic reaction
Mutagenic Effects:	Possible
Reproductive Toxicity:	Fetal effects occurred only at doses toxic to the mother.
Carcinogenic Effects:	Triethanolamine is listed as Group 3 and Diethanolamine is listed as Group 2B and A3 Carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).
Teratogenicity and Embryo Toxicity:	No quantitative data available
Human Experience:	Moderate
Other Toxicity Information:	Toxicological Synergistic products: none known.

12. ECOLOGICAL INFORMATION

Avoid release into the environment – harmful to aquatic organisms. Runoff from fire control or dilution may cause pollution

Ingredients	**Ecotoxicity – Fish Species Data**	**Acute Crustaceans Toxicity**	**Ecotoxicity – Fresh water Algae**
Triethanolamine	LC50 10,600 to 13,000 mg/L LC50 (Pimephales promelas) 450 to 1,000 mg/L (96 hrs) LC50 (Lepomis macrochirus) LC50 (Pimephales promelas) 1,000 mg/L (96 hrs)	Not available	EC50 (Desmodesmus subspicatus) 169 mg/L (96 hrs) EC50 (Desmodesmus subspicatus) 216 mg/L (72 hrs)
Diethanolamine	LC50 1,200 to 1,580 mg/L LC50 (Pimephales promelas)	LC50 (Daphnia) 48 hr, 187 mg/L	2.1 to 2.3 mg/L EC50

	4,460 to 4,980 mg/L (96 hrs) LC50 (Pimephales promelas) LC50 (Lepomis macrochrius) 600 to 1,000 mg/L (96 hrs)		Pseudokirchneriella subcapitata 96 hr 7.8 mg/L EC50 Desmodesmus subspicatus 72 hr

Persistence and Degradability: Material is practically non-toxic to aquatic organisms but may increase pH of waterways and adversely affect aquatic life. Low persistence and no bioaccumulation expected.

Mobility: Product is liquid and therefore readily mobile.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package Dispose of waste in an approved incinerator or waste treatment site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage. Empty containers should be recycled locally or taken away for waste disposal.

14. TRANSPORT INFORMATION

Typical proper shipping name for this product are as follows:

PRODUCT IS NOT REGULATED FOR TRANSPORT

Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

Land Transport (US DOT)
DOT hazard label: Corrosive
DOT hazard class: 8

UN/NA number: 1813
Packing group: II

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

CANADA: Workplace Hazardous Material Information System (WHMIS)
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and is a WHMIS controlled product.

WHMIS CLASSIFICATION:
D2B – Materials causing other toxic effects – toxic material

Canadian Environmental Protection Act (CEPA): The substance(s) in this MSDS are included in or exempted from the Domestic Substance List (DSL)

National Pollutant Release Inventory (NPRI): This product does not contain any substances listed in Part 1A (Core Substances) of the NPRI at a concentration of one percent or more by weight.

Toxic Substances Control Act (TSCA): The substances in this MSDS are included in or exempted from the TSCA 8(b) Inventory (40 CFR 710)

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 2	Flammability: 1	Instability: 0	Other: n/a

HMIS

Health: 2	Flammability: 1	Instability: 0	Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning:	Caution
Label Precautions:	May cause irritation, swelling and tissue damage with prolonged contact. May cause allergic reaction in some individuals. Harmful if swallowed.
Label First Aid:	Wash product off of skin or out of eyes. If swallowed, do not induce vomiting without medical advice. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

ACB-144	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: ACB-144	Prepared by: HSE Dept
Date Issued: December 27, 2017	# & Version: 45 - 2.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	ACB-144
Product Purpose:	Initiator
Supplier Identification:	Australian Coil Services Pty Ltd 283 McDougall Street Toowoomba, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Danger

Primary Routes of Exposure: Eyes and skin

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Oxidizing solids (Category 3), H272
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Dermal (Category 4), H312
Skin irritation (Category 2), H315

Eye irritation (Category 2A), H319
Respiratory sensitization (Category 1), H334
Skin sensitization (Category 1), H317
Specific target organ toxicity - single exposure (Category 3) Respiratory system, H335
Acute aquatic toxicity (Category 3), H402

Hazard Statements:

H272 - May intensify fire; oxidizer
H302 + H312 - Harmful if swallowed or in contact with skin
H315 - Causes skin irritation
H317 - May cause an allergic skin reaction
H319 - Causes serious eye irritation
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
H335 - May cause respiratory irritation
H402 - Harmful to aquatic life

Precautionary Statements:

P220 - Keep/Store away from clothing/ combustible materials.
P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P280 - Wear protective gloves/ protective clothing.
P305 + P351 + P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor/ physician.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: Irritating, and may injure eye tissue if not removed promptly.
Skin: Can cause moderate irritation. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.
Ingestion: Not a likely route of exposure. Irritation of the gastro-intestinal tract possible. Harmful if swallowed.

Inhalation: May cause irritation with prolonged contact. May cause respiratory allergy. Irritating to the eyes, nose, throat and lungs.
Chronic: No adverse effect expected other than those mentioned above.

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Ammonium Persulphate	7727-54-0	60 to 100

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 15 minutes. If symptoms persist seek medical advice.

Skin Contact: Remove contaminated clothing. Immediately wash off all material with soap and copious amounts of water. Remove all contaminated clothing and footwear.

Ingestion: Do not induce vomiting without medical advice. If conscious, washout mouth and give person water to drink. Seek medical advice.

Inhalation: Remove to fresh air, treat symptomatically. If symptoms persist, seek medical advice.

5. FIRE FIGHTING MEASURES

Flash Point: Not flammable
Lower explosion Limit (LEL): Not flammable
Upper explosion Limit (UEL): Not flammable
Auto ignition temperature: Not applicable

Suitable Extinguishing Media:	Foam, carbon dioxide, dry powder or other suitable Class B extinguishing agents. Water spray or fog for larger fires is acceptable.
Fire and explosion Hazard:	Not flammable but can act as an oxidizing agent, enhancing the burning rate of other materials. May evolve oxides of nitrogen and sulfur under fire conditions.
Specific Methods:	Cool tanks and containers with water spray. Do not flush into surface water or sanitary sewer system. Keep product and empty containers away from heat and ignition sources.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.
Specific Hazards:	Non-combustible. Heating can release hazardous gases.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Avoid contact with skin, eyes and clothing. Evacuate personnel to safe areas. Keep people away from and upwind of spill or leak. PPE: see section 8.
Environmental Precautions:	Do not contaminate surface water. Do not released into the environment. Prevent product from entering any drains. Do not flush product into surface water or sanitary sewer systems.
Methods For Cleaning Up:	Sweep up and shovel and then place into an appropriate waste container. Remove soiled refuse and place in a suitable disposal container.
Disposal:	Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Handle wearing appropriate PPE as per section 8. Ensure adequate ventilation is available. Compatibility with plastic materials can vary. Test compatibility prior to use.

Storage Precautions: Store according to Provincial and Federal regulations. Store separately from other Oxidizers. Keep in a dry place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: *This product does contain substances that have an established exposure limit.*

Engineering Measures: General ventilation is recommended. Local Exhaust fan may be necessary when dust or mist is generated.

CAS	Chemical Name	ACGIH*
7727-54-0	Ammonium Persulphate	0.1 mg/m3

Hygiene Recommendations: Keep an eye wash fountain and safety shower available

Eye Protection: Wear safety glasses with side shields

Hand Protection: Wear Nitrile or PVC gloves.

Respiratory Protection: Respiratory protection is not normally needed. Where concentrations are high (mist or dust) – the use of a half or a full-face mask or air breathing apparatus is recommended. A suitable filter material depends on the amount and type of chemicals being handled. Consider using multi-contaminant cartridge filter with particulate filter. In the event of an emergency or planned entry into unknown concentrations positive, full-face SCBA should be used. If respiratory protection is required, institute a complete respiratory program including selection, fit testing, training, maintenance and inspections in accordance with Provincial and Federal regulations.

Skin and Body Protection: Wear standard protective clothing – consider to select type of protective clothing depending on quantity of chemical to be handled.

*ACGIH – Occupational exposure limits – TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Crystalline
Color:	Straw colored
Odor:	None
Boiling Point:	Not applicable
Vapor Pressure:	Not applicable
Vapor Density:	Not applicable
pH:	4 to 5 (1% solution)
Solubility:	Partially in water
Evaporation Rate:	Not applicable
Flash Point:	Not flammable
Melting Point:	Not determined
Specific Gravity:	2
Viscosity:	Not applicable

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions
Conditions to Avoid:	Temperature extremes and moisture and static discharges
Materials to Avoid:	Contact with reducing agents (ex. Hydrazine, sulfites, sulfide, aluminum or magnesium dust) as they may generate heat, fires, explosions and/or toxic vapors.
Hazardous Polymerization:	Will not occur
Hazardous Decomposition Products:	None

Under Fire Conditions: Heating can release hazardous gases

11. TOXICOLOGICAL INFORMATION

Acute Oral Toxicity:
LD50/oral/rat: 600 mg/kg
LD50/dermal/rabbit: > 10 g/kg
LC50/inhlalation/8hr/rat: 520 mg/L (1 hr)
Sensitization: Not determined
Mutagenic Effects: Not determined
Reproductive Toxicity: Not determined
Carcinogenic Effects: None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).
Teratogenicity and Embryo Toxicity: No quantitative data available
Human Experience: Ingestion may cause gastrointestinal irritation, nausea, vomiting, and diarrhea.
Other Toxicity Information: Toxicological Synergistic products: none known.

12. ECOLOGICAL INFORMATION

LC50/96 hr/goldfish: No data available
EC50/48 hr/daphnia: No data available
EC50/72 hr/algae: No data available
IC50/17 hr/bacteria: No data available
Persistence and Degradability: Low persistence and no bioaccumulation expected. Material will float on water.
Mobility: The environmental fate was estimated using a level III fugacity

model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models. If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate percentages:

Air @ < 5% Water @ 30 to 50% Soil/Sediment @ 50 to 70%

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package	Dispose of waste in an approved incinerator or waste treatment site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage. Empty containers should be recycled locally or taken away for waste disposal.

14. TRANSPORT INFORMATION

Typical proper shipping name for this product are as follows:

AMMONIUM PERSULPHATE	**CLASS 5.1**	**UN 1444**	**PKG GRP: III**

Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

SECONDARY NOTIFICATION CONDITIONS APPLY TO IMPORT INTO AUSTRALIA

CANADA: Workplace Hazardous Material Information System (WHMIS)
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and is a WHMIS controlled product.

WHMIS CLASSIFICATION:
C - Oxidizing Material
D2A – Materials causing other toxic effects – very toxic material
D2B – Materials causing other toxic effects – toxic material

Canadian Environmental Protection Act (CEPA): The substance(s) in this MSDS are included in or exempted from the Domestic Substance List (DSL)

National Pollutant Release Inventory (NPRI): This product does not contain any substances listed in Part 1A (Core Substances) of the NPRI at a concentration of one percent or more by weight.

Toxic Substances Control Act (TSCA): The substances in this MSDS are included in or exempted from the TSCA 8(b) Inventory (40 CFR 710)

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 2	Flammability: 0	Instability: 1	Other: n/a

HMIS

Health: 2	Flammability: 0	Instability: 1	Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning:	Oxidizer
Label Precautions:	May be irritating to eyes, nose, throat and lungs. Harmful if swallowed. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling. Store away from other oxidizers and reducing agents. Contact with combustible may cause a fire. May evolve oxides of nitrogen or sulfur under fire conditions.
Label First Aid:	Wash product off of skin or out of eyes. If swallowed, do not induce vomiting without medial advice. If conscious, washout mouth and give victim water to drink. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

ACF-144	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: ACF-144	Prepared by: HSE Dept
Date Issued: December 27, 2017	# & Version: 6-2.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	ACF-144
Product Purpose:	Water Foamer
Supplier Identification:	Australian Coil Services Pty Ltd 283 McDougall Street Toowoomba, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Danger

Primary Routes of Exposure: Eyes, and skin

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin corrosion/irritation (Category 2), H315
Serious eye damage/eye irritation (Category 2A), H319
Specific target organ toxicity – repeat exposure (Category 2) Kidney, H370

Hazard Statements:

H315 - Causes skin irritation
H319 - Causes serious eye irritation
H370 - Causes damage to organs

Precautionary Statements:

P260 - Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 - Wash skin thoroughly after handling.
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P303 + P361 + P353 + P312 - If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P311 - If exposed or concerned: Call a POISON CENTER or doctor/ physician.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: May cause irritation with prolonged contact or repeated exposure
Skin: May cause moderate irritation
Ingestion: Not a likely route of exposure. Large quantities may cause kidney damage.

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Ethoxylated C6-C10 Alcohol	68037-05-8	30 to 60
Ammonium Sulfate		
2-(2-butoxyethoxy)ethanol	112-34-5	10 to 30

Ethylene Glycol	107-21-1	1 to 5

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 15 minutes. Remove contact lenses if present and easy to do. Continue rinsing. Get medical attention immediately.

Skin Contact: Wash off immediately with plenty of water for at least 15 minutes. Use a mild soap if available. Get medical attention if irritation develops and persists.

Ingestion: Rinse mouth. Get medical attention if symptoms occur.

Inhalation: Remove to fresh air, treat symptomatically. If symptoms persist, seek medical advice.

5. FIRE FIGHTING MEASURES

Flash Point: No data available
Lower explosion Limit (LEL): No data available
Upper explosion Limit (UEL): No data available
Auto ignition temperature: No data available
Suitable Extinguishing Media: Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Fire and explosion Hazard: None.
Specific Methods: Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. In the event of fire and/or explosion do not breathe fumes.
Special Protective Equipment For Firefighters: Use personal protective equipment.
Specific Hazards: Not flammable or combustible.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Ensure adequate ventilation. Keep people away from and upwind of spill/leak. Avoid inhalation, ingestion and contact with skin and eyes. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. Ensure clean-up is conducted by trained personnel only. Refer to protective measures listed in sections 7 and 8.

Environmental Precautions: Do not allow contact with soil, surface or ground water.

Methods For Cleaning Up: Stop leak if safe to do so. Contain spillage, and then collect with noncombustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). For large spills, dike spilled material or otherwise contain material to ensure runoff does not reach a waterway. Flush away traces with water.

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

7. HANDLING AND STORAGE

Handling Precautions: Avoid contact with skin and eyes. Do not breathe dust/fume/gas/mist/vapours/spray. Do not get in eyes, on skin, or on clothing. Wash hands thoroughly after handling. Use only with

adequate ventilation.

Storage Precautions: Keep out of reach of children. Keep container tightly closed. Store in suitable labelled containers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: *This product does contain substances that have an established exposure limit.*

Engineering Measures: General ventilation is recommended. Maintain air concentrations below.

CAS	Chemical Name	ACGIH*
112-34-5	2-(2-butoxyethoxy)ethanol	10 ppm
107-21-1	Ethylene Glycol	100 mg/m3

Hygiene Recommendations: Keep an eye wash fountain and safety shower available

Eye Protection: Wear safety glasses with side shields

Hand Protection: Wear Neoprene or Nitrile or PVC or Rubber or Butyl gloves. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.

Respiratory Protection: Where concentrations in air may exceed the limits listed in this section, the use of a half face filter mask or supplied breathing apparatus is recommended.

Skin and Body Protection: Wear standard protective clothing.

*ACGIH – Occupational exposure limits – TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Form: Liquid
Color: Amber
Odor: Sweet

Boiling Point:	> 100 ^{O}C
Vapor Pressure:	4.1 kPa @ 37.8 ^{O}C
Vapor Density:	No data available
pH:	8.3 to 9.3
Solubility:	Soluble in water
Evaporation Rate:	No data available
Flash Point:	> 100 ^{O}C
Freezing Point:	Pour point: < -23 ^{O}C
Specific Gravity:	8.7-9.0 lb/gal
Viscosity:	@16 ^{O}C is 59 mm2/s

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions
Conditions to Avoid:	Freezing temperatures
Materials to Avoid:	Strong oxidizers and acids
Hazardous Polymerization:	Will not occur
Hazardous Decomposition Products:	Decomposition products may include the following materials: Carbon oxides nitrogen oxides (NOx) Sulphur oxides
Under Fire Conditions:	Heating can release hazardous gases

11. TOXICOLOGICAL INFORMATION

Acute Oral Toxicity:	2-(2-butoxyethoxy) ethanol	Ethoxylated C6-C10 Alcohol Ammonium Sulfate	Ethylene Glycol
LC50/inhalation:	Not classified due to data which are		

	conclusive although insufficient for classification		
LC50/dermal/4hr:	2,764 ppm, rabbit	8,000 mg/kg, rat	10,600 mg/kg, rat

Sensitization:	Not expected
Acute	Acute toxicity estimate: 3,737 mg/k
Mutagenic Effects:	Not determined
Reproductive Toxicity:	Not determined
Carcinogenic Effects:	Not determined
Teratogenicity and Embryo Toxicity:	Ethylene glycol has been shown to produce dose-related teratogenic effects in rats and mice when given by gavage or in drinking water at high concentrations. A mouse inhalation study of 1000 mg/m3 and 2500 mg/m3 showed malformations in the offspring

12. ECOLOGICAL INFORMATION

LC50/96 hr/goldfish:	No data available
EC50/48 hr/daphnia:	10-100mg/L
EC50/96 hr/algae:	6,500mg/L
IC50/17 hr/bacteria:	1,995mg/L
Persistence and Degradability:	This preparation or material is not expected to bioaccumulate.
Mobility:	The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models. If released into the environment this material is expected to

distribute to the air, water and soil/sediment in the approximate respective percentages;
Air: <5%
Water: 10 - 30%
Soil: 50 - 70%
The portion in water is expected to be soluble or dispersible.

13. DISPOSAL INFORMATION

Disposal Methods: The product should not be allowed to enter drains, water courses or the soil. Where possible recycling is preferred to disposal or incineration. If recycling is not practicable, dispose of in compliance with local regulations. Dispose of wastes in an approved waste disposal facility.

14. TRANSPORT INFORMATION

This product is not regulated (TDG, IATA, IMDG/IMO) during transport

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA):
The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).
National Pollutant Release Inventory (NPRI): This product contains the following substances listed in

Part 1A (Core Substances) of the NPRI at a concentration of one percent or more by weight.

Hazardous Substance	**CAS #**	**% (w/w)**
Ethylene Glycol	107-21-1	1 to 5

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 3* Flammability: 1 Instability: 0 Other: n/a

HMIS

Health: 2 Flammability: 3 Instability: 0 Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning:	DANGER.
Label Precautions:	May be irritating to eyes, and skin. Harmful if swallowed. Prolonged and/or repeated exposure through inhalation or extensive skin contact with EGBE may result in damage to the kidneys.
Label First Aid:	Wash product off of skin or out of eyes. If swallowed, do not induce vomiting without medial advice. If conscious, washout mouth and give victim water to drink. If irritation develops, seek medical attention.

ACF-144	

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: ACF-144	Prepared by: HSE Dept
Date Issued: December 27, 2017	# & Version: 6-2.0

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

ACF-147	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: ACF-147 — Prepared by: HSE Dept
Date Issued: September 29, 2020 — # & Version: 31-1.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	ACF-147
Product Purpose:	Water Foamer
Supplier Identification:	Australian Coil Services Pty Ltd 8-10 Moorebank Rd Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Warning

Primary Routes of Exposure: Eyes, and skin

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin corrosion/irritation (Category 2), H315
Serious eye damage/eye irritation (Category 2A), H319

Hazard Statements:	H315 - Causes skin irritation. H319 - Causes serious eye irritation.
Precautionary Statements:	P260 - Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.

P264 - Wash skin thoroughly after handling.
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P302 + P350 - If on skin (or hair): Wash with plenty of soap and water.
P305 + P351 + P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P311 - If exposed or concerned: Call a POISON CENTER or doctor/ physician.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Cocamidopropyl betaine	61789-40-0	10 to 30
2-Butoxyethanol	111-76-2	10 to 30

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 15 minutes. Remove contact lenses if present and easy to do. Continue rinsing. Get medical attention.

Skin Contact: Wash off immediately with plenty of water for at least 15 minutes. Use a mild soap if available. Get medical attention if irritation develops and persists.

Ingestion: Rinse mouth. Get medical attention if symptoms occur.

Inhalation: Remove to fresh air, treat symptomatically. If symptoms persist, seek medical advice.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Fire and explosion Hazard:	None known.
Specific Methods:	Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.
Special Protective Equipment For Firefighters:	Use personal protective equipment.
Specific Hazards:	Not flammable or combustible.
Hazardous combustion products:	Decomposition products may include the following materials: carbon oxides, nitrogen oxides.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Ensure clean-up is conducted by trained personnel only. Refer to protective measures listed in sections 7 and 8.
Environmental Precautions:	Do not allow contact with soil, surface or ground water.
Methods For Cleaning Up:	Stop leak if safe to do so. Contain spillage, and then collect with noncombustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). For large spills, dike spilled material or otherwise contain material to ensure runoff does not reach a waterway.
Disposal:	Dispose of contents/ container to an approved waste disposal plant.

7. HANDLING AND STORAGE

Handling Precautions: Avoid contact with skin and eyes. Wash hands thoroughly after handling.

Storage Precautions: Keep out of reach of children. Keep container tightly closed. Store in suitable labelled containers.

Suitable Material: Keep in properly labelled containers.

Unsuitable Material: Not determined.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: *This product does contain substances that have an established exposure limit.*

Chemical Name	CAS	Form of Exposure	Permissible Concentration	Basis
2-butoxyethanol	111-76-2	TWA	20 ppm 96.9 mg/m^3	AU OEL
		VLE	50 ppm 242 mg/m^3	AU OEL
		WES-TWA	25 ppm 121 mg/m^3	NZ OEL
		TWA	20 ppm	ACGIH
		TWA	5 ppm 24 mg/m^3	NIOSH REL
		TWA	50 ppm 240 mg/m^3	OSHA Z1

Engineering Measures: General ventilation is recommended. Maintain air concentrations below occupational exposure standards.

Hygiene Recommendations: Handle in accordance with good industrial hygiene and safety practice. Remove and wash contaminated clothing before re-use. Wash face, hands and any exposed skin thoroughly after handling.

Eye Protection:	Safety goggles with side shields
Hand Protection:	Wear protective gloves. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough – nitrile rubber or butyl rubber
Respiratory Protection:	No personal respiratory protective equipment normally required.
Skin and Body Protection:	Wear suitable protective clothing

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Liquid
Color:	Clear, colourless
Odor:	No data available
Boiling Point:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
pH:	6.0 – 7.0
Solubility:	No data available
Evaporation Rate:	No data available
Flash Point:	100 ^{O}C
Freezing Point:	No data available
Relative Density:	1.02 – 1.05 (20 ^{O}C)
Viscosity:	No data available

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions
Conditions to Avoid:	None known
Materials to Avoid:	None known
Hazardous Polymerization:	Will not occur

Hazardous Decomposition Products:	Decomposition products may include the following materials: Carbon oxides nitrogen oxides (NOx)

11. TOXICOLOGICAL INFORMATION

Potential Health Effects

Eyes:	Causes serious eye irritation
Skin:	Causes skin irritation
Ingestion:	Health injuries are not known or expected under normal use
Inhalation:	Health injuries are not known or expected under normal use
Chronic Exposure:	Health injuries are not known or expected under normal use

Experience with Human Exposure

Eye contact:	Redness, pain, irritation
Skin contact:	Redness, irritation
Ingestion:	No symptoms known or expected

Toxicity

Acute oral toxicity:	Estimate: > 2,000 mg/kg
Acute inhalation toxicity:	Estimate: > 20 mg/L Exposure time: 4 hr Test atmosphere: vapour
Acute dermal toxicity:	Estimate: > 2,000 mg/kg
Crcinogenicity:	No component of this product present at levels greater than or equal to .1% is identified as probable, possible, or confirmed human carcinogen by IARC
Reproductive Toxicity:	Not determined
Mutagenic Effects:	Contains no ingredient listed as a mutagen

Human Hazard Characterization

Based on our hazard characterization, the potential human hazard is: Moderate.

12. ECOLOGICAL INFORMATION

Environmental Effects: Harmful to aquatic life.

Product Toxicity to Fish: No data available
Product Toxicity to aquatic invertebrates: No data available
Product Toxicity to algae: No data available

Component Toxicity to Fish: Cocamidopropyl betaine
LC50 Fish: 2 mg/l
Exposure time: 96 hr
2-butoxyethanol
LC50: 1,474 mg/l
Exposure time: 96 hr

Component Toxicity to aquatic invertebrates: 2-butoxyethanol
EC50: 690 mg/l
Exposure time: 48 hr

Component Toxicity to algae: 2-butoxyethanol
EC50: 911 mg/l
Exposure time: 72 hr

Component Toxicity to bacteria: 2-butoxyethanol
EC50: 463 mg/l

Component Toxicity to Fish (chronic): 2-butoxyethanol
NOEC: > 100 mg/l
Exposure time: 21 days

Component Toxicity to aquatic invertebrates (chronic): 2-butoxyethanol
NOEC: > 100 mg/l
Exposure time: 21 days

Based on our hazard characterization, the potential environmental hazard is: Low

13. DISPOSAL INFORMATION

Disposal Methods: Where possible recycling is preferred to disposal or incineration. If recycling is not practicable, dispose of in compliance with local regulations. Dispose of wastes in an approved waste disposal facility.

Disposal Considerations: Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers.

14. TRANSPORT INFORMATION

Typical proper shipping name for this product are as follows:

PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Standard for the Uniform Scheduling of Medicines and Poisons: Schedule 6

Australian Industrial Chemical (Notification and Assessment) Act
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

16. OTHER INFORMATION

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

ACG-1412	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: ACG-1412	Prepared by: HSE Dept
Date Issued: December 27, 2017	# & Version: 31-2.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	ACG-1412
Product Purpose:	Water Gellant
Supplier Identification:	Australian Coil Services Pty Ltd 283 McDougall Street Toowoomba, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Warning

Primary Routes of Exposure: Eyes, and skin

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: May cause irritation with prolonged contact.
Skin: May cause irritation with prolonged contact.
Ingestion: Not a likely route of exposure. No adverse effect expected.

Inhalation: Repeated or prolonged exposure may irritate the respiratory tract.
Chronic: No adverse effect expected other than those mentioned above.

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight

This product is not regulated. None of the substances in this product are hazardous.

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 15 minutes. If symptoms persist seek medical advice.

Skin Contact: Remove contaminated clothing. Immediately wash off all chemicals with soap and copious amounts of water. Remove all contaminated clothing and footwear.

Ingestion: Do not induce vomiting without medical advice. If conscious, washout mouth and give person water to drink. Seek medical advice.

Inhalation: Remove to fresh air, treat symptomatically. If symptoms persist, seek medical advice.

5. FIRE FIGHTING MEASURES

Flash Point: 116 ^{O}C
Lower explosion Limit (LEL): Not available
Upper explosion Limit (UEL): Not available

Auto ignition temperature:	Not available
Suitable Extinguishing Media:	Water spray, foam, CO_2, dry chemical
Fire and explosion Hazard:	Not flammable or combustible under normal conditions
Specific Methods:	Cool tanks and containers with water spray. Do not flush into surface water or sanitary sewer system. Keep product and empty containers away from heat and ignition sources.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.
Specific Hazards:	Non-combustible. Heating can release hazardous gases.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Avoid contact with skin, eyes and clothing. Evacuate personnel to safe areas. Keep people away from and upwind of spill or leak. PPE: see section 8.
Environmental Precautions:	Do not contaminate surface water. Do not released into the environment. Prevent product from entering any drains. Do not flush product into surface water or sanitary sewer systems.
Methods For Cleaning Up:	Absorb any spill with an inert material such as sand or earth, and then place into an appropriate waste container. Remove soiled refuse and place in a suitable disposal container.
Disposal:	Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Handle wearing appropriate PPE as per section 8. Ensure adequate ventilation is available

Storage Precautions: Store according to Provincial and Federal regulations. Keep in a dry place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: *This product does not contain any substance that has an established exposure limit.*

Engineering Measures: General ventilation is recommended. Local Exhaust fan may be necessary when dust or mist is generated.

CAS	Chemical Name	ACGIH*
Not applicable	Not applicable	Not applicable

Hygiene Recommendations: Keep an eye wash fountain and safety shower available

Eye Protection: Wear safety glasses with side shields

Hand Protection: Wear Neoprene or Nitrile or PVC or Rubber or Butyl or Cloth gloves.

Respiratory Protection: Respiratory protection is not normally needed. Where concentrations are high (mist or dust) – the use of a half or a full-face mask or air breathing apparatus is recommended. A suitable filter material depends on the amount and type of chemicals being handled. Consider using multi-contaminant cartridge filter with particulate filter. In the event of an emergency or planned entry into unknown concentrations positive, full-face SCBA should be used. If respiratory protection is required, institute a complete respiratory program including selection, fit testing, training, maintenance and inspections in accordance with Provincial and Federal regulations.

Skin and Body Protection: Wear standard protective clothing – consider to select type of protective clothing depending on quantity of chemical to be handled.

*ACGIH – Occupational exposure limits – TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Liquid
Color:	Beige
Odor:	Hydrocarbon
Boiling Point:	Not determined
Vapor Pressure:	Not applicable
Vapor Density:	Not determined
Specific Gravity:	1.06 g/mL
pH:	6 to 8
Solubility:	Dispersible in water
Evaporation Rate:	Not applicable
Flash Point:	116 ^{O}C
Freezing Point:	-6.5 ^{O}C
Viscosity:	Not determined

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions
Conditions to Avoid:	None
Materials to Avoid:	Strong oxidizers
Hazardous Polymerization:	Will not occur
Hazardous Decomposition Products:	Fumes produced when heated may include oxides of carbon
Under Fire Conditions:	Heating can release hazardous gases.

11. TOXICOLOGICAL INFORMATION

Acute Oral Toxicity:	
LD50/oral/rat:	2.9 g/mg
LC50/inhlalation/8hr/rat:	No date available
Sensitization:	Not expected to be a sensitizer
Mutagenic Effects:	No data available
Reproductive Toxicity:	No data available
Carcinogenic Effects:	No data available
Teratogenicity and Embryo Toxicity:	No quantitative data available
Human Experience:	Ingestion may cause gastrointestinal irritation, nausea, vomiting, and diarrhea.
Other Toxicity Information:	Toxicological Synergistic products: none known.

12. ECOLOGICAL INFORMATION

No toxicity studies have been conducted on this product

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package	Dispose of waste in an approved incinerator or waste treatment site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage.

14. TRANSPORT INFORMATION

Typical proper shipping name for this product are as follows:

PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

CANADA: Workplace Hazardous Material Information System (WHMIS)
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and is not a WHMIS controlled product.
This section contains additional information that may have relevance to regulatory compliance. The information contained in this section id for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 0	Flammability: 0	Instability: 0	Other: n/a

HMIS

Health: 1	Flammability: 0	Instability: 0	Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning: Prolonged contact may cause irritation.
Label Precautions: Do not get in eyes, on skin or on clothing. Do not take internally and do not breathe dust. Wear suitable protective clothing.

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: ACG-1412	Prepared by: HSE Dept
Date Issued: December 27, 2017	# & Version: 31-2.0

Label First Aid: In case of contact with eyes or skin, wash with copious amounts of water for at least 15 minutes. If inhaled, not adverse affects expected. Seek medical attention if irritation develops.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

ACS-141	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: ACS-141	Prepared by: HSE Dept
Date Issued: December 27, 2017	# & Version: 94-2.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	ACS-141
Product Purpose:	Gellant
Supplier Identification:	Australian Coil Services Pty Ltd 283 McDougall Street Toowoomba, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Warning

Primary Routes of Exposure: Inhalation and skin

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Serious eye damage/eye irritation *(Category 1), H319*
Hazard Statements: H319 - Causes serious eye irritation
Precautionary Statements: None.
Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: Irritating
Skin: Irritating
Ingestion: No data available
Inhalation: Irritating
Chronic: No data available

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Polyethylene glycol diacrylate	26570-48-9	3 to 7

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 30 minutes. If symptoms persist seek medical advice.

Skin Contact: Remove contaminated clothing. Immediately wash off all material with soap and water. Get medical attention if irritation develops and persists.

Ingestion: Do not induce vomiting without medical advice. Seek medical advice.

Inhalation: No hazards which require special first aid measures. Cal physician if symptoms occur.

5. FIRE FIGHTING MEASURES

Flash Point: Does not flash.
Lower explosion Limit (LEL): Not available
Upper explosion Limit (UEL): Not available

Auto ignition temperature:	Not available
Suitable Extinguishing Media:	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Fire and explosion Hazard:	May evolve oxides of nitrogen and carbon under fire conditions.
Specific Methods:	Cool tanks and containers with water spray. Do not flush into surface water or sanitary sewer system. Keep product and empty containers away from heat and ignition sources.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.
Specific Hazards:	None.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Avoid contact with eyes.
Environmental Precautions:	Do not allow contact with soil, surface, or ground water.
Methods For Cleaning Up:	Soak up with inert absorbent material. Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water.
Disposal:	Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Handle wearing appropriate PPE as per section 8. Avoid contact with eyes.

Storage Precautions: Store according to Provincial and Federal regulations. Store in a cool, dry, well-ventilated area. Place away from incompatible materials. Keep containers in a dry, cool and well-ventilated place. Avoid acids, bases, oxidizing agents, reducing agents, initiators which may cause polymerization.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: None.

Engineering Measures: General ventilation is recommended. Local Exhaust fan may be necessary when mist is generated.

CAS	Chemical Name	ACGIH*	OSHA	IDLH
26570-48-9	Polyethylene glycol diacrylate	Not Available	Not Available	Not Available

Hygiene Recommendations: Keep an eye wash fountain and safety shower available.

Eye Protection: Wear safety glasses with side shields.

Hand Protection: Wear PVC, rubber or nitrile gloves.

Respiratory Protection: Not required except in case of aerosol formation.

Skin and Body Protection: Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.

*ACGIH – Occupational exposure limits – TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Form: Liquid

Color: Orange

Odor: Slight

Boiling Point:	> 100 ºC
Vapor Pressure:	2.3 kPa @ 20 ºC
Vapor Density:	~ 0.8 g/l
pH:	5-8
Solubility:	Soluble
Evaporation Rate:	Not Available
Flash Point:	Does not flash
Freezing Point:	< 0°C
Specific Gravity:	1.1 – 1.3
Viscosity:	Not Available

10. STABILITY AND REACTIVITY

Stability:	Stable under recommended storage conditions, polymerization initiated by free radicals, peroxides.
Conditions to Avoid:	Avoid extreme temperatures
Materials to Avoid:	Strong oxidizing or reducing agents, strong acids and bases, and polymerization initiators.
Hazardous Polymerization:	Will result in an exothermic reaction.
Hazardous Decomposition Products:	Oxides of nitrogen and carbon.
Under Fire Conditions:	Heating can release hazardous gases.

11. TOXICOLOGICAL INFORMATION

	Polyethylene glycol diacrylate
Acute Oral Toxicity:	No data available
LD50/oral/rat:	2,000 mg/kg
LC50/inhalation/4hr/rat:	No data available
LD50/dermal/4hr/rabbit:	2,000 mg/kg

Sensitization:	This product is not expected to be sensitizing.
Mutagenic Effects:	None.
Reproductive Toxicity:	None.
Carcinogenic Effects:	None.
Teratogenicity and Embryo Toxicity:	None. Non-toxic.
Human Experience:	High
Other Toxicity Information:	Toxicological Synergistic products: none known.

12. ECOLOGICAL INFORMATION

Ingredients	Ecotoxicity – Fish Species Data	Acute Crustaceans Toxicity	Ecotoxicity – Fresh water Algae
Polyethylene glycol diacrylate	LC50 > 100 mg/L 96 h (Fish)	EC50 > 100 mg/L 48 h (Daphnia)	EC50 1-10 mg/L 72 h (Algae)

Persistence and Degradability:	Material is readily biodegradable
Mobility:	Product is liquid and therefore readily mobile.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package	Dispose of waste in an approved incinerator or waste treatment site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage. Empty containers should be recycled locally or taken away for waste disposal.

14. TRANSPORT INFORMATION

Land Transport (ADG): Not classified.
Sea Transport (IMDG): Not classified.
Air Transport (IATA): Not classified.
Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Information on the product as supplied:

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING
Health: 2 Flammability: 0 Instability: 1 Other: n/a

HMIS
Health: 2 Flammability: 0 Instability: 1 Other: n/a
0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning: Warning
Label Precautions: Causes serious eye irritation.

Label First Aid: Wash product off of skin or out of eyes. If swallowed, do not

induce vomiting without medical advice. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

ACX-145	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: ACX-145	Prepared by: HSE Dept
Date Issued: March 11, 2020	# & Version: 10-2.2

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	ACX-145
Product Purpose:	Coupler
Supplier Identification:	Australian Coil Services Pty Ltd 8-10 Moorebank Rd Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Danger

Primary Routes of Exposure: Inhalation and skin

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Corrosive to metals (Category 1), H290
Acute toxicity, Oral (Category 4), H302
Skin corrosion/irritation (Sub-category 1A), H314
Serious eye damage/eye irritation (Category 1), H314
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

Reproductive toxicity (Category 1B), H360
Acute aquatic toxicity (Category 3), H402

Hazard Statements:
H290 - May be corrosive to metals
H302 - Harmful if swallowed
H314 - Causes severe skin burns and eye damage
H335 - May cause respiratory irritation
H360 - May damage fertility or the unborn child
H402 - Harmful to aquatic life

Precautionary Statements:
P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
P304 + P340 + P310 - If inhaled: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
P305 + P351 + P338 - In in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 - Call a POISON CENTER or doctor/ physician if you feel unwell.
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.
P501 - Dispose of contents/container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: Corrosive. May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness.
Skin: Corrosive. Initial contact may result in itching with increasing irritation if not removed. Causes severe skin irritation with tissue destruction. Prolonged contact and badly damaged skin may result in absorption causing redness and peeling of skin.
Ingestion: Maybe fatal if swallowed. Causes burns to the mouth, throat and stomach. Symptoms may include nausea, headache, and vomiting. Cardiac failure, pulmonary edema, and severe kidney damage may develop. Potassium carbonate is high caustic, and ingestion of either the granular or liquid forms will cause severe burning and pain in lips, mouth, tongue, throat and stomach.
Inhalation: Inhalation of mist may cause damage to nasal and respiratory passages. Inhalation of large amounts may cause nausea, vomiting and diarrhea. Irritation may lead to chemical pneumonitis and pulmonary edema.
Chronic: May cause asthma, lung diseases and skin diseases

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Potassium Carbonate	584-08-7	10 to 30
Boric Acid	10043-35-3	7 to 13
Potassium Hydroxide	1310-58-3	7 to 13

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the

	eyelids for at least 30 minutes. If symptoms persist seek medical advice.
Skin Contact:	Remove contaminated clothing. Immediately wash off all material with soap and copious amounts of water. Remove all contaminated clothing and footwear. Discard contaminated leather articles such as shoes and belt.
Ingestion:	Do not induce vomiting without medical advice. Seek medical advice.
Inhalation:	Remove to fresh air, treat symptomatically. If symptoms persist, seek medical advice. If person is not breathing and heart has stopped, begin performing cardiopulmonary resuscitation immediately.

5. FIRE FIGHTING MEASURES

Flash Point:	Not available
Lower explosion Limit (LEL):	Not available
Upper explosion Limit (UEL):	Not available
Auto ignition temperature:	Not available
Suitable Extinguishing Media:	Water fog or fine spray, carbon dioxide or dry chemical foam. Water spray or fog for larger fires is acceptable.
Fire and explosion Hazard:	May evolve oxides of nitrogen, potassium and carbon under fire conditions.
Specific Methods:	Cool tanks and containers with water spray. Do not flush into surface water or sanitary sewer system. Keep product and empty containers away from heat and ignition sources.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.
Specific Hazards:	Heating can release hazardous gases.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Avoid contact with skin, eyes and clothing. Evacuate personnel to safe areas. Keep people away from and upwind of spill or leak. PPE: see section 8.

Environmental Precautions: Do not contaminate surface water. Do not release into the environment. Prevent product from entering any drains. Do not flush product into surface water or sanitary sewer systems.

Methods For Cleaning Up: Sweep up and shovel and then place into an appropriate waste container. Remove soiled refuse and place in a suitable disposal container.

Disposal: Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Handle wearing appropriate PPE as per section 8. Ensure adequate ventilation is available to avoid breathing vapors. Avoid contact with eyes, skin and clothing. Do not ingest. Empty containers may contain product residues. Keep the containers closed when not in use. Protect against physical damage. Do not consume food, drink or smoke when handling this material. When mixing, slowly add to water to minimize heat generation and spattering.

Storage Precautions: Store according to Provincial and Federal regulations. Store in a cool, dry, well-ventilated area. Place away from incompatible materials. Keep containers tightly closed. Store at ambient temperatures. Tanks must be diked. Do not store near food, drugs or potable water supplies.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: *This product does contain substances that have an established exposure limit.*

Engineering Measures: General ventilation is recommended. Local Exhaust fan may be necessary when mist is generated.

CAS	Chemical Name	ACGIH*	OSHA	IDLH
584-08-7	Potassium Carbonate	Not Available	50 ppm Ceiling 125 mg/m³ Ceiling	Not Available
10043-35-3	Boric Acid	6 mg/m³ STEL 2 mg/m³ TLV-TWA	Not Available	Not Available
1310-58-3	Potassium Hydroxide	2 mg/m³ Ceiling	2 mg/m³ Ceiling	Not Available

Hygiene Recommendations: Keep an eye wash fountain and safety shower available

Eye Protection: Wear safety glasses with side shields or chemical goggles. Wear a face shield if splashing hazard exists.

Hand Protection: Wear PVC, rubber or nitrile gloves.

Respiratory Protection: If exposure exceeds occupational exposure limits, use an appropriate NIOSH-approved respirator. For most conditions, no respirator protection is needed; however, if handling at elevated temperatures without sufficient ventilation, use an approved air-purifying respirator. Organic vapor cartridge with a particulate pre-filter.

Skin and Body Protection: Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.

*ACGIH – Occupational exposure limits – TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Form: Liquid

Color: Clear to light brown

Odor: Characteristic

Boiling Point:	Not Available
Vapor Pressure:	Not Available
Vapor Density:	Not Available
pH:	>14
Solubility:	Soluble
Evaporation Rate:	Not Available
Flash Point:	Not Available
Freezing Point:	-20°C approx.
Specific Gravity:	1.35
Viscosity:	Not Available

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions.
Conditions to Avoid:	Avoid excessive heat, open flames and all ignition sources. Incompatible materials.
Materials to Avoid:	Strong oxidizing agents, strong acids and bases. Contact with reactive metals may produce flammable hydrogen gas.
Hazardous Polymerization:	Will not occur
Hazardous Decomposition Products:	Oxides of nitrogen, potassium and carbon.
Under Fire Conditions:	Heating can release hazardous gases

11. TOXICOLOGICAL INFORMATION

	Potassium Carbonate	**Boric Acid**	**Potassium Hydroxide**
Acute Oral Toxicity:	No data available	No data available	No data available
LD50/oral/rat:	1,870 mg/kg	2,660 mg/kg	214 mg/kg
LC50/inhalation/4hr/rat:	No data available	>0.16 mg/L in 4 hr	No data available
LD50/dermal/4hr/rabbit:	No data available	>2,000 mg/kg	No data available

Sensitization:	Possible and may cause allergic reaction
Mutagenic Effects:	Possible
Reproductive Toxicity:	Boric acid studies in rat, mouse and dog at high doses, have demonstrated effects on fertility and testes. Boric acid studies in rat, mouse, and rabbit demonstrate developmental effects on the fetus, including fetal weight loss and minor skeletal variations. The doses administered were many times in excess of those to which humans would normally be exposed
Carcinogenic Effects:	Boric acid is listed as A4 Carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).
Teratogenicity and Embryo Toxicity:	See information listed above in reproductive category.
Human Experience:	High
Other Toxicity Information:	Toxicological Synergistic products: none known.

12. ECOLOGICAL INFORMATION

Ingredients	**Ecotoxicity – Fish Species Data**	**Acute Crustaceans Toxicity**	**Ecotoxicity – Fresh water Algae**
Potassium Carbonate	LC50 = 63 mg/L 96 h (Rainbow Trout) LC 50 = 230 mg/L 96 h (Bluegill Sunfish)	EC50 = 430 mg/L 48 h (Daphnia Magna) EC50 = 200 mg/L 48 h (Daphnia Pulex)	Not available
Boric Acid	1,020 mg/L LC50 (Carassius auratus) 72 h flow through	Not available	Not available
Potassium Hydroxide	80 mg/L LC50 (Gambusia affinis) 96 h static	Not available	Not available

Persistence and Degradability: Material isn't readily biodegradable
Mobility: Product is liquid and therefore readily mobile.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package: Dispose of waste in an approved incinerator or waste treatment site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage. Empty containers should be recycled locally or taken away for waste disposal.

14. TRANSPORT INFORMATION

Typical proper shipping name for this product are as follows:

POTASSIUM HYDROXIDE, SOLUTION	CLASS 8	UN 1814	PKG GRP: II

Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

CANADA: Workplace Hazardous Material Information System (WHMIS)
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and is a WHMIS controlled product.

WHMIS CLASSIFICATION:
D1B – Toxic materials
D2A – Very toxic materials
E – Corrosive material

Canadian Environmental Protection Act (CEPA): The substance(s) in this MSDS are included in or exempted from the Domestic Substance List (DSL)

National Pollutant Release Inventory (NPRI): This product does not contain any substances listed in Part 1A (Core Substances) of the NPRI at a concentration of one percent or more by weight.

Toxic Substances Control Act (TSCA): The substances in this MSDS are included in or exempted from the TSCA 8(b) Inventory (40 CFR 710)

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 3	Flammability: 0	Instability: 1	Other: n/a

HMIS

Health: 3	Flammability: 0	Instability: 1	Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning:	Corrosive
Label Precautions:	Inhalation of mist may cause damage to nasal and respiratory passages. Inhalation of large amounts may cause nausea, vomiting and diarrhea. Irritation may lead to chemical pneumonitis and pulmonary edema. Corrosive. May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Corrosive. Initial contact may result in itching with increasing irritation if not removed. Causes severe skin irritation with tissue destruction. Prolonged contact and badly damaged skin may result in absorption causing redness and peeling of skin.
Label First Aid:	Wash product off skin or out of eyes. If swallowed, do not induce vomiting without medical advice. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

ACX-145	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: ACX-145	Prepared by: HSE Dept
Date Issued: December 27, 2017	# & Version: 94-2.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	ACX-145
Product Purpose:	Coupler
Supplier Identification:	Australian Coil Services Pty Ltd 283 McDougall Street Toowoomba, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Danger

Primary Routes of Exposure: Inhalation and skin

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Corrosive to metals (Category 1), H290
Acute toxicity, Oral (Category 4), H302
Skin corrosion/irritation (Sub-category 1A), H314
Serious eye damage/eye irritation (Category 1), H314

Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Reproductive toxicity (Category 1B), H360
Acute aquatic toxicity (Category 3), H402

Hazard Statements:

H290 - May be corrosive to metals
H302 - Harmful if swallowed
H314 - Causes severe skin burns and eye damage
H335 - May cause respiratory irritation
H360 - May damage fertility or the unborn child
H402 - Harmful to aquatic life

Precautionary Statements:

P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
P304 + P340 + P310 - If inhaled: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
P305 + P351 + P338 - In in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 - Call a POISON CENTER or doctor/ physician if you feel unwell.
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.

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

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: Corrosive. May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness.
Skin: Corrosive. Initial contact may result in itching with increasing irritation if not removed. Causes severe skin irritation with tissue destruction. Prolonged contact and badly damaged skin may result in absorption causing redness and peeling of skin.
Ingestion: Maybe fatal if swallowed. Causes burns to the mouth, throat and stomach. Symptoms may include nausea, headache, and vomiting. Cardiac failure, pulmonary edema, and severe kidney damage may develop. Potassium carbonate is high caustic, and ingestion of either the granular or liquid forms will cause severe burning and pain in lips, mouth, tongue, throat and stomach.
Inhalation: Inhalation of mist may cause damage to nasal and respiratory passages. Inhalation of large amounts may cause nausea, vomiting and diarrhea. Irritation may lead to chemical pneumonitis and pulmonary edema.
Chronic: May cause asthma, lung diseases and skin diseases

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Potassium Carbonate	584-08-7	10 to 30
Boric Acid	10043-35-3	7 to 13
Potassium Hydroxide	1310-58-3	7 to 13

4. FIRST AID MEASURES

Eye Contact:	Rinse eyes immediately with copious amounts of water and under the eyelids for at least 30 minutes. If symptoms persist seek medical advice.
Skin Contact:	Remove contaminated clothing. Immediately wash off all material with soap and copious amounts of water. Remove all contaminated clothing and footwear. Discard contaminated leather articles such as shoes and belt.
Ingestion:	Do not induce vomiting without medical advice. Seek medical advice.
Inhalation:	Remove to fresh air, treat symptomatically. If symptoms persist, seek medical advice. If person is not breathing and heart has stopped, begin performing cardiopulmonary resuscitation immediately.

5. FIRE FIGHTING MEASURES

Flash Point:	Not available
Lower explosion Limit (LEL):	Not available
Upper explosion Limit (UEL):	Not available
Auto ignition temperature:	Not available
Suitable Extinguishing Media:	Water fog or fine spray, carbon dioxide or dry chemical foam. Water spray or fog for larger fires is acceptable.
Fire and explosion Hazard:	May evolve oxides of nitrogen, potassium and carbon under fire conditions.
Specific Methods:	Cool tanks and containers with water spray. Do not flush into surface water or sanitary sewer system. Keep product and empty containers away from heat and ignition sources.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.
Specific Hazards:	Heating can release hazardous gases.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Avoid contact with skin, eyes and clothing. Evacuate personnel to safe areas. Keep people away from and upwind of spill or leak. PPE: see section 8.

Environmental Precautions: Do not contaminate surface water. Do not release into the environment. Prevent product from entering any drains. Do not flush product into surface water or sanitary sewer systems.

Methods For Cleaning Up: Sweep up and shovel and then place into an appropriate waste container. Remove soiled refuse and place in a suitable disposal container.

Disposal: Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Handle wearing appropriate PPE as per section 8. Ensure adequate ventilation is available to avoid breathing vapors. Avoid contact with eyes, skin and clothing. Do not ingest. Empty containers may contain product residues. Keep the containers closed when not in use. Protect against physical damage. Do not consume food, drink or smoke when handling this material. When mixing, slowly add to water to minimize heat generation and spattering.

Storage Precautions: Store according to Provincial and Federal regulations. Store in a cool, dry, well-ventilated area. Place away from incompatible materials. Keep containers tightly closed. Store at ambient temperatures. Tanks must be diked. Do not store near food, drugs or potable water supplies.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: *This product does contain substances that have an established exposure limit.*

Engineering Measures: General ventilation is recommended. Local Exhaust fan may be necessary when mist is generated.

CAS	Chemical Name	ACGIH*	OSHA	IDLH
584-08-7	Potassium Carbonate	Not Available	50 ppm Ceiling 125 mg/m³ Ceiling	Not Available
10043-35-3	Boric Acid	6 mg/m³ STEL 2 mg/m³ TLV-TWA	Not Available	Not Available
1310-58-3	Potassium Hydroxide	2 mg/m³ Ceiling	2 mg/m³ Ceiling	Not Available

Hygiene Recommendations: Keep an eye wash fountain and safety shower available

Eye Protection: Wear safety glasses with side shields or chemical goggles. Wear a face shield if splashing hazard exists.

Hand Protection: Wear PVC, rubber or nitrile gloves.

Respiratory Protection: If exposure exceeds occupational exposure limits, use an appropriate NIOSH-approved respirator. For most conditions, no respirator protection is needed; however, if handling at elevated temperatures without sufficient ventilation, use an approved air-purifying respirator. Organic vapor cartridge with a particulate pre-filter.

Skin and Body Protection: Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.

*ACGIH – Occupational exposure limits – TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Liquid
Color:	Clear to light brown
Odor:	Characteristic
Boiling Point:	Not Available
Vapor Pressure:	Not Available
Vapor Density:	Not Available
pH:	>14
Solubility:	Soluble
Evaporation Rate:	Not Available
Flash Point:	Not Available
Freezing Point:	-20°C approx.
Specific Gravity:	1.35
Viscosity:	Not Available

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions.
Conditions to Avoid:	Avoid excessive heat, open flames and all ignition sources. Incompatible materials.
Materials to Avoid:	Strong oxidizing agents, strong acids and bases. Contact with reactive metals may produce flammable hydrogen gas.
Hazardous Polymerization:	Will not occur
Hazardous Decomposition Products:	Oxides of nitrogen, potassium and carbon.
Under Fire Conditions:	Heating can release hazardous gases

11. TOXICOLOGICAL INFORMATION

	Potassium Carbonate	Boric Acid	Potassium Hydroxide
Acute Oral Toxicity:	No data available	No data available	No data available
LD50/oral/rat:	1,870 mg/kg	2,660 mg/kg	214 mg/kg
LC50/inhalation/4hr/rat:	No data available	>0.16 mg/L in 4 hr	No data available
LD50/dermal/4hr/rabbit:	No data available	>2,000 mg/kg	No data available

Sensitization: Possible and may cause allergic reaction

Mutagenic Effects: Possible

Reproductive Toxicity: Boric acid studies in rat, mouse and dog at high doses, have demonstrated effects on fertility and testes. Boric acid studies in rat, mouse, and rabbit demonstrate developmental effects on the fetus, including fetal weight loss and minor skeletal variations. The doses administered were many times in excess of those to which humans would normally be exposed

Carcinogenic Effects: Boric acid is listed as A4 Carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

Teratogenicity and Embryo Toxicity: See information listed above in reproductive category.

Human Experience: High

Other Toxicity Information: Toxicological Synergistic products: none known.

12. ECOLOGICAL INFORMATION

Ingredients	Ecotoxicity – Fish Species Data	Acute Crustaceans Toxicity	Ecotoxicity – Fresh water Algae
Potassium Carbonate	LC50 63 mg/L 96 h (Rainbow Trout) LC 50 230 mg/L 96 h (Bluegill Sunfish)	EC50 430 mg/L 48 h (Daphnia Magna) EC50 200 mg/L 48 h (Daphnia Pulex)	Not available
Boric Acid	1,020 mg/L LC50 (Carassius auratus) 72 h flow through	Not available	Not available
Potassium Hydroxide	80 mg/L LC50 (Gambusia affinis) 96 h static	Not available	Not available

Persistence and Degradability: Material isn't readily biodegradable
Mobility: Product is liquid and therefore readily mobile.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package Dispose of waste in an approved incinerator or waste treatment site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage. Empty containers should be recycled locally or taken away for waste disposal.

14. TRANSPORT INFORMATION

Typical proper shipping name for this product are as follows:

POTASSIUM HYDROXIDE, SOLUTION	CLASS 8	UN 1814	PKG GRP: II

Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

CANADA: Workplace Hazardous Material Information System (WHMIS)
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and is a WHMIS controlled product.

WHMIS CLASSIFICATION:
D1B – Toxic materials
D2A – Very toxic materials
E – Corrosive material

Canadian Environmental Protection Act (CEPA): The substance(s) in this MSDS are included in or exempted from the Domestic Substance List (DSL)

National Pollutant Release Inventory (NPRI): This product does not contain any substances listed in Part 1A (Core Substances) of the NPRI at a concentration of one percent or more by weight.

Toxic Substances Control Act (TSCA): The substances in this MSDS are included in or exempted from the TSCA 8(b) Inventory (40 CFR 710)

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 3	Flammability: 0	Instability: 1	Other: n/a

HMIS

Health: 3	Flammability: 0	Instability: 1	Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning:	Corrosive
Label Precautions:	Inhalation of mist may cause damage to nasal and respiratory passages. Inhalation of large amounts may cause nausea, vomiting and diarrhea. Irritation may lead to chemical pneumonitis and pulmonary edema. Corrosive. May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Corrosive. Initial contact may result in itching with increasing irritation if not removed. Causes severe skin irritation with tissue destruction. Prolonged contact and badly damaged skin may result in absorption causing redness and peeling of skin.
Label First Aid:	Wash product off skin or out of eyes. If swallowed, do not induce vomiting without medical advice. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

HALLIBURTON

SAFETY DATA SHEET

ALDACIDE® G ANTIMICROBIAL

Revision Date: 13-Oct-2017 **Revision Number:** 2

1. Identification of the hazardous chemical and of the supplier

Product identifier

Product Name ALDACIDE® G ANTIMICROBIAL

Other means of identification

Hazardous Material Number: HB003462

Recommended use of the chemical and restrictions on use

Recommended Use Biocide

Supplier details

Halliburton Energy Service (M) Sdn Bhd
10th Floor, G Tower,
199 Jalan Tun Razak,
50400, Kuala Lumpur, Malaysia
Phone Number: +603-9206 6888

Halliburton Energy Service (M) Sdn Bhd
Labuan Base,
Ranca-Ranca Industrial Estate
Labuan FT, LAB 82223 Malaysia
Phone Number: +60 87-596 200 ext Gate B-886086263

Halliburton Energy Service (M) Sdn Bhd
Warehouse 38, Phase 2, Kemaman Supply Base (KSB)
24007, Kemaman
Terengganu, Malaysia
Phone Number : +609-862 8000

For further information, please contact

E-mail Address fdunexchem@halliburton.com

Emergency Phone number

+60 015 4 877 0772
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazard Identification

Classification of the hazardous chemical

Acute Oral Toxicity	Category 4 - H302
Acute inhalation toxicity - vapor	Category 3 - H331
Skin Corrosion / Irritation	Category 1 - H314
Serious Eye Damage/Irritation	Category 1 - H318
Respiratory Sensitization	Category 1 - H334
Skin Sensitization	Category 1 - H317
Acute Aquatic Toxicity	Category 1 - H400
Chronic Aquatic Toxicity	Category 3 - H412

Label Elements

Hazard Pictograms

Signal Word: **Danger**

Hazard Statements

H302 - Harmful if swallowed
H314 - Causes severe skin burns and eye damage
H317 - May cause an allergic skin reaction
H318 - Causes serious eye damage
H331 - Toxic if inhaled
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
H400 - Very toxic to aquatic life
H411 - Toxic to aquatic life with long lasting effects

Precautionary Statements

Prevention

P260 - Do not breathe dust/fume/gas/mist/vapors/spray
P264 - Wash face, hands and any exposed skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P271 - Use only outdoors or in a well-ventilated area
P272 - Contaminated work clothing should not be allowed out of the workplace
P273 - Avoid release to the environment
P280 - Wear protective gloves/eye protection/face protection
P285 - In case of inadequate ventilation wear respiratory 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 [or shower].
P363 - Wash contaminated clothing before reuse
P304 + P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P310 - Immediately call a POISON CENTER or doctor/physician
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P391 - Collect spillage

Storage

P405 - Store locked up

Disposal

P501 - Dispose of contents/container to an approved incineration plant

Contains Substances	**CAS Number**
Glutaraldehyde	111-30-8
Methanol	67-56-1

Other hazards which do not result in classification

This mixture contains no substance considered to be persistent, bioaccumulating nor toxic (PBT).
This mixture contains no substance considered to be very persistent nor very bioaccumulating (vPvB).

3. Composition and information on ingredients of the hazardous chemical

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Malaysia
Glutaraldehyde	111-30-8	10 - 30%	Met. Corr. 1 (H290) Acute Tox. 3 (H301)

			Acute Tox. 3 (H331) Skin Corr. 1B (H314) Eye Dam. 1 (H318) Resp. Sens. 1 (H334) Skin Sens. 1 (H317) Aquatic Acute 1 (H400) Aquatic Chronic 2 (H411)
Methanol	67-56-1	< 1%	Acute Tox. 3 (H301) Acute Tox. 3 (H311) Acute Tox. 3 (H331) Repr. 1 (H360) STOT SE 1 (H370) Flam. Liq. 2 (H225)

4. First aid measures

Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes Immediately flush eyes with large amounts of water for at least 30 minutes. Seek prompt medical attention.

Skin In case of contact, immediately flush skin with plenty of soap and water for at least 30 minutes and remove contaminated clothing, shoes and leather goods immediately. Get medical attention immediately.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Most important symptoms and effects, both acute and delayed

Causes severe eye irritation which may damage tissue. Causes severe skin irritation with tissue destruction. May cause allergic skin reaction. May cause allergic respiratory reaction. May cause respiratory irritation. Harmful if swallowed. Toxic if inhaled. Potential reproductive hazard. May cause birth defects.

Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable extinguishing media

Suitable Extinguishing Media

Water fog, carbon dioxide, foam, dry chemical.

Extinguishing media which must not be used for safety reasons

None known.

Physicochemical hazards arising from the chemical

Special exposure hazards in a fire

Decomposition in fire may produce harmful gases.

Special protective equipment and precautions for fire fighters

Special protective equipment for firefighters

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment. Ensure adequate ventilation. Avoid breathing vapors. Avoid contact with skin, eyes and clothing. Evacuate all persons from the area. Use only competent persons for cleanup.
See Section 8 for additional information

Environmental precautions

Prevent from entering sewers, waterways, or low areas.

Methods and material for containment and cleaning up
Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. Handling and storage

Precautions for safe handling
Use appropriate protective equipment. Ensure adequate ventilation. Avoid breathing vapors. Avoid breathing mist. Avoid contact with eyes, skin, or clothing. Wash hands after use. Launder contaminated clothing before reuse.
Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities
Store away from acids. Store away from alkalis. Store in a well ventilated area. Keep container closed when not in use. Store locked up. Product has a shelf life of 36 months.

8. Exposure controls and personal protection

Control parameters
Exposure Limits

Substances	CAS Number	Malaysia OEL	ACGIH TLV-TWA
Glutaraldehyde	111-30-8	Not applicable	Not applicable
Methanol	67-56-1	200 ppm	TWA: 200 ppm STEL: 250 ppm

Appropriate engineering controls
Engineering Controls Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation. If vapors are strong enough to be irritating to the nose or eyes, the TLV is probably being exceeded and special ventilation or respiratory protection maybe required.

Individual protection measures, such as personal protective equipment
Personal Protective Equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.
Respiratory Protection If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional.
Organic vapor respirator.

Hand Protection Use gloves which are suitable for the chemicals present in this product as well as other environmental factors in the workplace.
Skin Protection Wear impervious protective clothing, including boots, gloves, lab coat, apron, rain jacket, pants or coverall, as appropriate, to prevent skin contact.
Eye Protection Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions Eyewash fountains and safety showers must be easily accessible.
Environmental Exposure Controls Do not allow material to contaminate ground water system

9. Physical and chemical properties

Information on basic physical and chemical properties
Physical State: Liquid
Odor: Sharp
Color Clear light yellow
Odor Threshold: No information available

Property	Values	Remarks/ - Method
pH:	3.1-4.5	

Freezing Point / Range	(-5) - (-10) °C
Melting Point / Range	No data available
Boiling Point / Range	100.5 °C / 213 °F
Flash Point	No data available
Evaporation rate	0.9
Vapor Pressure	0.2 mmHg
Vapor Density	0.8
Specific Gravity	1.064
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	-0.333
Autoignition Temperature	> 275 °C / > 527 °F
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

Other information
VOC Content (%) No data available

10. Stability and reactivity

Reactivity
Not expected to be reactive.

Chemical stability
Stable

Possibility of hazardous reactions
Will Not Occur

Conditions to avoid
Keep away from heat, sparks and flame.

Incompatible materials
Strong acids. Strong alkalis.

Hazardous decomposition products
Carbon monoxide and carbon dioxide.

11. Toxicological information

Information on possible routes of exposure
Principle Route of Exposure Eye or skin contact, inhalation; Ingestion.

Symptoms related to exposure
Most Important Symptoms/Effects
Causes severe eye irritation which may damage tissue. Causes severe skin irritation with tissue destruction. May cause allergic skin reaction. May cause allergic respiratory reaction. May cause respiratory irritation. Harmful if swallowed. Toxic if inhaled. Potential reproductive hazard. May cause birth defects.

Numerical measures of toxicity

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Glutaraldehyde	111-30-8	50 mg/kg (Guinea Pig)	560 µL/kg (Rabbit)	0.28-0.5 mg/L (Rat) 4h
Methanol	67-56-1	300 mg/kg-bw (human) < 790 to 13,000 mg/kg (rat)	1000 mg/kg-bw (human) 17,100 mg/kg (rabbit)	10 mg/L (human, 4h, vapor)

Immediate, delayed and chronic health effects from exposure
Inhalation Toxic if inhaled. Causes severe respiratory irritation. May cause allergic respiratory

reaction. Inhalation of vapors may result in skin sensitization.

Eye Contact Causes severe eye irritation which may damage tissue.

Skin Contact Causes severe burns. May cause an allergic skin reaction.

Ingestion Harmful if swallowed. Causes burns of the mouth, throat and stomach.

Chronic Effects/Carcinogenicity Prolonged or repeated exposure can cause delayed kidney damage.

Exposure Levels
No data available

Interactive effects
Skin disorders. Lung disorders. Liver disorders.

Data limitations
No data available

Substances	CAS Number	Skin corrosion/irritation
Glutaraldehyde	111-30-8	Causes severe skin irritation with tissue destruction. (Rabbit)
Methanol	67-56-1	Non-irritating to the skin (Rabbit)

Substances	CAS Number	Serious eye damage/irritation
Glutaraldehyde	111-30-8	Causes severe eye irritation which may damage tissue. (Rabbit)
Methanol	67-56-1	Non-irritating to the eye (Rabbit)

Substances	CAS Number	Skin Sensitization
Glutaraldehyde	111-30-8	Skin sensitizer in guinea pig.
Methanol	67-56-1	Did not cause sensitization on laboratory animals (guinea pig)

Substances	CAS Number	Respiratory Sensitization
Glutaraldehyde	111-30-8	May cause sensitization by inhalation
Methanol	67-56-1	No information available

Substances	CAS Number	Mutagenic Effects
Glutaraldehyde	111-30-8	In vivo tests did not show mutagenic effects.
Methanol	67-56-1	The weight of evidence from available in vitro and in vivo studies indicates that this substance is not expected to be mutagenic.

Substances	CAS Number	Carcinogenic Effects
Glutaraldehyde	111-30-8	Did not show carcinogenic effects in animal experiments
Methanol	67-56-1	No data of sufficient quality are available.

Substances	CAS Number	Reproductive toxicity
Glutaraldehyde	111-30-8	Not a confirmed teratogen or embryotoxin.
Methanol	67-56-1	Experiments have shown reproductive toxicity effects on laboratory animals

Substances	CAS Number	STOT - single exposure
Glutaraldehyde	111-30-8	No information available
Methanol	67-56-1	May cause disorder and damage to the Central Nervous System (CNS)

Substances	CAS Number	STOT - repeated exposure
Glutaraldehyde	111-30-8	May cause disorder and damage to the Kidney
Methanol	67-56-1	No data of sufficient quality are available.

Substances	CAS Number	Aspiration hazard
Glutaraldehyde	111-30-8	Not applicable
Methanol	67-56-1	Not applicable

12. Ecological information

Ecotoxicity
12.1. Toxicity
Ecotoxicity effects

Very toxic to aquatic life. Harmful to aquatic life with long lasting effects.

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Glutaraldehyde	111-30-8	EC50(72h): 0.61 mg/L (Desmodesmus subspicatus) EC50(72h): 0.5 mg/L (Skeletonema costatum)	LC50(96h): 10 mg/L (Lepomis macrochirus) NOEC(97d): 1.6 mg/L (Oncorhynchus mykiss) LC50(96h): 3.5 mg/L (Oncorhynchus mykiss) LC50(96h): 60 mg/L (Scophthalmus maximus)	EC50 (17h) 6.65 mg/L (Pseudomonas putida)	EC50(48h): 0.35 mg/L (Daphnia magna) EC50(48h): 0.7 mg/L (Acartia tonsa) NOEC(21d): 0.13 mg/L (Daphnia magna) EC50(48h): 0.1 mg/L (Acartia tonsa)
Methanol	67-56-1	EC50 (96 h) =22000 mg/L (Pseudokirchnerella subcapitata) NOEC (8 d) =8000 mg/L (Scenedesmus quadricauda)	LC50 (96 h) =15400 mg/L (Lepomis macrochirus) EC50 (200 h) =14536 mg/L (Oryzias latipes)	IC50 (3h) > 1000 mg/L (activated sludge)	EC50 (96 h) =18260 mg/L (Dapnia magna) NOEC (21 d) =208 mg/L (Dapnia magna)

Persistence and degradability

Readily biodegradable

Substances	CAS Number	Persistence and Degradability
Glutaraldehyde	111-30-8	Readily biodegradable (75% @ 28d)
Methanol	67-56-1	Readily biodegradable (95% @ 20d)

Bioaccumulative potential

Does not bioaccumulate.

Substances	CAS Number	Log Pow
Glutaraldehyde	111-30-8	-0.36
Methanol	67-56-1	Not Bioaccumulative; BCF=1

Mobility in soil

Substances	CAS Number	Mobility
Glutaraldehyde	111-30-8	Potential for mobility in soil is high (Koc between 50 and 150). Given its very low Henry'sconstant (3.3E-08 atm*m3/mole; 25 °C Measured), volatilization from natural bodies of water or moist soil is not expected to be an important fate process.
Methanol	67-56-1	No information available

Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal considerations

Disposal methods

Disposal methods Disposal should be made in accordance with federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. Transportation information

Transportation Information

UN Number UN3265

UN proper shipping name: Corrosive Liquid, Acidic, Organic, N.O.S. (Contains Glutaraldehyde)

Transport Hazard Class(es): 8

Packing Group: II

Environmental Hazards: Marine Pollutant

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

Not applicable

Special precautions for user

None

HazChem Code
None Allocated

15. Regulatory information

International Agreements

Montreal Protocol - Ozone Depleting Substances:	Does not apply
Stockholm Convention - Persistent Organic Pollutants:	Does not apply
Rotterdam Convention - Prior Informed Consent:	Does not apply
Basel Convention - Hazardous Waste:	Does not apply

Safety, health, and environmental regulations specific for the hazardous chemcial

Malaysia Occupation Safety and Health - Prohibition of Use Substances:	Does not apply
Malaysia Substances Requiring Medical Surveillance:	Does not apply
Malaysia Environmentally Hazardous Substances (EHS):	One or more components listed.

16. Other information

Revision Date: 13-Oct-2017
Revision Note
SDS sections updated:
2

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID

Key or legend to abbreviations and acronyms used in the safety data sheet
bw – body weight
CAS – Chemical Abstracts Service
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
ErC50 – Effective Concentration growth rate 50%
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL0 – Lethal Loading 0%
LL50 – Lethal Loading 50%
MARPOL – International Convention for the Prevention of Pollution from Ships
mg/kg – milligram/kilogram
mg/L – milligram/liter
NIOSH – National Institute for Occupational Safety and Health
NOEC – No Observed Effect Concentration
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
PC – Chemical Product category
PEL – Permissible Exposure Limit
ppm – parts per million
PROC – Process category
STEL – Short Term Exposure Limit
h - hour
d - day

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all

conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

AUS DEX

COHO Resources

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

Product Identifier

Product name	AUS DEX
Synonyms	Not Available
Other means of identification	Not Available

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

Relevant identified uses	Drilling fluid additive.

Details of the supplier of the safety data sheet

Registered company name	**COHO Resources**
Address	3/35 Astor Terrace, Spring Hill QLD 4000, Australia
Telephone	+61 (7) 3870 0849
Website	www.cohoresources.com.au
Email	info@coho-resources.com

Emergency telephone number

Association / Organisation	**Chemwatch**
Emergency telephone numbers	1800 039 008
Other emergency telephone numbers	Not Available

CHEMWATCH EMERGENCY RESPONSE

Primary Number	Alternative Number 1	Alternative Number 2
1800 039 008	1800 039 008	+612 9186 1132

Once connected and if the message is not in your preferred language then please dial 01

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

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

CHEMWATCH HAZARD RATINGS

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

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

Poisons Schedule	Not Applicable
Classification	Not Applicable

Label elements

Hazard pictogram(s)	Not Applicable

SIGNAL WORD	NOT APPLICABLE

Hazard statement(s)

Not Applicable

Precautionary statement(s) General

P101	If medical advice is needed, have product container or label at hand.
P102	Keep out of reach of children.

Precautionary statement(s) Prevention

Not Applicable

Precautionary statement(s) Response

Not Applicable

Precautionary statement(s) Storage

Not Applicable

Precautionary statement(s) Disposal

Not Applicable

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
9005-25-8	>60	starch
		(modified)

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with eyes: Wash out immediately with water. If irritation continues, seek medical attention. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin contact occurs: Immediately remove all contaminated clothing, including footwear. Flush skin and hair with running water (and soap if available). Seek medical attention in event of irritation.
Inhalation	If dust is inhaled, remove from contaminated area. Encourage patient to blow nose to ensure clear passage of breathing. If irritation or discomfort persists seek medical attention.
Ingestion	Immediately give a glass of water. First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

- Water spray or fog.

- Foam.

Special hazards arising from the substrate or mixture

Fire Incompatibility	▸ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

Advice for firefighters

Fire Fighting	Alert Fire Brigade and tell them location and nature of hazard. Wear breathing apparatus plus protective gloves.
Fire/Explosion Hazard	Combustible solid which burns but propagates flame with difficulty; it is estimated that most organic dusts are combustible (circa 70%) - according to the circumstances under which the combustion process occurs, such materials may cause fires and / or dust explosions. Organic powders when finely divided over a range of concentrations regardless of particulate size or shape and suspended in air or some other oxidizing medium may form explosive dust-air mixtures and result in a fire or dust explosion (including secondary explosions). Combustion products include: carbon monoxide (CO) carbon dioxide (CO2) other pyrolysis products typical of burning organic material.
HAZCHEM	Not Applicable

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	Clean up all spills immediately. Avoid breathing dust and contact with skin and eyes.
Major Spills	Moderate hazard. **CAUTION**: Advise personnel in area.

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

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	Avoid all personal contact, including inhalation. Wear protective clothing when risk of exposure occurs.
Other information	Keep dry. Store under cover. Storage temperature: 15-25 deg C.

Conditions for safe storage, including any incompatibilities

Suitable container	Polyethylene or polypropylene container. Check all containers are clearly labelled and free from leaks.
Storage incompatibility	Avoid reaction with oxidising agents

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	starch	Starch	10 mg/m3	Not Available	Not Available	Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
starch	Thyodene; (Amylodextrin)	30 mg/m3	330 mg/m3	2,000 mg/m3

Ingredient	Original IDLH	Revised IDLH
starch	Not Available	Not Available

MATERIAL DATA

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
Personal protection	
Eye and face protection	Safety glasses with side shields. Chemical goggles.
Skin protection	See Hand protection below
Hands/feet protection	The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application. Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present. polychloroprene.
Body protection	See Other protection below
Other protection	Overalls. P.V.C.

Respiratory protection

Particulate. (AS/NZS 1716 & 1715, EN 143:2000 & 149:001, ANSI Z88 or national equivalent)

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 10 x ES	P1 Air-line*	- -	PAPR-P1 -
up to 50 x ES	Air-line**	P2	PAPR-P2
up to 100 x ES	-	P3	-
		Air-line*	-
100+ x ES	-	Air-line**	PAPR-P3

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

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	White to off-white granulate with a characteristic odour; soluble in water.

Physical state	Divided Solid	**Relative density (Water = 1)**	Not Available
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	>400
pH (as supplied)	Not Applicable	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	Not Available	**Viscosity (cSt)**	Not Applicable

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

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	Unstable in the presence of incompatible materials. Product is considered stable.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	The material is not thought to produce adverse health effects or irritation of the respiratory tract (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting. Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled. If prior damage to the circulatory or nervous systems has occurred or if kidney damage has been sustained, proper screenings should be conducted on individuals who may be exposed to further risk if handling and use of the material result in excessive exposures.
Ingestion	Starch has such a low oral acute toxicity that rats given 10-20% of their body weight, show only minimal effects. This may not be true of modified starches but given their use in foods as stabilisers and thickeners, there is probably little cause for concern.
Skin Contact	The material may produce mild skin irritation; limited evidence or practical experience suggests, that the material either: produces mild inflammation of the skin in a substantial number of individuals following direct contact, and/or produces significant, but mild, inflammation when applied to the healthy intact skin of animals (for up to four hours), such inflammation being present twenty-four hours or more after the end of the exposure period. Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (non allergic).
Eye	Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may cause transient discomfort characterised by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result.
Chronic	Principal routes of exposure are by accidental skin and eye contact and inhalation of generated dusts. Some workers may develop chronic occupational dermatitis (generally mild) through the handling of starch products. When starch is used as a lubricant in surgical gloves, small amounts, released into the patient during the course of surgery, have resulted in granulomas and peritonitis.

AUS DEX	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
starch	**TOXICITY**	**IRRITATION**
	Not Available	Skin (human): 0.3 mg/3d-I mild

Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

STARCH	The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling epidermis.

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

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

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

AUS DEX

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Available	Not Available	Not Available	Not Available	Not Available

starch

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Available	Not Available	Not Available	Not Available	Not Available

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

DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
	No Data available for all ingredients	No Data available for all ingredients

Bioaccumulative potential

Ingredient	Bioaccumulation
	No Data available for all ingredients

Mobility in soil

Ingredient	Mobility
	No Data available for all ingredients

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. ▸ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ▸ It may be necessary to collect all wash water for treatment before disposal.

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant	NO
HAZCHEM	Not Applicable

Land transport (DOT): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

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

Not Applicable

SECTION 15 REGULATORY INFORMATION

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

STARCH(9005-25-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Exposure Standards | Australia Inventory of Chemical Substances (AICS)

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

SECTION 16 OTHER INFORMATION

Revision Date	01/09/2019
Initial Date	Not Available

Other information

Ingredients with multiple CAS numbers

Name	CAS No
starch	9005-25-8, 65996-63-6, 68441-21-4, 9005-84-9

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

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

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average PC—
STEL: Permissible Concentration-Short Term Exposure Limit IARC:
International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level

LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **BARACARB® 1200**

Revision Date: 10-Apr-2018 **Revision Number:** 21

1. Identification

1.1. Product Identifier

Product Trade Name: BARACARB® 1200
Synonyms None
Chemical Family Mineral
Internal ID Code HM006496

1.2 Recommended use and restrictions on use

Application Bridging Agent
Uses advised against No information available

1.3 Manufacturer's Name and Contact Details

Halliburton Energy Services, Inc.
645 - 7th Ave SW Suite 1800
Calgary, AB
T2P 4G8
Canada
Telephone: 1-403-231-9300

Manufacturer/Supplier
Baroid Fluid Services
Product Service Line of Halliburton Energy Services, Inc.
P.O. Box 1675
Houston, TX 77251
Telephone: (281) 871-4000

Prepared By Chemical Stewardship
Telephone: 1-281-871-6107
e-mail: fdunexchem@halliburton.com

1.4. Emergency telephone number

Emergency Telephone Number 1-866-519-4752 or 1-760-476-3962
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazard Identification

2.1 Classification of the substance or mixture

Carcinogenicity	Category 1A - H350

2.2. Label Elements

Hazard Pictograms

Signal Word: Danger

Hazard Statements H350 - May cause cancer by inhalation

Precautionary Statements

Prevention P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P280 - Wear protective gloves/protective clothing/eye protection/face protection
Response P308 + P313 - IF exposed or concerned: Get medical advice/attention
Storage P405 - Store locked up
Disposal P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

2.3 Other hazards which do not result in classification

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Canada	HMIRA Registry Number	Filing Date	Decision Granted Date
Crystalline silica, quartz	14808-60-7	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)	Not applicable	Not applicable	Not applicable

The exact percentage (concentration) of the composition has been withheld as proprietary.

4. First aid measures

4.1. Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
Skin Wash with soap and water. Get medical attention if irritation persists.
Ingestion Under normal conditions, first aid procedures are not required.

4.2 Most important symptoms/effects, acute and delayed

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

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

Notes to Physician Treat symptomatically.

5. Fire-fighting measures

5.1. Extinguishing media

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons
None known.

5.2 Specific hazards arising from the substance or mixture
Special exposure hazards in a fire
None anticipated

5.3 Special protective equipment and precautions for fire-fighters
Special protective equipment for firefighters
Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Use appropriate protective equipment. Avoid creating and breathing dust. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.
See Section 8 for additional information

6.2. Environmental precautions
Prevent from entering sewers, waterways, or low areas.

6.3. Methods and material for containment and cleaning up
Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. Handling and Storage

7.1. Precautions for safe handling
Handling Precautions
Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust. This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.
Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities
Storage Information
Store away from acids. Store in a cool, dry location. Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container. Product has a shelf life of 60 months.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Crystalline silica, quartz	14808-60-7	TWA: 50 µg/m³	TWA: 0.025 mg/m³

8.2 Appropriate engineering controls
Engineering Controls Use in a well ventilated area. Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

8.3 Individual protection measures, such as personal protective equipment
Personal Protective Equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be

	determined by an industrial hygienist or other qualified professional based on the specific application of this product.
Respiratory Protection	Wear a NIOSH certified, European Standard EN 149 (FFP2/FFP3), AS/NZS 1715, or equivalent respirator when using this product.
Hand Protection	Normal work gloves.
Skin Protection	Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.
Eye Protection	Wear safety glasses or goggles to protect against exposure.
Other Precautions	None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Solid Powder	**Color**	White
Odor:	Odorless	**Odor Threshold:**	No information available

Property Remarks/ - Method	Values
pH:	8-9
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	2.7
Water Solubility	Insoluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%)	No data available

10. Stability and Reactivity

10.1. Reactivity

Not expected to be reactive.

10.2. Chemical stability

Stable

10.3. Possibility of hazardous reactions

Will Not Occur

10.4. Conditions to avoid

None anticipated

10.5. Incompatible materials

Strong acids.

10.6. Hazardous decomposition products

Carbon monoxide and carbon dioxide. Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

11. Toxicological Information

11.1 Information on likely routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

11.2 Symptoms related to the physical, chemical and toxicological characteristics

Acute Toxicity

Inhalation Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).

Eye Contact May cause mechanical irritation to eye.

Skin Contact None known.

Ingestion None known.

Chronic Effects/Carcinogenicity Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2). There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

11.3 Toxicity data

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Crystalline silica, quartz	14808-60-7	> 15000 mg/kg (human)	No data available	No data available

Substances	CAS Number	Skin corrosion/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin

Substances	CAS Number	Serious eye damage/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the eye

Substances	CAS Number	Skin Sensitization
Crystalline silica, quartz	14808-60-7	No information available.

Substances	CAS Number	Respiratory Sensitization
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	Mutagenic Effects
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
Crystalline silica, quartz	14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure.

Substances	CAS Number	Reproductive toxicity
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	STOT - single exposure
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Crystalline silica, quartz	14808-60-7	Not applicable

12. Ecological Information

12.1. Toxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Crystalline silica, quartz	14808-60-7	EC50 (72 h) =440 mg/L (Selenastrum capricornutum)(similar substance)	LL0 (96 h) =10000 mg/L (Danio rerio)(similar substance)	No information available	LL50 (24 h) >10000 mg/L (Daphnia magna)(similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Crystalline silica, quartz	14808-60-7	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Crystalline silica, quartz	14808-60-7	No information available

12.5 Other adverse effects
No information available

13. Disposal Considerations

13.1. Waste treatment methods

Disposal methods Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations. Contaminated packaging may be disposed of by: rendering packaging incapable of containing any substance, or treating packaging to remove residual contents, or treating packaging to make sure the residual contents are no longer hazardous, or by disposing of packaging into commercial waste collection.

14. Transport Information

Canadian TDG

UN Number Not restricted
UN proper shipping name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

US DOT

UN Number Not restricted
UN proper shipping name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

IMDG/IMO

UN Number Not restricted
UN proper shipping name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

IATA/ICAO

UN Number Not restricted
UN proper shipping name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable
Special Precautions for User None

15. Regulatory Information

Canadian Regulations

Canadian Domestic Substances List (DSL) All components listed on inventory or are exempt.

US Regulations

US TSCA Inventory All components listed on inventory or are exempt.

TSCA Significant New Use Rules - S5A2

Substances	CAS Number	TSCA Significant New Use Rules - S5A2
Crystalline silica, quartz	14808-60-7	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Crystalline silica, quartz	14808-60-7	Not applicable

EPA SARA (311,312) Hazard Class

Carcinogenicity

EPA SARA (313) Chemicals

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Crystalline silica, quartz	14808-60-7	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Crystalline silica, quartz	14808-60-7	Not applicable

EPA RCRA Hazardous Waste Classification

If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMIS Ratings: Health 1*, Flammability 0, Physical Hazard 0

16. Other information

Preparation Information

Prepared By Chemical Stewardship
Telephone: 1-281-871-6107
e-mail: fdunexchem@halliburton.com

Revision Date: 10-Apr-2018

Reason for Revision SDS sections updated:
2

Additional information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

Key or legend to abbreviations and acronyms used in the safety data sheet

bw – body weight
CAS – Chemical Abstracts Service
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter

NIOSH – National Institute for Occupational Safety and Health
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
UN – United Nations
h - hour
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
w/w - weight/weight
d - day

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name:
BARAZAN® D

Revision Date:
16-Jun-2016

Revision Number:
23

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product Identifier

Product Trade Name:
BARAZAN® D
Synonyms
None
Chemical Family:
Polysaccharide
Internal ID Code
HM003534

Recommended use and restrictions on use
Application:
Viscosifier
Uses advised against
No information available

Manufacturer's Name and Contact Details
Manufacturer/Supplier
Halliburton Energy Services
10/F West Tower, World Financial Centre No. 1 E 3Rd Ring Middle Rd Chaoyang District
Beijing
010
China
100020
Telephone Number
+8601059247105

Additional Information

Prepared By
Chemical Stewardship
Telephone: 1-281-871-6107
e-mail: fdunexchem@halliburton.com

Emergency Telephone Number
+86 4001 2001 74

2. HAZARDS IDENTIFICATION

Classification

Not classified

Hazard Pictograms

Signal Word

Not Classified

Hazard Statements
Not Hazardous

Precautionary Statements

Prevention
None
Response
None
Storage
None
Disposal
None

Contains

Substances	**CAS Number**
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA

Additional Information
This substance is not considered to be persistent, bioaccumulating nor toxic (PBT).
This substance is not considered to be very persistent nor very bioaccumulating (vPvB).

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	**CAS Number**	**PERCENT (w/w)**	**GHS Classification - China**
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Classified.

4. FIRST AID MEASURES

First-aid Measures
Inhalation
If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Skin
Wash with soap and water. Get medical attention if irritation persists.
Eyes
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
Ingestion
Under normal conditions, first aid procedures are not required.

Most important symptoms and effects, both acute and delayed
No significant hazards expected.

Indication of any immediate medical attention and special treatment needed
Notes to Physician
Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media
Suitable Extinguishing Media
Water fog, carbon dioxide, foam, dry chemical.
Extinguishing media which must not be used for safety reasons
None known.

Specific hazards arising from the chemical
Decomposition in fire may produce harmful gases. Organic dust in the presence of an ignition source can be explosive in high concentrations. Good housekeeping practices are required to minimize this potential.

Special protective actions for fire-fighters
Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures
Use appropriate protective equipment. Avoid creating and breathing dust. Avoid contact with skin, eyes and clothing. Ensure adequate ventilation.

Environmental Precautions
Prevent from entering sewers, waterways, or low areas.

Methods and material for containment and cleaning up
Scoop up and remove.

Additional Information
See Section 8 and 13 for additional information.

7. HANDLING AND STORAGE

Precautions for safe handling
Slippery when wet. Avoid creating or inhaling dust. Avoid contact with eyes, skin, or clothing. Ensure adequate ventilation. Wash hands after use. Launder contaminated clothing before reuse. Use appropriate protective equipment.

Conditions for safe storage, including any incompatibilities
Store away from oxidizers. Store in a cool, dry location. Product has a shelf life of 24 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
Exposure Limits

Substances	CAS Number	China	ACGIH TLV-TWA
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable	Not applicable

Appropriate engineering controls
Use in a well ventilated area.

Individual protection measures, such as personal protective equipment
If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.
Respiratory Protection
Not normally needed. But if significant exposures are possible then the following respirator is recommended:
Dust/mist respirator. (N95, P2/P3)
Hand Protection
Normal work gloves.
Skin Protection
Normal work coveralls.
Eye Protection
Wear safety glasses or goggles to protect against exposure.
Other Precautions

None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:
Powder
Color
White to off white
Odor:
Slight
Odor Threshold:
No information available
pH:
7 (1%)
Specific Gravity @ 20 C (Water=1):
1.6
Freezing Point/Range (°C):
No information available
Boiling Point/Range (C):
No information available
Flash Point/Range (°C):
No information available
Flash Point Method:
No information available
Flammability Limits in Air - Lower (%):
No information available
Flammability Limits in Air - Upper (%):
No information available
Autoignition Temperature (°C):
204
Evaporation Rate (Butyl Acetate=1):
No information available
Vapor Pressure @ 20 C (mmHg):
No information available
Vapor Density (Air=1):
No information available
Water Solubility
Soluble in water
Decomposition Temperature (C):
No information available
Viscosity, Dynamic @ 20 C (centipoise):
No information available
Viscosity, Kinematic @ 20 C (centistokes):
No information available
Partition Coefficient/n-Octanol/Water:
No information available
Molecular Weight (g/mole):
1,000,000

10. STABILITY AND REACTIVITY

Reactivity
Not expected to be reactive.

Chemical Stability
Stable

Possibility of hazardous reactions
Will Not Occur

Conditions to Avoid
None anticipated

Incompatible materials
Strong oxidizers.

Hazardous decomposition products
Carbon monoxide and carbon dioxide.

Additional Guidelines
Not Applicable

11. TOXICOLOGICAL INFORMATION

Information on Toxicological Effects
Acute Toxicity

Inhalation
May impede respiration.
Eye Contact
May cause mechanical irritation to eye.
Skin Contact
None known.
Ingestion
None known.

Chronic Effects/Carcinogenicity
No data available to indicate product or components present at greater than 0.1% are chronic health hazards.

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No data available	No data available	No data available

12. ECOLOGICAL INFORMATION

Toxicity

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Contains no hazardous substances in concentrations	NA	No information available	No information available	No information available	No information available

above cut-off values according to the competent authority					

Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

Bioaccumlation potential

Substances	CAS Number	Log Pow
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

Mobility in soil

Substances	CAS Number	Mobility
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

Other adverse effects
No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods
Disposal methods
Bury in a licensed landfill according to federal, state, and local regulations.
Contaminated Packaging
Follow all applicable national or local regulations.
Other Information
No information available

14. TRANSPORT INFORMATION

UN Number
Not restricted

UN proper shipping name:
Not restricted

Transport Hazard Class(es):
Not applicable

Packing Group:
Not applicable

Environmental Hazards:
Not applicable

Special Precautions for User
None

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable

15. REGULATORY INFORMATION

Regulatory Information
Chinese Inventory:
All components listed on inventory or are exempt.

16. OTHER INFORMATION

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID

Revision Date:
16-Jun-2016
Revision Note
SDS sections updated: 2

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

SAFETY DATA SHEET

Blended Cement

Section 1: Identification of the Material and Supplier

Company Details

Cement Australia Pty Limited

ABN 75 104 053 474

18 Station Avenue
Darra, Queensland 4076

Tel: 1300 CEMENT (1300 236 368)
Fax: 1800 CEMENT (1800 236 368)
Website: www.cementaustralia.com.au

Emergency Contact Number:

Contact Person: Technical Manager
Telephone: 1300 CEMENT (1300 236 368 - Business Hours) or
Poisons Information Centre 13 11 26

Manufacturing Plants

Gladstone:	Landing Rd, Fisherman's Landing, Gladstone QLD 4680
Brisbane:	77 Pamela St, Pinkenba QLD 4008
Railton:	Cement Works Rd, Railton, TAS 7305
Port Kembla	Off Christy Rd, Port Kembla, NSW 2505

Terminals

Glebe:	Sommerville Rd, Glebe Island, NSW 2037
Clyde:	Highgate St. Auburn, NSW 2144
Melbourne:	Currajong St. West Footscray, VIC 3012
Townsville:	Benwell Rd, Townsville Port Townsville, QLD 4810
Bulwer:	77 Pamela St, Pinkenba QLD 4008
Gladstone:	Landing Rd, Fisherman's Landing, Gladstone QLD 4680
Newcastle:	Highgate Street, Auburn NSW 2144

Product

Name: **Blended Cement**

Other Names:
General Purpose Blended Cement
Low Heat Cement
Shrinkage Limited (SL)
Sulphate Resisting Cement

Use:
Blended Cement is used as a binder in concrete, concrete masonry, mortar and grouts. It is also used in the manufacture of fibre cement products, in soil stabilisation in building construction and civil engineering projects.

Blended Cements can contain various proportions of pozzolans depending on the use case. This SDS covers all blends and incorporates a GHS Hazard identification for the blend with the highest proportion of materials requiring the highest hazard rating. This SDS reflects the handling of Cement Powder in bulk or bagged form. Adding water to Cement changes the properties and the SDS for the listed use cases above should be referenced.

Section 2: Hazards Identification

Hazardous Substance. Non-dangerous Goods

Serious Eye Damage / Eye Irritation: Category 2A
Skin Corrosion/Irritation: Category 2
Specific Target Organ Systemic Toxicity (Single Exposure): Category 3 *
Specific Target Organ Systemic Toxicity (Repeated Exposure): Category 2

DANGER

Hazard statement(s)

H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H373	May cause damage to organs through prolonged or repeated exposure.

Prevention statement(s)

P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/protective clothing/eye protection/face protection rated for Dust.
P260 + P261	Avoid/Do not breathe dust. Cement can become easily airborne.

Response statement(s)

P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P332 + P313	If skin irritation occurs: Get medical advice/attention.
P304 + P340 + P305	IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
P351 + P338 P337 + P313	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
P314 + P312	Call a POISON CENTER or doctor/physician/medical treatment if you feel unwell.
P321	Specific treatment is advised - see first aid instructions.
P362	Take off contaminated clothing and wash before re-use.

Storage statement(s)

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

Disposal statement(s)

P501	Dispose of contents/container in accordance with relevant regulations.

* Specific Target Organ Systemic Toxicity (Single Exposure): Category 3 relates to the addition of Fly ash in Blended Cement. Some Cement Blends contain no Fly ash; therefore, Crystalline Silica risk is not strictly applicable. However, the use of recommended PPE is still advised.

Section 3: Composition/Information on Ingredients

Blended Cement consists of a crystalline mass manufactured from substances mined from the earth's crust. It contains trace amounts of naturally occurring, metals such as chromium and nickel and crystalline silica. Blended Cements have up to 80% of added supplementary cementitious material (fly ash or ground granulated slag).

Chemical Entity	Proportion	CAS Number
Portland Cement Clinker	20-95%	65997-15-1
Ground Granulated Blast Furnace slag (where applicable)	8-80%	65996-69-2
Fly ash (where applicable)	8-50%	68131-74-8
Crystalline Silica (Quartz) in ash	<1 up to 10%	14808-60-7
Total respirable silica	Below reporting limits	14808-60-7
Gypsum ($CaSO_4$ $2H_2O$)	0-5%	10101-41-4
Calcium Oxide	0-3%	1305-78-8
Limestone ($CaCO_3$)	0-5%	1317-65-3
Hexavalent Chromium Cr (VI)	<10 ppm	18540-29-9

Section 4: First Aid Measures

Swallowed: Rinse mouth and lips with water. Do not induce vomiting. Give water to drink to dilute stomach contents. If symptoms persist, seek medical attention.

Eyes: Flush thoroughly with flowing water for 15 minutes to remove all traces. If symptoms such as irritation or redness persist, seek medical attention. If wet cement is splashed in the eye, always treat as above, and seek urgent medical attention.

Skin: Remove heavily contaminated clothing immediately. Wash off skin thoroughly with water.

Use a mild soap if available. Shower if necessary. Seek medical attention for persistent irritation or burning of the skin.

Inhaled: Remove to fresh air, away from dusty area. If symptoms persist, seek medical attention.

First Aid Facilities: Eye wash station. Washing facilities with running water.

Advice to Doctor: Treat symptomatically. Wet cement burns to skin or eye may result in corrosive caustic burns.

Ingestion of significant amounts of cement dry or wet is unlikely. Do not induce emesis or perform gastric lavage. Neutralization with acidic agents is not advised because of increased risks of exothermic burns. Water-mineral oil soaks may aid in removing hardened cement from the skin.

Ophthalmological opinion should be sought for ocular burns.

Section 5: Fire Fighting Measures

Fire/Explosion Hazard: Blended Cements are stable substances, compatible with most other building materials, will not decompose into hazardous by-products and do not polymerise

Hazchem Code: None allocated

Flammability: Not flammable

Extinguishing Media: None required

Hazards from Combustion Products: None

Special Protective Precautions and equipment for fire fighters: None required

Section 6: Accidental Release Measures

Spills: Spills are best cleaned up by vacuum device to avoid generating airborne dust.

Recommendations on Exposure Control and Personal Protection should be followed during spill clean-up.

Keep product out of storm water and sewer drains.

Wetting during clean-up will cause formation of setting cement.

Section 7: Handling and Storage

Handling: When supplied in bags these need to be handled in accordance with Hazardous Manual Tasks Code of Practice.

Storage: Protect from moisture to prevent hardening. Storage of cement may be in concrete silos, steel bins, or plastic lined multi-ply paper bags.

Section 8: Exposure Controls/Personal Protection

8.1 Control parameters

Exposure standards

Ingredient	Reference	TWA		STEL	
		ppm	mg/m³	ppm	mg/m³
Calcium carbonate (Limestone, Marble, Whiting)	SWA (AUS)	--	10	--	--
Calcium oxide	SWA (AUS)	--	2	--	--
Chromium (VI) compounds (as Cr)	SWA (AUS)	--	0.05	--	--
Gypsum (Calcium sulphate)	SWA (AUS)	--	10	--	--
Magnesium oxide (fume)	SWA (AUS)	--	10	--	--
Portland Cement	SWA (AUS)	--	10	--	--
Silica – Crystalline Quartz (respirable dust)	SWA (AUS)	--	0.05	--	--

8.2 Exposure controls

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

PPE

Eye / Face	Wear safety glasses or dust-proof goggles when handling material to avoid contact with eyes.
Hands	Wear PVC, rubber or cotton gloves when handling material to prevent skin contact.
Body	Wear long sleeved shirt and full-length trousers.
Respiratory	Where an inhalation risk exists wear a Class P1 (Particulate) respirator, dependent on a site-specific risk assessment.

Section 9: Physical and Chemical Properties

Appearance:	A fine powder ranging in colour from grey to off-white
Odour:	No distinctive odour
Boiling/Melting Point:	Melting point >1200ºC
Vapour Pressure:	Not applicable
Specific Gravity:	2.7 – 3.2
Flash Point:	Non applicable
Flammability Limits:	Not applicable
Solubility in Water:	Slight, reacts on mixing with water forming an alkaline (caustic) solution (pH >11)
Particle Size:	Up to 40% of the fresh dry material may be respirable (below 10 microns)

Section 10: Stability and Reactivity

Blended Cements are stable substances, compatible with most other building materials, will not decompose into hazardous by-products and do not polymerise.

Chemical Stability:	Chemically stable
Conditions to Avoid:	Keep free of moisture during storage
Incompatible Materials:	None
Hazardous Decomposition Products:	None
Hazardous Reactions:	None

Section 11: Toxicological Information

11.1 Information on toxicological effects

Acute toxicity	No known toxicity data is available for this product. Based on available data, the classification criteria are not met.
Skin	Irritating to the skin. Contact with powder or wetted form may result in irritation, rash and dermatitis.
Eye	Irritating to the eyes. Contact may result in irritation, lacrimation, pain, redness, corneal burns and possible permanent damage.
Sensitization	This product is not classified as a skin or respiratory sensitiser. However, some individuals may exhibit an allergic response upon exposure to cement, possibly due to trace amounts of chromium.
Mutagenicity	Insufficient data available to classify as a mutagen.
Carcinogenicity	This product may contain crystalline silica, when the blend contains Fly ash, which is classified as carcinogenic to humans (IARC Group 1). However, there is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis. Therefore, preventing the onset of silicosis will also reduce the cancer risk.
Reproductive	Insufficient data available to classify as a reproductive toxin.
STOT – single exposure	Irritating to the respiratory system. Over exposure may result in irritation of the nose and throat, with coughing. High level exposure may result in breathing difficulties.
STOT – repeated exposure	Repeated exposure to respirable silica may result in pulmonary fibrosis (silicosis). Silicosis is a fibronodular lung disease caused deposition in the lungs of fine respirable particles of crystalline silica. Principal symptoms of silicosis are coughing and breathlessness. In the wet state, the likelihood of an inhalation hazard is reduced.
Aspiration	This product is a solid and aspiration hazards are not expected to occur.

Section 12: Ecological Information

Ecotoxicity:	Product forms an alkaline slurry when mixed with water.
Persistence and Degradability:	Product is persistent and would have a low degradability.
Bio accumulative potential:	This product is not expected to bioaccumulate.
Mobility:	A low mobility would be expected in a landfill situation.

Section 13: Disposal Considerations

Blended Cement can be treated as a common waste for disposal or dumped into a landfill site, in accordance with local authority guidelines.

Keep material out of storm water and sewer drains.

Measures should be taken to prevent dust generation during disposal, and exposure and personal precautions should be observed (see above)

Section 14: Transport Information

Transportation is done in bulk or bag form by Ship, Rail and Road.

UN Number:	None allocated
Proper Shipping Name:	None allocated
Class and Subsidiary Risk:	None allocated
Packing Group:	None allocated
Special precautions for user:	Avoid generating and breathing dust
Hazchem Code:	None allocated

Section 15: Regulatory Information

Blended Cement is not classified as Dangerous Goods.

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

All chemicals listed on the Australian Inventory of Chemical Substances (AICS)

Section 16: Other Information

For further information on this product contact:

Telephone: 1300 CEMENT (1300 236 368 - Business Hours)
Facsimile: 1800 CEMENT (1800 236 368)

Previous Edition: 2014 – GHS Compliance edits made and supplementary compliance edits added.

Next Review Date for this MSDS: 31 December 2024.

Australian and New Zealand Standards:

AS 2161: Industrial Safety Gloves and Mittens (excluding electrical and medical gloves).

AS/NZ 1336: Recommended Practices for Occupational Eye Protection.

AS/NZS 1715: Selection, use and maintenance of respiratory protective devices.

AS/NZS 1716: Respiratory protective devices.

AS/NZS 4501: Occupational protective clothing.

Advice Note:

Cement Australia believes the information in this document to be accurate as at the date of preparation noted below, but, to the maximum extent permitted by law, Cement Australia accepts no responsibility for any loss or damage caused by any person acting or refraining from action because of this information.

The provision of this information should not be construed by anyone as a recommendation to use this product. No one should use any product in violation of any patent or other intellectual proprietary rights or in breach of any statute or regulation.

Users should rely on their own knowledge and inquiries and make their own determination as to the applicability of this information in relation to their particular purposes and specific circumstances. Each user should read this SDS and consider the information in the context of how the product will be handled and used in the workplace and in conjunction with other substances or products.

[END SDS]

HALLIBURTON

SAFETY DATA SHEET

CAUSTIC SODA

Revision Date: 01-Jun-2015 **Revision Number:** 29

1. Identification of the hazardous chemical and of the supplier

Product identifier

Product Name CAUSTIC SODA

Other means of identification

Product Code: HM003599

Recommended use of the chemical and restrictions on use

Recommended Use pH Control

Supplier details

Halliburton Energy Service (M) Sdn Bhd
10th Floor, G Tower,
199 Jalan Tun Razak,
50400, Kuala Lumpur, Malaysia
Phone Number: +603-9206 6888

Halliburton Energy Service (M) Sdn Bhd
Labuan Base,
Ranca-Ranca Industrial Estate
Labuan FT, LAB 82223 Malaysia
Phone Number: +60 87-596 200 ext Gate B-886086263

Halliburton Energy Service (M) Sdn Bhd
Warehouse 38, Phase 2, Kemaman Supply Base (KSB)
24007, Kemaman
Terengganu, Malaysia
Phone Number : +609-862 8000

For further information, please contact

E-Mail address: fdunexchem@halliburton.com

Emergency Phone number

+1 281 575 5000

2. Hazard Identification

Classification of the hazardous chemical

Skin Corrosion / Irritation	Category 1 - H314
Serious Eye Damage / Eye Irritation	Category 1 - H318

Label Elements

Hazard Pictograms

Signal Word **Danger**

Hazard Statements
H314 - Causes severe skin burns and eye damage
H318 - Causes serious eye damage

Precautionary Statements

Prevention
P260 - Do not breathe dust/fume/gas/mist/vapors/spray
P264 - Wash face, hands and any exposed skin thoroughly after handling
P280 - Wear protective gloves/eye protection/face protection

Response
P301 + P330 + P331 - IF SWALLOWED: rinse mouth. Do NOT induce vomiting
P303 + P361 + P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
P363 - Wash contaminated clothing before reuse
P304 + P340 - IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing
P310 - Immediately call a POISON CENTER or doctor/physician
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing

Storage
P405 - Store locked up

Disposal
P501 - Dispose of contents/container to an approved landfill

Contains

Substances	CAS Number
Sodium hydroxide	1310-73-2

Other hazards which do not result in classification
This substance is not considered to be persistent, bioaccumulating nor toxic (PBT)
This substance is not considered to be very persistent nor very bioaccumulating (vPvB).

3. Composition and information on ingredients of the hazardous chemical

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Malaysia
Sodium hydroxide	1310-73-2	> 60%	Metal Corr. 1 (H290) Skin Corr. 1A (H314) Eye Dam. 1 (H318) STOT SE 3 (H335)

4. First-aid measures

Description of first aid measures

Inhalation
If inhaled, move victim to fresh air and seek medical attention.

Eyes
Immediately flush eyes with large amounts of water for at least 30 minutes. Seek prompt medical attention.

Skin In case of contact, immediately flush skin with plenty of soap and water for at least 30 minutes and remove contaminated clothing, shoes and leather goods immediately. Get medical attention immediately.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Most important symptoms and effects, both acute and delayed

Causes severe skin burns and eye damage. May cause respiratory irritation. Causes severe skin irritation with tissue destruction. Causes severe eye irritation which may damage tissue.

Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable extinguishing media

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Physicochemical hazards arising from the chemical

Special Exposure Hazards

May form explosive mixtures with strong acids. Reaction with steel and certain other metals generates flammable hydrogen gas.

Special protective equipment and precautions for fire fighters

Special Protective Equipment for Fire-Fighters

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment. Avoid contact with skin, eyes and clothing. Avoid creating and breathing dust. Ensure adequate ventilation.

See Section 8 for additional information

Environmental precautions

Prevent from entering sewers, waterways, or low areas. Consult local authorities.

Methods and material for containment and cleaning up

Neutralize to pH of 6-8. Scoop up and remove.

7. Handling and storage

Precautions for safe handling

Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust. Ensure adequate ventilation. Launder contaminated clothing before reuse. Use appropriate protective equipment.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Store away from acids. Store in a cool, dry location. Store locked up.

8. Exposure controls and personal protection

Control parameters

Exposure Limits

Substances	CAS Number	Malaysia OEL	ACGIH TLV-TWA
Sodium hydroxide	1310-73-2	Not applicable	2 mg/M3

Appropriate engineering controls

Engineering Controls	Use in a well ventilated area. Localized ventilation should be used to control dust levels.

Individual protection measures, such as personal protective equipment

Personal Protective Equipment	If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.
Respiratory Protection	Wear a NIOSH certified, European Standard EN 149 (FFP2/FFP3), AS/NZS 1715, or equivalent respirator when using this product.
Hand Protection	Chemical-resistant protective gloves (EN 374) Suitable materials for longer, direct contact (recommended: protection index 6, corresponding to > 480 minutes permeation time as per EN 374): Nitrile gloves. Butyl rubber gloves. (>= 0.7 mm thickness) This information is based on literature references and on information provided by glove manufacturers, or is derived by analogy with similar substances. Please note that in practice the working life of chemical-resistant protective gloves may be considerably shorter than the permeation time determined in accordance with EN 374 as a result of the many influencing factors (e.g. temperature). If signs of wear and tear are noticed then the gloves should be replaced. Manufacturer's directions for use should be observed because of great diversity of types.
Skin Protection	Full protective chemical resistant clothing. Rubber boots.
Eye Protection	Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions	Eyewash fountains and safety showers must be easily accessible.
Environmental Exposure Controls	Do not allow material to contaminate ground water system

9. Physical and chemical properties

Information on basic physical and chemical properties

Physical State:	Solid	**Color:**	White to off white
Odor:	Odorless	**Odor Threshold:**	No information available

Property Remarks/ - Method	Values
pH:	14
Freezing Point/Range	No data available
Melting Point/Range	No data available
Boiling Point/Range	1390 °C / 2535 °F
Flash Point	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	2.13
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

Other information

Molecular Weight	40
VOC Content (%)	No data available

10. Stability and reactivity

Reactivity

Not expected to be reactive.

Chemical stability
Stable

Possibility of hazardous reactions
Will Not Occur

Conditions to avoid
None anticipated

Incompatible materials
Contact with acids. Peroxides. Halogenated compounds. Prolonged contact with aluminum, lead, or zinc may liberate flammable hydrogen.

Hazardous decomposition products
None known.

11. Toxicological information

Information on possible routes of exposure
Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure
Most Important Symptoms/Effects
Causes severe skin burns and eye damage. May cause respiratory irritation. Causes severe skin irritation with tissue destruction. Causes severe eye irritation which may damage tissue.

Numerical measures of toxicity

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium hydroxide	1310-73-2	No data available	1350 mg/kg (Rabbit)	No data available

Immediate, delayed and chronic health effects from exposure
Inhalation May cause respiratory irritation.
Eye Contact Causes serious eye damage.
Skin Contact Causes severe burns.
Ingestion Causes burns of the mouth, throat and stomach.

Chronic Effects/Carcinogenicity No data available to indicate product or components present at greater than 0.1% are chronic health hazards.

Exposure Levels
No data available

Interactive effects
Skin disorders.

Data limitations
No data available

Substances	CAS Number	Skin corrosion/irritation
Sodium hydroxide	1310-73-2	Causes severe burns

Substances	CAS Number	Eye damage/irritation
Sodium hydroxide	1310-73-2	Causes severe eye burns (Rabbit)

Substances	CAS Number	Skin Sensitization

Sodium hydroxide	1310-73-2	Did not cause sensitization on laboratory animals (guinea pig)

Substances	CAS Number	Respiratory Sensitization
Sodium hydroxide	1310-73-2	No information available

Substances	CAS Number	Mutagenic Effects
Sodium hydroxide	1310-73-2	Did not show mutagenic effects in animal experiments In vitro tests did not show mutagenic effects

Substances	CAS Number	Carcinogenic Effects
Sodium hydroxide	1310-73-2	No data of sufficient quality are available.

Substances	CAS Number	Reproductive toxicity
Sodium hydroxide	1310-73-2	No information available

Substances	CAS Number	STOT - single exposure
Sodium hydroxide	1310-73-2	May cause respiratory irritation.

Substances	CAS Number	STOT - repeated exposure
Sodium hydroxide	1310-73-2	No significant toxicity observed in animal studies at concentration requiring classification. Not applicable due to corrosivity of the substance.

Substances	CAS Number	Aspiration hazard
Sodium hydroxide	1310-73-2	Not applicable

12. Ecological information

Ecotoxicity

12.1. Toxicity

Ecotoxicity Effects

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Sodium hydroxide	1310-73-2	No information available	LC50 (96h) 125 mg/L (Gambusia affinis) LC50 (48h) 189 mg/L (Leuciscus melanotus) LC50 (24h) 145 mg/L (Poecilia reticulate)	No information available	EC50 (48h) 40.4 mg/L (Ceriodaphnia sp.)

Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Sodium hydroxide	1310-73-2	The methods for determining biodegradability are not applicable to inorganic substances.

Bioaccumulative potential

Substances	CAS Number	Log Pow
Sodium hydroxide	1310-73-2	No information available

Mobility in soil

Substances	CAS Number	Mobility
Sodium hydroxide	1310-73-2	No information available

Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal considerations

Disposal Method

Disposal Method Disposal should be made in accordance with federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations. Contaminated packaging may be disposed of by: rendering packaging incapable of containing any substance, or treating packaging to remove residual contents, or treating packaging to make sure the residual contents are no longer hazardous, or by disposing of packaging into commercial waste collection.

14. Transportation information

Transportation Information

UN Number: UN1823
UN Proper Shipping Name: Sodium Hydroxide, Solid
Transport Hazard Class(es): 8
Packing Group: II
Environmental Hazards: Not applicable

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:
Not applicable

Special precautions for user
None

HazChem Code
2R

15. Regulatory information

International agreements

Montreal Protocol - Ozone Depleting Substances: Does not apply
Stolkhom Convention - Persistent Organic Pollutants: Does not apply
Rotterdam Convention - Prior Informed Consent: Does not apply
Basel Convention - Hazardous Waste: Does not apply

Safety, health, and environmental regulations specific for the hazardous chemcial

Malaysia Occupation Safety and Health - Prohibition of Use Substances: Does not apply
Malaysia Substances Requiring Medical Surveillance: Does not apply
Malaysia Environmentally Hazardous Substances (EHS): One or more components listed.

16. Other information

Revision Date: 01-Jun-2015
Revision Note
Update to Format SECTION: 2

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID

Key or legend to abbreviations and acronyms
bw – body weight
CAS – Chemical Abstracts Service
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
ErC50 – Effective Concentration growth rate 50%
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL0 – Lethal Loading 0%
LL50 – Lethal Loading 50%
MARPOL – International Convention for the Prevention of Pollution from Ships
mg/kg – milligram/kilogram
mg/L – milligram/liter
NIOSH – National Institute for Occupational Safety and Health
NOEC – No Observed Effect Concentration
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
PC – Chemical Product category
PEL – Permissible Exposure Limit
ppm – parts per million
PROC – Process category
STEL – Short Term Exposure Limit
h - hour
d - day

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

CM102	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 011 - 587 - 353 - 2940 (24 Hrs)

Product Name: CM102	Prepared by: HSE Dept
Date Issued: March 15, 2019	# & Version: 20-1.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	CM102
Product Purpose:	Retarder
Supplier Identification:	Australian Coil Services Pty Ltd 8-14 Moorebank Rd Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word:	Warning
Primary Routes of Exposure:	Skin contact, ingestion

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin irritation (Category 2)
Eye irritation (Category 2A)

Hazard Statements:	H320, H315, H335 - May cause eye, skin and respiratory irritation. H303 – May be harmful if swallowed.
Precautionary Statements:	P202 – Do not handle until all safety precautions have been read and understood

P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 – IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
P340 – IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P305 + P351 + P338 – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing.
P312 - Call a POISON CENTER or doctor/ physician if you feel unwell.
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.
P501 - Dispose of contents/ container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC) or not covered by GHS – *none*

Acute Effects:

Eye: Irritating
Skin: Irritating
Ingestion: Gastro-intestinal irritation, nausea, vomiting and diarrhea.
Inhalation: Irritation of mucous membranes resulting in coughing, irritation of the eyes, headaches and dizziness, may affect central nervous system.
Chronic: No data available

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Organophosphates	1429-50-1	5 to 15
Water	7732-18-5	85 to 95

4. FIRST AID MEASURES

Eye Contact:	Rinse eyes immediately with copious amounts of water and under the eyelids for at least 15 minutes. If symptoms persist seek medical advice.
Skin Contact:	Remove contaminated clothing. Immediately wash off all material with soap and water. Get medical attention if irritation develops and persists.
Ingestion:	If swallowed, and the victim is conscious and alert, induce vomiting immediately, as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Inhalation:	Remove person to fresh air. If signs/symptoms persist continue get medical attention.

5. FIRE FIGHTING MEASURES

Flash Point:	Not available.
Lower explosion Limit (LEL):	Not available
Upper explosion Limit (UEL):	Not available
Auto ignition temperature:	Not available
Suitable Extinguishing Media:	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Fire and explosion Hazard:	Product is not expected to burn unless all the water is boiled away. Decomposition in fire may produce toxic gases.
Specific Methods:	Use water to cool exposed containers. Water stream directed into fire may cause frothing with subsequent spread of fire.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.
Specific Hazards:	None.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	No action should be taken involving any personal risk or without suitable training. Use appropriate protective equipment.
Environmental Precautions:	Do not allow contact with soil, surface, or ground water.
Emergency Procedures:	Prevent further leakage or spillage if safe to do so.
Methods For Cleaning Up:	Isolate spill and stop leak where safe. Sprinkle sand or other inert absorbent material onto spill, scoop up and remove. Wipe up further residue with a paper towel and place in container. Wash spill area with soap and water.
Disposal:	Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions:	Wash thoroughly after handling. Avoid contact with eyes, skin or clothing. Avoid breathing vapors or mist. Do not ingest. Do not expose container to heat, flame or ignition. Launder contaminated clothing before reuse.

Storage Precautions: Store according to Provincial and Federal regulations. Store in a cool, dry, well-ventilated area. Place away from incompatible materials. Keep containers in a dry, cool and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: No data available.
Engineering Measures: General ventilation is recommended. Local exhaust fan may be necessary when mist is generated.

CAS	Chemical Name	ACGIH*	OSHA	IDLH
1429-50-1	Organophosphates	Not Available	Not Available	Not Available

Hygiene Recommendations: Keep an eye wash fountain and safety shower available.
Eye Protection: Wear safety glasses with side shields.
Hand Protection: Wear PVC, rubber or nitrile gloves.
Respiratory Protection: Not required except in case of aerosol formation.
Skin and Body Protection: Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.

*ACGIH – Occupational exposure limits – TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Form: Liquid
Color: Red Brown
Odor: Bland
Boiling Point: Not determined.
Vapor Pressure: Not determined.
Vapor Density: Not determined.
pH: Not determined.

Solubility:	Soluble
Evaporation Rate:	Not determined.
Flash Point:	Not determined.
Freezing Point:	< -10°C
Specific Gravity:	1.05.
Viscosity:	Not determined.

10. STABILITY AND REACTIVITY

Stability:	Stable under recommended storage conditions.
Conditions to Avoid:	None anticipated.
Materials to Avoid:	Incompatible materials.
Hazardous Polymerization:	Will not occur.
Hazardous Decomposition Products:	Not applicable.
Under Fire Conditions:	Decomposition in fire may produce toxic gases.

11. TOXICOLOGICAL INFORMATION

	Organophosphates
Acute Oral Toxicity:	No data available
LD50/oral/rat:	No data available
LC50/inhalation/1hr/rat:	No data available
LD50/dermal/4hr/rabbit:	No data available
Carcinogenicity: *NOAEL/rat*	No data available
Reproductive toxicity: *NOAEL/rat:*	No data available
Prenatal development: *NOAEL/maternal toxicity/rat:* *NOAEL/developmental toxicity/rat:*	No data available

Sensitization: This product is not expected to be sensitizing.
Mutagenic Effects: No data available.
Reproductive Toxicity: No data available.
Carcinogenic Effects: No data available to indicate product or components present at greater than 1% are chronic health hazards.
Teratogenicity and Embryo Toxicity: No data available.
Other Toxicity Information: No data available.

12. ECOLOGICAL INFORMATION

Ingredients	Ecotoxicity – Fish Species Data	Acute Crustaceans Toxicity	Ecotoxicity – Fresh water Algae
Organophosphates	No data available.	No data available.	No data available.

Persistence and Degradability: No data available.
Mobility: No data available.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package Dispose of waste containers in accordance with all applicable regulations.

14. TRANSPORT INFORMATION

Land Transport (ADG): Not classified.
Sea Transport (IMDG): Not classified.
Air Transport (IATA): Not classified.
Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 1	Flammability: 0	Instability: 0	Other: n/a

HMIS

Health: 1	Flammability: 0	Instability: 0	Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning: Warning

Label Hazards:
H303 - May be harmful if swallowed
H320 - May cause eye irritation
H315 - May cause skin irritation
H335 - May cause respiratory irritation

Label Precautions:
P202 - Do not handle until all safety precautions have been read and understood.
P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.

P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing.
P305 + P351 + P338 - In in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 - Call a POISON CENTER or doctor/ physician if you feel unwell.
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.
P501 - Dispose of contents/ container to an approved waste disposal plant.

Label First Aid: Wash product off skin or out of eyes. If swallowed, induce vomiting with medical advice. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

CM200	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 011 - 587 - 353 - 2940 (24 Hrs)

Product Name: CM200	Prepared by: HSE Dept
Date Issued: March 11, 2019	# & Version: 16-1.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	CM200
Product Purpose:	Dispersant
Supplier Identification:	Australian Coil Services Pty Ltd 283 McDougall Street Toowoomba, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Warning

Primary Routes of Exposure: Skin contact, ingestion

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin irritation (Category 2)
Eye irritation (Category 2A)

Hazard Statements: H320, H315, H335 - May cause eye, skin and respiratory irritation.
H303 – May be harmful if swallowed.

Precautionary Statements:

P202 - Do not handle until all safety precautions have been read and understood.
P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing.
P305 + P351 + P338 - In in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 - Call a POISON CENTER or doctor/ physician if you feel unwell.
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.
P501 - Dispose of contents/ container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: Irritating
Skin: Irritating
Ingestion: May cause nausea and vomiting. No specific effects known.
Inhalation: Irritation of mucous membranes resulting in coughing, irritation of the eyes, headaches and dizziness, may affect central nervous system.
Chronic: No data available

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Sodium salt of polycarboxylate	62601-60-9	40
Water	7732-18-5	60

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 15 minutes. If symptoms persist seek medical advice.

Skin Contact: Remove contaminated clothing. Immediately wash off all material with soap and water. Get medical attention if irritation develops and persists.

Ingestion: If swallowed, under normal conditions, first aid procedures are not required. If symptoms develop, get medical attention immediately.

Inhalation: Remove person to fresh air. If signs/symptoms persist continue get medical attention.

5. FIRE FIGHTING MEASURES

Flash Point: Not available.
Lower explosion Limit (LEL): Not available
Upper explosion Limit (UEL): Not available
Auto ignition temperature: Not available
Suitable Extinguishing Media: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Fire and explosion Hazard: Product is not expected to burn unless all the water is boiled away. Decomposition in fire may produce toxic gases.
Specific Methods: Use water to cool exposed containers. Water stream directed into fire may cause frothing with subsequent spread of fire.
Special Protective Equipment Wear self-contained breathing apparatus for fire fighting if required.

For Firefighters:
Specific Hazards: None.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: No action should be taken involving any personal risk or without suitable training. Use appropriate protective equipment.

Environmental Precautions: Do not allow contact with soil, surface, or ground water.

Emergency Procedures: Prevent further leakage or spillage if safe to do so.

Methods For Cleaning Up: Isolate spill and stop leak where safe. Sprinkle sand or other inert absorbent material onto spill, scoop up and remove. Wipe up further residue with a paper towel and place in container. Wash spill area with soap and water.

Disposal: Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Wash thoroughly after handling. Avoid contact with eyes, skin or clothing. Avoid breathing vapors or mist. Do not ingest. Do not expose

container to heat, flame or ignition. Launder contaminated clothing before reuse.

Storage Precautions: Store according to Provincial and Federal regulations. Store in a cool, dry, well-ventilated area. Place away from incompatible materials. Keep containers in a dry, cool and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: No data available.
Engineering Measures: General ventilation is recommended. Local exhaust fan may be necessary when mist is generated.

CAS	Chemical Name	ACGIH*	OSHA	IDLH
62601-60-9	Sodium salt of polycarboxylate	Not Available	Not Available	Not Available

*ACGIH – Occupational Exposure limits – TWA

Hygiene Recommendations: Keep an eye wash fountain and safety shower available.
Eye Protection: Wear safety glasses with side shields.
Hand Protection: Wear PVC, rubber or nitrile gloves.
Respiratory Protection: Not required except in case of aerosol formation.
Skin and Body Protection: Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form: Liquid
Color: Slight Yellow
Odor: Aromatic (Slight)

Boiling Point:	Not determined.
Vapor Pressure:	Not determined.
Vapor Density:	Not determined.
pH:	8.0 (25°C, 50 g/L)
Solubility:	Miscible with water
Evaporation Rate:	Not determined.
Flash Point:	Not determined.
Freezing Point:	Not determined.
Specific Gravity:	1.1
Viscosity:	Not determined.

10. STABILITY AND REACTIVITY

Stability:	Stable under recommended storage conditions.
Conditions to Avoid:	No data available.
Materials to Avoid:	Strong acids
Hazardous Polymerization:	Will not occur.
Hazardous Decomposition Products:	Carbon oxides, sodium oxides
Under Fire Conditions:	Decomposition in fire may produce toxic gases.

11. TOXICOLOGICAL INFORMATION

Acute Oral Toxicity:	No data available
LD50/oral/rat:	No data available
LC50/inhalation/1hr/rat:	No data available
LD50/dermal/4hr/rabbit:	No data available
Carcinogenicity: *NOAEL/rat*	No data available

Reproductive toxicity: *NOAEL/rat:*	No data available
Prenatal development: *NOAEL/maternal toxicity/rat:* *NOAEL/developmental toxicity/rat:*	No data available

Sensitization: This product is not expected to be sensitizing.
Mutagenic Effects: No data available.
Reproductive Toxicity: No data available.
Carcinogenic Effects: No data available to indicate product or components present at greater than 1% are chronic health hazards.
Teratogenicity and Embryo Toxicity: No data available.
Other Toxicity Information: No data available.

12. ECOLOGICAL INFORMATION

Ingredients	**Ecotoxicity – Fish Species Data**	**Acute Crustaceans Toxicity**	**Ecotoxicity – Fresh water Algae**
Sodium salt of polycarboxylate	No data available.	No data available.	No data available.

Persistence and Degradability: No data available.
Mobility: No data available.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package Dispose of waste containers in accordance with all applicable regulations.

14. TRANSPORT INFORMATION

Land Transport (ADG): Not classified.
Sea Transport (IMDG): Not classified.
Air Transport (IATA): Not classified.
Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
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This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING
Health: 1 Flammability: 0 Instability: 0 Other: n/a

HMIS
Health: 1 Flammability: 0 Instability: 0 Other: n/a
0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning: Warning
Label Hazards: H320, H315, H335 - May cause eye, skin and respiratory irritation.
H303 – May be harmful if swallowed.
Label Precautions: P202 - Do not handle until all safety precautions have been read

and understood.
P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing.
P305 + P351 + P338 - In in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 - Call a POISON CENTER or doctor/ physician if you feel unwell.
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.
P501 - Dispose of contents/ container to an approved waste disposal plant.

Label First Aid: Wash product off skin or out of eyes. If swallowed, induce vomiting with medical advice. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

CM300

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: CM300 | Prepared by: HSE Dept
Date Issued: August 09, 2016 | # & Version: 6.1.1.1

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	CM300
Product Purpose:	Cementing Extender Solid
Supplier Identification:	Australian Coil Services Pty Ltd 8/14 Moorebank Road Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Classification of the substance or mixture

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

Poisons Schedule: Not Applicable
Classification: Carcinogenicity Category 1B, Specific target organ toxicity - repeated exposure Category 1

Label elements
Hazard pictogram(s):

Signal Word: DANGER
Hazard Statement(s):
H350 May cause cancer
H372 Causes damage to organs through prolonged or repeated exposure.

Precautionary Statement(s) Prevention:
P201 Obtain special instructions before use.
P260 Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.

Precautionary Statement(s) Response:

P308+P313 If exposed or concerned get medical advice/ attention.
P314 get medical advice/ attention if you feel unwell.

Precautionary Statement(s) Storage:

P405 Store locked up.

Precautionary Statement(s) Disposal:

P501 Dispose of contents/ container in accordance with local regulations.

3. PRODUCT COMPOSITION/INGREDIENTS

Substances
See section below for composition of Mixtures

Mixtures

Chemical Name	CAS #	% by Weight
Bentonite	1302-78-9	>98
3Silica Crystalline - quartz	14808-60-7	<1.5

4. FIRST AID MEASURES

Eye Contact: If this product comes in contact with the eyes: Wash out immediately with fresh running water. Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. Seek medical attention without delay; if pain persists or recurs seek medical attention. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: If skin or hair contact occurs: Flush skin and hair with running water (and soap if available). Seek medical attention in event of irritation.

Ingestion: Immediately give a glass of water. First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

Inhalation: If fumes or combustion products are inhaled remove from contaminated area. Lay patient down. Keep warm and rested.

Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. Transport to hospital, or doctor. If dust is inhaled, remove from contaminated area. Encourage patient to blow nose to ensure clear breathing passages. Ask patient to rinse mouth with water but to not drink water. Seek immediate medical attention.

Indication of any immediate medical attention and special treatment needs
Treat symptomatically.

5. FIRE FIGHTING MEASURES

Extinguishing Media:	There is no restriction on the type of extinguisher which may be used. Use extinguishing media suitable for surrounding area.
Special hazards arising from the substrate or mixture:	None known.
Fire Incompatibility:	Alert Fire Brigade and tell them location and nature of hazard. Wear breathing apparatus plus protective gloves in the event of a fire.
Fire/ Explosion Hazard:	Non-combustible. Not considered a significant fire risk, however containers may burn.
HAZCHEM	Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, protective equipment and emergency procedures:	See section 8.
Environmental Precautions:	See section 12.
Methods and materials for containment and cleaning up:	Minor Spills Clean up waste regularly and abnormal spills immediately. Avoid breathing dust and contact with skin and eyes. Major Spills Clear area of personnel and move upwind. Alert Fire

Brigade and tell them location and nature of hazard.

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

7. HANDLING AND STORAGE

Precautions for sale handling

Safe handling: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.

Other information: Store in original containers.
Keep containers securely sealed.

Conditions for safe storage, including any incompatibilities

Suitable container: Polyethylene or polypropylene container.
Check all containers are clearly labelled and free from leaks.

Storage incompatibility: Silicas:

- react with hydrofluoric acid to produce silicon tetrafluoride gas
- react with xenon hexafluoride to produce explosive xenon trioxide
- reacts exothermically with oxygen difluoride, and explosively with chlorine trifluoride (these halogenated materials are not commonplace industrial materials) and other fluorine-containing compounds
- may react with fluorine, chlorates
- are incompatible with strong oxidisers, manganese trioxide, chlorine trioxide, strong alkalis, metal oxides, concentrated orthophosphoric acid, vinyl acetate
- may react vigorously when heated with alkali carbonates.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIANT DATA

Source	*Ingredient*	*Material name*	*TWA*	*STEL*	*Peak*
Australian Exposure	Silica Crystalline -	Silica Crystalline -	0.1 mg/ m3	Not Available	Not Available

Standards quartz quartz

EMERGENCY LIMITS

Ingredient	*Material name*	*TEEL-1*	*TEEL-2*	*TEEL-3*
Bentonite	Calcium Chloride	30 mg/ m3	330 mg/ m3	2000 mg/ m3
Silica Crystalline - quartz	Silica, Crystalline-quartz; Silicon Dioxide	0.075 mg/ m3	33 mg/ m3	200 mg/ m3

Ingredient	*Original IDHL*	*Revised IDLH*
Bentonite	Not Available	Not Available
Silica Crystalline - quartz	N. E. mg/ m3 N.E. ppm	50 mg/ m3

MATERIAL DATA
Exposure controls

Appropriate engineering controls: Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.

Eye and face protection: Safety glasses with side shields.
Chemical goggles.
Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants.

Hand/ feet Protection: The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.
Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.

- polychloroprene.

Skin protection: See hand protection above.
Body protection: See Other protection below.
Other protection: Employees working with confirmed human carcinogens should be provided with, and be required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area. [AS/NZS ISO 6529:2006 or national equivalent] Employees engaged in handling operations involving carcinogens should be provided with and required to wear and use half-face filter-type respirators with filters for dusts, mists and fumes, or air purifying canisters or cartridges. Prior to each exit from an area containing confirmed human carcinogens, employees should be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers must be identified with suitable labels.
Overalls.
P.V.C.
Thermal hazards: Not Available.

Respiratory protection
Particulate. (AS/NZS 1716 & 1715, EN 143:2000 & 149:001, ANSI Z88 or national equivalent)
If inhalation risk above the TLV exists, wear approved dust respirator.
Use respirators with protection factors appropriate for the exposure level.

- Up to 5 X TLV, use valveless mask type; up to 10 X TLV, use 1/2 mask dust respirator.
- Up to 50 X TLV, use full face dust respirator or demand type C air supplied respirator.
- Up to 500 X TLV, use powered air-purifying dust respirator or a Type C pressure demand supplied-air respirator.
- Over 500 X TLV wear full-face self-contained breathing apparatus with positive pressure mode or a combination respirator with a Type C positive pressure supplied-air full-face respirator and an auxiliary self-contained breathing apparatus operated in pressure demand or other positive pressure mode.

- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory protection. These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on the basic physical and chemical properties

Appearance:	Grey/tan odourless solid powder, insoluble in water - forms a colloidal suspension.
Physical state:	Divided Solid
Odour:	Not Available
Odour Threshold:	Not Available
pH:	Not Applicable
Melting point/ freezing point:	Not Available
Initial boiling point and boiling range:	Not Applicable
Flash point:	Not Applicable
Evaporation Rate:	Not Applicable
Flammability (solid, gas):	Not Applicable
Upper explosion limit:	Not Applicable
Lower explosion limit:	Not Applicable
Vapour pressure:	Not Applicable
Water solubility:	Immiscible
Vapour density:	Not Applicable
Relative density:	2.4-2.6
Partition coefficient:	Not Available

Auto-ignition temperature:	Not Applicable
Decomposition temperature:	Not Available
Viscosity:	Not Applicable
Molecular weight:	Not Applicable
Taste:	Not Available
Explosive properties:	Not Available
Oxidising properties:	Not Available
Surface tension	Not Applicable
Volatile Component:	Not Applicable
Gas group:	Not Available
PH as a solution:	Not Applicable
VOC:	Not Applicable

10. STABILITY AND REACTIVITY

Reactivity:	See section 7.
Chemical stability:	Unstable in the presence of incompatible materials. Product is considered stable.
Possibility of hazardous reactions:	See section 7.
Conditions to avoid:	See section 7.
Incompatible materials:	See section 7.
Hazardous decomposition products:	See section 5.

11. TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled:	Inhalation of dusts, generated by the material during the course of normal handling, may be damaging to the health of the individual. Effects on lungs are significantly enhanced in the presence of respirable particles. Overexposure to respirable dust may produce wheezing, coughing and breathing difficulties leading to or symptomatic of impaired respiratory function.
Ingestion:	The material has NOT been classified by EC Directives or other

	classification systems as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence.
Skin Contact:	The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting. Open cuts, abraded or irritated skin should not be exposed to this material.
Eye:	Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may cause transient discomfort characterised by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result.
Chronic:	On the basis, primarily, of animal experiments, the material may be regarded as carcinogenic to humans. There is sufficient evidence to provide a strong presumption that human exposure to the material may result in cancer on the basis of: - appropriate long-term animal studies - other relevant information Toxic: danger of serious damage to health by prolonged exposure through inhalation. The health hazards associated with bentonite, kaolin, and common clay, which are commercially important clay products, as well as the related phyllosilicate minerals montmorillonite, kaolinite, and illite, have an extensive literature. Fibrous clay minerals, such as sepiolite, attapulgite, and zeolites, have a separate literature. Chronic symptoms produced by crystalline silicas included decreased vital lung capacity and chest infections. Lengthy exposure may cause silicosis a disabling form of pneumoconiosis which may lead to fibrosis, a scarring of the lining of the air sacs in the lung. Overexposure to respirable dust may cause coughing, wheezing, difficulty in breathing and impaired lung function. Chronic symptoms may include decreased vital lung capacity, chest infections Repeated exposures, in an occupational setting, to

	high levels of fine- divided dusts may produce a condition known as pneumoconiosis which is the lodgement of any inhaled dusts in the lung irrespective of the effect.
Bentonite Toxicity:	Dermal (rabbit) LD50: >2000 mg/kg[1] dermal (rat) LD50: >2000 mg/kg[1] Inhalation (rat) LC50: >200 mg/l1 hr[1] Inhalation (rat) LC50: 50 mg/l/4hr[1] Oral (rat) LD50: >2000 mg/kg[1] Oral (rat) LD50: >5000 mg/kg[1]
Bentonite Irritation:	Not Available
Silica Crystalline – quartz Toxicity:	Not Available
Silica Crystalline – quartz Irritation:	Not Available
Legend:	1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances.
Bentonite:	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. No significant acute toxicological data identified in literature search. for bentonite clays: Bentonite (CAS No. 1302-78-9) consists of a group of clays formed by crystallisation of vitreous volcanic ashes that were deposited in water. The expected acute oral toxicity of bentonite in humans is very low (LD50>15 g/kg).
Silica Crystalline – quartz:	WARNING: For inhalation exposure ONLY: This substance has been classified by the IARC as Group 1: CARCINOGENIC TO HUMANS The International Agency for Research on Cancer (IARC) has classified occupational exposures to respirable (<5 um) crystalline silica as being carcinogenic to humans. This classification is based on what IARC considered sufficient evidence from epidemiological studies of humans for the

carcinogenicity of inhaled silica in the forms of quartz and cristobalite.

12. ECOLOGICAL INFORMATION

Toxicity

Ingredient:	Bentonite
Endpoint:	LC50
Test Duration (HR):	96
Species:	Fish
Value:	19000 mg/L
Source:	4
Legend:	Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data.

DO NOT discharge into sewer or waterways.
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements.

Persistence and degradability
No data available for all ingredients.
Mobility in soil
No data available for all ingredients.
Bioaccumulative potential
No data available for all ingredients.

13. DISPOSAL INFORMATION

Waste treatment methods

Product/ Packaging disposal: Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area.
DO NOT allow wash water from cleaning or process equipment

to enter drains.
It may be necessary to collect all wash water for treatment before disposal.
Recycle wherever possible or consult manufacturer for recycling options.
Consult State Land Waste Management Authority for disposal.

14. TRANSPORT INFORMATION

Labels Required	
Marine Pollutant:	No
HAZCHEM:	Not Applicable
Land transport (ADG):	NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS
Air transport (ICAO-IATA/ DGR):	NOT REGULATED FOR TRANSPORTAT OF DANGEROUS GOODS
Sea Transport (IMDG/ GGVSee)	NOT REGULATED FOR TRANSPORTAT OF DANGEROUS GOODS
Transport in bulk according to Annex II MARPOL and the IBC code:	Not Applicable

15. REGULATORY INFORMATION

Safety, health and environmental regulations/ legislation specific for the substance or mixture
Bentonite (1302-78-9) is found on the following regulatory lists:
Australia Inventory of Chemical Substances (AICS)
Silica Crystalline – quartz (14808-60-7) is found on the following regulatory lists:
Australia Exposure Standards, Australia Hazardous Substances Information System – Consolidated Lists, Australia Inventory of Chemical Substances (AICS) and International Agency for Research on Cancer (IARC) – Agents Classified by the IARC Monographs.

National Inventory	*Status*
Australia – AICS	Yes
Canada – DSL	Yes
Canada – NDSL	No

China – IECSC	Yes
Europe – EINEC/ ELINCS/ NLP	Yes
Japan – ENCS	No
Korea – ENCS	Yes
New Zealand – NZIOC	Yes
Philippines – PICCS	Yes
USA – TSCA	Yes
Legend:	Yes = All ingredients are on the inventory No = Not determined or one or more ingredients are not on the inventory and are not exempt from listing (see specific ingredients in brackets)

16. OTHER INFORMATION

Ingredients with multiple CAS numbers
Name: Bentonite
CAS No: 1302-78-9, 11004-12-9, 10043-07-9, 115628-71-2, 12198-92-4, 12199-69-8, 135945-01-6, 37320-72-2, 52623-66-2, 850872-77-4, 67479-91-8, 89382-86-5, 90989-60-9, 85049-30-5, 97862-66-3, 84776-12-5, 70131-50-9, 90989-59-6
Name: Silica Crystalline - quartz
CAS No: 14808-60-7, 122304-48-7, 122304-49-8, 12425-26-2, 1317-79-9, 70594-95-5, 87347-84-0

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

Definitions and abbreviations

PC − TWA: Permissible Concentration-Time Weighted Average

PC − STEL: Permissible Concentration-Short Term Exposure Limit

IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit

TEEL: Temporary Emergency Exposure Limit。

IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL: No Observed Adverse Effect Level

LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index.

CM301	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 011 - 587 - 353 - 2940 (24 Hrs)

Product Name: CM301	Prepared by: HSE Dept
Date Issued: March 11, 2019	# & Version: 17-1.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	CM301
Product Purpose:	Extender
Supplier Identification:	Australian Coil Services Pty Ltd 8-14 Moorebank Rd Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: DANGER

Primary Routes of Exposure: Skin contact, Ingestion

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Serious Eye Damage/Eye Irritation (Category 1)
Skin Irritation/Corrosion (Category 2)
Ingestion (Category 4)

Hazard Statements:

H318 – Causes serious eye damage
H315 – Causes skin irritation
H302 – Harmful if swallowed.

Precautionary Statements:

P202 - Do not handle until all safety precautions have been read and understood.
P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing.
P305 + P351 + P338 - In in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 - Call a POISON CENTER or doctor/ physician if you feel unwell.
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.
P501 - Dispose of contents/ container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: Category 1 - Causes serious eye damage
Skin: Category 2 - Causes skin irritation.
Ingestion: Category 4 - Harmful if swallowed.
Inhalation: Irritation of mucous membranes resulting in coughing, irritation of the eyes, headaches and dizziness, may affect central

nervous system.
Carcinogenicity: Not classified as a carcinogen per GHS criteria. This product is not classified as a carcinogen by NTP, IARC or OSHA.
Chronic: No data available

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Sodium silicate	1344-09-8	40
Water	7732-18-5	60

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 15 minutes. If symptoms persist seek medical advice.

Skin Contact: Remove contaminated clothing. Immediately wash off all material with soap and water. Get medical attention if irritation develops and persists.

Ingestion: If swallowed, rinse mouth. Contact a Poison Center, or a doctor/physician, or get medical attention if you feel unwell.

Inhalation: Remove person to fresh air. If signs/symptoms persist continue get medical attention.

5. FIRE FIGHTING MEASURES

Flash Point: Not available.
Lower explosion Limit (LEL): Not available
Upper explosion Limit (UEL): Not available

Auto ignition temperature:	Not available
Suitable Extinguishing Media:	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Fire and explosion Hazard:	Product is not expected to burn unless all the water is boiled away.
Specific Methods:	Use water to cool exposed containers. Water stream directed into fire may cause frothing with subsequent spread of fire.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.
Specific Hazards:	None.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	No action should be taken involving any personal risk or without suitable training. Use appropriate protective equipment. Do not get in eyes, on skin or on clothing. Avoid breathing mist, vapor, or spray. Dries to form glass film which can easily cut skin. Spilled material may cause a slipping hazard. Wear appropriate personal protective equipment recommended in Section 8, Exposure Controls / Personal Protection, of the SDS.
Environmental Precautions:	Do not allow contact with soil, surface, or ground water. This material is alkaline and may raise the pH of surface waters with low buffering capacity. Keep out of water supplies and sewers. Releases should be

reported, if required, to appropriate agencies.

Emergency Procedures: Prevent further leakage or spillage if safe to do so.

Methods For Cleaning Up: Flush spill area with water, if appropriate. Liquid material may be removed with a vacuum truck. Shovel dried residue into suitable container. Recycle or dispose according to regulations.

Disposal: Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. Avoid breathing vapor, mist, or spray. Product shipped/handled hot can cause thermal burns. Use care when handling hot material. Do not eat, drink or smoke in areas where this material is used. Use appropriate personal protective equipment (PPE). See Section 8, Exposure Controls and Personal Protection, for additional information.

Storage Precautions: Store and handle in accordance with all current regulations and standards. Keep container tightly closed and properly labeled. Do not store in aluminum container or use aluminum fittings or transfer lines, as flammable hydrogen gas may be generated. Keep separated from incompatible substances (see below or Section 10 of the Safety Data Sheet).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: None. This product does not contain any components that have regulatory occupational exposure limits (OEL's) established.

Engineering Measures: General ventilation is recommended. Local exhaust fan may be necessary when mist is generated.

CAS	Chemical Name	ACGIH*	OSHA	IDLH
1344-09-8	Sodium silicate	Not Available	Not Available	Not Available

*ACGIH – Occupational Exposure limits – TWA

Hygiene Recommendations:	Keep an eye wash fountain and safety shower available.
Eye Protection:	Wear safety glasses with side shields.
Hand Protection:	Wear PVC, rubber or nitrile gloves.
Respiratory Protection:	Not required except in case of aerosol formation.
Skin and Body Protection:	Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Liquid
Color:	Colourless
Odor:	Odourless
Boiling Point:	The lowest known value is 100°C (212°F) (Water)
Vapor Pressure:	The highest known value is 17.535 mm of Hg (@ 20°C) (Water)
Vapor Density:	The highest known value is 0.62 (Air = 1) (Water)
pH:	11.4 - 12.9
Solubility:	Miscible with water
Evaporation Rate:	Not determined.
Flash Point:	Not determined.
Freezing Point:	Not determined.
Specific Gravity:	Weighted average: 1.375
Viscosity:	Not determined.

10. STABILITY AND REACTIVITY

Stability: Stable under recommended storage conditions.
Conditions to Avoid: No data available.
Materials to Avoid: Can generate heat when mixed with acids, Avoid prolonged contact with alkali sensitive metals such as: aluminum, brass, bronze, copper, lead, tin, zinc because flammable hydrogen gas can be generated.
Hazardous Polymerization: Will not occur
Hazardous Decomposition Products: None known

11. TOXICOLOGICAL INFORMATION

PRODUCT TOXICITY DATA: LIQUID SODIUM SILICATE

LD50 Oral	LD50 Dermal	LC50 Inhalation
1153 mg/kg (Rat)	4640 mg/kg (Rabbit)	No data available

COMPONENT TOXICITY DATA:
Note: The component toxicity data is populated by the LOLI database and may differ from the product toxicity data given.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium silicate 1344-09-8	1153 mg/kg (Rat)	-	-

Sensitization: This product is not expected to be sensitizing.
Mutagenic Effects: No data available.
Reproductive Toxicity: No data available.
Carcinogenic Effects: No data available to indicate product or components present at greater than 1% are chronic health hazards.

Teratogenicity and Embryo Toxicity: No data available.
Other Toxicity Information: No data available.

12. ECOLOGICAL INFORMATION

Aquatic Toxicity: This material has exhibited moderate toxicity to aquatic organisms

Ingredients	Ecotoxicity – Fish Species Data	Acute Crustaceans Toxicity	Ecotoxicity – Fresh water Algae
Sodium silicate	No data available.	No data available.	No data available.

Persistence and Degradability: This material is believed to persist in the environment. This material is inorganic and not subject to biodegradation.
Mobility: No data available.
Additional Ecological Information: This material has exhibited slight toxicity to terrestrial organisms.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package Dispose of waste containers in accordance with all applicable regulations.

14. TRANSPORT INFORMATION

Land Transport (ADG): Not classified.
Sea Transport (IMDG): Not classified.

Air Transport (IATA): Not classified.
Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING
Health: 3 Flammability: 0 Instability: 0 Other: n/a

HMIS
Health: 3 Flammability: 0 Instability: 0 Other: n/a
0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning: DANGER
Label Hazards: H318 – Causes serious eye damage
H315 – Causes skin irritation
H302 – Harmful if swallowed
Label Precautions: P202 - Do not handle until all safety precautions have been read and understood.
P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.

P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing.
P305 + P351 + P338 - In in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 - Call a POISON CENTER or doctor/ physician if you feel unwell.
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.
P501 - Dispose of contents/ container to an approved waste disposal plant.

Label First Aid: Wash product off skin or out of eyes. If swallowed, induce vomiting with medical advice. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

CM401	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 011 - 587 - 353 - 2940 (24 Hrs)

Product Name: CM401 — Prepared by: HSE Dept
Date Issued: March 15, 2019 — # & Version: 22-1.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	CM401
Product Purpose:	Antifoam
Supplier Identification:	Australian Coil Services Pty Ltd 8-14 Moorebank Rd Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: DANGER

Primary Routes of Exposure: Inhalation, skin contact, ingestion

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 4)
Acute toxicity (Inhalation) (Category 4)
Aspiration hazard (Category 1)

Hazard Statements:
H227 – Combustible liquid
H304 – May be fatal if swallowed and enters airways
H332 – Harmful if inhaled.

Precautionary Statements:
P202 – Do not handle until all safety precautions have been read and understood
P210 – Keep away from heat, hot surface, sparks, open flames and other ignition sources. - No smoking.
P261 – Avoid breathing dust/fume/gas/mist/vapors/spray.
P280 – Wear protective gloves/protective clothing/eye protection/face protection.
P301+P310 – IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P301+P330+P331 – IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CENTER or doctor/ physician.
P304+P312+P340+P341 – IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
P403 – Store in a well-ventilated place.
P501 – Dispose of contents/ container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:
Inhalation – Category 4
Carcinogenicity: Not classified as a carcinogen per GHS criteria. This product is not classified as a carcinogen by NTP, IARC or OSHA.
Chronic: No data available

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Straight Run Middle Distillate	64741-44-2	30 – 60
Hydrotreated Light Distillate (petroleum)	64742-47-8	10 – 30
Polypropylene Glycol	25322-69-4	5 – 10
Stearic Acid	57-11-4	5 – 10
1-Octanol	111-87-5	1 – 5
Ethoxylated Tall Oil	61791-00-2	1 – 5
1-Decanol	112-30-1	1 – 5
Paraffin Wax	8002-74-2	1 – 5

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 15 minutes. If symptoms persist seek medical advice.

Skin Contact: Remove contaminated clothing. Immediately wash off all material with soap and water. Get medical attention if symptoms develop.

Ingestion: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Aspiration hazard if swallowed - can enter lungs and cause damage. Get medical attention immediately.

Inhalation: Remove to fresh air. Treat symptomatically. Get medical attention.

Protection of first-aiders: In event of emergency assess the danger before taking action. Do not put yourself at risk of injury. If in doubt, contact emergency responders. Use personal protective equipment as required

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media: Foam
Carbon dioxide

	Dry powder Other extinguishing agent suitable for Class B fires. For large fires, use water spray or fog, thoroughly drenching the burning material.
Unsuitable extinguishing media:	High volume water jet/
Fire and explosion Hazard:	Fire Hazard Keep away from heat and sources of ignition. Flash back possible over considerable distance.
Specific Methods:	Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. In the event of fire and/or explosion do not breathe fumes.
Hazardous combustion products:	Decomposition products may include the following materials: Carbon oxides nitrogen oxides (NOx) Sulphur oxides. Oxides of phosphorus.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Ensure adequate ventilation. Remove all sources of ignition. Ensure clean-up is conducted by trained personnel only. Refer to protective measures listed in sections 7 and 8.
Environmental Precautions:	Do not allow contact with soil, surface, or ground water.
Emergency Procedures:	Prevent further leakage or spillage if safe to do so.
Methods For Cleaning Up:	Eliminate all ignition sources if safe to do so. Stop leak if safe to do so. Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). For large spills, dike spilled material or otherwise contain material to ensure runoff does not reach a waterway. Do not flush into surface water or sanitary sewer system.
Disposal:	Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions:	Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapours). Keep away from fire, sparks and heated surfaces. Do not breathe dust/fume/gas/mist/vapours/spray. Wash hands thoroughly after handling. Use only with adequate ventilation.
Storage Precautions:	Keep away from heat and sources of ignition. Keep away from oxidizing agents. Keep out of reach of children. Keep container tightly closed. Store in suitable labelled containers.
Suitable Material:	The following compatibility data is suggested based on similar product data and/or industry experience: Brass, Stainless Steel 304, Stainless Steel 316L, Plasite 4300, Plasite 7122, Mild steel, Fluoroelastomer, HDPE (high density polyethylene), Nylon, PVC, PTFE,

	Chlorosulfonated polyethylene rubber, Perfluoroelastomer, Epoxy phenolic resin, 100% phenolic resin liner.
Unsuitable material:	The following compatibility data is suggested based on similar product data and/or industry experience: Neoprene, EPDM, Nitrile, Polypropylene (rigid), Buna-N.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Measures: Effective exhaust ventilation system. Maintain air concentrations below occupational exposure standards.

Component	CAS-No.	Form of exposure	Permissible concentration	Basis
Hydrotreated Light Distillate (petroleum)	64742-47-8	TWA	500 ppm 2,000 mg/m^3	OSHA Z1
		TWA	200 mg/m^3 (as total hydrocarbon vapour)	ACGIH
		TWA (Mist)	5 mg/m^3	OSHA Z1
		TWA (Mist)	5 mg/m^3	NIOSH REL
		STEL (Mist)	10 mg/m^3	NIOSH REL
Polypropylene Glycol	25322-69-4	TWA (Aerosol)	10 mg/m^3	AIHA WEEL
Stearic Acid	57-11-4	TWA (Inhalable fraction)	10 mg/m^3	ACGIH
		TWA (Respirable fraction)	3 mg/m^3	ACGIH
1-Octanol	111-87-5	TWA	50 ppm	AIHA WEEL
Paraffin Wax	8002-74-2	TWA (Fumes)	2 mg/m^3	ACGIH
		TWA (Fumes)	2 mg/m^3	NIOSH REL

Hygiene Recommendations:	Handle in accordance with good industrial hygiene and safety practice. Remove and wash contaminated clothing before re-use. Wash face, hands and any exposed skin thoroughly after handling.
Eye Protection:	Wear safety glasses with side shields. Face-shield
Hand Protection:	Wear PVC, rubber or nitrile gloves. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.
Respiratory Protection:	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
Skin and Body Protection:	Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.
Human Exposure Characterization:	Based on our recommended product application and personal protective equipment, the potential human exposure is : Moderate.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Liquid
Color:	Clear. Light yellow to amber.
Odour:	Hydrocarbon-like.
Odour Threshold:	No data available.
Initial Boiling Point:	132.2 °C, Method: ASTM D 86.
Vapor Pressure:	5.1 mm Hg, (37.8 °C), ASTM D 5191
Vapor Density:	No data available.
pH:	Not applicable.
Solubility:	Insoluble with water
Evaporation Rate:	No data available.
Flash Point:	92 °C, Method: ASTM D 93, Pensky-Martens closed cup.
Freezing Point:	POUR POINT: -18 °C.
Specific Gravity:	0.84, (25 °C), ASTM D-1298.
Viscosity, dynamic:	10 mPa.s (22.2 °C), Method: ASTM D 2983
Viscosity, kinematic:	7.94 mm2/s (40 °C), Method: ASTM D 445

10. STABILITY AND REACTIVITY

Stability:	Stable under recommended storage conditions.
Conditions to Avoid:	Heat, flames, and sparks.
Materials to Avoid:	Strong oxidizing agents.
Hazardous Decomposition Products:	In case of fire, hazardous decomposition products may be produced such as: Carbon oxides nitrogen oxides (NOx) Sulphur oxides Oxides of phosphorus

11. TOXICOLOGICAL INFORMATION

PRODUCT TOXICITY DATA:

Oral (Acute Toxicity Estimate)	**Dermal (LD50)**	**Inhalation (Acute Toxicity Estimate)**
>5,000 mg/kg	>3,038 mg/kg (Rabbit)	3.38 mg/L (exposure: 4h)
Skin Corrosion/irritation (Draize Test)	**Serious eye damage/irritation (Draize Test)**	**Respiratory sensitization**
3.1 (Rabbit)	6.0 (Rabbit)	No data available

Sensitization:	No data available.
Mutagenic Effects:	No data available.
Reproductive Toxicity:	No data available.
Carcinogenic Effects:	No data available.
Teratogenicity and Embryo Toxicity:	No data available.
Other Toxicity Information:	No data available.

Human Hazard Characterization
Based on our hazard characterization, the potential human hazard is: Moderate

12. ECOLOGICAL INFORMATION

Aquatic Toxicity: Harmful to aquatic life.

Toxicity to fish:

LC50 Oncorhynchus mykiss (rainbow trout): 310 mg/l
Exposure time: 96 hrs
Test substance: Product

LC50 Pimephales promelas (fathead minnow): 190 mg/l
Exposure time: 96 hrs
Test substance: Similar Product

NOEC Oncorhynchus mykiss (rainbow trout): < 78 mg/l
Exposure time: 96 hrs
Test substance: Product

NOEC Pimephales promelas (fathead minnow): 100 mg/l
Exposure time: 96 hrs
Test substance: Similar Product

Toxicity to daphnia and other aquatic invertebrates:

LC50 Daphnia magna (Water flea): 220 mg/l
Exposure time: 48 hrs
Test substance: Product

LC50 Ceriodaphnia dubia: 4.32 mg/l
Exposure time: 48 hrs
Test substance: Similar Product

EC50 Daphnia magna (Water flea): 130 mg/l

Exposure time: 48 hrs
Test substance: Product

NOEC Daphnia magna (Water flea): 16 mg/l
Exposure time: 48 hrs
Test substance: Product

NOEC Ceriodaphnia dubia: 2.50 mg/l
Exposure time: 48 hrs
Test substance: Similar Product

Toxicity to algae: No data available

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity):

NOEC: 1.5 mg/l
Exposure time: 7 d
Species: Ceriodaphnia dubia
Test substance: Product
LOEC: 3.0 mg/l
Exposure time: 7 d
Species: Ceriodaphnia dubia
Test substance: Product

NOEC: 0.19 mg/l
Exposure time: 7 d
Species: Ceriodaphnia dubia
Test substance: Product

LOEC: 0.38 mg/l
Exposure time: 7 d
Species: Ceriodaphnia dubia
Test substance: Product

EC25 / IC25: 0.40 mg/l

Exposure time: 7 d
Species: Ceriodaphnia dubia
Test substance: Product

Components
Toxicity to algae: Hydrotreated Light Distillate (petroleum)
EC50 : > 1,000 mg/l
Exposure time: 72 h

Components
Toxicity to bacteria: Hydrotreated Light Distillate (petroleum)
> 1,000 mg/l
Exposure time: 48 h

Persistence and Degradability: Total Organic Carbon (TOC) : 195,870 mg/l
Chemical Oxygen Demand (COD): 2,200,000 mg/l
Biochemical Oxygen Demand (BOD): 102,440 mg/l

Mobility: The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;
Air : 10 - 30%
Water : 30 - 50%
Soil : 30 - 50%
The portion in water is expected to be soluble or dispersible.

Environmental Hazard and Exposure Characterization
Based on our hazard characterization, the potential environmental hazard is: Moderate
Based on our recommended product application and the product's characteristics, the potential environmental exposure is: High

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package	Dispose of waste containers in accordance with all applicable regulations.

14. TRANSPORT INFORMATION

Land Transport (ADG):	Not classified.
Sea Transport (IMDG):	Proper shipping name : ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. Technical name(s) : 1-Octanol UN/ID No. : UN 3082 Transport hazard class(es) : 9 Packing group : III Marine pollutant : 1-Octanol
Air Transport (IATA):	Proper shipping name : ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. Technical name(s) : 1-Octanol UN/ID No. : UN 3082 Transport hazard class(es) : 9 Packing group : III

Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 2	Flammability: 2	Instability: 0	Other: n/a

HMIS

Health: 2	Flammability: 2	Instability: 0	Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Signal Word:	DANGER
Label Hazard Warnings:	H227 – Combustible liquid H304 – May be fatal if swallowed and enters airways H332 – Harmful if inhaled
Label Precautions:	P202 – Do not handle until all safety precautions have been read and understood P210 – Keep away from heat, hot surface, sparks, open flames and other ignition sources. - No smoking. P261 – Avoid breathing dust/fume/gas/mist/vapors/spray. P280 – Wear protective gloves/protective clothing/eye protection/face protection. P301+P310 – IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.

	P301+P330+P331 – IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CENTER or doctor/ physician. P304+P312+P340+P341 – IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell. P403 – Store in a well-ventilated place. P501 – Dispose of contents/ container to an approved waste disposal plant.
Label First Aid:	Wash product off skin or out of eyes. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Aspiration hazard if swallowed - can enter lungs and cause damage. Get medical attention immediately. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

CM500	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: CM500	Prepared by: HSE Dept
Date Issued: June 24, 2016	# & Version: 1.1

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	CM500
Product Purpose:	Cementing Additive
Supplier Identification:	Australian Coil Services Pty Ltd 8-14 Moorebank Road Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

GHS Classification

Specific target organ toxicity: - repeated exposure Category 2 (Kidney)

GHS Label element

Hazard pictograms:

Signal Word: Warning

Hazard Statements: May cause damage to organs (Kidney) through prolonged or repeated exposure.

Precautionary Statements: Prevention:
Do not breathe dust/fume/gas/mist/vapours/spray.
Response:
Get medical advice/ attention if you feel unwell.
Storage:
Store in accordance with local regulations.
Disposal:
Dispose of contents/ container to an approved waste disposal plant.

Other hazards: None known.

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Ethylene Glycol	107-21-1	10 to 30

4. FIRST AID MEASURES

Eye Contact:	Rinse with plenty of water. Get medical attention if symptoms occur.
Skin Contact:	Wash off with soap and plenty of water. Get medical attention if symptoms occur.
Ingestion:	Contact the Poison's Information Centre (e.g. Australia 13 1126; New Zealand 0800 764 766). Rinse mouth. Get medical attention if symptoms occur.
Inhalation:	Remove to fresh air. Treat symptomatically. Get medical attention if symptoms occur.
Notes to physician:	Treat symptomatically.
Most important symptoms and effects, both acute and delayed:	See Section 11 for more detailed information on health effects and symptoms.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media:	None known.
Specific hazards during firefighting:	Not flammable or combustible.
Hazardous combustion products:	Decomposition products may include the following materials: Carbon oxides.
Special Protective Equipment for firefighters:	Use personal protective equipment.
Specific extinguishing methods:	Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, protective equipment and emergency procedures:	Refer to protective measures listed in sections 7 and 8.
Environmental Precautions:	Do not allow contact with soil, surface or ground water.
Methods and materials for containment and cleaning up:	Stop leak if safe to do so. Contain spillage, and then collect with noncombustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). Flush away traces with water. For large spills, dike spilled material or otherwise contain material to ensure runoff does not reach a waterway.

7. HANDLING AND STORAGE

Advice on safe handling:	Do not ingest. Do not breathe dust/fume/gas/mist/vapours/spray. Wash hands thoroughly after handling. Use only with adequate ventilation.
Conditions for safe storage:	Keep out of reach of children. Keep container tightly closed. Store in suitable labeled containers.
Suitable material:	The following compatibility data is suggested based on similar product data and/or industry experience: Stainless Steel 304, Stainless Steel 316L, Aluminum, Copper, Hastelloy C-276, Brass, Buna-N, Ethylene propylene, Neoprene, PVC, HDPE (high density polyethylene), PTFE, Polytetrafluoroethylene/polypropylene copolymer, Chlorosulfonated polyethylene rubber, Fluoroelastomer, Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use.
Unsuitable material:	The following compatibility data is suggested based on similar product data and/or industry experience: Mild steel.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

Components	*CAS-No.*	*Form of exposure*	*Permissible concentration*	*Basis*
Ethylene Glycol	107-21-1	TWA (Vapour)	20 ppm 52 mg/ m3	AU OEL
		VLE (Vapour)	40 ppm 104 mg/ m3	AU OEL
		TWA (Particulate)	10 mg/ m3	AU OEL
Ethylene Glycol:	107-21-1	WES-Ceiling (Vapour and mist)	50 ppm 127 mg/ m3	NZ OEL
Ethylene Glycol:	107-21-1	Ceiling (Aerosol only)	100 mg/ m3	ACGIH

Engineering measures: Effective exhaust ventilation system. Maintain air concentrations below occupational exposure standards.

Personal protective equipment

Eye protection: Safety glasses

Hand Protection: Wear protective gloves.
Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.

Skin protection: Wear suitable protective clothing.

Respiratory protection: When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Hygiene measures: Handle in accordance with good industrial hygiene and safety practice. Remove and wash contaminated clothing before re-use. Wash face, hands and any exposed skin thoroughly after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Liquid
Colour: brown
Odour: Somewhat sweet
Flash point: > 93.3 °C, does not flash
pH: 7.5, 100 %
Odour Threshold: POUR POINT: -17.7 °C

Melting point/ freezing point:	no data available
Initial boiling point and boiling range:	no data available
Evaporation Rate:	no data available
Flammability (solid, gas):	no data available
Upper explosion limit:	no data available
Lower explosion limit:	no data available
Vapour pressure:	2.48 kPa, (25 °C),
Relative vapour density:	no data available
Relative density:	1.14, (15 °C),
Density:	9.47 lb/gal
Water solubility:	completely soluble
Solubility in other solvents:	no data available
Partition coefficient:	no data available
Auto-ignition temperature:	no data available
Thermal decomposition temperature:	no data available
Viscosity, dynamic:	400 mPa.s (20 °C)
Viscosity, kinematic:	no data available
Molecular weight:	no data available
VOC:	no data available

10. STABILITY AND REACTIVITY

Chemical stability:	Stable under normal conditions.
Possibility of hazardous reactions:	No dangerous reaction known under conditions of normal use.
Conditions to Avoid:	None known.
Incompatible materials:	None known.
Hazardous decomposition products:	Decomposition products may include the following materials: carbon oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure:	Inhalation, Eye contact, Skin contact
Potential Health Effects	
Eyes:	Health injuries are not known or expected under normal use.

Skin	Health injuries are not known or expected under normal use.
Ingestion:	Health injuries are not known or expected under normal use.
Inhalation:	Health injuries are not known or expected under normal use.
Chronic Exposure:	May cause damage to organs through prolonged or repeated exposure
Experience with human exposure	
Eye contact:	No symptoms known or expected.
Skin contact:	No symptoms known or expected.
Ingestion:	No symptoms known or expected.
Inhalation:	No symptoms known or expected.
Toxicity	
Product	
Acute oral toxicity:	Acute toxicity estimate: > 2,000 mg/kg
Acute inhalation toxicity:	no data available
Acute dermal toxicity:	no data available
Skin corrosion/irritation:	no data available
Serious eye damage/eye irritation:	no data available
Respiratory or skin sensitization:	no data available
Carcinogenicity:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
Reproductive effects:	No toxicity to reproduction
Germ cell mutagenicity:	Contains no ingredient listed as a mutagen
Teratogenicity:	no data available
STOT - single exposure:	no data available
STOT - repeated exposure:	no data available
Aspiration toxicity:	No aspiration toxicity classification
Components	
Acute dermal toxicity:	Ethylene Glycol LD50 rabbit: 10,600 mg/kg

Human Hazard Characterization

Based on our hazard characterization, the potential human hazard is: High

12. ECOLOGICAL INFORMATION

Ecotoxicity

Environmental Effects:	This product has no known ecotoxicological effects
Product	
Toxicity to fish	no data available
Toxicity to daphnia and other aquatic invertebrates	no data available
Toxicity to algae	no data available
Components	
Toxicity to fish	Ethylene Glycol LC50 : 72,860 mg/l Exposure time: 96 h
Components	
Toxicity to daphnia and other aquatic invertebrates	Ethylene Glycol EC50 : > 100 mg/l Exposure time: 48 h
Components	
Toxicity to algae	Ethylene Glycol EC50: 6,500 mg/l Exposure time: 96 h
Components	
Toxicity to bacteria	Ethylene Glycol > 1,995 mg/l
Components	
Toxicity to fish (Chronic toxicity)	Ethylene Glycol NOEC: 15,380 mg/l Exposure time: 7 d
Components	
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	Ethylene Glycol NOEC: 8,590 mg/l Exposure time: 7 d

Persistence and degradability

The organic portion of this preparation is expected to be inherently biodegradable.

Mobility

The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models. If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air:	<5%
Water:	30 - 50%
Soil:	50 - 70%

The portion in water is expected to be soluble or dispersible.

Bioaccumulative potential

This preparation or material is not expected to bioaccumulate.

Other information

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION Based on our hazard characterization; the potential environmental hazard is: Low

13. DISPOSAL INFORMATION

Disposal methods:	Where possible recycling is preferred to disposal or incineration. If recycling is not practicable, dispose of in compliance with local regulations. Dispose of wastes in an approved waste disposal facility.
Disposal considerations:	Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers.

14. TRANSPORT INFORMATION

The shipper/consignor/sender is responsible to ensure that the packaging, labeling, and markings are in compliance with the selected mode of transport.

Land Transport

Proper shipping name: PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Sea Transport (IMDG/IMO)

Proper shipping name: PRODUCT IS NOT REGULATED DURING

TRANSPORTATION

Air Transport (IATA)
Proper shipping name: PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15. REGULATORY INFORMATION

Standard of the Uniform Scheduling of Medicines and Poisons: Schedule 6

INTERNATIONAL CHEMICAL CONTROL LAWS:

TOXIC SUBSTANCES CONTROL ACT (TSCA)
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)
The substances in this preparation are listed on the Domestic Substances List (DSL), are exempt, or have been reported in accordance with the New Substances Notification Regulations.

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

JAPAN
This product contains substance(s) which are not in compliance with the Law Regulating the Manufacture and Importation of Chemical Substances and are not listed on the Existing and New Chemical Substances list (ENCS).

KOREA

This product contains substance(s) which are not in compliance with the Chemical Control Act (CCA) and may require additional review.

PHILIPPINES
This product contains substance(s) which are not in compliance with the Republic Act 6969 (RA 6969) and may require additional review.

16. OTHER INFORMATION

REFERENCES

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH, (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

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. For additional copies of an SDS visit www.nalco.com and request access.

CM502	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 011 - 587 - 353 - 2940 (24 Hrs)

Product Name: CM502	Prepared by: HSE Dept
Date Issued: March 15, 2019	# & Version: 21-1.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	CM502
Product Purpose:	Fluid Loss Additive
Supplier Identification:	Australian Coil Services Pty Ltd 8-14 Moorebank Rd Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Warning

Primary Routes of Exposure: Skin contact, eye contact, ingestion

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Skin irritation (Category 2)

Eye irritation (Category 2A)

Hazard Statements: H320, H315, H335 - May cause eye, skin and respiratory irritation.
H303 – May be harmful if swallowed.

Precautionary Statements: P202 – Do not handle until all safety precautions have been read and

understood
P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 – IF SWALLOWED: Do NOT induce vomiting. Call a POISON CENTER or doctor/physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
P340 – IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P305 + P351 + P338 – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing.
P312 - Call a POISON CENTER or doctor/ physician if you feel unwell.
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.
P501 - Dispose of contents/ container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: Irritating
Skin: Irritating
Ingestion: Gastro-intestinal irritation, may cause nausea, vomiting and diarrhea.
Inhalation: May cause transient irritation.
Chronic: No data available

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
AMPS	15214-89-8	15 to 25
Water	7732-18-5	75 to 85

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 15 minutes. If symptoms persist seek medical advice.

Skin Contact: Remove contaminated clothing. Immediately wash off all material with soap and water. Get medical attention if irritation develops and persists.

Ingestion: If swallowed, and the victim is conscious and alert, DO NOT induce vomiting, Slowly dilute with one to two glasses of water or milk. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Inhalation: Remove person to fresh air. If signs/symptoms persist continue get medical attention.

5. FIRE FIGHTING MEASURES

Flash Point: Not available.
Lower explosion Limit (LEL): Not available
Upper explosion Limit (UEL): Not available
Auto ignition temperature: Not available
Suitable Extinguishing Media: All standard firefighting media.
Fire and explosion Hazard: Product is not expected to burn unless all the water is boiled away.

Specific Methods:	Standard firefighting procedure/
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.
Specific Hazards:	None.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	No action should be taken involving any personal risk or without suitable training. Use appropriate protective equipment.
Environmental Precautions:	Do not allow contact with soil, surface, or ground water.
Emergency Procedures:	Prevent further leakage or spillage if safe to do so.
Methods For Cleaning Up:	Isolate spill and stop leak where safe. Sprinkle sand or other inert absorbent material onto spill, scoop up and remove. Wipe up further residue with a paper towel and place in container. Wash spill area with soap and water.
Disposal:	Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Wash thoroughly after handling. Avoid contact with eyes, skin or clothing. Avoid breathing vapors or mist. Do not ingest. Do not expose container to heat, flame or ignition. Launder contaminated clothing before reuse.

Storage Precautions: Store according to Provincial and Federal regulations. Store in a cool, dry, well-ventilated area. Place away from incompatible materials. Keep containers in a dry, cool and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: No data available.

Engineering Measures: General ventilation is recommended. Local exhaust fan may be necessary when mist is generated.

CAS	Chemical Name	ACGIH*	OSHA	IDLH
15214-89-8	2-Acrylamido 2-Methyl-Propane Sulphonic Acid	Not Available	Not Available	Not Available

*ACGIH – Occupational exposure limits – TWA

Hygiene Recommendations: Keep an eye wash fountain and safety shower available.

Eye Protection: Wear safety glasses with side shields.

Hand Protection: Wear PVC, rubber or nitrile gloves.

Respiratory Protection: Not required except in case of aerosol formation.

Skin and Body Protection: Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Liquid
Color:	Colourless to light yellow
Odor:	Odourless
Boiling Point:	Not determined.
Vapor Pressure:	Not determined.
Vapor Density:	Not determined.
pH:	6.0 – 7.0
Solubility:	Soluble
Evaporation Rate:	Not determined.
Flash Point:	Not determined.
Freezing Point:	< -10°C
Specific Gravity:	1.10 ± 0.05
Viscosity:	Not determined.

10. STABILITY AND REACTIVITY

Stability:	Stable under recommended storage conditions.
Conditions to Avoid:	None anticipated.
Materials to Avoid:	Strong oxidizing agents.
Hazardous Polymerization:	Will not occur.
Hazardous Decomposition Products:	Not applicable.

11. TOXICOLOGICAL INFORMATION

Threshold Test	**Organophosphates**
Acute Oral Toxicity:	No data available

LD50/oral/rat:	No data available
LC50/inhalation/1hr/rat:	No data available
LD50/dermal/4hr/rabbit:	No data available
Carcinogenicity: *NOAEL/rat*	No data available
Reproductive toxicity: *NOAEL/rat:*	No data available
Prenatal development: *NOAEL/maternal toxicity/rat:* *NOAEL/developmental toxicity/rat:*	No data available

Sensitization: This product is not expected to be sensitizing.
Mutagenic Effects: No data available.
Reproductive Toxicity: No data available.
Carcinogenic Effects: No data available to indicate product or components present at greater than 1% are chronic health hazards.
Teratogenicity and Embryo Toxicity: No data available.
Other Toxicity Information: No data available.

12. ECOLOGICAL INFORMATION

Ingredients	**Ecotoxicity – Fish Species Data**	**Acute Crustaceans Toxicity**	**Ecotoxicity – Fresh water Algae**
Organophosphates	No data available.	No data available.	No data available.

Persistence and Degradability: No data available.
Mobility: No data available.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package — Dispose of waste containers in accordance with all applicable regulations.

14. TRANSPORT INFORMATION

Land Transport (ADG): Not classified.
Sea Transport (IMDG): Not classified.
Air Transport (IATA): Not classified.

Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING
Health: 1 Flammability: 0 Instability: 0 Other: n/a

HMIS
Health: 1 Flammability: 0 Instability: 0 Other: n/a
0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning:	Warning
Label Hazards:	H303 - May be harmful if swallowed H320 - May cause eye irritation H315 - May cause skin irritation H335 - May cause respiratory irritation
Label Precautions:	P202 - Do not handle until all safety precautions have been read and understood. P261 - Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray. P264 - Wash skin thoroughly after handling. P270 - Do not eat, drink or smoke when using this product. P271 - Use only outdoors or in a well-ventilated area. P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection. P301 + P312 + P330 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth. P302 + P352 - If on skin: Wash with plenty of water. P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing. P305 + P351 + P338 - In in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P312 - Call a POISON CENTER or doctor/ physician if you feel unwell. P403 + P233 - Store in a well-ventilated place. Keep container tightly closed. P501 - Dispose of contents/ container to an approved waste disposal plant.
Label First Aid:	Wash product off skin or out of eyes. If swallowed, DO NOT induce vomiting. Seek medical attention.

CM502	

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 011 - 587 - 353 - 2940 (24 Hrs)

Product Name: CM502	Prepared by: HSE Dept
Date Issued: March 15, 2019	# & Version: 21-1.0

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

CM600	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: CM600	Prepared by: HSE Dept
Date Issued: April 02, 2016	# & Version: 6.1.1.1

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	CM600
Product Purpose:	Cementing Accelerator
Supplier Identification:	Australian Coil Services Pty Ltd 8-14 Moorebank Road Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Classification of the substance or mixture

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

Poisons Schedule: Not Applicable
Classification: Acute Toxicity (Oral) Category 4, Eye Irritation Category 2A

Label elements
Hazard pictogram(s):

Signal Word: WARNING
Hazard Statement(s):
H302 Harmful if swallowed.
AUH066 Repeated exposure may cause skin dryness and cracking.
H319 Causes serious eye irritation.

Precautionary Statement(s) Prevention:
P270 Do not eat, drink or smoke when using this product.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

Precautionary Statement(s) Response:
P305+P351+P338 If in eyes rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Precautionary Statement(s) Storage:
Not applicable

Precautionary Statement(s) Disposal:
P501 Dispose of contents/ container in accordance with local regulations.

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Calcium chloride	10043-52-4	>85
3% Sodium chloride	Not available	

4. FIRST AID MEASURES

Eye Contact:
Wash out immediately with fresh running water.
Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
Seek medical attention without delay; if pain persists or recurs seek medical attention.
Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact:
Flush skin and hair with running water (and soap if available).
Seek medical attention in event of irritation.

Ingestion:
IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
For advice, contact a Poisons Information Centre or a doctor.
Urgent hospital treatment is likely to be needed. In the meantime, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
If the services of a medical officer or medical doctor are readily

available, the patient should be placed in his/her care and a copy of the SDS should be provided. Further action will be the responsibility of the medical specialist.
If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the SDS.

Where medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:
INDUCE vomiting with fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
NOTE: Wear a protective glove when inducing vomiting by mechanical means.

Inhalation: If fumes, aerosols or combustion products are inhaled remove from contaminated area. Other measures are usually unnecessary.

5. FIRE FIGHTING MEASURES

Extinguishing Media: There is no restriction on the type of extinguisher which may be used.
Use extinguishing media suitable for surrounding area.

Special hazards arising from the substrate or mixture: None known.

Advice for firefighters: Alert Fire Brigade and tell them location and nature of hazard.
Wear breathing apparatus plus protective gloves in the event of a fire.

Fire/ Explosion Hazard: Non-combustible. Not considered a significant fire risk, however containers may burn.
Decomposition may produce toxic fumes of: hydrogen chloride, and metal oxides.
May emit poisonous fumes. May emit corrosive fumes.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, protective equipment and emergency procedures:	See section 8.
Environmental Precautions:	See section 12.
Methods and materials for containment and cleaning up:	Minor Spills: Remove all ignition sources and clean up all spills immediately. Major Spills: Caution, Advise personnel in area.

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

7. HANDLING AND STORAGE

Precautions for sale handling

Safe handling:	Avoid all personal contact, including inhalation. Wear protective clothing when risk of exposure occurs.
Other information:	Material is hygroscopic, i.e. absorbs moisture from the air. Keep containers well sealed in storage. Store in original containers. Keep containers securely sealed.

Conditions for safe storage, including any incompatibilities

Suitable container:	DO NOT use aluminium or galvanised containers Polyethylene or polypropylene container. Check all containers are clearly labelled and free from leaks.
Storage incompatibility:	Inorganic alkaline earth metal derivative. Derivative of very electropositive metal. Calcium chloride (and its hydrates): - are incompatible with boric acid, calcium oxide, bromine trifluoride, 2-furan, percarboxylic acid - may produce explosive hydrogen gas on contact with zinc - catalyse exothermic polymerisation of methyl vinyl ether - produce heat on contact with water - attack metals Addition of a quantity of calcium chloride to boiling water has generated heat sufficient to cause a violent steam explosion

on several occasions.

- Metals and their oxides or salts may react violently with chlorine trifluoride and bromine trifluoride.
- These trifluorides are hypergolic oxidisers.
- In presence of moisture, the material is corrosive to aluminium, zinc and tin producing highly flammable hydrogen gas.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
OCCUPATIONAL EXPOSURE LIMITS (OEL)
INGREDIANT DATA
Not Available

EMERGENCY LIMITS

Ingredient	*Material name*	*TEEL-1*	*TEEL-2*	*TEEL-3*
Calcium Chloride	Calcium Chloride	12 mg/ m3	130 mg/ m3	790 mg/ m3

Ingredient	*Original IDHL*	*Revised IDLH*
Calcium Chloride	Not Available	Not Available

MATERIAL DATA
It is the goal of the ACGIH (and other Agencies) to recommend TLVs (or their equivalent) for all substances for which there is evidence of health effects at airborne concentrations encountered in the workplace.
At this time no TLV has been established, even though this material may produce adverse health effects (as evidenced in animal experiments or clinical experience).
Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers' responses to various airborne concentrations.

Engineering measures: Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions

to provide this high level of protection.

Personal protective equipment

Eye and face protection: Safety glasses with side shields.
Chemical goggles.

Hand/ feet Protection: The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.
Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
- polychloroprene.

Skin protection: See hand protection above.

Body protection: See Other protection below.

Other protection:
- Overalls.
- P.V.C.

Respiratory protection

Particulate. (AS/NZS 1716 & 1715, EN 143:2000 & 149:001, ANSI Z88 or national equivalent)

- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory protection. These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on the basic physical and chemical properties

Appearance:	Material is hygroscopic, absorbs moisture from surrounding air. Small white crystals, granules, or flakes. No odour.
Physical state:	Divided Solid
Odour:	Not Available
Flash point:	Not Applicable
pH:	Not Applicable
Odour Threshold:	Not Available
Melting point/ freezing point:	772
Initial boiling point and boiling range:	>1600
Evaporation Rate:	Not Applicable
Flammability (solid, gas):	Not Applicable
Upper explosion limit:	Not Applicable
Lower explosion limit:	Not Applicable
Vapour pressure:	Negligible
Vapour density:	Not Applicable
Relative density:	2.15
Viscosity:	Not Applicable
Water solubility:	Miscible
Taste:	Not Available
Partition coefficient:	Not Available
Auto-ignition temperature:	Not Applicable
Decomposition temperature:	Not Available
Explosive properties:	Not Available
Oxidising properties:	Not Available
Molecular weight:	110.99
VOC:	Not Applicable
Surface tension	Not Applicable
Volatile Component:	Nil

10. STABILITY AND REACTIVITY

Reactivity:	See section 7.
Chemical stability:	Unstable in the presence of incompatible materials. Product is considered stable.
Possibility of hazardous reactions:	See section 7.
Conditions to avoid:	See section 7.
Incompatible materials:	See section 7.
Hazardous decomposition products:	See section 5.

11. TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled: The material is not thought to produce either adverse health effects or irritation of the respiratory tract following inhalation (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.
Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.
If prior damage to the circulatory or nervous systems has occurred or if kidney damage has been sustained, proper screenings should be conducted on individuals who may be exposed to further risk if handling and use of the material result in excessive exposures.

Ingestion: Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the

	individual. Compared with other metals, the calcium ion and most calcium compounds have low toxicity. Acute calcium poisoning is rare, and difficult to achieve unless calcium compounds are administered intravenously or taken in high doses over a prolonged period. Use as a food additive indicates tolerance of small amounts, but irritant properties and toxic effects of large amounts are well documented. Estimated lethal dose for adult is 30 grams.
Skin Contact:	Skin contact is not thought to produce harmful health effects (as classified under EC Directives using animal models). Systemic harm, however, has been identified following exposure of animals by at least one other route and the material may still produce health damage following entry through wounds, lesions or abrasions. Repeated exposure may cause skin cracking, flaking or drying following normal handling and use. Open cuts abraded or irritated skin should not be exposed to this material. Solution of material in moisture on the skin, or perspiration, may increase irritant effects. Entry into the bloodstream through, for example, cuts, abrasions, puncture wounds or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected. If skin is wet or moist with perspiration, superficial burns may result. Contact with abraded skin or cuts may rapidly cause severe skin burns.
Eye:	Evidence exists, or practical experience predicts, that the material may cause severe eye irritation in a substantial number of individuals and/or may produce significant ocular lesions which are present twenty-four hours or more after instillation into the eye(s) of experimental animals. Eye contact may cause significant inflammation with pain.
Chronic:	Prolonged or repeated skin contact may cause drying with

	cracking, irritation and possible dermatitis following. Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems. High blood concentrations of calcium ion may give rise to vasodilation and depress cardiac function leading to hypotension and syncope. Calcium ions enhance the effects of digitalis on the heart and may precipitate digitalis intoxication. Long term exposure to high dust concentrations may cause changes in lung function (i.e. pneumoconiosis) caused by particles less than 0.5 micron penetrating and remaining in the lung. A prime symptom is breathlessness.
Calcium Chloride Toxicity:	Dermal (rat) LD50: =2630 mg/kg^2 Oral (rat) LD50: 1000 mg/kg^2
Calcium Chloride Irritation:	Eye (unknown): severe* Skin (unknown): moderate*
Legend:	1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances.
Calcium Chloride:	Toxicity from calcium is not common because the gastrointestinal tract normally limits the amount of calcium absorbed. Therefore, short-term intake of large amounts of calcium does not generally produce any ill effects aside from **constipation** and an increased risk of kidney stones. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling the epidermis.

12. ECOLOGICAL INFORMATION

Toxicity

Environmental fate: Calcium chlorides vapour pressure is negligible and its water solubility is 745 g/L at 20 deg C. Calcium chloride is readily dissociated into calcium and chloride ions in water. These physico-chemical properties indicate that calcium chloride released into the environment is distributed into the water compartment in the form of calcium and chloride ions.
Calcium provides an important link between tectonics, climate and the carbon cycle. In the simplest terms, uplift of mountains exposes Ca-bearing rocks to chemical weathering and releases Ca2+ into surface water.
Although inorganic chloride ions are not normally considered toxic they can exist in effluents at acutely toxic levels (chloride >3000 mg/l). The resulting salinity can exceed the tolerances of most freshwater organisms.
DO NOT discharge into sewer or waterways.

Calcium Chloride

Toxicity to fish	LC50 - 96HR Test Duration with a Value of =3mg/L[1]
Toxicity to crustacea:	EC50 – 48HR Test Duration with a Value of 1-62mg/L[2]
Toxicity to algae or other aquatic plants:	EC50 – 72HR Test Duration with a Value of 2-900mg/L[2]
Toxicity to crustacea:	BCFD – 48HR Test Duration with a Value of 0.0832425mg/L[4]
Toxicity to algae or other aquatic plants:	EC20 – 72HR Test Duration with a Value of 1mg/L[2]
Toxicity to crustacea:	NOEC – 48HR Test Duration with a Value of 2mg/L[2]
Legend:	Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data.

Persistence and degradability

No data available for all ingredients

Mobility in soil
No data available for all ingredients
Bioaccumulative potential
No data available for all ingredients

13. DISPOSAL INFORMATION

Waste treatment methods

Product/ Packaging disposal: Containers may still present a chemical hazard/ danger when empty.
Return to supplier for reuse/ recycling if possible.
Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area.
DO NOT allow wash water from cleaning or process equipment to enter drains.
It may be necessary to collect all wash water for treatment before disposal.
Recycle wherever possible or consult manufacturer for recycling options.
Consult State Land Waste Management Authority for disposal.

14. TRANSPORT INFORMATION

Labels Required

Marine Pollutant:	No
HAZCHEM:	Not Applicable
Land transport (ADG):	NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS
Air transport (ICAO-IATA/ DGR):	NOT REGULATED FOR TRANSPORTAT OF DANGEROUS GOODS
Sea Transport (IMDG/ GGVSee)	NOT REGULATED FOR TRANSPORTAT OF DANGEROUS GOODS
Transport in bulk according to Annex II MARPOL and the IBC code:	Not Applicable

15. REGULATORY INFORMATION

Safety, health and environmental regulations/ legislation specific for the substance or mixture
Calcium Chloride (10043-52-4) is found on the following regulatory lists:
Australia Inventory of Chemical Substances (AICS)

National Inventory Status	
Australia – AICS	Yes
Canada – DSL	Yes
Canada – NDSL	No
China – IECSC	Yes
Europe – EINEC/ ELINCS/ NLP	Yes
Japan – ENCS	Yes
Korea – ENCS	Yes
New Zealand – NZIOC	Yes
Philippines – PICCS	Yes
USA – TSCA	Yes
Legend:	Yes = All ingredients are on the inventory No = Not determined or one or more ingredients are not on the inventory and are not exempt from listing (see specific ingredients in brackets)

16. OTHER INFORMATION

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

Definitions and abbreviations

PC − TWA: Permissible Concentration-Time Weighted Average

PC − STEL: Permissible Concentration-Short Term Exposure Limit

IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit

TEEL: Temporary Emergency Exposure Limit。

IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL: No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index.

CM601	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: CM601 — Prepared by: HSE Dept
Date Issued: August 13, 2019 — # & Version: 23-1.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	CM601
Product Purpose:	Cementing Accelerator
Supplier Identification:	Australian Coil Services Pty Ltd 283 McDougall Street Toowoomba, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Warning

Primary Routes of Exposure: Eyes and skin

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Skin corrosion/irritation (Category 2), H315
Serious eye damage/eye irritation (Category 1), H318
Specific target organ toxicity - repeated exposure (Category 2), H373

Acute aquatic toxicity (Category 3), H412
Chronic aquatic toxicity (Category 3), H412

Hazard Statements:

H302 - Harmful if swallowed
H315 - Causes skin irritation
H318 - Causes serious eye damage
H361- Suspected of damaging fertility or the unborn child.
H371 - May cause damage to organs (Liver, Kidney).
H373 - May cause damage to organs through prolonged or repeated exposure
H412 - Harmful to aquatic life with long lasting effects

Precautionary Statements:

P201 - Obtain special instructions before use.
P260 - Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P264 - Wash skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P280 - Wear protective gloves.
P301 + P312 + P330 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352 - If on skin: Wash with plenty of water.
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 or doctor/ physician.
P314 - Get medical advice/ attention if you feel unwell.
P332 + P313 - If skin irritation occurs: Get medical advice/ attention.
P501 - Dispose of contents/ container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

Acute Effects:

Eye: Irritating, and may injure eye tissue if not removed promptly.
Skin: Can cause moderate irritation. Prolonged or frequently

repeated skin contact may cause allergic reactions in some individuals. Repeated exposures may cause local redness, swelling and tissue damage.
Ingestion: Not a likely route of exposure. Irritation of the gastro-intestinal tract possible. Harmful if swallowed.
Inhalation: May cause irritation with prolonged contact.
Chronic: No adverse effect expected other than those mentioned above.

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Triethanolamine	102-71-6	30 to 60
Diethanolamine	111-42-2	5 to 10

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 20 minutes. If symptoms persist seek medical advice.

Skin Contact: Remove contaminated clothing and footwear. Immediately wash off all material with soap and copious amounts of water for at least 20 minutes.

Ingestion: Do not induce vomiting without medical advice. Seek medical advice.

Inhalation: Remove to fresh air, treat symptomatically. If symptoms persist, seek medical advice.

5. FIRE FIGHTING MEASURES

Flash Point:	194 ^{O}C
Lower explosion Limit (LEL):	Not available
Upper explosion Limit (UEL):	Not available
Auto ignition temperature:	Not available
Suitable Extinguishing Media:	Water fog or fine spray, carbon dioxide or dry chemical foam. Alcohol resistant foams are preferred. General purpose synthetic foams or protein foams may function but much less effectively. Water spray or fog for larger fires is acceptable.
Fire and explosion Hazard:	May evolve oxides of nitrogen and carbon under fire conditions.
Specific Methods:	Cool tanks and containers with water spray. Do not flush into surface water or sanitary sewer system. Keep product and empty containers away from heat and ignition sources.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting if required.
Specific Hazards:	Heating can release hazardous gases.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Avoid contact with skin, eyes and clothing. Evacuate personnel to safe areas. Keep people away from and upwind of spill or leak. PPE: see section 8.

Environmental Precautions:	Do not contaminate surface water. Do not release into the environment. Prevent product from entering any drains. Do not flush product into surface water or sanitary sewer systems.
Methods For Cleaning Up:	Sweep up and shovel and then place into an appropriate waste container. Remove soiled refuse and place in a suitable disposal container.
Disposal:	Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions:	Handle wearing appropriate PPE as per section 8. Ensure adequate ventilation is available to avoid breathing vapors. Don't use sodium nitrite or other nitrosating agents in formulations containing this product. Suspected cancer-causing nitrosamines could be formed. Spills of these organic liquids on hot fibrous insulations may lead to lowering of the auto ignition temperature possibly resulting in spontaneous combustion.
Storage Precautions:	Store according to Provincial and Federal regulations. Do not freeze. Thaw and mix well before using. Keep in a dry place. Store in stainless steel or plastic. Do not store in zinc, copper, copper alloys or galvanized containers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits:	*This product does contain substances that have an established exposure limit.*
Engineering Measures:	General ventilation is recommended. Local Exhaust fan may be necessary when mist is generated.

CAS	Chemical Name	ACGIH*	OSHA	IDLH
102-71-6	Triethanolamine	5 mg/m3 TLV-TWA	Not Available	Not Available
111-42-2	Diethanolamine	1 mg/m3 TLV-TWA	3 ppm TWA 15 mg/m3 TWA	Not Available

Hygiene Recommendations: Keep an eye wash fountain and safety shower available

Eye Protection: Wear safety glasses with side shields or chemical goggles.

Hand Protection: Wear polyethylene gloves, ethyl vinyl alcohol laminate, butyl rubber, natural rubber, polyvinyl, Viton, neoprene or nitrile gloves.

Respiratory Protection: If exposure exceeds occupational exposure limits, use an appropriate NIOSH-approved respirator. For most conditions, no respirator protection is needed; however, if handling at elevated temperatures without sufficient ventilation, use an approved air-purifying respirator. Organic vapor cartridge with a particulate pre-filter.

Skin and Body Protection: Wear standard protective clothing – consider to select type of protective clothing depending on quantity of chemical to be handled.

*ACGIH – Occupational exposure limits – TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Form: Liquid
Color: Colorless to yellow
Odor: Ammonia like
Boiling Point: 105 ^{O}C
Vapor Pressure: Not available.
Vapor Density: Not available.
pH: Not Available
Solubility: Soluble
Evaporation Rate: < 0.01
Flash Point: Not available.
Freezing Point: ~ 5 ^{O}C

Specific Gravity: 1.06
Viscosity: Not Available

10. STABILITY AND REACTIVITY

Stability: Stable under normal conditions. Hygroscopic (absorbs moisture from air)

Conditions to Avoid: Temperature extremes and moisture.

Materials to Avoid: Nitriles, strong acids and strong oxidizers. Product may react with various halogenated organic solvents, resulting in temperature and/or pressure increases. Corrosive when wet. Heating above 60 ^{O}C in the presence of aluminum can result in corrosion and generation of flammable hydrogen gas. Halogenated hydrocarbons.

Hazardous Polymerization: Will not occur

Hazardous Decomposition Products: Oxides of nitrogen and carbon.

Under Fire Conditions: Heating can release hazardous gases

Incompatibility materials: Acids, aluminum, copper, flammable liquids, magnesium, nitro compounds, nitromethane, organic materials, tin, trichloroethylene, zinc.

11. TOXICOLOGICAL INFORMATION

	Triethanolamine	Diethanolamine
Acute Oral Toxicity:	No data available	No data available
LD50/oral/rat:	4190 mg/kg	620 uL/kg
LC50/inhalation/4hr/rat:	No data available	No data available
LD50/dermal/4hr/rabbit:	>2,000 mg/kg	7,640 uL/kg

Sensitization: Possible and may cause allergic reaction

Mutagenic Effects:	Possible
Reproductive Toxicity:	Fetal effects occurred only at doses toxic to the mother.
Carcinogenic Effects:	Triethanolamine is listed as Group 3 and Diethanolamine is listed as Group 2B and A3 Carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).
Teratogenicity and Embryo Toxicity:	No quantitative data available
Human Experience:	Moderate
Other Toxicity Information:	Toxicological Synergistic products: none known.

12. ECOLOGICAL INFORMATION

Avoid release into the environment – harmful to aquatic organisms. Runoff from fire control or dilution may cause pollution

Ingredients	**Ecotoxicity – Fish Species Data**	**Acute Crustaceans Toxicity**	**Ecotoxicity – Fresh water Algae**
Triethanolamine	LC50 10,600 to 13,000 mg/L LC50 (Pimephales promelas) 450 to 1,000 mg/L (96 hrs) LC50 (Lepomis macrochirus) LC50 (Pimephales promelas) 1,000 mg/L (96 hrs)	Not available	EC50 (Desmodesmus subspicatus) 169 mg/L (96 hrs) EC50 (Desmodesmus subspicatus) 216 mg/L (72 hrs)
Diethanolamine	LC50 1,200 to 1,580 mg/L LC50 (Pimephales promelas) 4,460 to 4,980 mg/L (96 hrs) LC50 (Pimephales promelas)	LC50 (Daphnia) 48 hr, 187 mg/L	2.1 to 2.3 mg/L EC50 Pseudokirchneriella subcapitata 96 hr

	LC50 (Lepomis macrochrius) 600 to 1,000 mg/L (96 hrs)		7.8 mg/L EC50 Desmodesmus subspicatus 72 hr

Persistence and Degradability: Material is practically non-toxic to aquatic organisms but may increase pH of waterways and adversely affect aquatic life. Low persistence and no bioaccumulation expected.

Mobility: Product is liquid and therefore readily mobile.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package Dispose of waste in an approved incinerator or waste treatment site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage. Empty containers should be recycled locally or taken away for waste disposal.

14. TRANSPORT INFORMATION

Typical proper shipping name for this product are as follows:

PRODUCT IS NOT REGULATED FOR TRANSPORT

Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

Land Transport (US DOT)
DOT hazard label: Corrosive
DOT hazard class: 9
UN/NA number: 3082
Packing group: III

15. REGULATORY INFORMATION

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

CANADA: Workplace Hazardous Material Information System (WHMIS)
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and is a WHMIS controlled product.

WHMIS CLASSIFICATION:
D2B – Materials causing other toxic effects – toxic material

Canadian Environmental Protection Act (CEPA): The substance(s) in this MSDS are included in or exempted from the Domestic Substance List (DSL)

National Pollutant Release Inventory (NPRI): This product does not contain any substances listed in Part 1A (Core Substances) of the NPRI at a concentration of one percent or more by weight.

Toxic Substances Control Act (TSCA): The substances in this MSDS are included in or exempted from the TSCA 8(b) Inventory (40 CFR 710)

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 2	Flammability: 1	Instability: 0	Other: n/a

HMIS

Health: 2	Flammability: 1	Instability: 0	Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning:	Caution
Label Precautions:	May cause irritation, swelling and tissue damage with prolonged contact. May cause allergic reaction in some individuals. Harmful if swallowed.
Label First Aid:	Wash product off of skin or out of eyes. If swallowed, do not induce vomiting without medical advice. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

COHO RESOURCES

SAFETY DATA SHEET

According to Safe Work Australia

Printing date 25.01.2018 Revision: 25.01.2018

Product Name: Defoam

1 . IDENTIFICATION: PRODUCT IDENTIFIER AND CHEMICAL IDENTITY

Product Name:	**DEFOAM**
Recommended Use of the Chemical and Restriction on Use:	Drilling Fluid Additive, Alcohol and surfactant blend in petroleum distillate
Details of Manufacturer or Importer:	COHO Resources Pty. Ltd 26/43 Lang Parade, Milton QLD 4064
Phone Number:	07 3870 0849
Emergency telephone number:	04 2990 5030

2 . HAZARDS IDENTIFICATION

GHS classification of the substance/mixture	Acute toxicity, Inhalation (Category 4) Skin irritation (Category 2) Eye irritation (Category 2) Specific target organ toxicity - single exposure (Category 3), Respiratory system

3 . COMPOSITION AND INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Concentration %	Other Identifiers
2-Ethyl-1-hexanol	104-76-7	15-40	

Other Information

4 . FIRST AID MEASURES

Inhalation	Remove to fresh air. Do not allow victim to move about unnecessarily. Symptoms of pulmonary edema may be delayed. If breathing has stopped, trained personnel should begin artificial respiration (AR). If heart has stopped, trained personnel should begin cardiopulmonary resuscitation (CPR) immediately. Get medical attention immediately.
Ingestion	Have victim rinse mouth with water. Drink 2-3 glasses of water. DO NOT INDUCE VOMITING. If vomiting occurs naturally, keep the head below hips to prevent aspiration. Never give anything by mouth to an unconscious or convulsing victim. Have victim rinse mouth with water again. If breathing is

	difficult, trained personnel should administer emergency oxygen. If breathing has stopped, trained personnel should immediately begin artificial respiration (AR). Get immediate medical attention
Skin	Take off contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Quickly and gently blot or brush away excess chemical. Immediately flush with lukewarm, gently flowing water for 15-20 minutes. If irritation develops or persists, seek medical attention.
Eye contact	Quickly and gently blot or brush chemical off the face. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes, while holding the eyelid(s) open. Do not allow victim to rub eyes. If eye irritation develops or persists, seek medical attention
First Aid Facilities	Eyewash and normal washroom facilities
Advice to Doctor	Treat symptomatically.

5 . FIRE FIGHTING MEASURES

Flammable Properties	Not classified as flammable or combustible. Flash Point: > 93.3°C.
Suitable Extinguishing. Media	Use extinguishing agent suitable for surrounding fire
Unsuitable Extinguishing Media	DO NOT use water jet.
Protective Equipment	The use of self-contained breathing apparatus is recommended for firefighters. and
Precautions for Firefighters	Firefighters must wear a full-body encapsulating chemical protective suit with positive-pressure self-contained breathing apparatus (SCBA).
Flammable Properties	Not classified as flammable or combustible. Flash Point: > 93.3°C.

6 . ACCIDENTAL RELEASE MEASURES

Personal Precautions	Evacuate the area immediately and isolate the hazard area. Keep unnecessary and unprotected personnel from entering. Use the Personal Protective Equipment recommended in Section 8 of this MSDS.
Environmental Precautions	It is good practice to prevent releases into the environment. Do not allow into any sewer, on the ground or into any waterway.
Methods for Containment and Clean-up	Stop or reduce leak if safe to do so. Use appropriate safety equipment. Contain and soak up spill with absorbent that does not react with spilled product. Place used absorbent into suitable, covered, labelled containers for disposal. Contaminated absorbent poses the same hazard as the spilled product. Flush spill area. Collect washing for disposal

7 . HANDLING AND STORAGE

Handling	Practice reasonable caution and personal cleanliness. Avoid ingestion. Avoid contact with skin and eyes. Wear personal protective equipment to avoid direct contact with this chemical. Keep containers tightly closed when not in use.
Storage	Store in a cool, dry, well-ventilated place. Keep container tightly closed and away from incompatible materials. Do not store in unlabeled containers.

8 . EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits	Not established
Engineering Controls	General mechanical ventilation is recommended. Emergency eyewash and safety shower should be in close proximity
Personal Protective Equipment (PPE) Eye/Face Protection	Wear chemical safety goggles with side shields or splash-proof goggles.
Skin Protection	Wear coveralls, boots, gloves as needed to prevent skin exposure. Chemical resistant clothing such as gloves and apron are recommended.
Respiratory Protection	In the absence of proper ventilation, a NIOSH-approved respirator with an organic vapour cartridge is recommended.
General Hygiene Considerations	Handle in accordance with good industrial hygiene and safety practice. DO NOT eat, drink, smoke or store food in work areas. Remove contaminated clothing, etc prior to entering eating areas or leaving work area. It is good practice to: avoid breathing product; avoid skin and eye contact and wash hands after handling

9 . PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Appearance	Clear green liquid.
Odour	Sweet
Odour Threshold	Not available
Boiling Point	Not applicable
Melting Point	Not applicable
Freezing Point	Not applicable
Relative Density (water = 1)	0.890
Solubility in Water	Insoluble
pH	7 - 8 (1% solution)
Vapour Pressure	Not available
Vapour Density (air = 1)	Not available

Evaporation Rate	Not available
Flash Point	> 93.3 ºC
Lower Flammable/Explosive Limit	Not available
Upper Flammable/Explosive Limit	Not available

10 . STABILITY AND REACTIVITY

Chemical Stability	Normally stable.
Conditions to Avoid	High temperatures. Open flames, sparks, static discharge, heat and other ignition sources.
Incompatible Materials	Strong oxidizing agents (e.g. perchloric acid), organic acids (e.g. acetic acid).
Hazardous Decomposition Products	Oxides of carbon.
Possibility of Hazardous Reactions	None known

11 . TOXICOLOGICAL INFORMATION

General Comments	General irritancy of product is high.
	(2-Ethyl-1-hexanol)
	LD50 Oral Rat: 2500 mg/kg
	LD50 Dermal Rabbit: 1985 mg/kg
Skin Irritation/Corrosion	Animal tests show moderate to severe irritation (2-Ethyl-1-hexanol).
Eye Irritation/Corrosion	Animal tests show moderate to severe irritation (2-Ethyl-1-hexanol).
Carcinogenicity	Not a carcinogen
Mutagenicity	An ingredient in this product has caused mutagenic effects in vitro in the presence of activation.

No information was located for: Respiratory and/or Skin Sensitization, Teratogenicity / Embryotoxicity, Reproductive Toxicity, Toxicologically Synergistic Materials

12 . ECOLOGICAL INFORMATION

General Comments	No ecotoxicity or environmental fate data available.

13 . DISPOSAL CONSIDERATIONS

SAFETY DATA SHEET

According to Safe Work Australia

Printing date 25.01.2018 Revision: 25.01.2018

Product Name: Defoam

Disposal considerations	Dispose of in accordance with federal, provincial and local government regulations Recycle and reuse product, if possible.

14 . TRANSPORT INFORMATION

Road and Rail Transport (ADG Code):	No information available
Marine Transport (IMO/IMDG):	No information available
Air Transport (ICAO/IATA):	No information available
MARPOL:	No information available
U.N. Number	No information available
UN proper shipping name	Alcohol and surfactant blend in petroleum distillate
Transport hazard class(es)	No information available
IMDG Marine pollutant	No information available

15 . REGULATORY INFORMATION

Globally Harmonised System of Classification and labelling of Chemicals (GHS) including Work, Health and Safety regulations	Acute toxicity, Inhalation (Category 4) Skin irritation (Category 2) Eye irritation (Category 2) Specific target organ toxicity - single exposure (Category 3), Respiratory system
Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).	No Data Available
Poisons Schedule	Not Listed

16 . OTHER INFORMATION

Disclaimer This Health and Safety information is correct to the best of our knowledge and belief at the date of its publication, but we cannot accept liability for any loss, injury or damage which may result from its use. We shall ensure, so far as is reasonably practicable, that any revision of this Data Sheet is sent to all customers to whom we have directly supplied this substance, but must point out that it is the responsibility of any intermediate supplier to ensure that such revision is passed to the ultimate user. The information given in the Data Sheet is designed only as guidance for safe handling, storage, and the use of the substance. It is not a specification nor does it guarantee any specific properties. All chemicals should be handled only by competent personnel, within a controlled environment. Should further information be required, this can be obtained through the sales office whose address is at the top of this data sheet. END OF DOCUMENT

Safety Data Sheet

Product Name **GLUTE 9**

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Hazardous Statement

Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

- Harmful if swallowed
- Harmful if inhaled
- Causes skin irritation
- Causes serious eye damage
- May cause and allergic reaction
- May cause allergy, asthma symptoms or breathing difficulties
- May cause respiratory irritation
- Toxic to aquatic life.

Supplier name	**COHO Drilling Fluids**
Address	Unit 26/43 Lang Parade, Milton, QLD 4074 AUSTRALIA
Telephone	+61 7 3870 0849
Emergency	+61 4 56 780 809 info@coho-resources.com
Synonym(s)	N/A
Use(s)	Biocide
SDS Revision Date	25 March 2019

Australian Poisons Information Centre	24-hour hotline Police / Fire	13 11 26 000
New Zealand Poisons Information Centre	Dunedin:	+64 3 479 1200 (Business Hours) +64 3 474 0999 (Emergency)

2. HAZARDS IDENTIFICATION

NOT CLASSIFIED AS HAZARDOUS ACCORDING TO SAFE WORK AUSTRALIA CRITERIA

Risk Phrases None Allocated

Safety Phrases None Allocated

NOT CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE

UN Number None Allocated **Transport Hazard Class** None Allocated

Packing Group None Allocated **Hazchem Code** None Allocated

3. COMPOSITION/ INFORMATION ON INGREDIENTS

Ingredient	CAS Number	EC Number	Content

Glutaraldehyde	111-30-8	-	<10%

4. FIRST AID MEASURES

Eye If in eyes, hold eyelids apart and flush continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre, a doctor, or for at least 15 minutes. Transport to a doctor or medical facility.

Inhalation If inhaled, remove from contaminated area to fresh air. Lay patient down and keep warm. Transport to a doctor or medical facility. Apply artificial respiration if not breathing.

Skin If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with soap and running water. Seek medical attention of irritation persists.

Ingestion **Seek medical attention without delay.** Urgent hospital attention is likely to be needed. If medical attention is not immediately available (>15mins away). **Induce vomiting** with fingers down throat – wear gloves when inducing vomiting.

Advice to doctor Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flammability Non-combustible

Fire and explosion Not considered a significant fire risk but containers may burn and emit toxic fumes.

Extinguishing No restrictions

Hazchem code None Allocated

6. ACCIDENTAL RELEASE MEASURES

Personal precautions Wear Personal Protective Equipment (PPE). Avoid skin contact / inhalation.

Environmental precautions Prevent product from entering drains and waterways.

Methods of cleaning up Contain spillage with sand, earth or other inert / absorbent material.

References See Sections 8 and 13 for exposure controls and disposal.

7. STORAGE AND HANDLING

Storage Keep product in containers at all times when not in use. Check for leaks.
Gluteraldehyde is a strong reducing agent. It reacts with water forming an aqueous polymer solution.
Reacts violently with strong oxidizers, acids, bromine & ketones.
Incompatible with caustics, ammonia, amines, acetophenone, acetyl benzene, xylidenes
The activated form (in alkaline solutions) react readily with alcohol, ketones, amines, hydrazines and proteins.

Handling Avoid contact with skin, eyes or clothing. Always wear PPE.
Use in well ventilated areas.
Immediately remove contaminated clothing and wash affected area of the body.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure standards No exposure standard(s) allocated.

Biological limits No biological limit allocated.

Engineering controls Avoid inhalation. Use in a well-ventilated area. Localized ventilation should be used to control fume levels.

PPE

Eye / Face Safety glasses and Chemical goggles.

Hands	Chemical protective gloves e.g. PVC.
Body	Safety boots, preferably rubber. Overalls with a P.V.C apron. Barrier cream should be worn before using product.
Respiratory	Use a AS/NZS 1715:2009, or equivalent respirator when using this product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Clear light yellow liquid
Odour	Sharp
Flammability	Not applicable
Flash point	Not applicable
Boiling point	100.5°C / 213°F
Melting point	Not applicable
Evaporation rate	0.9
Ph as a solution (1%)	3.1 – 6.0
Vapour density	0.8
Specific gravity	1.064
Solubility (water)	Miscible in water
Vapour pressure	0.2 mmHg
Upper explosion limit	Not applicable
Lower explosion limit	Not applicable
Partition coefficient	-0.333
Autoignition temperature	>275°C / >527°F
Decomposition temperature	Not applicable
Viscosity	Not applicable
Explosive properties	Not applicable
Oxidising properties	Not applicable
Odour threshold	Not applicable
% Volatiles	Not applicable

10. STABILITY AND REACTIVITY

Chemical stability	Stable under recommended conditions of storage.
Conditions to avoid	None known.
Material to avoid	Strong alkalis, Strong acids, Strong oxidizers, Amines
Hazardous Decomposition Products	None known.
Hazardous Reactions	None known.

11. TOXICOLOGICAL INFORMATION

Health Hazard Summary	Causes severe eye irritation which may damage tissue. Causes severe skin irritation with tissue destruction. May cause allergic skin reaction. May cause allergic respiratory reaction. May cause respiratory irritation. Harmful if swallowed. Toxic if inhaled. Potential reproductive hazard. May cause birth defects.
Eye	Causes severe eye irritation which may damage tissue.
Inhalation	Toxic if inhaled. Causes severe respiratory irritation. May cause allergic respiratory reaction. Inhalation of vapors may result in skin sensitization.
Skin	Causes severe burns. May cause an allergic skin reaction.
Ingestion	Harmful if swallowed. Causes burns of the mouth, throat and stomach.

Toxicity data	**CAS Number**	LD50 Oral	LD50 Dermal	LC50 Inhalation
Glutaraldehyde	111-30-8	50 mg/kg (Guinea Pig)	560 µL/kg (Rabbit)	0.28-0.5 mg/L (Rat) 4h

12. ECOLOGICAL INFORMATION

Toxicity Significant effects and critical hazards.

Persistence and degradability Readily biodegradable (75% @ 28d).

Bioaccumulative potential -0.36 Log Pow.

Mobility in soil Potential for mobility in soils is high (Koc Between 50 and 150). Given its very low provided Henry's constant (3.3E-08atm*m3/mole; 25ºC Measured), volatilization from natural bodies of water or moist soil is not expected to be an important fate process.

Other adverse effects No information provided.

13. DISPOSAL CONSIDERATIONS

Waste disposal For small amounts, mop up and dispose of to an approved landfill site. Contact the manufacturer/supplier for additional information (if required). Ensure that appropriate personal protective equipment is used during disposal.

Legislation Dispose of in accordance with relevant local legislation.

14. TRANSPORT INFORMATION

NOT CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE, IMDG OR IATA

	LAND TRANSPORT (ADG)	SEA TRANSPORT (IMDG / IMO)	AIR TRANSPORT (IATA / ICAO)
UN Number	None Allocated	None Allocated	None Allocated
Proper Shipping Name	None Allocated	None Allocated	None Allocated
Transport Hazard Class	None Allocated	None Allocated	None Allocated
Packing Group	None Allocated	None Allocated	None Allocated

Environmental hazards No information provided

Special precautions for user None

Hazchem code None Allocated

15. REGULATORY INFORMATION

Poison schedule A poison schedule number of **S6** has been allocated to this product using the criteria in the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).

Inventory Listing(s) **AUSTRALIA: AICS (Australian Inventory of Chemical Substances)**
All components are listed on AICS or are exempt.

16. OTHER INFORMATION

Additional information

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

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

Abbreviations

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

Revision history

Revision	Description
1.0	Standard SDS Review

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

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Safety Data Sheet

Product Name **QUICKSEAL FMC (FINE, MEDIUM & COARSE)**

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Hazardous Statement	Non-Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG
Supplier name	**COHO Drilling Fluids**
Address	Unit 26/43 Lang Parade, Milton, QLD 4074 AUSTRALIA
Telephone	+61 7 3870 0849
Emergency	+61 4 56 780 809 info@coho-resources.com
Synonym(s)	N/A
Use(s)	Lost Circulation Material
SDS Revision Date	25 March 2019
Australian Poisons Information Centre	24-hour hotline 13 11 26 Police / Fire 000
New Zealand Poisons Information Centre	Dunedin: +64 3 479 1200 (Business Hours) +64 3 474 0999 (Emergency)

2. HAZARDS IDENTIFICATION

NOT CLASSIFIED AS HAZARDOUS ACCORDING TO SAFE WORK AUSTRALIA CRITERIA

Risk Phrases Not Hazardous

Safety Phrases None Allocated

NOT CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE

UN Number None Allocated **Transport Hazard Class** None Allocated

Packing Group None Allocated **Hazchem Code** None Allocated

3. COMPOSITION/ INFORMATION ON INGREDIENTS

Ingredient	CAS Number	EC Number	Content
Contains no hazardous substances in concentrations above the cut-off values according to the competent authority	N/A	-	60-100%

4. FIRST AID MEASURES

Eye If in eyes, hold eyelids apart and flush continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre, a doctor, or for at least 15 minutes.

Inhalation	If inhaled, remove from contaminated area to fresh air. Apply artificial respiration if not breathing.
Skin	If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with soap and running water. Seek medical attention of irritation persists.
Ingestion	Under normal conditions, first aid procedures are not required.
Advice to doctor	Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flammability	Non-flammable. May evolve toxic gases if strongly heated.
Fire and explosion	Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.
Extinguishing	Water fog, carbon dioxide, foam, dry chemical, full protective clothing and SCBA required.
Hazchem code	None Allocated

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	Wear Personal Protective Equipment (PPE). Avoid inhaling dust.
Environmental precautions	Prevent product from entering drains and waterways.
Methods of cleaning up	Contain spillage, scoop up collect and place in suitable containers for disposal.
References	See Sections 8 and 13 for exposure controls and disposal.

7. STORAGE AND HANDLING

Storage	Store in a cool, dry location. Keep away from oxidizers.
Handling	Avoid contact with skin, eyes or clothing. Avoid inhaling dust – ensure adequate ventilation. Wash hands after contact. Launder contaminated clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure standards	No exposure standard(s) allocated.
Biological limits	No biological limit allocated.
Engineering controls	Avoid inhalation. Use in a well-ventilated area. Localized ventilation should be used to control dust levels.
PPE	
Eye / Face	Dust proof goggles.
Hands	Normal work gloves.
Body	Normal work coveralls.
Respiratory	Dust mask.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Brown
Odour	Woody
Flammability	Not applicable
Flash point	Not applicable
Boiling point	Not applicable
Melting point	Not applicable

Evaporation rate	Not applicable
Ph as a solution (1%)	Not applicable
Vapour density	Not available
Specific gravity	0.3
Solubility (water)	Insoluble in water
Vapour pressure	Not applicable
Upper explosion limit	Not applicable
Lower explosion limit	Not applicable
Partition coefficient	Not applicable
Autoignition temperature	Not applicable
Decomposition temperature	Not applicable
Viscosity	Not applicable
Explosive properties	Not applicable
Oxidising properties	Not applicable
Odour threshold	Not applicable
% Volatiles	Not applicable

10. STABILITY AND REACTIVITY

Chemical stability	Stable under recommended conditions of storage.
Conditions to avoid	None known.
Material to avoid	Strong oxidizers.
Hazardous Decomposition Products	Carbon monoxide and carbon dioxide.
Hazardous Reactions	None known.

11. TOXICOLOGICAL INFORMATION

Health Hazard Summary	Low toxicity - low irritant. This product may present a hazard with direct eye contact or prolonged skin contact. Chronic effects are not anticipated.
Eye	May cause eye irritation.
Inhalation	May cause mild respiratory irritation. May cause allergic respiratory reaction.
Skin	May cause skin irritation in some individuals.
Ingestion	May cause irritation of the mouth, throat and stomach.

Toxicity data

12. ECOLOGICAL INFORMATION

Toxicity	No known significant effects or critical hazards.
Persistence and degradability	No information provided.
Bioaccumulative potential	No information provided.
Mobility in soil	No information provided.
Other adverse effects	No information provided.

13. DISPOSAL CONSIDERATIONS

Waste disposal For small amounts, sweep up and dispose of to an approved landfill site. Contact the manufacturer/supplier for additional information (if required). Ensure that appropriate personal protective equipment is used during disposal.

Legislation Dispose of in accordance with relevant local legislation.

14. TRANSPORT INFORMATION

NOT CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE, IMDG OR IATA

	LAND TRANSPORT (ADG)	SEA TRANSPORT (IMDG / IMO)	AIR TRANSPORT (IATA / ICAO)
UN Number	None Allocated	None Allocated	None Allocated
Proper Shipping Name	None Allocated	None Allocated	None Allocated
Transport Hazard Class	None Allocated	None Allocated	None Allocated
Packing Group	None Allocated	None Allocated	None Allocated

Environmental hazards No information provided

Special precautions for user None

Hazchem code None Allocated

15. REGULATORY INFORMATION

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

Inventory Listing(s) **AUSTRALIA: AICS (Australian Inventory of Chemical Substances)**
All components are listed on AICS or are exempt.

16. OTHER INFORMATION

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

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

Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
CAS #	Chemical Abstract Service number - used to uniquely identify chemical compounds
CNS	Central Nervous System
EC No.	EC No - European Community Number
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ppm	Parts Per Million
STEL	Short-Term Exposure Limit
STOT-RE	Specific target organ toxicity (repeated exposure)
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SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
SWA	Safe Work Australia
TLV	Threshold Limit Value
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Revision history

Revision	Description
1.0	Standard SDS Review

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COHO RESOURCES

SAFETY DATA SHEET

According to Safe Work Australia

Printing date 25/01/18

Revision: 25/01/18

Product Name: SAPP

1 . IDENTIFICATION: PRODUCT IDENTIFIER AND CHEMICAL IDENTITY

Product Name:	**SAPP**
Recommended Use of the Chemical and Restriction on Use:	Cleaners, drilling mud, metal cleaning and phosphatizing, detergents, ceramics, paint, paper, cement, water treatment, Acting as pH-buffering agent, Chelating agent and Stabilizer, raising agent, food additive, sequestrant.
Details of Manufacturer or Importer:	Redox Pty Ltd **2 Swettenham Road** **Minto NSW 2566** **Australia**
Phone Number:	02 97333000
Emergency telephone number:	1800-127406 +64-4-9179888

Other Names
Sodium Acid Pyrophosphate, Diphosphoric Acid, Disodium Salt; Disodium Dihydrogen Pyrophosphate; S.A.P.P

2 . HAZARDS IDENTIFICATION

Poisons Schedule (Aust)		Not scheduled	
Globally Harmonised System Hazard Classification		Hazardous	
Hazard Categories		Serious Eye Damage/Irritation - Category 2A	
Signal Word		Warning	
Hazard Statements		H319	Causes serious eye irritation.
Precautionary Statements	Prevention	P264	Wash exposed skin thoroughly after handling.
		P280	Wear protective gloves/protective clothing/eye protection/face protection.
	Response	P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
		P337 + P313	If eye irritation persists: Get medical advice/attention

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

SAFETY DATA SHEET

According to Safe Work Australia

Printing date 25/01/18 Revision: 25/01/18

Product Name: SAPP

3 . COMPOSITION AND INFORMATION ON INGREDIENTS

Chemical Entity	Formula	CAS Number	Proportion
Sodium Acid Pyrophosphate	No Data	7758-16-9	100.0 %

4 . FIRST AID MEASURES

Swallowed	Rinse mouth with water. Give plenty of water to drink provided victim is conscious. Never give anything by mouth to an unconscious person. If symptoms persist consult doctor.
Eye	Immediately flush eyes with plenty of water for at least 15 minutes, while holding eyelids open. If symptoms persist, consult a doctor.
Skin	Remove contaminated clothing. Wash affected area with plenty of Soap and water for at least 15 minutes. Seek medical attention if irritation develops or persists. Wash contaminated clothing and shoes before reuse.
Inhaled	Remove victim from exposure to fresh air. If not breathing, apply artificial respiration. If breathing is difficult, give oxygen. Consult doctor in case of complaints.
Advice to Doctor	Treat symptomatically based on judgement of doctor and individual reactions of patient.
Medical Conditions Aggravated by Exposure	No information available on medical conditions aggravated by exposure to this product.

5 . FIRE FIGHTING MEASURES

General Measures	Clear fire area of all non-emergency personnel. Stay upwind. Keep out of low areas. Eliminate ignition sources. Move fire exposed containers from fire area if it can be done without risk.
Flammability Conditions	Product is a non-flammable solid.
Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Fire and Explosion Hazard	This product is non-flammable. Product does not present an explosion hazard
Hazardous Products of Combustion	Oxides of phosphorus, Sodium oxides.
Special Fire Fighting Instructions	Do NOT allow fire fighting water to reach waterways, drains or sewers. Store fire fighting water for treatment.
Personal Protective Equipment	Fire fighters should wear a positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots and gloves).

Flash Point	No Data Available
Lower Explosion Limit	No Data Available
Upper Explosion Limit	No Data Available
Auto Ignition Temperature	No Data Available
Hazchem Code	No Data Available

6 . ACCIDENTAL RELEASE MEASURES

General Response Procedure	Avoid accidents, clean up immediately. Slippery when spilt. Eliminate all sources of ignition. Increase ventilation.
	Avoid generating dust. Stop leak if safe to do so. Isolate the danger area. Use clean, non-sparking tools and equipment.
Clean Up Procedures	Contain and sweep/shovel up spills with dust binding material or use an industrial vacuum cleaner. Transfer to a suitable, labelled container and dispose of promptly as hazardous waste.
Containment	Stop leak if safe to do so. Isolate the danger area.
Environmental Precautionary Measures	Do NOT let product reach drains or waterways. If product does enter a waterway, advise the Environmental Protection Authority or your local Waste Management.
Evacuation Criteria	Evacuate all unnecessary personnel.
Personal Precautionary Measures	Personnel involved in the clean up should wear full protective clothing as listed in section 8.

7 . HANDLING AND STORAGE

Handling	Ensure good ventilation/exhaustion at the workplace. Avoid contact with eyes. Avoid long or repeated skin contact. Prevent formation of dust. Any deposit of dust which cannot be avoided must be removed regularly. Do not breathe dust. Make sure that all applicable workplace limits are observed.
Storage	Store in a cool, dry, well-ventilated area. Keep containers tightly closed when not in use. Inspect regularly for deficiencies such as damage or leaks. Protect against physical damage. Store away from incompatible materials as listed in section 10. This product is not classified dangerous for transport according to The Australian Code for the Transport of Dangerous Goods By Road and Rail.
Container	Store in original packaging as approved by manufacturer.

8 . EXPOSURE CONTROLS AND PERSONAL PROTECTION

General	No exposure standard has been established for this product by the Australian Safety and Compensation Council (ASCC). However, the

	exposure standard for dust not otherwise specified is 10mg/m3 (for inspirable dust) and 3mg/m3 (for respirable dust). NOTE: The exposure value at the TWA is the average airborne concentration of a particular substance when calculated over a normal 8 hour working day for a 5 day working week. These exposure standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.
Exposure Limits	No Data Available
Biological Limits	No information available on biological limit values for this product.
Engineering Measures	A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area.
Personal Protection Equipment	EYES: Tightly sealed goggles (AS1336/1337).
	HANDS: The glove material has to be impermeable and resistant to the product/ the substance/ the preparation. Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation. Material of gloves: Rubber gloves. Penetration time of glove material: The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed (AS2161).
	CLOTHING: Long-sleeved protective clothing and safety footwear (AS3765/2210).
Work Hygienic Practices	Keep away from foodstuffs, beverages and feed. Immediately remove all soiled and contaminated clothing Wash hands before breaks and at the end of work. Avoid contact with the eyes. Avoid contact with the eyes and skin..

9 . PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Solid
Appearance	Powder
Odour	Odourless
Colour pH	White
Vapour Pressure	4.0 - 4.7 10 g/L (20 deg C)
Relative Vapour Density	No Data Available Relative Vapour Density
Boiling Point	>450 °C

Melting Point	No Data Available
Freezing Point	Soluble
Solubility	No Data Available
Specific Gravity	No Data Available
Flash Point	No Data Available
Auto Ignition Temp	No Data Available
Evaporation Rate	No Data Available
Bulk Density	No Data Available
Corrosion Rate	No Data Available
Decomposition Temperature	No Data Available
Density	1.1 g/cm3
Specific Heat	No Data Available
Molecular Weight	221.94 g/mol
Net Propellant Weight	No Data Available
Octanol Water Coefficient	No Data Available
Particle Size	No Data Available
Partition Coefficient	No Data Available
Saturated Vapour Concentration	No Data Available
Vapour Temperature	No Data Available
Viscosity	No Data Available
Volatile Percent	No Data Available
VOC Volume	No Data Available
Additional Characteristics	No Data Available
Potential for Dust Explosion	Product does not present an explosion hazard.
Fast or Intensely Burning Characteristics	No Data Available
Flame Propagation or Burning Rate of Solid Materials	No Data Available
Non-Flammables That Could	No Data Available
Contribute Unusual Hazards to a Fire	No Data Available
Properties That May Initiate or Contribute to Fire Intensity	No Data Available
Reactions That Release Gases or Vapours	No Data Available
Release of Invisible Flammable Vapours and Gases	No Data Available

10 . STABILITY AND REACTIVITY

General Information	
Chemical Stability	Product is stable under normal conditions of use, storage and temperature
Conditions to Avoid	Avoid heat and moisture.

Materials to Avoid	Strong oxidizing agents.
Hazardous Decomposition Products	No decomposition if used according to specifications. Phosphorus oxides (e.g. P2O5)
Hazardous Polymerisation	No Data Available

11 . TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label.

Symptoms or effects that may arise if the product is mishandled and overexposure occurs are:

General Information	LD50 Oral - mouse - 2,650 mg/kg LC50 Inhalation - rat - male and female - 4 h - > 0.58 mg/l (OECD Test Guideline 403) LD50 Dermal - rat - male and female - > 2,000 mg/kg (OECD Test Guideline 402) Skin corrosion/irritation Skin - rabbit Result: No skin irritation (OECD Test Guideline 404) Serious eye damage/eye irritation Eyes - rabbit Result: Irritating to eyes. (OECD Test Guideline 405) Respiratory or skin sensitisation - mouse Did not cause sensitisation on laboratory animals. (OECD Test Guideline 429)
Eye Irritant	Irritating effect.
Ingestion	
Inhalation	No sensitizing effects known..
Skin Irritant	No irritant effect. No sensitizing effects known.
Carcinogen Category	No Data Available

12 . ECOLOGICAL INFORMATION

Ecotoxicity	No ecological information available for this product.
Persistence/Degradability	No information available on persistence/degradability for this product.
Mobility	No information available on mobility for this product.
Environmental Fate	Do NOT let product reach waterways, drains and sewers.
Bioaccumulation Potential	No information available on bioaccumulation for this product.
Environmental Impact	No Data Available

13 . DISPOSAL CONSIDERATIONS

General information	Dispose of in accordance with all local, state and federal regulations. All empty packaging should be disposed of in accordance with Local, State, and Federal Regulations or recycled/reconditioned at an approved facility.
Special precautions	Contact a specialist disposal company or the local waste regulator for advice. Must not be disposed together with household garbage. Do not allow product to reach sewage system.

SAFETY DATA SHEET

According to Safe Work Australia

Printing date 25/01/18 Revision: 25/01/18

Product Name: SAPP

14 . TRANSPORT INFORMATION

Land Transport (Australia)
ADG Code

Proper Shipping Name	SODIUM ACID PYROPHOSPHATE
Class	No Data Available
Subsidiary Risk(s)	No Data Available No Data Available
EPG	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	

Air Transport

IATA **DGR**	
Proper Shipping Name	SODIUM ACID PYROPHOSPHATE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

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

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

15 . REGULATORY INFORMATION

General Information	No Data Available
Poisons Schedule (Aust)	No Data Available
National/Regional Inventories Australia (AICS)	Listed

SAFETY DATA SHEET

According to Safe Work Australia

Printing date 25/01/18 Revision: 25/01/18

Product Name: SAPP

16 . OTHER INFORMATION

Key/Legend

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

SAFETY DATA SHEET

According to Safe Work Australia

Printing date 25/01/18 Revision: 25/01/18

Product Name: SAPP

END OF DOCUMENT

SDS no. MI10216
Version 8
Revision date 08/Aug/2014
Supersedes date 06/May/2014

Safety Data Sheet
DUO-VIS†

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name DUO-VIS†
Product code MI10216

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

Recommended Use Viscosifier.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I Australia Pty Ltd
Level 5
256 St. George Terrace
Perth
WA 6000
T= 08 9440 2900
MISDS@slb.com

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600

2. Hazards identification

2.1 Classification of the substance or mixture

Classification according to (EC) No. 1272/2008

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards Not classified

2.2 Label elements

Signal word
None

Hazard statements
This product is not classified as hazardous therefore no (H) hazard statements assigned.

EU specific hazard statements
EUH208 - Contains (Glyoxal). May produce an allergic reaction

Precautionary Statements - EU (§28, 1272/2008)
This product is not classified as hazardous therefore has no (P) precautionary statements assigned.

-

Classification according to EU Directives 67/548/EEC or 1999/45/EC

Indication of danger
Not classified

Contains

Glyoxal

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

2.3 Other data

Not classified as PBT/vPvB by current EU criteria

3. Composition/information on ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

Component	EC-No.	CAS-No	Weight % - range	Classification (67/548)	Classification (Reg. 1272/2008)	REACH registration number
Glyoxal	203-474-9	107-22-2	<1	Xn; R20, Muta cat.3 68 Xi; R36/37/38, 43	Acute Tox. 4 (H332) Skin Irrit. 2 (H315) Eye Irrit. 2 (H319) Skin Sens. 1B (H317) Muta. 2 (H341) STOT SE 3 (H335)	No data available

Comments
The product contains other ingredients which do not contribute to the overall classification.

4. First aid measures

4.1 First-Aid Measures

Inhalation — If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion — Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.

Skin contact Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact Remove contact lenses. Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation Please see Section 11. Toxicological Information for further information.

Ingestion Please see Section 11. Toxicological Information for further information.

Skin contact Please see Section 11. Toxicological Information for further information.

Eye contact Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Fog, Alcohol Foam, CO_2, Dry Chemical.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Dust may form explosive mixture in air.

Hazardous combustion products
Fire or high temperatures create:, Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. See also section 8. If spilled, take caution, as material can cause surfaces to become very slippery.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment. Local authorities should be advised if significant spillages cannot be contained.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. Prevent dust cloud. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. When using do not smoke, eat or drink. Wash hands before eating, drinking or smoking. Remove contaminated clothing.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions	Ensure adequate ventilation. Keep airborne concentrations below exposure limits. Keep away from heat, sparks, and flame.
Storage precautions	Keep containers tightly closed in a dry, cool and well-ventilated place. Avoid contact with: Strong oxidizing agents Protect from moisture
Storage class	Chemical storage.
Packaging material	Use specially constructed containers only

7.3 Specific end uses

See Section 1.2.

8. Exposure controls/personal protection

8.1 Control parameters

Component	EU OEL	Austria	Australia	Denmark
Glyoxal	Not determined	Not determined	Not determined	0.2 ppm Ceiling 0.5 mg/m³ Ceiling

Component	Finland	France	Germany	Hungary
Glyoxal	Not determined	Not determined	Not determined	Not determined

Component	New Zealand	Italy	Netherlands	Norway
Glyoxal	Not Determined	Not determined	Not determined	Not determined

Component	Poland	Portugal	Romania	Russia
Glyoxal	Not determined	0.1 mg/m³ TWA inhalable fraction, aerosol and vapor	Not determined	Not determined

Component	Spain	Switzerland	Turkey	UK
Glyoxal	0.1 mg/m³ VLA-ED it is prohibited the partial or complete commercialization or use of this substance as a phytosanitary o biocide compound inhalable fraction and vapor	Not determined	Not determined	Not determined

Derived No Effect Level (DNEL)

Long term exposure local effects

Glyoxal

Inhalation	0.04 mg/m³

Long term exposure systemic effects

Glyoxal

Dermal	10.8 mg/kg
Inhalation	5.29 mg/m³

Predicted No Effect Concentration (PNEC)

Glyoxal

Fresh water	0.319 mg/l
Sea water	0.0319 mg/l
Fresh water sediment	0.685 mg/l
Sea sediment	0.0685 mg/l
Soil	4.06 mg/l
Impact on sewage treatment	4.1 mg/l
Intermittent release	1.1 mg/l

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation. Local exhaust ventilation.

Personal protective equipment

Eye protection	It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.
Hand protection	Repeated or prolonged contact:, Use protective gloves made of:, Butyl, Neoprene, Nitrile.
Respiratory protection	No personal respiratory protective equipment normally required, In case of insufficient ventilation wear suitable respiratory equipment, Half mask with a particle filter P2 (European Norm EN 143 = former DIN 3181).
Skin and body protection	Wear suitable protective clothing, Eye wash and emergency shower must be available at the work place.

Hygiene measures Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid
Appearance	Powder Dust
Odor	Mild
Color	Cream - Tan
Odor threshold	Not applicable

Property	**Values**	**Remarks**
pH	Not applicable	
pH @ dilution	7	@ 1% sol.
Melting/freezing point		
Boiling point/range	No information available	
Flash point	No information available	
Evaporation rate (BuAc =1)		
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	Not applicable	
Lower flammability limit	Not applicable	
Vapor pressure	No information available	
Vapor density	No information available	
Specific gravity	1.5	20 °C
Bulk density	50 lb/ft³ (800 kg/m³)	
Relative density	No information available	
Water solubility	Soluble in water	
Solubility in other solvents	No information available	
Autoignition temperature	> 200 °C	
Decomposition temperature	No information available	
Kinematic viscosity		
Dynamic viscosity	No information available	
Log Pow	Not determined	

Explosive properties	Not Applicable
Oxidizing properties	None known.

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	None
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

10.4 Conditions to avoid

Heat, flames and sparks. Protect from moisture.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

See also section 5.2.

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation Inhalation of dust in high concentration may cause irritation of respiratory system.

Eye contact May cause slight irritation.

Skin contact Prolonged contact may cause redness and irritation.

Ingestion Ingestion may cause stomach discomfort.

Unknown acute toxicity .

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Glyoxal	= 3300 mg/kg (Rat)	No data available	= 2410 mg/m³, 3-4 hrs

Sensitization Repeated or prolonged contact may cause allergic reactions in very susceptible persons.

Mutagenic effects Contains no ingredients above reportable quantities listed as a mutagenic.

Carcinogenicity This product does not contain any known or suspected carcinogens.

Reproductive toxicity None known.

Routes of exposure None known.

Routes of entry No route of entry noted.

Specific target organ toxicity (single exposure) Not classified

Specific target organ toxicity (repeated exposure) Not classified.

Aspiration hazard No hazard from product as supplied.

12. Ecological information

12.1 Toxicity

The product component(s) are 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.

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Glyoxal	215 mg/L LC50 (Pimephales promelas) = 96 h 460 - 680 mg/L LC50 (Leuciscus idus) = 96 h	500 mg/L EC50 (Desmodesmus subspicatus) = 72 h 348.59 mg/L EC50 (Pseudokirchneriella subcapitata) = 96 h 500 mg/L EC50 (Desmodesmus subspicatus) = 96 h	404 mg/L EC50 (Daphnia magna) = 48 h

12.2 Persistence and degradability

The product contains substances which are not expected to be biodegradable.

12.3 Bioaccumulative potential

Does not bioaccumulate.

12.4 Mobility in soil

Mobility
Soluble in water.

12.5 Results of PBT and vPvB assessment

Not classified as PBT/vPvB by current EU criteria.

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.
EWC Waste disposal No.	According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used. The following Waste Codes are only suggestions: EWC waste disposal No: 07 01 99.

14. Transport information

The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

14.1 UN Number
Not regulated

14.2 Proper shipping name
Not regulated

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions
Not Applicable

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Please contact MISDS@slb.com for info regarding transport in Bulk.

15. Regulatory information

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

Germany, Water Endangering Classes (VwVwS)	Water endangering class = 1

Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, including amendments.

This safety data sheet complies with the requirements of Regulation (EC) No. 1272/2008.

Dutch Mining Regulations: In accordance with Mining Regulations 9.2 and Chapter 4 of the Working Conditions Decree.

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

Contact REACH@miswaco.slb.com for REACH information.

15.2 Chemical Safety Report

No information available

16. Other information

Prepared by	Global Regulatory Compliance - Chemicals (GRC - Chemicals)
Supersedes date	06/May/2014
Revision date	08/Aug/2014
Version	8

The following sections have been revised	2. Hazards Identification, 3. Composition/information on Ingredients, 11. Toxicological information, Section 16: Other information.

Text of R phrases mentioned in Section 2 and 3
Not classified
R20 - Harmful by inhalation
R43 - May cause sensitization by skin contact
R68 - Possible risks of irreversible effects.

R36/37/38 - Irritating to eyes, respiratory system and skin

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

This product is not classified as hazardous therefore no (H) hazard statements assigned.
H332 - Harmful if inhaled
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H317 - May cause an allergic skin reaction
H341 - Suspected of causing genetic defects if inhaled
H335 - May cause respiratory irritation
EUH208 - Contains (Glyoxal). May produce an allergic reaction

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.

COHO RESOURCES

SAFETY DATA SHEET

According to Safe Work Australia

Revision: 27-01-2022

F2V CS

SECTION 1: Identification

1.1 Product identifier

Product name **F2V CS**

1.2 Uses and uses advised against

Use(s) Applied in drilling fluids for clay inhibition and as fertiliser when the well has been completed.

1.3 Details of the supplier of the product

Supplier name **COHO Resources**

Address 3/35 Astor Terrace Spring Hill 4000

Telephone 0447 725 362

1.4 Emergency telephone number(s)

Emergency 0447725362

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 as amended

Hazard summary

Low hazard for recommended handling by trained personnel.

2.2. Label elements

Label according to Regulation (EC) No. 1272/2008 as amended

Contains: Polysaccharide

Hazard statement

Not assigned.

Precautionary statements

Prevention: Not assigned.

Response: Not assigned.

Storage: Not assigned.

Disposal: Not assigned.

Supplemental label information: None.

2.3 Other hazards

None known.

SECTION 3: Composition/information on ingredients

Name	Product identifier	%	GHS-US classification
Nitrogen containing polysaccharide	(CAS No.) 56780-58-6	95-99	

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : If medical advice is needed, have product container or label at hand.

First-aid measures after inhalation : If inhaled, remove to fresh air and keep at rest in a position comfortable for breathing. Give oxygen or artificial respiration if necessary. Obtain medical attention if breathing difficulty persists.

First-aid measures after skin contact : Wash skin thoroughly with mild soap and water. Obtain medical attention if irritation develops or persists.

First-aid measures after eye contact : Immediately rinse with water for a prolonged period while holding the eyelids wide open. Obtain medical attention if irritation develops or persists.

First-aid measures after ingestion : Seek medical attention

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

Symptoms/injuries : Irritation to eyes, skin and respiratory tract.

Symptoms/injuries after inhalation : Difficulty in breathing. Dry/sore throat. Symptoms may be delayed.

Symptoms/injuries after skin contact : May cause skin irritation.

Symptoms/injuries after eye contact : May cause eye irritation.

Symptoms/injuries after ingestion : May cause discomfort.

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

Treat symptomatically

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Chemical type foam, Carbon Dioxide (CO_2), dry chemical, water fog.

Unsuitable extinguishing media : None known.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Under conditions of fire this material may produce:CO2 or nitrogen containing compounds.

Explosion hazard : Dust in may be explosive.

Reactivity : Stable at ambient temperature and under normal conditions of use.

5.3. Advice for firefighters

Firefighting instructions : Keep upwind. Under conditions of fire this material may produce: CO2 or nitrogen containing compounds.

Protection during firefighting : Wear full fire-fighting turn-out gear (full Bunker gear) and respiratory protection (SCBA).

Other information : Do not allow run-off from firefighting to enter drains or water courses.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

General measures : Do not breathe fumes from fires or vapors from decomposition.

6.1.1. For non-emergency personnel

Protective equipment : Wear suitable protective clothing, gloves and eye/face protection.

Emergency procedures : Collect as any solid. Ventilate area.

6.1.2. For emergency responders

Protective equipment : Wear suitable protective clothing, gloves and eye/face protection.

Emergency procedures : If possible, stop flow of product. Contain and collect as any solid. Ventilate area.

6.2 Environmental precautions

Prevent any spills that could potentially enter any waterway, including intermittent dry creeks

6.3 Methods and material for containment and cleaning up

For containment : If contaminated with other materials, contain and collect as any solid in suitable containers. Do not allow into drains or water courses or dispose of where ground or surface waters may be affected. Prevent large quantities from contacting vegetation.

Methods for cleaning up : Recover the product by vacuuming, shoveling or sweeping and place in appropriate container to be disposed at an appropriate disposal facility according to current applicable laws and regulations and product characteristics at the time of disposal. Provide adequate ventilation. Avoid generation of dust during clean-up of spills. If uncontaminated, recover and reuse product. Practice good housekeeping – spillage can be slippery on smooth surface either wet or dry.

6.4 Reference to other sections

No additional information available

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed : When heated, material emits irritating fumes.

Precautions for safe handling : Handle in accordance with good industrial hygiene and safety procedures. Avoid contact with skin and eyes. Do not eat, drink or smoke when using this product.

Hygiene measures : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store tightly closed in a dry, cool and well-ventilated place. Protect from moisture.

Incompatible materials : Alkalis and caustic products; strong acids; copper and its alloys.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits: For national occupational exposure limits see section 15, National regulations

Recommended monitoring procedures: Not established.

DNEL: Not available.

PNEC: Not available.

8.2. Exposure controls

Appropriate engineering controls : Ensure adequate ventilation, especially in confined areas. Avoid high dust concentration.

Personal protective equipment : Gloves. Safety glasses. Protective clothing.

Hand protection : Impermeable protective gloves.

Eye protection : Protective goggles.

Skin and body protection : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Wear suitable protective clothing. Wash contaminated clothing before reuse. Handle in accordance with good industrial hygiene and safety practice.

Respiratory protection : Wear NIOSH approved respiratory protective equipment when exposure exceeds the OSHA nuisance dust standard of 15 mg/m3 or the ACGIH nuisance dust limit of 10 mg/m3 for the eight hour time weighted average. When stored in closed area, a self-contained breathing apparatus is required to protect against ammonia gas.

Environmental exposure controls : Ensure adequate ventilation, especially in confined areas.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Solid
Appearance	: Granular solid
Molecular mass	: Not available
Odour	: NA
Odour threshold	: No data available
pH	: NA
Relative evaporation rate (butylacetate=1)	: No data available
Melting point	: NA

Freezing point	: No data available
Boiling point	: Decomposes
Flash point	: Not applicable
Self ignition temperature	: Not flammable
Decomposition temperature	: No data available
Flammability (solid, gas)	: Not flammable
Vapour pressure	: No data available
Relative vapour density at 20 °C	: No data available
Relative density	: No data available
Density	: 1.5 g/cm³ (at 20 °C)
Bulk Density	: No data available
Solubility	: Soluble
Log Pow	: No data available. Based on water solubility it is expected that the log P_{ow} would be very low.
Log Kow	: No data available
Viscosity	: No data available
Explosive properties	: No data available
Oxidising properties	: No oxidizing properties
Explosive limits	: No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

Stable at ambient temperature and under normal conditions of use.

10.2. Chemical stability

Stable at standard temperature and pressure.

10.3. Possibility of hazardous reactions

Hazardous polymerization will not occur.

10.4. Conditions to avoid

Incompatible materials. Minimize dust generation and accumulation.

10.5. Incompatible materials

Strong oxidising products.

10.6. Hazardous decomposition products

No hazardous decomposition products are known..

SECTION 11: Toxicological information

11.1. Information on toxicological effects

General information: Under normal conditions of intended use, this material does not pose a risk to health.

Information on likely routes of exposure: Ingestion
No harmful effects expected in amounts likely to be ingested by accident.

Inhalation: Under normal conditions of intended use, this material is not expected to be an inhalation hazard.

Skin contact: None known.

Eye contact: Direct contact with eyes may cause temporary irritation.

Symptoms: Dust may irritate the eyes and the respiratory system.

11.1 Information on toxicological effects

Acute toxicity: Dust may irritate the eyes and the respiratory system.

Skin corrosion/irritation: Not assigned.

Serious eye damage/eye irritation: Direct contact with eyes may cause temporary irritation.

Respiratory sensitization: None known.

Skin sensitization: None known.

Germ cell mutagenicity: Not assigned.

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

Reproductive toxicity
None known.

Specific target organ toxicity - single exposure
None known.

Specific target organ toxicity - repeated exposure

None known.

Aspiration hazard
Not applicable.

Mixture versus substance information
Not available.

Other information
Not available.

SECTION 12: Ecological information

12.1 Toxicity
No toxicity data noted for the ingredient(s).

12.2 Persistence and degradability
No data available.

12.3 Bioaccumulative potential
No data available.

Mobility
Not available.

Environmental fate - Partition coefficient
Not available.

12.4 Mobility in soil
Not available.

12.5 Results of PBT and vPvB assessment
Not available.

12.6 Other adverse effects
None known.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Residual waste
Dispose of in accordance with local regulations.
Contaminated packaging
Since emptied containers may retain product residue, follow label warnings even after container is emptied.

EU waste code
Waste codes should be assigned by the user based on the application for which the product was used.

SECTION 14: Transport information

In accordance with DOT / TDG / ADR / RID / ADNR / IMDG / ICAO / IATA

14.1. UN number

No dangerous good in sense of transport regulations.

14.2. UN proper shipping name

Not applicable

14.2 Additional information

Other information : No supplementary information available.

Overland transport

No additional information available

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

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

Other regulations

The product is classified and labelled in accordance with EC directives or respective national laws. This Safety Data Sheet complies with the requirements of Regulation (EC) No 1907/2006.

15.2 Chemical safety assessment
A Chemical Safety Assessment is not required for this substance.
Commission Regulation (EU) No. 453/2010
amending Regulation (EC) No. 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

SECTION 16: Other information

Disclaimer

This SDS is prepared in accord with the Safe Work Australia document “Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals - December 2011”

The information contained in this safety data sheet is provided in good faith and is believed to be accurate at the date of issuance. COHO Resources Pty. Ltd makes no representation of the accuracy or comprehensiveness of the information and to the full extent allowed by law excludes all liability for any loss or damage related to the supply or use of the information in this material safety data sheet. The user is cautioned to make their own determinations as to the suitability of the information provided to the circumstances in which the product is used.

COHO RESOURCES

SAFETY DATA SHEET

According to Safe Work Australia

Revision: 14-08-2020 F2V N12

Section 1. Identification

1.1 Product identifier

Product name **F2V N12**

1.2 Uses and uses advised against

Use(s) Applied in drilling fluids for clay inhibition and as fertiliser when the well is finished.

1.3 Details of the supplier of the product

Supplier name **COHO Resources**

Address 3/35 Astor Terrace Spring Hill 4000

Telephone 0447 725 362

1.4 Emergency telephone number(s)

Emergency 0447725362

Section 2. Hazards identification

OSHA/HCS status : While this material is not classified as hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200), due to lack of data, this SDS contains valuable information critical to the safe handling and proper use of the product.

Classification of the substance or mixture : Not classified.

Hazards not otherwise classified : None known.

Percentage of the mixture consisting of ingredient(s) of unknown oral toxicity: 25%
Percentage of the mixture consisting of ingredient(s) of unknown dermal toxicity: 25%
Percentage of the mixture consisting of ingredient(s) of unknown inhalation toxicity: 25%

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Avoid release to the environment.

Prevention : All workers using this product must be trained in proper use and disposal of chemicals in the workplace. Do not eat, drink or smoke when using this product. Do not get in eyes, on skin, or on clothing. Do not breathe vapor or spray. Use personal protective equipment as required.

Response : IF SWALLOWED: Rinse mouth. Call a POISON CENTER or physician if you feel unwell.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, get medical advice/ attention.
IF ON SKIN: Take off contaminated clothing. Rinse skin with water or shower. Wash contaminated clothing before reuse.

Storage : Store in accordance with all local, regional, national and international regulations.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Ingredient name	%	CAS number
Trade secret. The specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.		

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact

: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation

: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact

: Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : **Wash out mouth with water. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.**

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation Skin contact Ingestion: **No specific data.**

: No specific data.

: No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : No specific data.

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".Environmental precautions**:** Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Trade secret	None.

Appropriate engineering controls

Environmental exposure controls: Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures Hygiene measures :

Eye/face protection :

Skin protection

Wash hands, forearms and face oroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period.
Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side- shields.

Hand protection

Body protection: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection **:** Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection **:** Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Personal protective equipment (Pictograms)

:

Section 9. Physical and chemical properties

Appearance

Physical state Color	
Odor	: Liquid.
Odor threshold	: Not available.
pH	: Not available.
Melting point	: Not available.
	: 4 to 6.5
	: <0°C (<32°F)
Boiling point	: >100°C (>212°F)
Flash point	: Not applicable.
Evaporation rate	: Not available.
Flammability (solid, gas)	: Not available.
Lower and upper explosive (flammable) limits	: Not available.
Vapor pressure	: Not available
Relative density	: 1.087
Solubility in water	: 1431 g/l
Partition coefficient: n-**octanol/water**	: 0.11 to 0.12
Auto-ignition temperature	: Not available.
Decomposition temperature	: Not available.
Viscosity	: Not available
Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: No specific data.
Incompatible materials	: No specific data.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous reactions will not occur.

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Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : No specific data.

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

Section 11. Toxicological information

The toxicological properties of this substance have not been thoroughly investigated.

Section 12. Ecological information

Not available.

Section 13. Disposal considerations

Disposal methods : Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. For more detailed information, please refer to the regulation. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

For more detailed information, please refer to the regulation.

Section 14. Transport information

	Transport information
UN number	Not regulated.
UN proper shipping name	-
Transport hazard class(es)	-
Packing group	-
Environmental hazards	No.

Section 15. Regulatory information

Special precautions for user: Transport within user's premises: **always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.**

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Listed and active

United States inventory (TSCA 8b) All components are listed on the TSCA inventory and active

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Not applicable.

Composition/information on ingredients

No products were found.

Section 16. Other information

Procedure used to derive the classification

Classification	Justification
Not classified.	

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

Disclaimer

This SDS is prepared in accord with the Safe Work Australia document “Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals - December 2011”

The information contained in this safety data sheet is provided in good faith and is believed to be accurate at the date of issuance. COHO Resources Pty. Ltd makes no representation of the accuracy or comprehensiveness of the information and to the full extent allowed by law excludes all liability for any loss or damage related to the supply or use of the information in this material safety data sheet. The user is cautioned to make their own determinations as to the suitability of the information provided to the circumstances in which the product is used.

COHO RESOURCES

SAFETY DATA SHEET

According to Safe Work Australia

Printing date 21/03/20 Revision: 21/03/2020

1 . IDENTIFICATION: PRODUCT IDENTIFIER AND CHEMICAL IDENTITY

Product Name:	**FLOC C**
Recommended Use of the Chemical and Restriction on Use:	For flocculating solids in fluids
Emergency telephone number:	0447 725 362

2 . HAZARDS IDENTIFICATION

GHS Classification

Not a hazardous substance or mixture. Precautionary Statements :

Prevention:
Wash hands thoroughly after handling.
Response:
Get medical advice/ attention if you feel unwell.
Storage:
Store in accordance with local regulations.
Disposal:
Dispose of contents/ container to an approved waste disposal plant.

Other hazards : None known.

3 . COMPOSITION AND INFORMATION ON INGREDIENTS

Components	CAS	Proportion	Hazard Codes
No hazardous ingredients			

4 . FIRST AID MEASURES

Swallowed	Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Seek medical attention if irritation occurs.
Eye	Remove contact lenses. Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.
Skin	Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Inhaled	Remove victim from area of exposure - avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. Seek medical advice if effects persist.
Most important symptoms and effects (acute and delayed)	No additional information available
Immediate medical attention and special treatment, if necessary	Other medical advice or treatment : Treat symptomatically.

5 . FIRE FIGHTING MEASURES

5.1. Suitable extinguishing media	Water spray. Dry powder. Foam.
5.2. Unsuitable extinguishing media	No additional information available
5.3. Specific hazards arising from the hazardous product	Not flammable or combustible.
5.4. Special protective equipment and precautions for fire-fighters	Do not attempt to take action without suitable protective equipment. Self-contained breathing apparatus. Complete protective clothing.

6 . ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures	Use personal protective equipment.
6.2. Methods and materials for containment and cleaning up	Mechanically recover the product. Do not use water to wash away as it gets very slippery and slimy. Other information : Dispose of materials or solid residues at an authorized site.
6.3. Reference to other sections	For further information refer to section 8: "Exposure controls/personal protection"

7 . HANDLING AND STORAGE

7.1. Precautions for safe handling	Ensure good ventilation of the work station. Wear personal protective equipment. Avoid dust formation. Protect eyes and skin. Hygiene measures : Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

7.2. Conditions for safe storage, including any incompatibilities	Keep out of reach of children. Keep container tightly closed. Store in suitable labelled containers.

8 . EXPOSURE CONTROLS AND PERSONAL PROTECTION

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

Engineering measures : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Personal protective equipment

Eye protection : Wear safety glasses with side-shields.

Hand protection : Wear protective gloves.
NITRILE GLOVES
NEOPRENE GLOVES PVC
GLOVES
Rubber gloves
Butyl gloves
Cloth gloves
Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.

Skin protection : Wear suitable protective clothing.

Respiratory protection : Respiratory protection is not normally needed.
Where concentrations in air may exceed the limits given in this section, the use of a nuisance dust mask is recommended.

Hygiene measures : Wash hands before breaks and immediately after handling the product.

9 . PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Granular
Colour	:	white
Odour	:	Slight
Flash point	:	does not flash
pH	:	7, 1 %, Method: ASTM E 70
Odour Threshold	:	no data available
Melting point/freezing point	:	no data available
Initial boiling point and boiling range	:	no data available

Evaporation rate	:	no data available
Flammability (solid, gas)	:	no data available
Upper explosion limit	:	no data available
Lower explosion limit	:	no data available
Vapour pressure	:	no data available
Relative vapour density	:	no data available
Relative density	:	0.75,
Density	:	6.2 lb/gal
Water solubility	:	completely soluble
Solubility in other solvents	:	no data available
Partition coefficient: n-octanol/water	:	no data available
Auto-ignition temperature	:	no data available
Thermal decomposition temperature	:	no data available
Viscosity, dynamic	:	100 mPa.s
Viscosity, kinematic	:	no data available
Molecular weight	:	no data available
VOC	:	no data available

10 . STABILITY AND REACTIVITY

Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	No dangerous reaction known under conditions of normal use.
Conditions to avoid	:	None known.
Incompatible materials	:	Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors. Strong Bases
Hazardous decomposition products	:	Decomposition products may include the following materials: Carbon oxides nitrogen oxides (NOx)

11 . TOXICOLOGICAL INFORMATION

Information on likely routes of exposure	:	Eye contact, Skin contact

Potential Health Effects

Eyes	:	Health injuries are not known or expected under normal use.
Skin	:	Health injuries are not known or expected under normal use.
Ingestion	:	Health injuries are not known or expected under normal use.
Inhalation	:	Health injuries are not known or expected under normal use.
Chronic Exposure	:	Health injuries are not known or expected under normal use.

Experience with human exposure

Eye contact	:	No symptoms known or expected.
Skin contact	:	No symptoms known or expected.
Ingestion	:	No symptoms known or expected.
Inhalation	:	No symptoms known or expected.

Toxicity

Product

Acute oral toxicity	:	no data available
Acute inhalation toxicity	:	no data available
Acute dermal toxicity	:	no data available
Skin corrosion/irritation	:	no data available
Serious eye damage/eye irritation	:	no data available
Respiratory or skin sensitization	:	no data available
Carcinogenicity	:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
Reproductive effects	:	No toxicity to reproduction
Germ cell mutagenicity	:	Contains no ingredient listed as a mutagen
Teratogenicity	:	no data available
STOT - single exposure	:	no data available
STOT - repeated exposure	:	no data available
Aspiration toxicity	:	No aspiration toxicity classification

Human Hazard Characterization

Based on our hazard characterization, the potential human hazard is: Low

12 . ECOLOGICAL INFORMATION

Ecotoxicity

Environmental Effects	:	This product has no known ecotoxicological effects.

Product

Toxicity to fish	:	LC50 Lepomis macrochirus (Bluegill sunfish): > 1,000 mg/l Exposure time: 96 hrs Test substance: Product LC50 Oncorhynchus mykiss (rainbow trout): > 1,000 mg/l Exposure time: 96 hrs Test substance: Product LC50 Pimephales promelas (fathead minnow): > 1,000 mg/l Exposure time: 96 hrs Test substance: Product
Toxicity to daphnia and other aquatic invertebrates	:	no data available
Toxicity to algae	:	LC50 Green Algae (Pseudokirchneriella subcapitata, previously Selenastrum capricornutum): > 500 mg/l Exposure time: 96 hrs Test substance: Product

Persistence and degradability

Chemical Oxygen Demand (COD): 839,000 mg/l

Mobility

The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	:	<5%
Water	:	<5%
Soil	:	> 90%

The portion in water is expected to float on the surface.

Bioaccumulative potential

No bioaccumulation will occur. The large size of the polymer is incompatible with transport across the cellular membranes.

Other information

no data available

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Low

13 . DISPOSAL CONSIDERATIONS

Disposal methods	:	Where possible recycling is preferred to disposal or incineration. If recycling is not practicable, dispose of in compliance with local regulations. Dispose of wastes in an approved waste disposal facility.
Disposal considerations	:	Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers.

14 . TRANSPORT INFORMATION

The shipper/consignor/sender is responsible to ensure that the packaging, labeling, and markings are in compliance with the selected mode of transport.

Land transport

Proper shipping name	:	PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Air transport (IATA)

Proper shipping name	:	PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Sea transport (IMDG/IMO)

Proper shipping name	:	PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15 . REGULATORY INFORMATION

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

FOOD AND DRUG ADMINISTRATION (FDA) Federal Food, Drug and Cosmetic Act :
When use situations necessitate compliance with FDA regulations, this product is acceptable under : 21 CFR

176.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 176.180 Components of paper and paperboard in contact with dry foods. 21 CFR 173.315 chemicals used in washing or to assist in the lye peeling of fruits and vegetables

Product is limited to a maximum of 2% of paper or paperboard as an adjuvant in the making of paper and paperboard. Limitation for 173.315: May be used to assist in the washing of fruits and vegetables at a concentration not to exceed 10 ppm (as product) in the wash water.

INTERNATIONAL CHEMICAL CONTROL LAWS :

TOXIC SUBSTANCES CONTROL ACT (TSCA)
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)
The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

KOREA
All substances in this product comply with the Chemical Control Act (CCA) and are listed on the Existing Chemicals List (ECL)

NEW ZEALAND
All substances in this product comply with the Hazardous Substances and New Organisms (HSNO) Act 1996,and are listed on or are exempt from the New Zealand Inventory of Chemicals.

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16 . OTHER INFORMATION

REFERENCES

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version),

Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH,
(TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

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FOAM-X

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: FOAM-X
Date Issued: March 17, 2020

Prepared by: HSE Dept
& Version: 11-2.2

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	FOAM-X
Product Purpose:	Wellbore reinforcement
Supplier Identification:	Australian Coil Services Pty Ltd 8-10 Moorebank Rd Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms: none
Signal word: none
Precautionary statements: none required

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight	GHS-US classification
KOH	1310-58-3	0.1 - 1	Acute Tox.4 (oral), H302 Skin Corr, 1A, H314 Aquatic Acute 3, H402

No other reportable hazardous substances contained in the mixture

4. FIRST AID MEASURES

Eye Contact:	Rinse immediately with plenty of water. May cause slight irritation
Skin Contact:	Wash with soap and water. May cause slight irritation
Ingestion:	Dilute with water or milk. Do not induce vomiting. Call physician if necessary

Inhalation: Not expected to require first aid. If necessary, move to fresh air

5. FIRE FIGHTING MEASURES

Flash Point:	Does not flash
Lower explosion Limit (LEL):	Not available
Upper explosion Limit (UEL):	Not available
Auto ignition temperature:	Not available
Suitable Extinguishing Media:	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide
Fire and explosion Hazard:	Hazardous decomposition products formed under fire conditions – carbon oxides, sodium oxides
Conditions of flammability:	Not flammable or combustible
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire-fighting if required
Specific Hazards:	None

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Wear appropriate PPE for the size and nature of the spill. As a general rule, wear safety glasses and gloves.
Environmental Precautions:	Do not let product enter drains.
Emergency Procedures:	Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable closed containers for disposal.
Disposal:	Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Avoid contact with skin and eyes. Avoid formation of dust and

aerosols. Provide appropriate exhaust ventilation at places where dust is formed.

Storage Precautions: Keep container tightly closed in a dry and well ventilated place. Incompatible with strong acids and oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

CAS	Chemical Name	ACGIH – Threshold limit values - Ceilings
1310-58-3	Potassium hydroxide	2 mg/m^3 ceiling

Engineering Measures: General ventilation is recommended. Local Exhaust fan may be necessary when mist is generated.

Hygiene Recommendations: Keep an eye wash fountain and safety shower available.
Eye Protection: Wear safety glasses with side shields.
Hand Protection: Wear nitrile gloves.
Respiratory Protection: Not required except in case of dust exposure – For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.
Skin and Body Protection: Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form: Solid
Color: White
Odor: Slight
Boiling Point: No data available
Vapor Pressure: No data available
Vapor Density: No data available

pH:	8-10
Solubility:	Insoluble in water
Evaporation Rate:	No data available
Flash Point:	Does not flash
Freezing Point:	No data available
Specific Gravity:	1.05 – 1.10 g/mL
Viscosity:	No data available

10. STABILITY AND REACTIVITY

Stability:	Stable under recommended storage conditions
Conditions to Avoid:	No data available
Materials to Avoid:	Strong oxidizing agents and acids
Hazardous Decomposition Products:	Carbon oxides, magnesium oxides
Under Fire Conditions:	Hazardous decomposition products formed under fire conditions – carbon oxides, sodium oxides

11. TOXICOLOGICAL INFORMATION

Acute Toxicity:	LD50, Oral, Rat: (Potassium Hydroxide) 273 mg/kg, details of toxic effects not reported other than lethal dose value. Irritation data: skin, rabbit:50 mg/24H severe; eye, rabbit: 1 mg/24H moderate.
Acute toxicity:	No data available
Sensitization:	This product is not expected to be sensitizing.
Mutagenic Effects:	No data available
Reproductive Toxicity:	No data available
Carcinogenic Effects:	No data available
Teratogenicity and Embryo Toxicity:	No data available

Other Toxicity Information: Toxicological Synergistic products: none known.

12. ECOLOGICAL INFORMATION

Acute toxicity to bacteria: *EC50/Allivibrio fischeri/15 min* > 75,400 mg/L
Persistence and Degradability: Material is not readily biodegradable
Mobility: No data available

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package

Dispose in accordance with local and national regulations. Can be landfilled or incinerated, when in compliance with local regulations. Contaminated packaging: If recycling is not practicable, dispose of in compliance with local regulations. Can be landfilled or incinerated, when in compliance with local regulations. Recycling: In accordance with local and national regulations.

14. TRANSPORT INFORMATION

Land Transport (ADG): Not classified.
Sea Transport (IMDG): Not classified.
Air Transport (IATA): Not classified.
Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Information on the product as supplied:
Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 1 Flammability: 0 Instability: 0 Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

FOAM-X (UNSET)	AUSCOIL

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: FOAM-X (UNSET)	Prepared by: HSE Dept
Date Issued: July 7, 2020	# & Version: 30-1.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	FOAM-X (UNSET)
Product Purpose:	Wellbore reinforcement
Supplier Identification:	Australian Coil Services Pty Ltd 8-10 Moorebank Rd Charlton, Qld 4350 Australia

PREPARER'S TELEPHONE NUMBER: 0011 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

Hazard Pictograms:

Signal word: Danger

Primary Routes of Exposure: Inhalation and skin

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Serious eye damage/eye irritation *(Category 1), H319*
Hazard Statements: H340 – May cause genetic defects
H350 – May cause cancer

Precautionary Statements:

P202 – Do not handle until all safety precautions have been read and understood
P308 + P313 – If exposed: get medical advice/attention
P303 + P361 + P353 – IF ON SKIN (or hair): Remove/take off clothing immediately. Rinse skin with water/shower
P304 + P340 – IF INHALED:Remove victim to fresh air and keep at rest in a position comfortable for breathing
P305 + P351 + P338 – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing.

Hazards not otherwise classified (HNOC) or not covered by GHS *– none*

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight	Classification according to Model Work Health and Safety Regulations
Polyethylene glycol diacrylate	26570-48-9	3 to 7	Eye Irrit. 2A; H319
N,N'-methylenediacrylamide	110-26-9	< 1	Acute Tox. 3;H301, Acute Tox. 4;H312, Acute Tox. 4;H332, Muta. 1B;H340, Carc. 1B;H350, Repr. 2;H361, STOT RE 1;H372
KOH	1310-58-3	0.1 - 1	Acute Tox.4 (oral), H302 Skin Corr, 1A, H314 Aquatic Acute 3, H402

4. FIRST AID MEASURES

Eye Contact:

Rinse eyes immediately with copious amounts of water and under the eyelids for at least 30 minutes. If symptoms persist seek medical advice.

Skin Contact:	Remove contaminated clothing. Immediately wash off all material with soap and water. Get medical attention if irritation develops and persists.
Ingestion:	If swallowed, and the victim is conscious and alert, induce vomiting immediately, as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Inhalation:	Remove person to fresh air. If signs/symptoms persist continue get medical attention.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media:	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Fire and explosion Hazard:	May evolve oxides of nitrogen and carbon under fire conditions. Hydrogen cyanide (hydrocyanic acid) may be produced in the event of combustion in an oxygen deficient atmosphere.
Specific Methods:	Cool tanks with water to avoid polymerization.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus for fire fighting.
Specific Hazards:	None.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	No action should be taken involving any personal risk or without suitable training. Stay upwind. Wear adequate personal protective equipment.
Environmental Precautions:	Do not allow contact with soil, surface, or ground water.
Emergency Procedures:	Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Prevent further leakage or spillage if safe to do so.

Methods For Cleaning Up: Small spill: Cover with suitable absorbent material, eg diatomite. Keep in suitable, closed containers for disposal
Large spills: Do not allow solution to dry. Contain with dike, Pump into suitable labelled containers. One-to-one dilution is suitable to reduce reactivity.
Residue: Flush away with large quantities of water

Disposal: Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Avoid creating aerosols. Use only with adequate ventilation or personal protection. Do not store or consume food, drink, or tobacco in areas where they may become contaminated.

Storage Precautions: Store in a cool, dry, well-ventilated area. Place away from incompatible materials. Keep containers in a dry, cool and well-ventilated place. Avoid acids, bases, oxidizing agents, reducing agents, initiators which may cause polymerization.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits: None known.

Engineering Measures: Provide extraction ventilation at points where emissions occur. The use of mechanical dilution ventilation is recommended whenever this product is used in confined space, is heated above ambient temperatures or otherwise to maintain ambient concentration below the recommended threshold exposure limits.

CAS	Chemical Name	ACGIH*	OSHA	IDLH
26570-48-9	Polyethylene glycol diacrylate	Not Available	Not Available	Not Available
1310-58-3	Potassium hydroxide	2 mg/m^3 ceiling		

Engineering Measures:	General ventilation is recommended. Local exhaust fan may be necessary when mist is generated.
Eye Protection:	Wear safety glasses with side shields.
Hand Protection:	Wear PVC, rubber or nitrile gloves.
Respiratory Protection:	Not required except in case of aerosol formation.
Skin and Body Protection:	Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.

*ACGIH – Occupational exposure limits – TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Liquid
Color:	Beige
Odor:	Slight
Boiling Point:	> 100 ºC
Vapor Pressure:	No data available
Vapor Density:	No data available
pH:	8 – 10
Solubility:	Soluble
Evaporation Rate:	Not Available
Flash Point:	Does not flash
Freezing Point:	< 0°C
Specific Gravity:	1.05 – 1.1
Viscosity:	30 – 90 cP @ 25 ºC

10. STABILITY AND REACTIVITY

Stability:	Stable under recommended storage conditions, polymerization initiated by free radicals, peroxides.
Conditions to Avoid:	Avoid extreme temperatures

Materials to Avoid: Strong oxidizing or reducing agents, strong acids and bases, and polymerization initiators.

Hazardous Polymerization: Will result in an exothermic reaction.

Hazardous Decomposition Products: Oxides of nitrogen and carbon, hydrogen cyanide.

Under Fire Conditions: Heating can release hazardous gases. Hazardous decomposition products formed under fire conditions – carbon oxides, sodium oxides

11. TOXICOLOGICAL INFORMATION

	Polyethylene glycol diacrylate	**N,N'-dimethylenediacrylamide**	**Potassium Hydroxide**
LD50/oral/rat:	2,000 mg/kg	50-300 mg/kg	273 mg/kg
LC50/inhalation/1hr/rat:	No data available	12.1mg/L	
LD50/dermal/4hr/rabbit:	2,000 mg/kg	1,141 mg/kg	50 mg/24H
Carcinogenicity: NOAEL/rat		0.5 mg/kg/day	
Reproductive toxicity: NOAEL/rat:		2 mg/kg/day	
Prenatal development: NOAEL/maternal toxicity/rat: NOAEL/developmental toxicity/rat:		2.5 mg/kg/day 15mg/kg/day	

Sensitization: This product is not expected to be sensitizing.

Mutagenic Effects: Negative in Ames Test. Negative in the in vitro mammalian cell gene mutation test. Positive in the in vitro mammalian chromosome aberration test. Positive in the rodent dominant lethal test.

Reproductive Toxicity: Two generation reproduction toxicity (OECD 416)

- NOAEL/rat = 2 mg/kg/day (Based on results obtained from tests on analogous products)

Prenatal Development Toxicity Study (OECD 414)
- NOAEL/Maternal toxicity/rat = 2.5 mg/kg/day
- NOAEL/Developmental toxicity/rat = 15 mg/kg/day

Carcinogenic Effects: Carcinogenicity study in rate: NOAEL = 0.5mg/kg/day (EPA OPP 83-2) (Based on results obtained from tests on analogous products)

Teratogenicity and Embryo Toxicity: None.

Human Experience: Non-toxic.

Other Toxicity Information: High

Other Toxicity Information: Toxicological Synergistic products: none known.

12. ECOLOGICAL INFORMATION

Ingredients	Ecotoxicity – Fish Species Data	Acute Crustaceans Toxicity	Ecotoxicity – Fresh water Algae
Product as supplied	LC50 > 100 mg/L 96 h (Fish) estimated.	EC50 > 100 mg/L 48 h (Daphnia) estimated.	EC50 1-10 mg/L 72 h (Algae) estimated.
N,N'-dimethylenediacrylamide	LC50 > 100 mg/L 96 h (Fish)	EC50 > 100 mg/L 48 h (Daphnia)	EC50 1-10 mg/L 72 h (Algae)
Potassium Hydroxide	*EC50/Allivibrio fischeri/15 min* > 75,400 mg/L		

Persistence and Degradability: Material is readily biodegradable

Mobility: Product is liquid and therefore readily mobile.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package Waste from residues/unused product: Whenever possible, send residues and unused product to the production process. In the case of

contamination, polymerize the product and then send to landfill or incinerator.
Contaminated packaging: Completely drain containers and retain product residues. Rinse empty containers with water and use the rinse-water to prepare the working solution. Dispose of waste containers in accordance with all applicable regulations.
Recycling: The product and its packaging are not suitable for recycling.

14. TRANSPORT INFORMATION

Land Transport (ADG): Not classified.
Sea Transport (IMDG): Not classified.
Air Transport (IATA): Not classified.
Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

Information on the product as supplied:

Australian Inventory of Chemical Substances (AICS)
All components of this product are either listed on the inventory or are exempt from listing.

This section contains additional information that may have relevance to regulatory compliance. The information contained in this section is for reference only. Auscoil accepts no liability for the use of this information.

16. OTHER INFORMATION

FOAM-X (UNSET)	

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: 0011 - 587 - 353 - 2940 (24 Hrs)

Product Name: FOAM-X (UNSET) Prepared by: HSE Dept
Date Issued: July 7, 2020 # & Version: 30-1.0

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Auscoil for any additional information.

SDS no. MI14015
Version 4
Revision date 12/Feb/2015
Supersedes date 27/Feb/2014

Safety Data Sheet
FORM-A-BLOK†

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name FORM-A-BLOK†
Product code MI14015
Denmark Pr. no.: 2313300

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

Recommended Use Lost circulation material.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I Australia Pty Ltd / ALPINE
ABN: 67 009 214 162
Level 5
256 St. George Tce
Perth
WA 6000
T = +61 08 9440 2900
F = +61 08 9322 3080
+47 51577424
MISDS@slb.com

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600

2. Hazards identification

2.1 Classification of the substance or mixture

Classification according to (EC) No. 1272/2008

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards Not classified

2.2 Label elements

Signal word
None

Hazard statements
This product is not classified as hazardous therefore no (H) hazard statements assigned.

Precautionary Statements - EU (§28, 1272/2008)
This product is not classified as hazardous therefore has no (P) precautionary statements assigned.

-

Classification according to EU Directives 67/548/EEC or 1999/45/EC

Indication of danger
Not classified

Contains

Wollastonite (Ca(SiO3))

Cellulose

Kaolin

Polyvinyl alcohol

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

2.3 Other data

Not classified as PBT/vPvB by current EU criteria

Australian statement of hazardous/dangerous nature
Classified as Non-Hazardous according to the criteria of NOHSC.
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS.

3. Composition/information on ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

Component	EC-No.	CAS-No	Weight % - range	Classification (67/548)	Classification (Reg. 1272/2008)	REACH registration number
Wollastonite (Ca(SiO3))	237-772-5	13983-17-0	30-60	-	Not classified	No data available
Cellulose	232-674-9	9004-34-6	10-30	-	Not classified	No data available
Kaolin	310-194-1	1332-58-7	5-10	-	Not classified	No data available

Polyvinyl alcohol	polymer	9002-89-5	5-10	-	Not classified	No data available

Comments
The product contains other ingredients which do not contribute to the overall classification.

4. First aid measures

4.1 First-Aid Measures

Inhalation — If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion — Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.

Skin contact — Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact — Remove contact lenses. Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice — The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation — Please see Section 11. Toxicological Information for further information.

Ingestion — Please see Section 11. Toxicological Information for further information.

Skin contact — Please see Section 11. Toxicological Information for further information.

Eye contact — Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician — Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Fog, Alcohol Foam, CO_2, Dry Chemical.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Dust may form explosive mixture in air.

Hazardous combustion products
Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. If spilled, take caution, as material can cause surfaces to become very slippery. Use personal protective equipment. See also section 8.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment. Local authorities should be advised if significant spillages cannot be contained.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. Avoid dust formation. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation. If spilled, take caution, as material can cause surfaces to become very slippery.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure When using do not smoke, eat or drink. Wash hands before eating, drinking or smoking Remove contaminated clothing.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions Ensure adequate ventilation. Keep airborne concentrations below exposure limits. Keep away from heat, sparks, and flame.

Storage precautions Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from moisture
Avoid contact with: Strong oxidizing agents

Storage class Chemical storage.

Packaging material Use specially constructed containers only

7.3 Specific end uses

See Section 1.2.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits No biological limit allocated

Component	EU OEL	Austria	Australia	Denmark
Wollastonite (Ca(SiO3))	Not determined	Not determined	Not determined	1 fiber/cm3 TWA
Cellulose	Not determined	Not determined	10 mg/m³ TWA (containing no asbestos and <1% crystalline silica, inspirable dust)	Not determined
Kaolin	Not determined	Not determined	10 mg/m³ TWA (containing no asbestos and <1% crystalline silica, inspirable dust)	2 mg/m³ TWA
Polyvinyl alcohol	Not determined	Not determined	Not determined	Not determined

Component	Malaysia	France	Germany	Hungary
Wollastonite (Ca(SiO3))	Not determined	Not determined	Not determined	Not determined
Cellulose	10 mg/m³ TWA	10 mg/m³	Not determined	Not determined
Kaolin	2 mg/m³ TWA	10 mg/m³	Not determined	Not determined
Polyvinyl alcohol	Not determined	Not determined	Not determined	Not determined

Component	New Zealand	Italy	Netherlands	Norway
Wollastonite (Ca(SiO3))	Not Determined	Not determined	Not determined	Not determined
Cellulose	10 mg/m³ TWA	Not determined	Not determined	Not determined
Kaolin	10 mg/m³ TWA 2 mg/m³ TWA	Not determined	Not determined	Not determined
Polyvinyl alcohol	Not Determined	Not determined	Not determined	Not determined

Component	Poland	Portugal	Romania	Russia
Wollastonite (Ca(SiO3))	Not determined	Not determined	Not determined	Not determined
Cellulose	Not determined	10 mg/m³ TWA	Not determined	10 mg/m³ MAC

Kaolin	10.0 mg/m³ TWA <2% free crystalline silica and containing no asbestos total inhalable dust	2 mg/m³ TWA respirable fraction, particulate matter containing no Asbestos and < 1% Crystalline silica	Not determined	8 mg/m³ TWA aerosol Fibrogenic substance
Polyvinyl alcohol	Not determined	Not determined	Not determined	10 mg/m³ MAC

Component	Spain	Switzerland	Turkey	UK
Wollastonite (Ca(SiO3))	Not determined	Not determined	Not determined	Not determined
Cellulose	10 mg/m³ VLA-ED	3 mg/m³ MAK respirable	Not determined	20 mg/m³ STEL inhalable dust 12 mg/m³ STEL calculated respirable dust 10 mg/m³ TWA inhalable dust 4 mg/m³ TWA respirable dust
Kaolin	2 mg/m³ VLA-ED this value is for the particulated matter that is free from Asbestos and contains less than 1% of Crystalline silica respirable fraction	3 mg/m³ MAK respirable	Not determined	6 mg/m³ STEL calculated respirable dust 2 mg/m³ TWA respirable dust
Polyvinyl alcohol	Not determined	Not determined	Not determined	Not determined

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation. Mechanical ventilation or local exhaust ventilation is required.

Personal protective equipment

Eye protection — It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.

Hand protection — Use protective gloves made of:, Nitrile, Neoprene, Frequent change is advisable.

Respiratory protection — No personal respiratory protective equipment normally required, In case of insufficient ventilation wear suitable respiratory equipment, Half mask with a particle filter P2 (European Norm EN 143 = former DIN 3181).

Skin and body protection — Wear suitable protective clothing, Eye wash and emergency shower must be available at the work place.

Hygiene measures Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid
Appearance	Powder Dust
Odor	Odorless
Color	Light gray
Odor threshold	Not applicable

Property	Values	Remarks
pH	No information available	
pH @ dilution		
Melting/freezing point		
Boiling point/range	No information available	
Flash point	No information available	
Evaporation rate (BuAc =1)		
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	Not applicable	
Lower flammability limit	Not applicable	
Vapor pressure	No information available	
Vapor density	No information available	
Specific gravity	No information available	
Bulk density	No information available	
Relative density	1.98 sg	@ 20°C.
Water solubility	Insoluble in water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity		
Dynamic viscosity	No information available	
Log Pow	No information available	

Explosive properties	No information available
Oxidizing properties	No information available

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	No information available
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

10.4 Conditions to avoid

Protect from moisture. Avoid dust formation. Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

See also section 5.2.

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation Inhalation of dust in high concentration may cause irritation of respiratory system.

Eye contact May cause slight irritation.

Skin contact Prolonged contact may cause redness and irritation.

Ingestion Ingestion may cause stomach discomfort.

Unknown acute toxicity Not Applicable.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Wollastonite (Ca(SiO3))	No data available	No data available	No data available
Cellulose	> 5 g/kg (Rat)	> 2 g/kg (Rabbit)	> 5800 mg/m³ (Rat) 4 h
Kaolin	No data available	No data available	No data available
Polyvinyl alcohol	> 20 g/kg (Rat)	No data available	No data available

Sensitization This product does not contain any components suspected to be sensitizing.

Mutagenic effects This product does not contain any known or suspected mutagens.

Carcinogenicity This product does not contain any known or suspected carcinogens.

Reproductive toxicity	This product does not contain any known or suspected reproductive hazards.
Routes of exposure	None known.
Routes of entry	No route of entry noted.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	No hazard from product as supplied.

12. Ecological information

12.1 Toxicity

The product component(s) are 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.

Toxicity to algae
This product is not considered toxic to algae.

Toxicity to fish
This product is not considered toxic to fish.

Toxicity to daphnia and other aquatic invertebrates
This product is not considered toxic to invertebrates.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Wollastonite (Ca(SiO3))	No information available	No information available	No information available
Cellulose	No information available	No information available	No information available
Kaolin	No information available	No information available	No information available
Polyvinyl alcohol	No information available	No information available	No information available

12.2 Persistence and degradability

Not readily biodegradable.

12.3 Bioaccumulative potential

Does not bioaccumulate.

12.4 Mobility in soil

Mobility
Insoluble in water.

12.5 Results of PBT and vPvB assessment

Not classified as PBT/vPvB by current EU criteria.

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.
EWC Waste disposal No.	According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used. The following Waste Codes are only suggestions: EWC waste disposal No: 01 05 99

14. Transport information

The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

14.1 UN Number
Not regulated

14.2 Proper shipping name
Not regulated

14.3 Hazard class(es)

ADR/RID/ADN/ADG Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated

14.4 Packing group

ADR/RID/ADN/ADG Packing group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions
Not Applicable

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Please contact MISDS@slb.com for info regarding transport in Bulk.

15. Regulatory information

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

Australian Standard for the Uniform Scheduling of Drugs and Poisons
No Poisons Schedule number allocated

Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, including amendments.

This safety data sheet complies with the requirements of Regulation (EC) No. 1272/2008.

National Code of Practice for the Preparation of Material Safety Data Sheets 2nd Edition [NOHSC: 2011 (2003)].

National Occupational Health and Safety Commission's Approved Criteria for Classifying Hazardous Substances [NOHSC:1008 (2004) 3rd Edition].

National Occupational Health and Safety Commission's Exposure Standards for Atmospheric Contaminants in the occupational Environment [NOHSC:1003 (1995)].

Safe Work Australia.

Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP).

Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by road or rail.

Dutch Mining Regulations: In accordance with Mining Regulations 9.2 and Chapter 4 of the Working Conditions Decree.

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Does not Comply
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Does not Comply

New Zealand (NZIoC) Complies

Contact REACH@miswaco.slb.com for REACH information.

15.2 Chemical Safety Report

No information available

16. Other information

Prepared by	Global Regulatory Compliance - Chemicals (GRC - Chemicals) , Anne Karin (Anka) Fosse
Supersedes date	27/Feb/2014
Revision date	12/Feb/2015
Version	4
The following sections have been revised	This SDS have been made in a new database and therefore a new layout. No changes with regard to classification have been made, Updated according to GHS/CLP.

Text of R phrases mentioned in Section 3
Not classified

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

This product is not classified as hazardous therefore no (H) hazard statements assigned.

†A mark of M-I L.L.C.

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.

NEWPARK DRILLING FLUIDS

SAFETY DATA SHEET

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

1.1 Product identifier

Product name **IDCIDE-20**

Synonym(s) IDCIDE 20

1.2 Uses and uses advised against

Use(s) BIOCIDE • DRILLING FLUID ADDITIVE • WATER TREATMENT

1.3 Details of the supplier of the product

Supplier name **NEWPARK DRILLING FLUIDS (AUSTRALIA) LTD**

Address 11 Alacrity Place, Henderson, WA, 6166, AUSTRALIA

Telephone +61 8 9410 8200

Fax +61 8 9410 8299

Website www.newpark.com

1.4 Emergency telephone number(s)

Emergency 1800 127 406 (Australia); +64 3 3530199 (International)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

CLASSIFIED AS HAZARDOUS ACCORDING TO SAFE WORK AUSTRALIA CRITERIA

GHS classification
Skin Sensitization: Category 1
Skin Corrosion/Irritation: Category 2
Serious Eye Damage / Eye Irritation: Category 2A

2.2 Label elements

Signal word **WARNING**

Pictograms

Hazard statement(s)

H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.

Prevention statement(s)

P261	Avoid breathing dust/fume/gas/mist/vapours/spray.
P264	Wash thoroughly after handling.
P272	Contaminated work clothing should not be allowed out of the workplace.
P280	Wear protective gloves/protective clothing/eye protection/face protection.

Response statement(s)

P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P321	Specific treatment is advised - see first aid instructions.
P333 + P313	If skin irritation or rash occurs: Get medical advice/attention.
P362	Take off contaminated clothing and wash before re-use.

Storage statement(s)
None allocated.

Disposal statement(s)
P501 Dispose of contents/container in accordance with relevant regulations.

2.3 Other hazards
No information provided.

3. COMPOSITION/ INFORMATION ON INGREDIENTS

3.1 Substances / Mixtures

Ingredient	Identification	Classification		Content
		GHS	Risk	
TETRAKIS(HYDROXYMETHYL)PHOSPHONIUM SULPHATE	CAS: 55566-30-8 EC: 259-709-0	Not Available	Not Available	18 to 25%
WATER	CAS: 7732-18-5 EC: 231-791-2	Not Available	Not Available	Remainder

4. FIRST AID MEASURES

4.1 Description of first aid measures

Eye If in eyes, hold eyelids apart and flush continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre, a doctor, or for at least 15 minutes.

Inhalation If inhaled, remove from contaminated area. Apply artificial respiration if not breathing.

Skin If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. Continue flushing with water until advised to stop by a Poisons Information Centre or a doctor.

Ingestion For advice, contact a Poison Information Centre on 13 11 26 (Australia Wide) or a doctor (at once). If swallowed, do not induce vomiting.

First aid facilities Eye wash facilities should be available.

4.2 Most important symptoms and effects, both acute and delayed
See Section 11 for more detailed information on health effects and symptoms.

4.3 Immediate medical attention and special treatment needed
Treat symptomatically.

5. FIRE FIGHTING MEASURES

5.1 Extinguishing media
Use an extinguishing agent suitable for the surrounding fire.

5.2 Special hazards arising from the substance or mixture
Non flammable. May evolve toxic gases if strongly heated. May evolve carbon oxides, sulphur oxides and phosphates when heated to decomposition.

5.3 Advice for firefighters
Treat as per requirements for surrounding fires. Evacuate area and contact emergency services. Remain upwind and notify those downwind of hazard. Wear full protective equipment including Self Contained Breathing Apparatus (SCBA) when combating fire. Use waterfog to cool intact containers and nearby storage areas.

5.4 Hazchem code
None allocated.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear Personal Protective Equipment (PPE) as detailed in Section 8. Clear area of all unprotected personnel. Ventilate area where possible.

6.2 Environmental precautions
Prevent product from entering drains and waterways.

6.3 Methods of cleaning up
Contain spillage, then cover/absorb spill with non-combustible absorbent material (vermiculite, sand, or similar), collect and place in suitable containers for disposal.

6.4 Reference to other sections
See Sections 8 and 13 for exposure controls and disposal.

7. HANDLING AND STORAGE

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

7.2 Conditions for safe storage, including any incompatibilities
Store in a cool, dry, well ventilated area, removed from incompatible substances, heat or ignition sources and foodstuffs. Ensure containers are adequately labelled, protected from physical damage and sealed when not in use.

7.3 Specific end use(s)
No information provided.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters
Exposure standards

No exposure standards have been entered for this product.

Biological limits

No biological limit values have been entered for this product.

8.2 Exposure controls
Engineering controls Avoid inhalation. Use in well ventilated areas. Where an inhalation risk exists, mechanical extraction ventilation is recommended.

PPE

Eye / Face	Wear a faceshield and splash-proof goggles.
Hands	Wear PVC or rubber gloves.
Body	Not required under normal conditions of use.
Respiratory	Not required under normal conditions of use.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance	COLOURLESS TO PALE YELLOW LIQUID
Odour	SLIGHT ODOUR
Flammability	NON FLAMMABLE
Flash point	NOT RELEVANT
Boiling point	> 100°C
Melting point	< 0°C
Evaporation rate	AS FOR WATER
pH	3.0 to 3.5
Vapour density	NOT AVAILABLE
Specific gravity	1.08
Solubility (water)	SOLUBLE

9.1 Information on basic physical and chemical properties

Vapour pressure	18 mm Hg @ 20°C
Upper explosion limit	NOT RELEVANT
Lower explosion limit	NOT RELEVANT
Partition coefficient	NOT AVAILABLE
Autoignition temperature	NOT AVAILABLE
Decomposition temperature	NOT AVAILABLE
Viscosity	NOT AVAILABLE
Explosive properties	NOT AVAILABLE
Oxidising properties	NOT AVAILABLE
Odour threshold	NOT AVAILABLE

9.2 Other information

% Volatiles	> 60 % (Water)

10. STABILITY AND REACTIVITY

10.1 Reactivity

Carefully review all information provided in sections 10.2 to 10.6.

10.2 Chemical stability

Stable under recommended conditions of storage.

10.3 Possibility of hazardous reactions

Polymerization is not expected to occur.

10.4 Conditions to avoid

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

10.5 Incompatible materials

Incompatible with oxidising agents (eg. hypochlorites) and acids (eg. nitric acid).

10.6 Hazardous decomposition products

May evolve carbon oxides, sulphur oxides and phosphates when heated to decomposition.

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Health hazard summary	May be harmful - irritant. This product has the potential to cause adverse health effects with over exposure. Upon dilution, the potential for adverse health effects may be reduced.
Eye	Irritant. Contact may result in irritation, lacrimation, pain and redness.
Inhalation	Low to moderate irritant. Over exposure to vapours may result in irritation of the nose and throat, with coughing. High level exposure may result in dizziness, nausea and headache. Due to the low vapour pressure, an inhalation hazard is not anticipated with normal use.
Skin	Irritant. Contact may result in irritation. May cause sensitisation by skin contact.
Ingestion	May be harmful. Ingestion may result in gastrointestinal irritation, nausea, vomiting, abdominal pain and diarrhoea.
Toxicity data	TETRAKIS(HYDROXYMETHYL)PHOSPHONIUM SULPHATE (55566-30-8) LD50 (ingestion) 248 mg/kg (rat) TDLo (ingestion) 650 mg/kg/13 weeks - intermittent (rat)

12. ECOLOGICAL INFORMATION

12.1 Toxicity

75% TETRAKIS(HYDROXYMETHYL)PHOSPHONIUM SULPHATE (55566-30-8):
LC50 (Rainbow Trout) = 119 mg/L/96 hr
LC50(Bluegill Sunfish) = 93 mg/L/ 96 hr
EC50 (Daphnia Magna) = 19 mg/L/48 hr
LC50 (Brown Shrimp) = 340 mg/L/96 hr
LC50 (Mysid Shrimp) = 9.5 mg/L/96 hr
LC50 (Sheepshead Minnow) = 94 mg/L/96 hr
LC50 (Jevenile Plaice) = 86 mg/L/96 hr

Waste Water management
EC50 (Activated Sludge) = 24 mg/L/3 hr

12.2 Persistence and degradability

This product is readily biodegradable.

12.3 Bioaccumulative potential

No information provided.

12.4 Mobility in soil

No information provided.

12.5 Other adverse effects

No information provided.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Waste disposal For small amounts, absorb with sand, vermiculite or similar and dispose of to an approved landfill site. For larger amounts, contact the manufacturer for additional information. Prevent contamination of drains or waterways as aquatic life may be threatened and environmental damage may result.

Legislation Dispose of in accordance with relevant local legislation.

14. TRANSPORT INFORMATION

NOT CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE, IMDG OR IATA

	LAND TRANSPORT (ADG)	SEA TRANSPORT (IMDG / IMO)	AIR TRANSPORT (IATA / ICAO)
14.1 UN Number	None Allocated	None Allocated	None Allocated
14.2 Proper Shipping Name	None Allocated	None Allocated	None Allocated
14.3 Transport hazard class	None Allocated	None Allocated	None Allocated
14.4 Packing Group	None Allocated	None Allocated	None Allocated

14.5 Environmental hazards No information provided

14.6 Special precautions for user

Hazchem code None Allocated

15. REGULATORY INFORMATION

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

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

Classifications Safework Australia criteria is based on the Globally Harmonised System (GHS) of Classification and Labelling of Chemicals.

The classifications and phrases listed below are based on the Approved Criteria for Classifying Hazardous Substances [NOHSC: 1008(2004)].

Hazard codes	Xi	Irritant
Risk phrases	R36/38	Irritating to eyes and skin.
	R43	May cause sensitisation by skin contact.
Safety phrases	S23	Do not breathe gas/fumes/vapour/spray (where applicable).
	S24/25	Avoid contact with skin and eyes.
	S36	Wear suitable protective clothing.

Inventory listing(s) **AUSTRALIA: AICS (Australian Inventory of Chemical Substances)**
All components are listed on AICS, or are exempt.

16. OTHER INFORMATION

Additional information

EXPOSURE CONTROL: If utilised in a closed system the potential for over exposure is reduced. If not used in a closed system, local exhaust ventilation is recommended to control exposure. Provide eye wash and safety shower in close proximity to points of potential exposure. Where the potential for an inhalation risk exists, an approved respirator may be required. Do not eat, store, consume food, tobacco or drink in areas where product is used.

RESPIRATORS: In general the use of respirators should be limited and engineering controls employed to avoid exposure. If respiratory equipment must be worn ensure correct respirator selection and training is undertaken. Remember that some respirators may be extremely uncomfortable when used for long periods. The use of air powered or air supplied respirators should be considered where prolonged or repeated use is necessary.

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

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

Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
CAS #	Chemical Abstract Service number - used to uniquely identify chemical compounds
CNS	Central Nervous System
EC No.	EC No - European Community Number
GHS	Globally Harmonized System
IARC	International Agency for Research on Cancer
LC50	Lethal Concentration, 50% / Median Lethal Concentration
LD50	Lethal Dose, 50% / Median Lethal Dose
mg/m³	Milligrams per Cubic Metre
OEL	Occupational Exposure Limit
PEL	Permissible Exposure Limit
pH	relates to hydrogen ion concentration using a scale of 0 (high acidic) to 14 (highly alkaline).
ppm	Parts Per Million
REACH	Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals
STEL	Short-Term Exposure Limit
STOT-RE	Specific target organ toxicity (repeated exposure)
STOT-SE	Specific target organ toxicity (single exposure)
SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
SWA	Safe Work Australia
TLV	Threshold Limit Value
TWA	Time Weighted Average

Revision history

Revision	Description
2.0	Converted to GHS.
1.0	Initial SDS creation

Report status

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

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

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

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Revision: 2
SDS date: 28 July 2014

[End of SDS]

Kinetic 550D Biocide

Kinetic Chemicals

Chemwatch Hazard Alert Code: **3**

Chemwatch: **5276-04**
Version No: **2.1.1.1**
Safety Data Sheet according to WHS and ADG requirements

Issue Date: **09/28/2017**
Print Date: **01/16/2018**
S.GHS.AUS.EN

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

Product Identifier

Product name	Kinetic 550D Biocide
Synonyms	Not Available
Proper shipping name	CORROSIVE LIQUID, TOXIC, N.O.S. (contains glutaraldehyde)
Other means of identification	Not Available

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

Relevant identified uses	To treat SRB bacteria in production systems. Initial shock treatment of 50 - 100 ppm is recommended, followed by 25 ppm maintenance dosage to control SRB bacteria counts.

Details of the supplier of the safety data sheet

Registered company name	**Kinetic Chemicals**
Address	15 Magnesium Street Narangba QLD 4504 Australia
Telephone	+61 07 3204 8577
Fax	+61 07 3204 8588
Website	https://www.kinetic.group/
Email	info@kinetic.group

Emergency telephone number

Association / Organisation	**Chemwatch**
Emergency telephone numbers	+61 2 9186 1132
Other emergency telephone numbers	Not Available

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

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

Poisons Schedule	S6

Continued...

Classification [1]	Metal Corrosion Category 1, Acute Toxicity (Oral) Category 3, Acute Toxicity (Dermal) Category 4, Acute Toxicity (Inhalation) Category 2, Skin Corrosion/Irritation Category 1B, Serious Eye Damage Category 1, Respiratory Sensitizer Category 1, Skin Sensitizer Category 1, Acute Aquatic Hazard Category 1
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HSIS ; 3. Classification drawn from EC Directive 1272/2008 - Annex VI*

Label elements

Hazard pictogram(s)	
SIGNAL WORD	**DANGER**

Hazard statement(s)

H290	May be corrosive to metals.
H301	Toxic if swallowed.
H312	Harmful in contact with skin.
H330	Fatal if inhaled.
H314	Causes severe skin burns and eye damage.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H317	May cause an allergic skin reaction.
H400	Very toxic to aquatic life.

Precautionary statement(s) Prevention

P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.

Precautionary statement(s) Response

P301+P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P301+P330+P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.

Precautionary statement(s) Storage

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

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
111-30-8	25-50	glutaraldehyde
7732-18-5	balance	water

Continued...

SECTION 4 FIRST AID MEASURES

Description of first aid measures

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

Indication of any immediate medical attention and special treatment needed

Any material aspirated during vomiting may produce lung injury. Therefore emesis should not be induced mechanically or pharmacologically. Mechanical means should be used if it is considered necessary to evacuate the stomach contents; these include gastric lavage after endotracheal intubation. If spontaneous vomiting has occurred after ingestion, the patient should be monitored for difficult breathing, as adverse effects of aspiration into the lungs may be delayed up to 48 hours.
for corrosives:

BASIC TREATMENT

- Establish a patent airway with suction where necessary.
- Watch for signs of respiratory insufficiency and assist ventilation as necessary.
- Administer oxygen by non-rebreather mask at 10 to 15 l/min.
- Monitor and treat, where necessary, for pulmonary oedema .

Continued...

- Monitor and treat, where necessary, for shock.
- Anticipate seizures.
- Where eyes have been exposed, flush immediately with water and continue to irrigate with normal saline during transport to hospital.
- **DO NOT** use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.
- Skin burns should be covered with dry, sterile bandages, following decontamination.
- **DO NOT** attempt neutralisation as exothermic reaction may occur.

ADVANCED TREATMENT

- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use.
- Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolaemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary oedema.
- Hypotension with signs of hypovolaemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.

EMERGENCY DEPARTMENT

- Laboratory analysis of complete blood count, serum electrolytes, BUN, creatinine, glucose, urinalysis, baseline for serum aminotransferases (ALT and AST), calcium, phosphorus and magnesium, may assist in establishing a treatment regime.
- Positive end-expiratory pressure (PEEP)-assisted ventilation may be required for acute parenchymal injury or adult respiratory distress syndrome.
- Consider endoscopy to evaluate oral injury.
- Consult a toxicologist as necessary.

BRONSTEIN, A.C. and CURRANCE, P.L. EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

- Alcohol stable foam.
- Dry chemical powder.
- BCF (where regulations permit).

Special hazards arising from the substrate or mixture

Fire Incompatibility	‣ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

Advice for firefighters

Fire Fighting	‣ Alert Fire Brigade and tell them location and nature of hazard. ‣ Wear full body protective clothing with breathing apparatus. ‣ Prevent, by any means available, spillage from entering drains or water course.
Fire/Explosion Hazard	‣ Non combustible. ‣ Not considered a significant fire risk, however containers may burn. May emit corrosive fumes.
HAZCHEM	2X

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Continued...

Minor Spills	▸ Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material. ▸ Check regularly for spills and leaks. ▸ Clean up all spills immediately. ▸ Avoid breathing vapours and contact with skin and eyes. ▸ Control personal contact with the substance, by using protective equipment.
Major Spills	▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ May be violently or explosively reactive.

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

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ **DO NOT** allow clothing wet with material to stay in contact with skin ▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs. ▸ Use in a well-ventilated area.
Other information	▸ Store in original containers. ▸ Keep containers securely sealed. ▸ Store in a cool, dry, well-ventilated area.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ Lined metal can, lined metal pail/ can. ▸ Plastic pail. ▸ Polyliner drum. For low viscosity materials ▸ Drums and jerricans must be of the non-removable head type. ▸ Where a can is to be used as an inner package, the can must have a screwed enclosure. For materials with a viscosity of at least 2680 cSt.
Storage incompatibility	▸ Flammable and/or toxic gases are generated by the combination of aldehydes with azo, diazo compounds, dithiocarbamates, nitrides, and strong reducing agents. ▸ Many aldehydes are incompatible with strong acids, amines, strong oxidisers, and alkaline materials. ▸ Several medium range aldehydes ignite in air, particularly if exposure is increased by sorption on paper or cloth - ignition often occurs within 2 hours ▸ Incidents involving interaction of active oxidants and reducing agents, either by design or accident, are usually very energetic and examples of so-called redox reactions. ▸ Avoid strong bases. ▸ Dangerous goods of other classes.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	glutaraldehyde	Glutaraldehyde	Not Available	Not Available	0.41 mg/m3 / 0.1 ppm	Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
glutaraldehyde	Gluteraldehyde	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
glutaraldehyde	Not Available	Not Available
water	Not Available	Not Available

Continued...

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are: Process controls which involve changing the way a job activity or process is done to reduce the risk.
Personal protection	
Eye and face protection	‣ Chemical goggles. ‣ Full face shield may be required for supplementary but never for primary protection of eyes. ‣ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants.
Skin protection	See Hand protection below
Hands/feet protection	‣ Wear chemical protective gloves, e.g. PVC. ‣ Wear safety footwear or safety gumboots, e.g. Rubber ‣ When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots. The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application. The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.
Body protection	See Other protection below
Other protection	‣ Overalls. ‣ PVC Apron. ‣ PVC protective suit may be required if exposure severe.
Thermal hazards	Not Available

Respiratory protection

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

Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content. The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Clear corrosive liquid with mild odour; mixes with water.

Physical state	Liquid	**Relative density (Water = 1)**	1.125 @ 20C
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Available
pH (as supplied)	Not Available	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	Not Available	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	100	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	Not Available	**Explosive properties**	Not Available

Continued...

Flammability	Not Applicable	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Applicable	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	Not Applicable	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	Not Available	**Gas group**	Not Available
Solubility in water (g/L)	Miscible	**pH as a solution (1%)**	Not Available
Vapour density (Air = 1)	Not Applicable	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	‣ Unstable in the presence of incompatible materials. ‣ Product is considered stable. ‣ Hazardous polymerisation will not occur.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may produce toxic effects. The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage. Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by sleepiness, reduced alertness, loss of reflexes, lack of co-ordination, and vertigo. Inhalation hazard is increased at higher temperatures.
Ingestion	**Toxic effects** may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual. The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion. Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733)
Skin Contact	Skin contact with the material may be harmful; systemic effects may result following absorption. The material can produce chemical burns following direct contact with the skin. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
Eye	The material can produce chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating. If applied to the eyes, this material causes severe eye damage.
Chronic	Repeated or prolonged exposure to corrosives may result in the erosion of teeth, inflammatory and ulcerative changes in the mouth and necrosis (rarely) of the jaw. Bronchial irritation, with cough, and frequent attacks of bronchial pneumonia may ensue. Long-term exposure to respiratory irritants may result in airways disease, involving difficulty breathing and related whole-body problems. Inhaling this product is more likely to cause a sensitisation reaction in some persons compared to the general population. Skin contact with the material is more likely to cause a sensitisation reaction in some persons compared to

Continued...

	the general population. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure. Low concentrations cause skin reddening and irritation, occupational asthma, nasal discharge, sneezing and congestion. Long term exposure may cause chronic fatigue. There may be reduced body weight and damage to the nose with repeated high doses.

Kinetic 550D Biocide	TOXICITY	IRRITATION
	Not Available	Not Available
glutaraldehyde	TOXICITY	IRRITATION
	dermal (rat) LD50: >2500 mg/kg[2]	Eye (rabbit): 0.25mg/24h-SEVERE
	Inhalation (rat) LC50: 0.48 mg/l/4hd[2]	Eye (rabbit): 1 mg-SEVERE
	Oral (rat) LD50: 134 mg/kg[2]	Skin (human): 6 mg/3d-int-SEVERE
		Skin (rabbit): 13 mg open-mild
		Skin (rabbit): 2 mg/24h-SEVERE
water	TOXICITY	IRRITATION
	Not Available	Not Available
Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*	

GLUTARALDEHYDE	The following information refers to contact allergens as a group and may not be specific to this product. Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's oedema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. Allergic reactions involving the respiratory tract are usually due to interactions between IgE antibodies and allergens and occur rapidly. Allergic potential of the allergen and period of exposure often determine the severity of symptoms. Some people may be genetically more prone than others, and exposure to other irritants may aggravate symptoms. Attention should be paid to atopic diathesis, characterised by increased susceptibility to nasal inflammation, asthma and eczema. Exogenous allergic alveolitis is induced essentially by allergen specific immune-complexes of the IgG type; cell-mediated reactions (T lymphocytes) may be involved. Such allergy is of the delayed type with onset up to four hours following exposure. The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration. Animal testing shows that glutaraldehyde has a high acute toxicity through inhalation and it may cause lung damage. It is corrosive to the skin and eyes and exposure to its vapours has caused irritation to the nose and breathing difficulties. It can sensitise skin and irritate the joints in animal testing.
WATER	No significant acute toxicological data identified in literature search.

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

Legend: ✘ *– Data available but does not fill the criteria for classification*

Continued...

✔ – *Data available to make classification*
⊘ – *Data Not Available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

Kinetic 550D Biocide

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Available	Not Available	Not Available	Not Available	Not Available

glutaraldehyde

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	3.5mg/L	4
EC50	48	Crustacea	0.75mg/L	4
EC50	72	Algae or other aquatic plants	=0.61mg/L	1
NOEC	96	Crustacea	<0.089mg/L	2

water

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Available	Not Available	Not Available	Not Available	Not Available

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

Very toxic to aquatic organisms.
Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.
Wastes resulting from use of the product must be disposed of on site or at approved waste sites.
Prevent, by any means available, spillage from entering drains or water courses.
DO NOT discharge into sewer or waterways.

Persistence and degradability

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

Bioaccumulative potential

Ingredient	Bioaccumulation
glutaraldehyde	LOW (LogKOW = -0.1821)
water	LOW (LogKOW = -1.38)

Mobility in soil

Ingredient	Mobility
glutaraldehyde	HIGH (KOC = 1.094)
water	LOW (KOC = 14.3)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal

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

Otherwise:

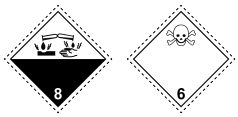
- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container

Continued...

	‣ cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill. ‣ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ‣ It may be necessary to collect all wash water for treatment before disposal. ‣ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ‣ Recycle wherever possible. ‣ Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified. ‣ Treat and neutralise at an approved treatment plant.

SECTION 14 TRANSPORT INFORMATION

Labels Required

	
Marine Pollutant	
HAZCHEM	2X

Land transport (ADG)

UN number	2922
UN proper shipping name	CORROSIVE LIQUID, TOXIC, N.O.S. (contains glutaraldehyde)
Transport hazard class(es)	Class: 8 Subrisk: 6.1
Packing group	II
Environmental hazard	Environmentally hazardous
Special precautions for user	Special provisions: 274 Limited quantity: 1 L

Air transport (ICAO-IATA / DGR)

UN number	2922
UN proper shipping name	Corrosive liquid, toxic, n.o.s. * (contains glutaraldehyde)
Transport hazard class(es)	ICAO/IATA Class: 8 ICAO / IATA Subrisk: 6.1 ERG Code: 8P
Packing group	II
Environmental hazard	Environmentally hazardous
Special precautions for user	Special provisions: A3 A803 Cargo Only Packing Instructions: 855 Cargo Only Maximum Qty / Pack: 30 L Passenger and Cargo Packing Instructions: 851 Passenger and Cargo Maximum Qty / Pack: 1 L Passenger and Cargo Limited Quantity Packing Instructions: Y840

Continued...

	Passenger and Cargo Limited Maximum Qty / Pack	0.5 L

Sea transport (IMDG-Code / GGVSee)

UN number	2922
UN proper shipping name	CORROSIVE LIQUID, TOXIC, N.O.S. (contains glutaraldehyde)
Transport hazard class(es)	IMDG Class: 8 IMDG Subrisk: 6.1
Packing group	II
Environmental hazard	Marine Pollutant
Special precautions for user	EMS Number: F-A , S-B Special provisions: 274 Limited Quantities: 1 L

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

Source	Product name	Pollution Category	Ship Type
IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk	Glutaraldehyde solutions (50% or less)	Y	3

SECTION 15 REGULATORY INFORMATION

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

GLUTARALDEHYDE(111-30-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Exposure Standards
Australia Inventory of Chemical Substances (AICS)
Australia Hazardous Substances Information System - Consolidated Lists

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

Australia Inventory of Chemical Substances (AICS)

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

SECTION 16 OTHER INFORMATION

Other information

Continued...

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios.

Kinetic 560

Kinetic Chemicals

Chemwatch Hazard Alert Code: **3**

Chemwatch: **5276-11**
Version No: **2.1.1.1**
Safety Data Sheet according to WHS and ADG requirements

Issue Date: **10/02/2017**
Print Date: **01/16/2018**
S.GHS.AUS.EN

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

Product Identifier

Product name	Kinetic 560
Synonyms	Not Available
Other means of identification	Not Available

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

Relevant identified uses	Double strength biocide.

Details of the supplier of the safety data sheet

Registered company name	**Kinetic Chemicals**
Address	15 Magnesium Street Narangba QLD 4504 Australia
Telephone	+61 07 3204 8577
Fax	+61 07 3204 8588
Website	https://www.kinetic.group/
Email	info@kinetic.group

Emergency telephone number

Association / Organisation	**Chemwatch**
Emergency telephone numbers	+61 2 9186 1132
Other emergency telephone numbers	Not Available

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

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

Poisons Schedule	Not Applicable
Classification [1]	Acute Toxicity (Oral) Category 4, Acute Toxicity (Dermal) Category 4, Skin Corrosion/Irritation Category 2, Serious Eye Damage Category 1, Respiratory Sensitizer Category 1, Skin Sensitizer Category 1,

Continued...

	Reproductive Toxicity Category 1B, Specific target organ toxicity - single exposure Category 3 (respiratory tract irritation), Acute Aquatic Hazard Category 2, Chronic Aquatic Hazard Category 2
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HSIS ; 3. Classification drawn from EC Directive 1272/2008 - Annex VI*

Label elements

Hazard pictogram(s)	
SIGNAL WORD	**DANGER**

Hazard statement(s)

H302	Harmful if swallowed.
H312	Harmful in contact with skin.
H315	Causes skin irritation.
H318	Causes serious eye damage.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H317	May cause an allergic skin reaction.
H360	May damage fertility or the unborn child.
H335	May cause respiratory irritation.
H411	Toxic to aquatic life with long lasting effects.

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.
P261	Avoid breathing mist/vapours/spray.
P271	Use only outdoors or in a well-ventilated area.

Precautionary statement(s) Response

P304+P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308+P313	IF exposed or concerned: Get medical advice/attention.

Precautionary statement(s) Storage

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

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
55566-30-8	30-60	tetrakis(hydroxymethyl)phosphonium sulfate
121-44-8	1-10	triethylamine

Continued...

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: ▸ Immediately hold eyelids apart and flush the eye continuously with running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. ▸ Transport to hospital or doctor without delay. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin contact occurs: ▸ Immediately remove all contaminated clothing, including footwear. ▸ Flush skin and hair with running water (and soap if available). ▸ Seek medical attention in event of irritation.
Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor.
Ingestion	▸ **IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.** ▸ For advice, contact a Poisons Information Centre or a doctor. ▸ Urgent hospital treatment is likely to be needed. ▸ In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition. ▸ If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the SDS should be provided. Further action will be the responsibility of the medical specialist. ▸ If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the SDS. **Where medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:** ▸ **INDUCE** vomiting with fingers down the back of the throat, **ONLY IF CONSCIOUS**. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. **NOTE:** Wear a protective glove when inducing vomiting by mechanical means.

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

The product contains a substantial proportion of water, therefore there are no restrictions on the type of extinguishing media which may be used. Choice of extinguishing media should take into account surrounding areas.
Though the material is non-combustible, evaporation of water from the mixture, caused by the heat of nearby fire, may produce floating layers of combustible substances.

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.

Advice for firefighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear breathing apparatus plus protective gloves in the event of a fire. ▸ Prevent, by any means available, spillage from entering drains or water courses.

Continued...

Fire/Explosion Hazard	‣ Non combustible. ‣ Not considered a significant fire risk, however containers may burn. Decomposes on heating and produces toxic fumes of: , carbon dioxide (CO2) , phosphorus oxides (POx) , sulfur oxides (SOx) , other pyrolysis products typical of burning organic material.
HAZCHEM	Not Applicable

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	‣ Clean up all spills immediately. ‣ Avoid breathing vapours and contact with skin and eyes. ‣ Control personal contact with the substance, by using protective equipment.
Major Spills	Moderate hazard. ‣ Clear area of personnel and move upwind. ‣ Alert Fire Brigade and tell them location and nature of hazard.

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

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	‣ **DO NOT** allow clothing wet with material to stay in contact with skin ‣ Avoid all personal contact, including inhalation. ‣ Wear protective clothing when risk of exposure occurs. ‣ Use in a well-ventilated area.
Other information	‣ Store in original containers. ‣ Keep containers securely sealed. ‣ Store in a cool, dry, well-ventilated area.

Conditions for safe storage, including any incompatibilities

Suitable container	‣ Lined metal can, lined metal pail/ can. ‣ Plastic pail. ‣ Polyliner drum.
Storage incompatibility	‣ Avoid strong bases.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes

Continued...

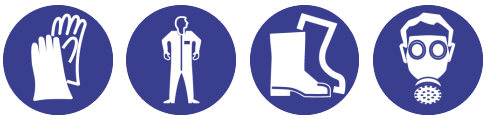
Australia Exposure Standards	triethylamine	Triethylamine	8 mg/m3 / 2 ppm	17 mg/m3 / 4 ppm	Not Available	Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
triethylamine	Triethylamine	1 ppm	170 ppm	1,000 ppm

Ingredient	Original IDLH	Revised IDLH
tetrakis(hydroxymethyl)phosphonium sulfate	Not Available	Not Available
triethylamine	200 ppm	Not Available

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are: Process controls which involve changing the way a job activity or process is done to reduce the risk.
Personal protection	
Eye and face protection	‣ Safety glasses with side shields. ‣ Chemical goggles. ‣ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants.
Skin protection	See Hand protection below
Hands/feet protection	‣ Wear chemical protective gloves, e.g. PVC. ‣ Wear safety footwear or safety gumboots, e.g. Rubber **NOTE:** ‣ The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact. ‣ Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed. The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application. The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.
Body protection	See Other protection below
Other protection	‣ Overalls. ‣ P.V.C. apron.
Thermal hazards	Not Available

Respiratory protection

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

Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content. The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Slightly yellow liquid with a pungent odour; mixes with water.

Physical state	Liquid	**Relative density (Water = 1)**	1.23-1.25

Continued...

Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Available
pH (as supplied)	4.0-6.0	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	Not Available	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	Not Available	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Available	**Taste**	Not Available
Evaporation rate	Not Available	**Explosive properties**	Not Available
Flammability	Not Available	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Available	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	Not Available	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	Not Available	**Gas group**	Not Available
Solubility in water (g/L)	Miscible	**pH as a solution (1%)**	Not Available
Vapour density (Air = 1)	Not Available	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	‣ Unstable in the presence of incompatible materials. ‣ Product is considered stable. ‣ Hazardous polymerisation will not occur.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	Not normally a hazard due to non-volatile nature of product Acute effects from inhalation of high vapour concentrations may be chest and nasal irritation with coughing, sneezing, headache and even nausea.
Ingestion	Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual. Considered an unlikely route of entry in commercial/industrial environments
Skin Contact	Skin contact with the material may be harmful; systemic effects may result following absorption. This material can cause inflammation of the skin on contact in some persons. The material may accentuate any pre-existing dermatitis condition Open cuts, abraded or irritated skin should not be exposed to this material
Eye	If applied to the eyes, this material causes severe eye damage.
Chronic	Principal routes of exposure are by accidental skin and eye contact and by inhalation of vapours especially at higher temperatures. Inhaling this product is more likely to cause a sensitisation reaction in some persons compared to the

Continued...

	general population. Skin contact with the material is more likely to cause a sensitisation reaction in some persons compared to the general population. Ample evidence exists, from results in experimentation, that developmental disorders are directly caused by human exposure to the material.

Kinetic 560	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
tetrakis(hydroxymethyl)phosphonium sulfate	**TOXICITY**	**IRRITATION**
	Oral (rat) LD50: 248 mg/kg[2]	Eye: moderate-SEVERE *
		Skin: moderate-SEVERE *
triethylamine	**TOXICITY**	**IRRITATION**
	Dermal (rabbit) LD50: 570 mg/kg[2]	Eye (rabbit): 0.25 mg/24h SEVERE
	Inhalation (rat) LC50: 3.61025 mg/l1 h[1]	Eye(rabbit): 50ppm/30d int SEVERE
	Oral (rat) LD50: 460 mg/kg[1]	Skin (rabbit): 365 mg open mild
Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*	

TETRAKIS(HYDROXYMETHYL)PHOSPHONIUM SULFATE	The following information refers to contact allergens as a group and may not be specific to this product. Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's oedema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Allergic reactions involving the respiratory tract are usually due to interactions between IgE antibodies and allergens and occur rapidly. Allergic potential of the allergen and period of exposure often determine the severity of symptoms. Some people may be genetically more prone than others, and exposure to other irritants may aggravate symptoms. Attention should be paid to atopic diathesis, characterised by increased susceptibility to nasal inflammation, asthma and eczema. Exogenous allergic alveolitis is induced essentially by allergen specific immune-complexes of the IgG type; cell-mediated reactions (T lymphocytes) may be involved. Such allergy is of the delayed type with onset up to four hours following exposure. For acid mists, aerosols, vapours Test results suggest that eukaryotic cells are susceptible to genetic damage when the pH falls to about 6.5. Cells from the respiratory tract have not been examined in this respect. Mucous secretion may protect the cells of the airway from direct exposure to inhaled acidic mists (which also protects the stomach lining from the hydrochloric acid secreted there). Tetrakis(hydroxymethyl)phosphonium salts (including THPS and THPC) are used as flame retardants. Animal testing showed that it can cause decreased body weight, liver cancers, and skin and eye reactions. High doses can cause congenital eye defects. The substance is classified by IARC as Group 3: **NOT** classifiable as to its carcinogenicity to humans. Evidence of carcinogenicity may be inadequate or limited in animal testing. Oral (rat) TDLo: 650 mg/kg/13W-I * Petrolite
TRIETHYLAMINE	Overexposure to most of these materials may cause adverse health effects. Many amine-based compounds can cause release of histamines, which, in turn, can trigger allergic and other physiological effects, including constriction of the bronchi or asthma and inflammation of the cavity of the nose. Whole-body symptoms include headache, nausea, faintness, anxiety, a decrease in blood pressure, rapid heartbeat, itching, reddening of the skin, urticaria (hives) and swelling of the face, which are usually transient. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. The material may cause skin irritation after prolonged or repeated exposure and

Continued...

	may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Inhalation (human) TCLo: 12mg/m3/11W contin.Skin (rabbitmild
TETRAKIS(HYDROXYMETHYL)PHOSPHONIUM SULFATE & TRIETHYLAMINE	Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant.

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

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

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

Kinetic 560

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Available	Not Available	Not Available	Not Available	Not Available

tetrakis(hydroxymethyl)phosphonium sulfate

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	94mg/L	4
EC50	48	Crustacea	15mg/L	4

triethylamine

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	36mg/L	2
EC50	48	Crustacea	17mg/L	2
NOEC	168	Crustacea	7.1mg/L	2

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

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
triethylamine	HIGH	HIGH

Bioaccumulative potential

Ingredient	Bioaccumulation
triethylamine	LOW (BCF = 7.45)

Mobility in soil

Continued...

Ingredient	Mobility
triethylamine	LOW (KOC = 107.2)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked. ▸ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ▸ It may be necessary to collect all wash water for treatment before disposal. ▸ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ▸ Recycle wherever possible. ▸ Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified. ▸ Dispose of by: burial in a land-fill specifically licensed to accept chemical and / or pharmaceutical wastes or incineration in a licensed apparatus (after admixture with suitable combustible material).

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant	
HAZCHEM	Not Applicable

Land transport (ADG): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

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

Not Applicable

SECTION 15 REGULATORY INFORMATION

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

TETRAKIS(HYDROXYMETHYL)PHOSPHONIUM SULFATE(55566-30-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Inventory of Chemical Substances (AICS)
International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs

TRIETHYLAMINE(121-44-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Exposure Standards
Australia Inventory of Chemical Substances (AICS)
Australia Hazardous Substances Information System - Consolidated Lists

National Inventory	Status
Australia - AICS	Y
Canada - DSL	Y
Canada - NDSL	N (triethylamine; tetrakis(hydroxymethyl)phosphonium sulfate)
China - IECSC	Y
Europe - EINEC / ELINCS / NLP	Y

Continued...

Japan - ENCS	Y
Korea - KECI	Y
New Zealand - NZIoC	Y
Philippines - PICCS	Y
USA - TSCA	Y
Legend:	*Y = All ingredients are on the inventory* *N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Other information

Ingredients with multiple cas numbers

Name	CAS No
tetrakis(hydroxymethyl)phosphonium sulfate	55566-30-8, 58591-11-0, 65257-04-7

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios.

Kinetic DBNPA 20% Solution

Kinetic Chemicals

Chemwatch Hazard Alert Code: **3**

Chemwatch: **5275-01**
Version No: **2.1.1.1**
Safety Data Sheet according to WHS and ADG requirements

Issue Date: **10/03/2017**
Print Date: **01/22/2018**
S.GHS.AUS.EN

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

Product Identifier

Product name	Kinetic DBNPA 20% Solution
Synonyms	Not Available
Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (contains 2,2-dibromo-3-nitrilopropionamide)
Other means of identification	Not Available

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

Relevant identified uses	Wildcat DBNPA Biocide is designed to treat SRB bacteria in production systems. Initial shock treatment of 50 - 100 ppm is recommended, followed by 25 ppm maintenance dosage to control SRB bacteria counts.

Details of the supplier of the safety data sheet

Registered company name	**Kinetic Chemicals**
Address	15 Magnesium Street Narangba QLD 4504 Australia
Telephone	+61 07 3204 8577
Fax	+61 07 3204 8588
Website	https://www.kinetic.group/
Email	info@kinetic.group

Emergency telephone number

Association / Organisation	**Chemwatch**
Emergency telephone numbers	+61 2 9186 1132
Other emergency telephone numbers	Not Available

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

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

Poisons Schedule	Not Applicable

Continued...

Classification [1]	Acute Toxicity (Oral) Category 4, Acute Toxicity (Inhalation) Category 4, Skin Corrosion/Irritation Category 1B, Serious Eye Damage Category 1, Skin Sensitizer Category 1, Reproductive Toxicity Category 2, Acute Aquatic Hazard Category 2, Chronic Aquatic Hazard Category 2
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HSIS ; 3. Classification drawn from EC Directive 1272/2008 - Annex VI*

Label elements

Hazard pictogram(s)	
SIGNAL WORD	**DANGER**

Hazard statement(s)

H302	Harmful if swallowed.
H332	Harmful if inhaled.
H314	Causes severe skin burns and eye damage.
H317	May cause an allergic skin reaction.
H361	Suspected of damaging fertility or the unborn child.
H411	Toxic to aquatic life with long lasting effects.

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P271	Use only outdoors or in a well-ventilated area.

Precautionary statement(s) Response

P301+P330+P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Precautionary statement(s) Storage

P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
10222-01-2	20	2,2-dibromo-3-nitrilopropionamide
25265-71-8	60	dipropylene glycol
7732-18-5	20	water

SECTION 4 FIRST AID MEASURES

Continued...

Description of first aid measures

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

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.
▸ Polyethylene glycols are generally poorly absorbed orally and are mostly unchanged by the kidney.
▸ Dermal absorption can occur across damaged skin (e.g. through burns) leading to increased osmolality, anion gap metabolic acidosis, elevated calcium, low ionised calcium, CNS depression and renal failure.
▸ Treatment consists of supportive care.
[Ellenhorn and Barceloux: Medical Toxicology]

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

▸ Alcohol stable foam.
▸ Dry chemical powder.
▸ BCF (where regulations permit).

Special hazards arising from the substrate or mixture

Fire Incompatibility	▸ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

Advice for firefighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear breathing apparatus plus protective gloves in the event of a fire. ▸ Prevent, by any means available, spillage from entering drains or water courses.

Continued...

Fire/Explosion Hazard	▸ Non combustible. ▸ Not considered a significant fire risk, however containers may burn. Other decomposition products include: , carbon dioxide (CO2) , nitrogen oxides (NOx) , sulfur oxides (SOx) , other pyrolysis products typical of burning organic material.
HAZCHEM	•3Z

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	Environmental hazard - contain spillage. ▸ Clean up all spills immediately. ▸ Avoid breathing vapours and contact with skin and eyes. ▸ Control personal contact with the substance, by using protective equipment.
Major Spills	Environmental hazard - contain spillage. ▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear breathing apparatus plus protective gloves.

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

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ **DO NOT** allow clothing wet with material to stay in contact with skin ▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs. ▸ Use in a well-ventilated area.
Other information	▸ Store in original containers. ▸ Keep containers securely sealed. ▸ Store in a cool, dry, well-ventilated area.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ Polyethylene or polypropylene container. ▸ Packing as recommended by manufacturer. ▸ Check all containers are clearly labelled and free from leaks.
Storage incompatibility	2,2-Dibromo-3-nitrilopropionamide (DBNPA): ▸ is incompatible with bases, reducing substances and nucleophiles; corrosive to mild steel, iron and aluminum Dipropylene glycol: ▸ is incompatible with sulfuric acid, perchloric acid, isocyanates and strong oxidisers. ▸ Glycols and their ethers undergo violent decomposition in contact with 70% perchloric acid. This seems likely to involve formation of the glycol perchlorate esters (after scission of ethers) which are explosive, those of ethylene glycol and 3-chloro-1,2-propanediol being more powerful than glyceryl nitrate, and the former so sensitive that it explodes on addition of water.

Continued...

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
Kinetic DBNPA 20% Solution	Not Available	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
2,2-dibromo-3-nitrilopropionamide	Not Available	Not Available
dipropylene glycol	Not Available	Not Available
water	Not Available	Not Available

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are: Process controls which involve changing the way a job activity or process is done to reduce the risk.
Personal protection	
Eye and face protection	‣ Chemical goggles. ‣ Full face shield may be required for supplementary but never for primary protection of eyes. ‣ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants.
Skin protection	See Hand protection below
Hands/feet protection	‣ Wear chemical protective gloves, e.g. PVC. ‣ Wear safety footwear or safety gumboots, e.g. Rubber **NOTE:** ‣ The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact. ‣ Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed. The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application. The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.
Body protection	See Other protection below
Other protection	‣ Overalls. ‣ P.V.C. apron.
Thermal hazards	Not Available

Respiratory protection

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

Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content. The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.

Continued...

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Clear amber liquid; soluble in water.

Physical state	Liquid	**Relative density (Water = 1)**	1.16-1.21 @20C
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Applicable
pH (as supplied)	Not Available	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	Not Available	**Viscosity (cSt)**	Not Applicable
Initial boiling point and boiling range (°C)	Not Available	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	Not Applicable	**Explosive properties**	Not Available
Flammability	Not Applicable	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Applicable	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	Not Applicable	**Volatile Component (%vol)**	Not Applicable
Vapour pressure (kPa)	Not Applicable	**Gas group**	Not Available
Solubility in water (g/L)	Miscible	**pH as a solution (1%)**	Not Applicable
Vapour density (Air = 1)	Not Applicable	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	‣ Unstable in the presence of incompatible materials. ‣ Product is considered stable. ‣ Hazardous polymerisation will not occur.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful. Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by sleepiness, reduced alertness, loss of reflexes, lack of co-ordination, and vertigo.

Continued...

Ingestion	Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual. The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion.
Skin Contact	The material can produce chemical burns following direct contact with the skin. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
Eye	The material can produce chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating. If applied to the eyes, this material causes severe eye damage.
Chronic	Repeated or prolonged exposure to corrosives may result in the erosion of teeth, inflammatory and ulcerative changes in the mouth and necrosis (rarely) of the jaw. Bronchial irritation, with cough, and frequent attacks of bronchial pneumonia may ensue. Skin contact with the material is more likely to cause a sensitisation reaction in some persons compared to the general population. Based on experience with animal studies, exposure to the material may result in toxic effects to the development of the foetus, at levels which do not cause significant toxic effects to the mother. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure. Chronic poisoning from ionic bromides has historically resulted from medical use of bromides but not from exposure in the environment or workplace. In the absence of other signs of poisoning, there may be depression, hallucinations and schizophrenia-like psychosis. Bromides may also cause sedation, irritability, agitation, delirium, memory loss, confusion, disorientation, forgetfulness, inability to speak, difficulty speaking, weakness, fatigue, a spinning sensation, stupor, coma, decreased appetite, nausea, vomiting, an acne-like rash on the face (bronchoderma), legs and trunk, swelling of the bronchi and a profuse discharge from the nostrils. Animal testing suggests that dibromoacetonitrile may lead to lung tumours. An increase in the incidence of animals with benign and malignant skin tumours has been reported.

	TOXICITY	IRRITATION
Kinetic DBNPA 20% Solution	Dermal (Rabbit) LD50: >4000 mg/kg[2]	Not Available
	Oral (Rat) LD50: 1387 mg/kg[2]	
2,2-dibromo-3-nitrilopropionamide	**TOXICITY**	**IRRITATION**
	Dermal (rabbit) LD50: >2000 mg/kg[2]	Eye (rabbit): 100 mg - SEVERE
	Inhalation (rat) LC50: 0.32 mg/l/4h**[2]	Skin (rabbit): 500 mg-SEVERE
	Oral (rat) LD50: 177 mg/kg[2]	
dipropylene glycol	**TOXICITY**	**IRRITATION**
	Dermal (rabbit) LD50: >5010 mg/kg[1]	Eye (rabbit): 510 mg
	Oral (rat) LD50: 14850 mg/kg[2]	Skin (rabbit): 500 mg/24h mild
water	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*	

2,2-DIBROMO-3-NITRILOPROPIONAMIDE	The following information refers to contact allergens as a group and may not be specific to this product. Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's oedema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS)

Continued...

	which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. For 2,2-dibromo-3-nitrilopropionamide (DBNPA): Several human incident reports have been reported. These include eye, throat and respiratory irritation, runny nose, and headache. Generally the effects arose with spills or misuse. ** Registration Eligibility Decision (RED) US EPA
DIPROPYLENE GLYCOL	For dipropylene glycol (DPG) and its isomers: Acute toxicity: Animal testing shows dipropylene glycol is not acutely toxic by mouth, skin contact or inhalation. DPG is slightly irritating to the skin and eyes of rabbits. Based on human data, DPG does not cause skin sensitization.
WATER	No significant acute toxicological data identified in literature search.

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

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

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

Kinetic DBNPA 20% Solution

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Available	Not Available	Not Available	Not Available	Not Available

2,2-dibromo-3-nitrilopropionamide

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	0.55mg/L	4
EC50	48	Crustacea	0.74mg/L	4

dipropylene glycol

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
EC50	48	Crustacea	>100mg/L	2

water

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Available	Not Available	Not Available	Not Available	Not Available

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

On the basis of available evidence concerning either toxicity, persistence, potential to accumulate and or observed environmental fate and behaviour, the material may present a danger, immediate or long-term and /or delayed, to the structure and/ or functioning of natural ecosystems.
Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.
Wastes resulting from use of the product must be disposed of on site or at approved waste sites.
|Fish 96-hr LC50:|Rainbow Trout – 2.3 mg/lt|Sheepshead minnow – 3.4 mg/lt|Bluegill Sunfish – 2.3 mg/lt|Mysid Shrimp – 0.72 mg/lt|Eastern Oyster – 0.37 mg/lt|Daphnia Magna 48-hr EC50 0.85 mg/lt|Avian Toxicity:|Oral Bobwhite Quail LD50 354 mg/kg|Dietary Mallard Duck LC50 gt;5620 ppm|Dietary Bobwhite Quail LC50 gt;5620 ppm

Persistence and degradability

Continued...

Ingredient	Persistence: Water/Soil	Persistence: Air
2,2-dibromo-3-nitrilopropionamide	HIGH	HIGH
dipropylene glycol	LOW	LOW
water	LOW	LOW

Bioaccumulative potential

Ingredient	Bioaccumulation
2,2-dibromo-3-nitrilopropionamide	LOW (LogKOW = 0.82)
dipropylene glycol	LOW (BCF = 4.6)
water	LOW (LogKOW = -1.38)

Mobility in soil

Ingredient	Mobility
2,2-dibromo-3-nitrilopropionamide	LOW (KOC = 8.978)
dipropylene glycol	HIGH (KOC = 1)
water	LOW (KOC = 14.3)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	▸ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ▸ It may be necessary to collect all wash water for treatment before disposal. ▸ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ▸ Recycle wherever possible or consult manufacturer for recycling options. ▸ Consult State Land Waste Authority for disposal. ▸ Bury or incinerate residue at an approved site.

SECTION 14 TRANSPORT INFORMATION

Labels Required

	
Marine Pollutant	
HAZCHEM	•3Z

Land transport (ADG)

UN number	3082
UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (contains 2,2-dibromo-3-nitrilopropionamide)
Transport hazard class(es)	Class: 9 Subrisk: Not Applicable
Packing group	III

Continued...

Environmental hazard	Environmentally hazardous
Special precautions for user	Special provisions: 274 331 335 375 AU01 Limited quantity: 5 L

Environmentally Hazardous Substances meeting the descriptions of UN 3077 or UN 3082 are not subject to this Code when transported by road or rail in;
(a) packagings;
(b) IBCs; or
(c) any other receptacle not exceeding 500 kg(L).
- Australian Special Provisions (SP AU01) - ADG Code 7th Ed.

Air transport (ICAO-IATA / DGR)

UN number	3082
UN proper shipping name	Environmentally hazardous substance, liquid, n.o.s. * (contains 2,2-dibromo-3-nitrilopropionamide)
Transport hazard class(es)	ICAO/IATA Class: 9 ICAO / IATA Subrisk: Not Applicable ERG Code: 9L
Packing group	III
Environmental hazard	Environmentally hazardous
Special precautions for user	Special provisions: A97 A158 A197 Cargo Only Packing Instructions: 964 Cargo Only Maximum Qty / Pack: 450 L Passenger and Cargo Packing Instructions: 964 Passenger and Cargo Maximum Qty / Pack: 450 L Passenger and Cargo Limited Quantity Packing Instructions: Y964 Passenger and Cargo Limited Maximum Qty / Pack: 30 kg G

Sea transport (IMDG-Code / GGVSee)

UN number	3082
UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (contains 2,2-dibromo-3-nitrilopropionamide)
Transport hazard class(es)	IMDG Class: 9 IMDG Subrisk: Not Applicable
Packing group	III
Environmental hazard	Marine Pollutant
Special precautions for user	EMS Number: F-A , S-F Special provisions: 274 335 969 Limited Quantities: 5 L

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

Not Applicable

SECTION 15 REGULATORY INFORMATION

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

2,2-DIBROMO-3-NITRILOPROPIONAMIDE(10222-01-2) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Continued...

Australia Inventory of Chemical Substances (AICS)

DIPROPYLENE GLYCOL(25265-71-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Inventory of Chemical Substances (AICS)

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

Australia Inventory of Chemical Substances (AICS)

National Inventory	Status
Australia - AICS	Y
Canada - DSL	N (2,2-dibromo-3-nitrilopropionamide)
Canada - NDSL	N (dipropylene glycol; water)
China - IECSC	Y
Europe - EINEC / ELINCS / NLP	Y
Japan - ENCS	Y
Korea - KECI	Y
New Zealand - NZIoC	Y
Philippines - PICCS	Y
USA - TSCA	Y
Legend:	*Y = All ingredients are on the inventory* *N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Other information

Ingredients with multiple cas numbers

Name	CAS No
dipropylene glycol	25265-71-8, 110-98-5, 106-62-7, 108-61-2

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios.

HALLIBURTON

SAFETY DATA SHEET

KWIK SEAL ADDITIVE

Revision Date: 05-Oct-2017 **Revision Number:** 20

1. Product and Company Identification

Product identifier

Product Name KWIK SEAL ADDITIVE

Other means of identification

Hazardous Material Number: HM000976

Recommended use of the chemical and restrictions on use

Recommended Use Lost Circulation Material

Supplier details

Halliburton Energy Services
Av. Amazonas N37-29 y Villalengua Edif.
Quito
Ecuador

Halliburton Energy Services
Carrera 7 No. 71-52
Floor 7, Torre B
Bogotá
Colombia

Halliburton Energy Services
Avenida Principal De Santa Rita Sector
Punta
Santa Rita, WES
Venezuela

For further information, please contact

E-mail Address fdunexchem@halliburton.com

Emergency Phone number

+1-760-476-3962
Argentina: +54 11 5219 8871
Chile: +56 44 8905208
Colombia: +57 1 344 1317
Peru: +50 78 387596
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazards Identification

Classification of the hazardous chemical

Not classified

Label Elements

Not classified

Hazard Pictograms

Signal Word: None

Hazard Statements Not Classified

Precautionary Statements

Prevention None
Response None

Storage None
Disposal None

Contains

Substances	**CAS Number**
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA

Other hazards which do not result in classification
This mixture contains no substance considered to be persistent, bioaccumulating nor toxic (PBT).
This mixture contains no substance considered to be very persistent nor very bioaccumulating (vPvB).

3. Composition and Information on Ingredients

Product Classification: Mixture

Substances	CAS Number	PERCENT (w/w)	GHS Classification
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Classified

4. First Aid Measures

Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin Wash with soap and water. Get medical attention if irritation persists.

Ingestion Rinse mouth with water many times. Get medical attention if symptoms occur

Most important symptoms and effects, both acute and delayed
No significant hazards expected.

Indication of any immediate medical attention and special treatment needed
Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable extinguishing media
Suitable Extinguishing Media
Water fog, carbon dioxide, foam, dry chemical.
Extinguishing media which must not be used for safety reasons
None known.

Physicochemical hazards arising from the chemical
Special exposure hazards in a fire
Decomposition in fire may produce harmful gases.

Special protective equipment and precautions for fire fighters
Special protective equipment for firefighters
Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Spillage, Accidental Release Measures

Personal precautions, protective equipment and emergency procedures
Use appropriate protective equipment. Avoid creating and breathing dust. Ensure adequate ventilation. Avoid contact with skin,

eyes and clothing.
See Section 8 for additional information

Environmental precautions
None known.

Methods and material for containment and cleaning up
Scoop up and remove.

7. Handling and storage

Precautions for safe handling
Avoid creating or inhaling dust. Ensure adequate ventilation. Avoid contact with eyes, skin, or clothing. Wash hands after use. Launder contaminated clothing before reuse. Use appropriate protective equipment.
Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities
Store away from oxidizers. Store in a cool, dry location.

8. Exposure Controls and Personal Protection

Control parameters
Exposure Limits

Substances	CAS Number	Venzuela	Colombia	Argentina
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable	Not applicable	Not applicable

Appropriate engineering controls
Engineering Controls Use in a well ventilated area.

Individual protection measures, such as personal protective equipment
Respiratory Protection Not normally needed. But if significant exposures are possible then the following respirator is recommended:
Dust/mist respirator. (N95, P2/P3)
Hand Protection Use gloves which are suitable for the chemicals present in this product as well as other environmental factors in the workplace.
Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.
Eye Protection Wear safety glasses or goggles to protect against exposure.
Other Precautions None known.
Environmental Exposure Controls Do not allow material to contaminate ground water system

9. Physical and Chemical Properties

Information on basic physical and chemical properties
Physical State: Solid
Odor: Woody
Color Brown
Odor Threshold: No information available

Property Remarks/ - Method	Values
pH:	No data available
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	No data available
Evaporation rate	No data available
Vapor Pressure	No data available

Vapor Density	No data available
Specific Gravity	0.3
Water Solubility	Insoluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

Other information
VOC Content (%) No data available

10. Stability and Reactivity

Reactivity
Not expected to be reactive.

Chemical stability
Stable

Possibility of hazardous reactions
Will Not Occur

Conditions to avoid
None anticipated

Incompatible materials
Strong oxidizers.

Hazardous decomposition products
Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on possible routes of exposure
Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure
Most Important Symptoms/Effects
No significant hazards expected.

Numerical measures of toxicity

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No data available	No data available	No data available

Immediate, delayed and chronic health effects from exposure

Inhalation	May cause mild respiratory irritation.
Eye Contact	May cause mild eye irritation.
Skin Contact	May cause mild skin irritation.
Ingestion	May cause abdominal pain, vomiting, nausea, and diarrhea.

Chronic Effects/Carcinogenicity No data available to indicate product or components present at greater than 0.1% are

chronic health hazards.

12. Ecological Information

Ecotoxicity

12.1. Toxicity

Ecotoxicity effects

Product is not classified as hazardous to the environment.

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available	No information available	No information available	No information available

Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

Bioaccumulative potential

Substances	CAS Number	Log Pow
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

Mobility in soil

Substances	CAS Number	Mobility
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Disposal methods

Disposal methods Follow all applicable community, national or regional regulations regarding waste management methods.

Contaminated Packaging Follow all applicable national or local regulations.

14. Transport Information

Transportation Information

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable

Special precautions for user
None

15. Regulatory Information

International Agreements

Montreal Protocol - Ozone Depleting Substances:	Does not apply
Stockholm Convention - Persistent Organic Pollutants:	Does not apply
Rotterdam Convention - Prior Informed Consent:	Does not apply
Basel Convention - Hazardous Waste:	Does not apply

NFPA Ratings:	Health 0, Flammability 0, Reactivity 0
HMIS Ratings:	Health 0, Flammability 0, Physical Hazard 0 , PPE: B

16. Other Information

Revision Date: 05-Oct-2017
Revision Note
Update to Format

Key literature references and sources for data
www.ChemADVISOR.com/

Key or legend to abbreviations and acronyms used in the safety data sheet
bw – body weight
CAS – Chemical Abstracts Service
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
ErC50 – Effective Concentration growth rate 50%
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL0 – Lethal Loading 0%
LL50 – Lethal Loading 50%
MARPOL – International Convention for the Prevention of Pollution from Ships
mg/kg – milligram/kilogram
mg/L – milligram/liter
NIOSH – National Institute for Occupational Safety and Health
NOEC – No Observed Effect Concentration
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
PC – Chemical Product category
PEL – Permissible Exposure Limit
ppm – parts per million
PROC – Process category
STEL – Short Term Exposure Limit
h - hour
d - day

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

SDS no. MI10299
Version 7
Revision date 30/Aug/2014
Supersedes date 08/Jul/2011

Safety Data Sheet
M-I-X† II (All Grades)

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name	M-I-X† II (All Grades)
Product code	MI10299
REACH registration name	Exempt
Denmark Pr. no.:	1470662

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

Recommended Use	Lost circulation material.
Uses advised against	Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I Australia Pty Ltd
ABN: 67 009 214 162
Level 5
256 St. George Tce
Perth
WA 6000
T = +61 08 9440 2900
F = +61 08 9322 3080
+47 51577424
MISDS@slb.com

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600

2. Hazards identification

2.1 Classification of the substance or mixture

Classification according to (EC) No. 1272/2008

Health hazards	Not classified
Environmental hazards	Not classified
Physical Hazards	Not classified

2.2 Label elements

Signal word
None

Hazard statements
This product is not classified as hazardous therefore no (H) hazard statements assigned.

Precautionary Statements - EU (§28, 1272/2008)
This product is not classified as hazardous therefore has no (P) precautionary statements assigned.

Classification according to EU Directives 67/548/EEC or 1999/45/EC

Indication of danger
Not classified

Contains

Crystalline silica (impurity)

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

2.3 Other data

Not classified as PBT/vPvB by current EU criteria

Australian statement of hazardous/dangerous nature
Classified as Non-Hazardous according to the criteria of NOHSC.
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS.

3. Composition/information on ingredients

3.1 Substances

Component	EC-No.	CAS-No	Weight % - range	Classification (67/548)	Classification (Reg. 1272/2008)	REACH registration number
	Not Listed	Proprietary	60-100	-	Not classified	No data available
Crystalline silica (impurity)	238-878-4	14808-60-7	1-5	Xn; R48/20	STOT Rep. 2 - H373	Exempt

3.2 Mixtures

Not Applicable

Comments
Naturally occuring mineral. This product contains a small quantity of quartz, crystalline silica. Prolonged and repeated exposure to concentrations of crystalline silica exceeding the workplace exposure limit (WEL) may lead to chronic lung disease such as silicosis. IARC Monographs, Vol. 68, 1997, concludes that there is sufficient evidence that inhaled crystalline silica in the form of quartz or cristobalite from occupational sources causes cancer in humans. IARC Classification Group I.

4. First aid measures

4.1 First-Aid Measures

Inhalation	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Ingestion	Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.
Skin contact	Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.
Eye contact	Remove contact lenses. Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice	The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.
Main symptoms	
Inhalation	Please see Section 11. Toxicological Information for further information.
Ingestion	Please see Section 11. Toxicological Information for further information.
Skin contact	Please see Section 11. Toxicological Information for further information.
Eye contact	Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician	Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing media appropriate for surrounding material.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
None.

Hazardous combustion products
Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. See also section 8. If spilled, take caution, as material can cause surfaces to become very slippery.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment. Local authorities should be advised if significant spillages cannot be contained.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. When using do not smoke, eat or drink. Wash thoroughly after handling Remove contaminated clothing.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions	Ensure adequate ventilation. Keep airborne concentrations below exposure limits.
Storage precautions	Keep containers tightly closed in a dry, cool and well-ventilated place. Avoid contact with: Oxidizing agents Heat, flames and sparks
Storage class	Chemical storage.
Packaging material	Use specially constructed containers only

7.3 Specific end uses

See Section 1.2.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits	No biological limit allocated

Component	EU OEL	Austria	Australia	Denmark
	Not determined	Not determined	10 mg/m³ TWA (containing no asbestos and <1% crystalline silica, inspirable dust)	Not determined
Crystalline silica (impurity)	Not determined	Not determined	0.1 mg/m³ TWA	0.1mg/m³

Component	Malaysia	France	Germany	Hungary
	10 mg/m³ TWA	10 mg/m³	Not determined	Not determined
Crystalline silica (impurity)	0.1 mg/m³ TWA	0.1 mg/m³	Not determined	Not determined

Component	New Zealand	Italy	Netherlands	Norway
	10 mg/m³ TWA	Not determined	Not determined	Not determined
Crystalline silica (impurity)	0.2 mg/m³ TWA Known or presumed human carcinogen	Not determined	0.075 mg/m³	0.3 mg/m³ TWA total dust 0.1 mg/m³ TWA respirable dust 0.9 mg/m³ STEL total dust 0.3 mg/m³ STEL respirable dust Carcinogen

Component	Poland	Portugal	Romania	Russia
	Not determined	10 mg/m³ TWA	Not determined	10 mg/m³ MAC
Crystalline silica (impurity)	2 mg/m³ TWA >50% free crystalline silica total inhalable dust 0.3 mg/m³ TWA >50% free crystalline silica respirable dust 4.0 mg/m³ TWA 2% to 50% free crystalline silica total inhalable dust 1.0 mg/m³ TWA 2% to 50% free crystalline silica respirable dust	0.025 mg/m³ TWA respirable fraction	Not determined	1 mg/m³ MAC 3 mg/m³ STEL 1 mg/m³ TWA aerosol Fibrogenic substance

Component	Spain	Switzerland	Turkey	UK
	10 mg/m³ VLA-ED	3 mg/m³ MAK respirable	Not determined	20 mg/m³ STEL inhalable dust 12 mg/m³ STEL calculated respirable dust 10 mg/m³ TWA inhalable dust 4 mg/m³ TWA respirable dust
Crystalline silica (impurity)	0.1 mg/m³ VLA-ED respirable fraction	0.15 mg/m³ MAK respirable	Not determined	0.3 mg/m³ STEL calculated respirable 0.1 mg/m³ TWA respirable

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection	It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.
Hand protection	Repeated or prolonged contact:, Use protective gloves made of:, Nitrile, Neoprene.
Respiratory protection	No personal respiratory protective equipment normally required, In case of insufficient ventilation wear suitable respiratory equipment, Half mask with a particle filter P2 (European Norm EN 143 = former DIN 3181).
Skin and body protection	Wear suitable protective clothing, Provide eyewash station.

Hygiene measures Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid
Appearance	Powder
Odor	Slight
Color	Tan
Odor threshold	Not applicable

Property	Values	Remarks
pH	No information available	
pH @ dilution		
Melting/freezing point		
Boiling point/range	No information available	
Flash point	No information available	
Evaporation rate (BuAc =1)		
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	Not applicable	
Lower flammability limit	Not applicable	
Vapor pressure	No information available	
Vapor density	No information available	

Specific gravity	No information available	
Bulk density	352-513 kg/m³ / 22-32 lb/ft³	
Relative density	1.4 - 1.65	@ 20°C.
Water solubility	Insoluble in water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity		
Dynamic viscosity	No information available	
Log Pow	Not determined	

Explosive properties	Not Applicable
Oxidizing properties	None known.

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	None
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

10.4 Conditions to avoid

Avoid heat, flames and other sources of ignition.

10.5 Incompatible materials

Oxidizing agents.

10.6 Hazardous decomposition products

See also section 5.2.

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation	Inhalation of dust in high concentration may cause irritation of respiratory system.
Eye contact	May cause slight irritation.
Skin contact	Prolonged contact may cause redness and irritation.

Ingestion Ingestion may cause stomach discomfort.

Unknown acute toxicity Not Applicable.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
	> 5 g/kg (Rat)	> 2 g/kg (Rabbit)	> 5800 mg/m³ (Rat) 4 h
Crystalline silica (impurity)	= 500 mg/kg (Rat)	No data available	No data available

Sensitization This product does not contain any components suspected to be sensitizing.

Mutagenic effects This product does not contain any known or suspected mutagens.

Carcinogenicity Contains a known or suspected carcinogen.

Reproductive toxicity None known.

Routes of exposure None known.

Routes of entry Inhalation.

Specific target organ toxicity (single exposure) Not classified

Specific target organ toxicity (repeated exposure) Not classified.

Aspiration hazard No hazard from product as supplied.

12. Ecological information

12.1 Toxicity

The product component(s) are 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. Listed on PLONOR list of OSPAR

Toxicity to algae
This product is not considered toxic to algae.

Toxicity to fish
This product is not considered toxic to fish.

Toxicity to daphnia and other aquatic invertebrates
This product is not considered toxic to invertebrates.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
	No information available	No information available	No information available
Crystalline silica (impurity)	No information available	No information available	No information available

12.2 Persistence and degradability

This product is expected to be readily biodegradable.

12.3 Bioaccumulative potential

The product does not contain any substances expected to be bioaccumulating.

12.4 Mobility in soil

Mobility
Insoluble in water.

12.5 Results of PBT and vPvB assessment

Not classified as PBT/vPvB by current EU criteria.

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.
EWC Waste disposal No.	According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used. The following Waste Codes are only suggestions: EWC waste disposal No: 01 05 99 - wastes not otherwise specified

14. Transport information

The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

14.1 UN Number
Not regulated

14.2 Proper shipping name
Not regulated

14.3 Hazard class(es)

ADR/RID/ADN/ADG Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated

14.4 Packing group

ADR/RID/ADN/ADG Packing group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated

14.5 Environmental hazard
No

14.6 Special precautions
Not Applicable

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Please contact MISDS@slb.com for info regarding transport in Bulk.

15. Regulatory information

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

Germany, Water Endangering Classes (VwVwS) Water endangering class = 1

Australian Standard for the Uniform Scheduling of Drugs and Poisons
No Poisons Schedule number allocated

New Zealand hazard classification Not classified.

HSNO approval no. Not required.

Group number Not required.

Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, including amendments.

This safety data sheet complies with the requirements of Regulation (EC) No. 1272/2008.

National Code of Practice for the Preparation of Material Safety Data Sheets 2nd Edition [NOHSC: 2011 (2003)].

National Occupational Health and Safety Commission's Approved Criteria for Classifying Hazardous Substances [NOHSC:1008 (2004) 3rd Edition].

National Occupational Health and Safety Commission's Exposure Standards for Atmospheric Contaminants in the occupational Environment [NOHSC:1003 (1995)].

Safe Work Australia.

Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP).

Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by road or rail.

Dutch Mining Regulations: In accordance with Mining Regulations 9.2 and Chapter 4 of the Working Conditions Decree.

Occupational Safety and Health (Classification, Labelling and Safety Data Sheet of Hazardous Chemicals) Regulations 2013 [P.U.(A) 310/2013] (CLASS Regulations)

The Industry Code of Practice on Chemical Classification and Hazard Communication 2014 [P.U. (B) 128/2014] (ICOP)
International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

Contact REACH@miswaco.slb.com for REACH information.

15.2 Chemical Safety Report

No information available

16. Other information

Prepared by	Global Regulatory Compliance - Chemicals (GRC - Chemicals) , Anne Karin (Anka) Fosse
Supersedes date	08/Jul/2011
Revision date	30/Aug/2014
Version	7
The following sections have been revised:	This SDS have been made in a new database and therefore a new layout. No changes with regard to classification have been made, Updated according to GHS/CLP.

Text of R phrases mentioned in Section 3

R48/20 - Harmful: danger of serious damage to health by prolonged exposure through inhalation

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

This product is not classified as hazardous therefore no (H) hazard statements assigned.
H373 - May cause damage to organs through prolonged or repeated exposure if inhaled

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.

SDS no. MI12588
Version 2
Revision date 25/Feb/2015
Supersedes date 12/Jun/2012

Safety Data Sheet
PLATINUM PAC† (ALL GRADES)

Quantity restrictions apply! Not to be used in quantities of 1 tonne or more within the EEA.

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name PLATINUM PAC† (ALL GRADES)
Product code MI12588
Synonyms PLATINUM† PAC R, PLATINUM† PAC UL

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

Recommended Use Fluid loss reducer.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I Australia Pty Ltd
Level 5
256 St. George Terrace
Perth
WA 6000
T= 08 9440 2900
MISDS@slb.com

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600

2. Hazards identification

2.1 Classification of the substance or mixture

Classification according to (EC) No. 1272/2008

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards Not classified

2.2 Label elements

Signal word
None

Hazard statements
This product is not classified as hazardous therefore no (H) hazard statements assigned.

Precautionary Statements - EU (§28, 1272/2008)
This product is not classified as hazardous therefore has no (P) precautionary statements assigned.

Classification according to EU Directives 67/548/EEC or 1999/45/EC

Indication of danger
Not classified

Contains

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

2.3 Other data

Not classified as PBT/vPvB by current EU criteria

Australian statement of hazardous/dangerous nature
Classified as Non-Hazardous according to the criteria of NOHSC.
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS.

3. Composition/information on ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

No classified ingredients, or those having occupational exposure limits, present above the level of disclosure.

4. First aid measures

4.1 First-Aid Measures

Inhalation	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Ingestion	Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.
Skin contact	Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.
Eye contact	Remove contact lenses. Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation Please see Section 11. Toxicological Information for further information.

Ingestion Please see Section 11. Toxicological Information for further information.

Skin contact Please see Section 11. Toxicological Information for further information.

Eye contact Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing media appropriate for surrounding material.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Dust may form explosive mixture in air.

Hazardous combustion products
Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. If spilled, take caution, as material can cause surfaces to become very slippery. Use personal protective equipment. See also section 8.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment. Local authorities should be advised if significant spillages cannot be contained.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. Avoid dust formation. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid dust formation. Do not breathe vapors/dust. Avoid contact with skin and eyes. If spilled, take caution, as material can cause surfaces to become very slippery.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. When using do not smoke, eat or drink. Wash hands before eating, drinking or smoking. Remove contaminated clothing.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions	Ensure adequate ventilation. Keep away from heat, sparks, and flame.
Storage precautions	Keep containers tightly closed in a dry, cool and well-ventilated place. Avoid contact with: Strong oxidizing agents Protect from moisture
Storage class	Chemical storage.
Packaging material	Use specially constructed containers only

7.3 Specific end uses

See Section 1.2.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits	NUI = Nuisance dust, TWA 4mg/m^3 Respirable Dust, 10mg/m^3 Total Dust. No biological limit allocated

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation. Local exhaust ventilation.

Personal protective equipment

Eye protection	It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.
Hand protection	Repeated or prolonged contact:, Use protective gloves made of:, Neoprene, Nitrile, Frequent change is advisable.
Respiratory protection	No personal respiratory protective equipment normally required, In case of insufficient ventilation wear suitable respiratory equipment, Half mask with a particle filter P2 (European Norm EN 143 = former DIN 3181), At work in confined or poorly ventilated spaces, respiratory protection with air supply must be used.
Skin and body protection	Wear suitable protective clothing, Eye wash and emergency shower must be available at the work place.
Hygiene measures	Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid
Appearance	Powder Dust
Odor	Odorless
Color	White - Yellow
Odor threshold	Not applicable

Property	Values	Remarks
pH	No information available	
pH @ dilution	6.5 - 9.0	@ 1%
Melting/freezing point		
Boiling point/range	No information available	
Flash point	No information available	
Evaporation rate (BuAc =1)		
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		

Upper flammability limit	Not applicable	
Lower flammability limit	Not applicable	
Vapor pressure	No information available	
Vapor density	No information available	
Specific gravity	No information available	
Bulk density	300-900 kg/m³	
Relative density	1.5 - 1.6 sg	@ 20°C.
Water solubility	Soluble in water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity		
Dynamic viscosity	No information available	
Log Pow	No information available	

Explosive properties	Not Applicable
Oxidizing properties	None known.

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	None
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

10.4 Conditions to avoid

Avoid dust formation. Protect from moisture. Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

See also section 5.2.

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation Inhalation of dust in high concentration may cause irritation of respiratory system.

Eye contact	Dust may cause mechanical irritation.
Skin contact	Prolonged contact may cause redness and irritation.
Ingestion	Ingestion may cause stomach discomfort.

Sensitization	This product does not contain any components suspected to be sensitizing.
Mutagenic effects	This product does not contain any known or suspected mutagens.
Carcinogenicity	This product does not contain any known or suspected carcinogens.

Reproductive toxicity	This product does not contain any known or suspected reproductive hazards.
Routes of exposure	None known.
Routes of entry	No route of entry noted.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	No hazard from product as supplied.

12. Ecological information

12.1 Toxicity

The product component(s) are 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.

Toxicity to algae
This product is not considered toxic to algae.

Toxicity to fish
This product is not considered toxic to fish.

Toxicity to daphnia and other aquatic invertebrates
This product is not considered toxic to invertebrates.

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No product level data available.

12.4 Mobility in soil

Mobility
Soluble in water.

12.5 Results of PBT and vPvB assessment

Not classified as PBT/vPvB by current EU criteria.

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.
EWC Waste disposal No.	According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used. The following Waste Codes are only suggestions: EWC waste disposal No: 07 01 99

14. Transport information

The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

14.1 UN Number
Not regulated

14.2 Proper shipping name
Not regulated

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated

14.5 Environmental hazard
No

14.6 Special precautions
Not Applicable

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Please contact MISDS@slb.com for info regarding transport in Bulk.

15. Regulatory information

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

Germany, Water Endangering Classes (VwVwS)	Hazardous to water/Class 1

Australian Standard for the Uniform Scheduling of Drugs and Poisons
No Poisons Schedule number allocated

New Zealand hazard classification	Not classified
HSNO approval no.	Not required
Group number	Not required

Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, including amendments.

This safety data sheet complies with the requirements of Regulation (EC) No. 1272/2008.

National Code of Practice for the Preparation of Material Safety Data Sheets 2nd Edition [NOHSC: 2011 (2003)].

National Occupational Health and Safety Commission's Approved Criteria for Classifying Hazardous Substances [NOHSC:1008 (2004) 3rd Edition].

National Occupational Health and Safety Commission's Exposure Standards for Atmospheric Contaminants in the occupational Environment [NOHSC:1003 (1995)].

Safe Work Australia.

Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP).

Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by road or rail.

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

Restricted for use in Europe until REACH assessed. Please contact REACH@miswaco.slb.com if intended for use in Europe.

15.2 Chemical Safety Report

No information available

16. Other information

Prepared by	Global Regulatory Compliance - Chemicals (GRC - Chemicals) , Anne Karin (Anka) Fosse
Supersedes date	12/Jun/2012
Revision date	25/Feb/2015
Version	2
The following sections have been revised	This SDS have been made in a new database and therefore a new layout. No changes with regard to classification have been made, Updated according to GHS/CLP.

Text of R phrases mentioned in Section 2 and 3
Not classified

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

This product is not classified as hazardous therefore no (H) hazard statements assigned.
Not classified

†A mark of M-I L.L.C.

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.

SDS no. MI11076
Version 6
Revision date 30/Mar/2015
Supersedes date 22/Apr/2014

Safety Data Sheet
POLY-PLUS† RD

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name POLY-PLUS† RD
Product code MI11076

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

Recommended Use Drilling fluid additive.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I Australia Pty Ltd
Level 5
256 St. George Terrace
Perth
WA 6000
T= 08 9440 2900
MISDS@slb.com

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600

2. Hazards identification

2.1 Classification of the substance or mixture

Classification according to (EC) No. 1272/2008

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards Not classified

2.2 Label elements

Signal word
None

Hazard statements
This product is not classified as hazardous therefore no (H) hazard statements assigned.

Precautionary Statements - EU (§28, 1272/2008)
This product is not classified as hazardous therefore has no (P) precautionary statements assigned.

Classification according to EU Directives 67/548/EEC or 1999/45/EC

Indication of danger
Not classified

Contains

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

2.3 Other data

Not classified as PBT/vPvB by current EU criteria

Australian statement of hazardous/dangerous nature
Classified as Non-Hazardous according to the criteria of NOHSC.
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS.

3. Composition/information on ingredients

3.1 Substances

No classified ingredients, or those having occupational exposure limits, present above the level of disclosure.

3.2 Mixtures

Not Applicable

4. First aid measures

4.1 First-Aid Measures

Inhalation	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Ingestion	Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.
Skin contact	Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.
Eye contact	Remove contact lenses. Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation Please see Section 11. Toxicological Information for further information.

Ingestion Please see Section 11. Toxicological Information for further information.

Skin contact Please see Section 11. Toxicological Information for further information.

Eye contact Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing media appropriate for surrounding material.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Dust may form explosive mixture in air.

Hazardous combustion products
When heated strongly or burned, oxides of carbon, nitrogen oxides, ammonia and harmful organic chemical fumes are released.

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. See also section 8.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation. If spilled, take caution, as material can cause surfaces to become very slippery.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. When using do not smoke, eat or drink. Wash hands and face before breaks and immediately after handling the product. Remove contaminated clothing.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions	Ensure adequate ventilation. Keep airborne concentrations below exposure limits.
Storage precautions	Keep containers tightly closed in a dry, cool and well-ventilated place. Avoid contact with: Oxidizing agents Protect from moisture
Storage class	Chemical storage.
Packaging material	Use specially constructed containers only

7.3 Specific end uses

See Section 1.2.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits	NUI = Nuisance dust, TWA 4mg/m^3 Respirable Dust, 10mg/m^3 Total Dust. No biological limit allocated

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation. Mechanical ventilation or local exhaust ventilation is required.

Personal protective equipment

Eye protection	It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.
Hand protection	Repeated or prolonged contact:, Use protective gloves made of:, Nitrile, Neoprene.
Respiratory protection	In case of insufficient ventilation wear suitable respiratory equipment, Suitable mask with particle filter P3 (European Norm 143), At work in confined or poorly ventilated spaces, respiratory protection with air supply must be used.
Skin and body protection	Wear suitable protective clothing, Eye wash and emergency shower must be available at the work place.
Hygiene measures	Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid
Appearance	Powder Granules
Odor	Odorless
Color	White
Odor threshold	Not applicable

Property	Values	Remarks
pH	Not applicable	
pH @ dilution	7.7	@ 1% sol.
Melting/freezing point		
Boiling point/range	No information available	
Flash point	No information available	
Evaporation rate (BuAc =1)		
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	Not applicable	
Lower flammability limit	Not applicable	

Vapor pressure	No information available	
Vapor density	No information available	
Specific gravity	1.25 – 1.40	@ 20 °C
Bulk density	641 – 737 kg/m³ (40 – 46 lb/ft2)	
Relative density	No information available	
Water solubility	Soluble in water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity		
Dynamic viscosity	No information available	
Log Pow	Not determined	

Explosive properties	Not Applicable
Oxidizing properties	None known.

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	None
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

10.4 Conditions to avoid

Protect from moisture. Heat.

10.5 Incompatible materials

Oxidizing agents.

10.6 Hazardous decomposition products

See also section 5.2.

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation	Inhalation of dust in high concentration may cause irritation of respiratory system.
Eye contact	May cause slight irritation.

Skin contact	Prolonged contact may cause redness and irritation.
Ingestion	Ingestion may cause stomach discomfort.
Unknown acute toxicity	Not Applicable.

Sensitization	This product does not contain any components suspected to be sensitizing.
Mutagenic effects	This product does not contain any known or suspected mutagens.
Carcinogenicity	This product does not contain any known or suspected carcinogens.

Reproductive toxicity	This product does not contain any known or suspected reproductive hazards.
Routes of exposure	None known.
Routes of entry	No route of entry noted.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	No hazard from product as supplied.

12. Ecological information

12.1 Toxicity

The product component(s) are 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.

Toxicity to algae
This product is not considered toxic to algae.

Toxicity to fish
This product is not considered toxic to fish.

Toxicity to daphnia and other aquatic invertebrates
This product is not considered toxic to invertebrates.

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

Does not bioaccumulate.

12.4 Mobility in soil

Mobility
Soluble in water.

12.5 Results of PBT and vPvB assessment

Not classified as PBT/vPvB by current EU criteria.

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.
EWC Waste disposal No.	According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used. The following Waste Codes are only suggestions: EWC waste disposal No: 07 01 99.

14. Transport information

The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA,ADR/RID/ADG).

14.1 UN Number
Not regulated

14.2 Proper shipping name
Not regulated

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated

14.5 Environmental hazard
No

14.6 Special precautions
Not Applicable

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Please contact MISDS@slb.com for info regarding transport in Bulk.

15. Regulatory information

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

Germany, Water Endangering Classes (VwVwS)	Water endangering class = 2

Australian Standard for the Uniform Scheduling of Drugs and Poisons
No Poisons Schedule number allocated

New Zealand hazard classification	Not classified.
HSNO approval no.	Not required.
Group number	Not required.

Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, including amendments.

This safety data sheet complies with the requirements of Regulation (EC) No. 1272/2008.

National Code of Practice for the Preparation of Material Safety Data Sheets 2nd Edition [NOHSC: 2011 (2003)].

National Occupational Health and Safety Commission's Approved Criteria for Classifying Hazardous Substances [NOHSC:1008 (2004) 3rd Edition].

National Occupational Health and Safety Commission's Exposure Standards for Atmospheric Contaminants in the occupational Environment [NOHSC:1003 (1995)].

Safe Work Australia.

Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP).

Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by road or rail.

Dutch Mining Regulations: In accordance with Mining Regulations 9.2 and Chapter 4 of the Working Conditions Decree.

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Does not Comply
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

Contact REACH@miswaco.slb.com for REACH information.

15.2 Chemical Safety Report

No information available

16. Other information

Prepared by	Global Regulatory Compliance - Chemicals (GRC - Chemicals) , Anne Karin (Anka) Fosse
Supersedes date	22/Apr/2014
Revision date	30/Mar/2015
Version	6
The following sections have been revised	1,, 2,, 3,, 8,, 11,, 12,, 16, Updated according to GHS/CLP.

Text of R phrases mentioned in Section 2 and 3
Not classified

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

This product is not classified as hazardous therefore no (H) hazard statements assigned.

†A mark of M-I L.L.C.

Disclaimer
The information contained herein is considered in good faith as reliable of the date issued and is based upon on measurements, tests or data derived from supplier's own study or furnished by others. In providing this SDS information, Supplier makes no express or implied warranties as to the information or product; merchantability or fitness of purpose; any express or implied warranty; or non-infringement of intellectual property rights; and supplier assumes no responsibility for any direct, special or consequential damages, results obtained, or the activities of others. To the maximum extent permitted by law, supplier's warranty obligations and buyer's sole remedies are as stated in separate agreement between the parties.

HALLIBURTON

SAFETY DATA SHEET
POTASSIUM CHLORIDE

according to Regulation (EC) No. 453/2010

Revision Date: 21-Sep-2017 **Revision Number:** 24
Preparation Date 21-Sep-2017 **Internal ID Code** HM001200

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

1.1. Product Identifier

Product Name POTASSIUM CHLORIDE
Internal ID Code HM001200

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

Recommended Use Brine
Sector of uses SU2 - Mining, (including offshore industries)
Product category(ies) PC20 - Products such as pH-regulators, flocculants, precipitants, neutralization agents, other unspecific
Process categories PROC 26 - Handling of solid inorganic substances at ambient temperature

1.3. Details of the supplier of the safety data sheet

Halliburton Energy Services
Halliburton House, Howemoss Place
Kirkhill Industrial Estate
Dyce
Aberdeen, AB21 0GN
United Kingdom

www.halliburton.com

For further information, please contact
E-mail Address: fdunexchem@halliburton.com

1.4. Emergency telephone number

+44 8 08 189 0979 / 1-760-476-3961
Global Incident Response Access Code: 334305
Contract Number: 14012

Emergency telephone - §45 - (EC)1272/2008	
Turkey	Ulusal Zehir Danisma Merkezi (UZEM) :114 Acil Saglik Hizmetleri : 112
Europe	**112**
Bulgaria	Bulgarian poison centre: +359 2 915-44-09 or +359 2 915-43-46
Croatia	Centar za kontrolu otrovanja (CKO): (+385 1) 23-48-342 (Poison Control Center (PCC) - Institute for Medical Research and Occupational Health)
Cyprus	00357 22 88 7171
Denmark	Poison Control Hotline (DK): +45 82 12 12 12
France	ORFILA (FR): + 01 45 42 59 59
Germany	Poison Center Berlin (DE): +49 030 30686 790
Italy	Poison Center, Milan (IT): +39 02 6610 1029
Netherlands	National Poisons Information Center (NL): +31 30 274 88 88 (NB: this service is only available to health professionals)
Norway	Poisons Information (NO):+ 47 22 591300
Poland	Poison Control and Information Centre, Warsaw (PL): +48 22 619 66 54; +48 22 619 08 97
Portugal	CIAV - Centro de Informação Antivenenos (Portuguese Poison Centre): + 351 213 303 271
Romania	+40 21 318 36 06
Spain	Poison Information Service (ES): +34 91 562 04 20
United Kingdom	NHS Direct (UK): +44 0845 46 47

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Regulation (EC) No 1272/2008

Not classified

2.2. Label Elements

Not classified

Hazard Pictograms

Signal Word: **None**

Hazard Statements:
Not Classified

Precautionary Statements:
None

Contains

Substances	**CAS Number**
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA

2.3. Other Hazards

This substance is not considered to be persistent, bioaccumulating nor toxic (PBT).
This substance is not considered to be very persistent nor very bioaccumulating (vPvB).

SECTION 3: Composition/information on ingredients

3.1. Substances Substance

Substances	EINECS	CAS Number	PERCENT (w/w)	EU - CLP Substance Classification	REACH Reg. No
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	NA	60 - 100%	Not classified	No data available

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

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, or suspected contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention immediately after flushing.

Skin Wash with soap and water. Get medical attention if irritation persists.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

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

No significant hazards expected.

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

Notes to Physician Treat symptomatically

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

5.2. Special hazards arising from the substance or mixture

Special exposure hazards in a fire

Not applicable

5.3. Advice for firefighters

Special protective equipment for firefighters

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment. Avoid creating and breathing dust. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.
See Section 8 for additional information

6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas.

6.3. Methods and material for containment and cleaning up

Scoop up and remove.

6.4. Reference to other sections

See Section 8 and 13 for additional information.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust. Ensure adequate ventilation. Wash hands after use. Launder contaminated clothing before reuse. Use appropriate protective equipment.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Store in a cool, dry location. Product has a shelf life of 60 months.

7.3. Specific end use(s)

Exposure scenario No information available
Other Guidelines No information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure Limits

Substances	CAS Number	EU	UK	Netherlands	France
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable	Not applicable	Not applicable	Not applicable

Substances	CAS Number	Germany	Spain	Portugal	Finland
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable	Not applicable	Not applicable	Not applicable

Substances	CAS Number	Austria	Ireland	Switzerland	Norway
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable	Not applicable	Not applicable	Not applicable

Substances	CAS Number	Italy	Poland	Hungary	Czech Republic
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable	Not applicable	Not applicable	Not applicable

Substances	CAS Number	Denmark	Romania	Croatia	Cyprus
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable	Not applicable	Not applicable	Not applicable

Derived No Effect Level (DNEL) No information available

Worker

General Population

Predicted No Effect Concentration (PNEC) No information available.

8.2. Exposure controls

Engineering Controls Use in a well ventilated area.

Personal protective equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Respiratory Protection Dust/mist respirator. (N95, P2/P3)
Hand Protection Normal work gloves.
Skin Protection Normal work coveralls.
Eye Protection Dust proof goggles.
Other Precautions None known.

Environmental Exposure Controls No information available

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical State: Solid **Color:** White to gray
Odor: Odorless **Odor Threshold:** No information available

Property	Values	Remarks/ - Method
pH:	~7	
Freezing Point / Range	771 °C	
Melting Point / Range	No data available	

Boiling Point / Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	1.99
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

Molecular Weight	74.55
VOC Content (%)	No data available

SECTION 10: Stability and reactivity

10.1. Reactivity
Not expected to be reactive.
10.2. Chemical stability
Stable
10.3. Possibility of hazardous reactions
Will Not Occur
10.4. Conditions to avoid
None anticipated
10.5. Incompatible materials
None known.
10.6. Hazardous decomposition products
None known.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute Toxicity

Inhalation	May cause mild respiratory irritation.
Eye Contact	Non-irritating to rabbit's eye
Skin Contact	Not irritating to skin in rabbits.
Ingestion	May cause abdominal pain, vomiting, nausea, and diarrhea.

Chronic Effects/Carcinogenicity No data available to indicate product or components present at greater than 0.1% are chronic health hazards.

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No data available	No data available	No data available

SECTION 12: Ecological information

12.1. Toxicity

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available	No information available	No information available	No information available

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

12.5. Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating nor toxic (PBT). This substance is not considered to be very persistent nor very bioaccumulating (vPvB).

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Disposal methods Bury in a licensed landfill according to federal, state, and local regulations. Substance should NOT be deposited into a sewage facility.

Contaminated Packaging Follow all applicable national or local regulations. Contaminated packaging may be disposed of by: rendering packaging incapable of containing any substance, or treating packaging to remove residual contents, or treating packaging to make sure the residual contents are no longer hazardous, or by disposing of packaging into commercial waste collection.

SECTION 14: Transport information

IMDG/IMO

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

RID

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group	Not applicable
Environmental Hazards:	Not applicable

ADR

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group	Not applicable
Environmental Hazards:	Not applicable

IATA/ICAO

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

14.1. UN Number Not restricted

14.2. UN proper shipping name: Not restricted

14.3. Transport Hazard Class(es): Not applicable

14.4. Packing Group Not applicable

14.5. Environmental Hazards: Not applicable

14.6. Special Precautions for User None

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable

SECTION 15: Regulatory information

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

International Inventories

EINECS (European Inventory of Existing Chemical Substances)	This product, and all its components, complies with EINECS
US TSCA Inventory	All components listed on inventory or are exempt.
Canadian Domestic Substances List (DSL)	All components listed on inventory or are exempt.

Legend
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

Denmark PR No.: 1153077

Germany, Water Endangering Classes (WGK) WGK 1: Low hazard to waters.

15.2. Chemical safety assessment
No information available

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3
None

Key or legend to abbreviations and acronyms used in the safety data sheet
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
ErC50 – Effective Concentration growth rate 50%
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL0 – Lethal Loading 0%
LL50 – Lethal Loading 50%
MARPOL – International Convention for the Prevention of Pollution from Ships
mg/kg – milligram/kilogram
mg/L – milligram/liter
NIOSH – National Institute for Occupational Safety and Health
NOEC – No Observed Effect Concentration
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
PC – Chemical Product category
PEL – Permissible Exposure Limit
ppm – parts per million
PROC – Process category
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
STEL – Short Term Exposure Limit
SU – Sector of Use category

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID

Revision Date: 21-Sep-2017
Revision Note
SDS sections updated:
1

This safety data sheet complies with the requirements of Regulation (EC) No. 453/2010

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is

obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

SDS no. PID1361
Version 8
Revision date 18-Feb-2016
Supersedes date 02-Apr-2014

Safety Data Sheet
SAFE-CARB* (All Grades)

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name SAFE-CARB* (All Grades)
Product code PID1361
Synonyms SAFE-CARB* 2, 10, 20, 25, 40, 250, 500, 600, 750, 1400, 2500
REACH registration name Exempt
Denmark Pr. no.: 2175905

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

Recommended Use Lost circulation material. Weighting agent. Bridging material.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I Australia Pty Ltd
ABN: 67 009 214 162
Level 5
256 St. George Tce
Perth
WA 6000
T = +61 08 9440 2900
F = +61 08 9322 3080
+47 51577424

MISDS@slb.com

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600

Denmark	Poison Control Hotline (DK): +45 82 12 12 12
Norway	Poison information centre: +47 22 59 13 00

2. Hazards identification

2.1 Classification of the substance or mixture

Classification according to (EC) No. 1272/2008

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards Not classified

2.2 Label elements

Signal word
None

Hazard statements
This product is not classified as hazardous therefore no (H) hazard statements assigned.

Precautionary Statements - EU (§28, 1272/2008)
This product is not classified as hazardous therefore has no (P) precautionary statements assigned.

-

-

Contains
Calcium carbonate

Crystalline silica (impurity)

2.3 Other data

Not classified as PBT/vPvB by current EU criteria

Australian statement of hazardous/dangerous nature
Classified as Non-Hazardous according to the criteria of NOHSC.
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS.

3. Composition/information on ingredients

3.1 Substances

Component	EC-No.	CAS-No	Weight % - range	Classification (67/548)	Classification (Reg. 1272/2008)	REACH registration number
Calcium carbonate	207-439-9	471-34-1	60-100	-	Not classified	Exempt
Crystalline silica (impurity)	238-878-4	14808-60-7	<1	Xn; R48/20	STOT Rep. 2 - H373	Exempt

3.2 Mixtures

Not Applicable

Comments
Naturally occuring mineral.

This product contains a small quantity of quartz, crystalline silica. Prolonged and repeated exposure to concentrations of crystalline silica exceeding the workplace exposure limit (WEL) may lead to chronic lung disease such as silicosis. IARC Monographs, Vol. 68, 1997, concludes that there is sufficient evidence that inhaled crystalline silica in the form of quartz or cristobalite from occupational sources causes cancer in humans. IARC Classification Group I.

4. First aid measures

4.1 First-Aid Measures

Inhalation	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Ingestion	Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.
Skin contact	Wash skin thoroughly with soap and water. Get medical attention if irritation persists.
Eye contact	Promptly wash eyes with lots of water while lifting eye lids. Remove contact lenses. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice	The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.
Main symptoms	
Inhalation	Please see Section 11. Toxicological Information for further information.
Ingestion	Please see Section 11. Toxicological Information for further information.
Skin contact	Please see Section 11. Toxicological Information for further information.
Eye contact	Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician	Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing media appropriate for surrounding material.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
None known.

Hazardous combustion products
Fire or high temperatures create:, Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. See also section 8.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment. Local authorities should be advised if significant spillages cannot be contained.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so. Cover powder spill with plastic sheet or tarp to minimize spreading.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. When using do not smoke, eat or drink. Wash hands and face before breaks and immediately after handling the product Remove contaminated clothing.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions	Ensure adequate ventilation. Keep airborne concentrations below exposure limits.
Storage precautions	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from moisture
Storage class	Chemical storage.
Packaging material	Use specially constructed containers only.

7.3 Specific end uses

See Section 1.2.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits No biological limit allocated

Component	EU OEL	Austria	Australia	Denmark

Calcium carbonate	Not determined	Not determined	10mg/m³TWAinhalable dust	Not determined
Crystalline silica (impurity)	Not determined	0.15 mg/m³ TWA alveolar dust, respirable fraction	0.1mg/m³TWArespirable dust	0.1mg/m³

Component	Malaysia	France	Germany	Hungary
Calcium carbonate	Not determined	10 mg/m³TWA	Not determined	Not determined
Crystalline silica (impurity)	0.1 mg/m³ TWA	0.1 mg/m³TWA	Not determined	0.15mg/m³TWA

Component	New Zealand	Italy	Netherlands	Norway
Calcium carbonate	Not Determined	Not determined	Not determined	Not determined
Crystalline silica (impurity)	0.2 mg/m³ TWA Known or presumed human carcinogen	Not determined	0.075 mg/m³	0.3 mg/m³ TWA total dust 0.1 mg/m³ TWA respirable dust 0.3 mg/m³ STEL total dust 0.1 mg/m³ STEL respirable dust Carcinogen

Component	Poland	Portugal	Romania	Russia
Calcium carbonate	10 mg/m³ TWA <2% free crystalline silica total inhalable dust	10 mg/m³ TWA particulate matter containing no Asbestos and < 1% Crystalline silica	Not determined	Not determined
Crystalline silica (impurity)	2 mg/m³ TWA NDS >50% free crystalline silica 0.3 mg/m³ TWA NDS >50% free crystalline silica 4.0 mg/m³ TWA NDS 2% to 50% free crystalline silica 1.0 mg/m³ TWA NDS 2% to 50% free crystalline silica	0.025 mg/m³ TWA respirable fraction	0.1mg/m³TWArespirable fraction, dust	3 mg/m³ STEL disintegration aerosol 3 mg/m³ STEL aerosol 1 mg/m³ TWA disintegration aerosol 1 mg/m³ TWA aerosol Fibrogenic substance and with its content in dust 2-10% and 10-70% Amorphous and vitreous silicon dioxide; Crystalline silicon dioxide

Component	Spain	Switzerland	Turkey	UK
Calcium carbonate	10 mg/m³ VLA-ED	Not determined	Not determined	Not determined
Crystalline silica (impurity)	0.05 mg/m³ TWA VLA-ED	0.15 mg/m³ TWA MAK	Not determined	0.3 mg/m³ STEL calculated respirable 0.1 mg/m³ TWA respirable

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation. Mechanical ventilation or local exhaust ventilation is required.

Personal protective equipment

Eye protection	Safety glasses with side-shields. Tightly fitting safety goggles.
Hand protection	Repeated or prolonged contact:, Use protective gloves made of:, Nitrile, Neoprene, Frequent change is advisable.
Respiratory protection	No personal respiratory protective equipment normally required, In case of insufficient ventilation wear suitable respiratory equipment, Suitable mask with particle filter P3 (European Norm 143), At work in confined or poorly ventilated spaces, respiratory protection with air supply must be used.
Skin and body protection	Wear suitable protective clothing, Eye wash and emergency shower must be available at the work place.

Hygiene measures Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid
Appearance	Powder Dust
Odor	Odorless
Color	White
Odor threshold	Not applicable

Property	**Values**	**Remarks**
pH	Not applicable	
pH @ dilution	8.5 - 9.5	@ 100 g/l
Melting/freezing point	No information available	
Boiling point/range	No information available	
Flash point	No information available	
Evaporation rate (BuAc =1)	No information available	
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	Not applicable	
Lower flammability limit	Not applicable	
Vapor pressure	No information available	
Vapor density	No information available	
Specific gravity	2.7 - 2.8	@ 20 °C
Bulk density	No information available	
Relative density	No information available	
Water solubility	Insoluble in water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	825 °C / 1517°F	

Kinematic viscosity	No information available
Dynamic viscosity	No information available
Log Pow	Not determined

Explosive properties	Not Applicable
Oxidizing properties	None known.

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	None
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

10.4 Conditions to avoid

Avoid dust formation. Protect from moisture.

10.5 Incompatible materials

No materials to be especially mentioned.

10.6 Hazardous decomposition products

See Section 5.2.

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Product information	This product contains a small quantity of quartz, crystalline silica. Prolonged and repeated exposure to concentrations of crystalline silica exceeding the workplace exposure limit (WEL) may lead to chronic lung disease such as silicosis.
Inhalation	Inhalation of dust in high concentration may cause irritation of respiratory system.
Eye contact	Dust may cause mechanical irritation.
Skin contact	Prolonged contact may cause redness and irritation.
Ingestion	Ingestion may cause stomach discomfort.
Unknown acute toxicity	Not Applicable.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Calcium carbonate	= 6450 mg/kg (Rat)	No data available	No data available
Crystalline silica (impurity)	= 500 mg/kg (Rat)	No data available	No data available

Sensitization This product does not contain any components suspected to be sensitizing.

Mutagenic effects This product does not contain any known or suspected mutagens.

Carcinogenicity Crystalline silica dust is listed by IARC in Group 1 as known to cause lung cancer in humans, if inhaled.

Reproductive toxicity This product does not contain any known or suspected reproductive hazards.

Routes of exposure Inhalation.

Routes of entry Inhalation.

Specific target organ toxicity (single exposure) Not classified

Specific target organ toxicity (repeated exposure) Not classified.

Aspiration hazard Not Applicable.

12. Ecological information

12.1 Toxicity

The product component(s) are 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.
Listed on PLONOR list of OSPAR

Toxicity to algae
This product is not considered toxic to algae.

Toxicity to fish
This product is not considered toxic to fish.

Toxicity to daphnia and other aquatic invertebrates
This product is not considered toxic to invertebrates.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Calcium carbonate	No information available	No information available	No information available
Crystalline silica (impurity)	No information available	No information available	No information available

12.2 Persistence and degradability

Not Applicable - Inorganic chemical.

12.3 Bioaccumulative potential

Not Applicable - Inorganic chemical.

12.4 Mobility in soil

Mobility
Insoluble in water.

12.5 Results of PBT and vPvB assessment

Not classified as PBT/vPvB by current EU criteria.

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.
EWC Waste disposal No.	According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used. The following Waste Codes are only suggestions: EWC waste disposal No: 06 03 99 - wastes not otherwise specified.

14. Transport information

14.1 UN Number
Not regulated

14.2 Proper shipping name
The product is not covered by international regulation on the transport of dangerous goods

14.3 Hazard class(es)

ADR/RID/ADN/ADG Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated

14.4 Packing group

ADR/RID/ADN/ADG Packing group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions

Not Applicable

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

Please contact MISDS@slb.com for info regarding transport in Bulk.

15. Regulatory information

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

Germany, Water Endangering Classes (VwVwS)	Water endangering class = nwg

Australian Standard for the Uniform Scheduling of Drugs and Poisons

No Poisons Schedule number allocated

New Zealand hazard classification	Not classified.
HSNO approval no.	Not required.
Group number	Not required.

Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, including amendments.

This safety data sheet complies with the requirements of Regulation (EC) No. 1272/2008.

National Code of Practice for the Preparation of Material Safety Data Sheets 2nd Edition [NOHSC: 2011 (2003)].

National Occupational Health and Safety Commission's Approved Criteria for Classifying Hazardous Substances [NOHSC:1008 (2004) 3rd Edition].

National Occupational Health and Safety Commission's Exposure Standards for Atmospheric Contaminants in the occupational Environment [NOHSC:1003 (1995)].

Safe Work Australia.

Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP).

Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by

road or rail.

Occupational Safety and Health (Classification, Labelling and Safety Data Sheet of Hazardous Chemicals) Regulations 2013 [P.U.(A) 310/2013] (CLASS Regulations)

The Industry Code of Practice on Chemical Classification and Hazard Communication 2014 [P.U. (B) 128/2014] (ICOP)
International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

Contact REACH@miswaco.slb.com for REACH information.

15.2 Chemical Safety Report

No information available

16. Other information

Prepared by	Global Regulatory Compliance - Chemicals (GRC - Chemicals) , Anne Karin (Anka) Fosse
Supersedes date	02-Apr-2014
Revision date	18-Feb-2016
Version	8
The following sections have been revised:	All sections, No changes with regard to classification have been made, Updated according to GHS/CLP.

Text of R phrases mentioned in Section 3

R48/20 - Harmful: danger of serious damage to health by prolonged exposure through inhalation

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

This product is not classified as hazardous therefore no (H) hazard statements assigned.

H373 - May cause damage to organs through prolonged or repeated exposure if inhaled

*A mark of M-I L.L.C., a Schlumberger Company

Disclaimer
The information contained herein is considered in good faith as reliable of the date issued and is based upon on

measurements, tests or data derived from supplier's own study or furnished by others. In providing this SDS information, Supplier makes no express or implied warranties as to the information or product; merchantability or fitness of purpose; any express or implied warranty; or non-infringement of intellectual property rights; and supplier assumes no responsibility for any direct, special or consequential damages, results obtained, or the activities of others. To the maximum extent permitted by law, supplier's warranty obligations and buyer's sole remedies are as stated in separate agreement between the parties.

Material Safety Data Sheet
Soda Ash Dense

1. IDENTIFICATION

Product Name	**Soda Ash Dense**
Other Names	Carbonic acid disodium salt; Carbonic acid, disodium salt; Disodium Carbonate; Soda Ash; Sodium Carbonate; Sodium Carbonate, Anhydrous
Uses	Glass manufacturing, chemical manufacturing, pulp and paper, water treatment and pH control, soap and detergent manufacturing, coal treatment, emission control, iron exchange resin regeneration.
Chemical Family	Inorganic (alkaline) salt
Chemical Formula	Na2CO3
Chemical Name	Soda Ash Dense
Product Description	No Data Available

Contact Information

Organisation	Location	Telephone	Ask For
Redox Pty Ltd	2 Swettenham Road Minto NSW 2566 Australia	+61-2-97333000	MSDS Officer
	11 Mayo Road Wiri Auckland 2104 New Zealand	+64-9-2506222	
Poisons Information Centre	Westmead NSW	1800-251525 131126	
Chemcall	Australia New Zealand	1800-127406 0800-243622 +64-3-3530199	
National Poisons Centre	New Zealand	0800-764766	

2. HAZARD IDENTIFICATION

ADG Code	Non-Dangerous Goods according to the criteria of the Australian Dangerous Goods Code (ADG Code).	
SWA Hazard Classification	Hazardous according to the criteria of Safe Work Australia [NOHSC:1008(2004)]	
Categories	**Xi**	Irritant
Risk Phrases	**R36**	Irritating to eyes.
Safety Phrases		
HSNO Hazard Classification	6.1D; 6.3A; 6.4A; 6.1E	
Poisons Schedule (Aust)	5	

This Material Safety Data Sheet may not provide exhaustive guidance for all HSNO Controls assigned to this substance. The EPA (New Zealand) web site should be consulted for a full list of triggered controls and cited regulations.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients

Chemical Entity	Formula	CAS Number	Proportion
Sodium Carbonate	Na2CO3	497-19-8	99.8 %

4. FIRST AID MEASURES

Description of necessary measures according to routes of exposure

Swallowed	If victim is conscious and alert, give 1-2 glasses of water to drink. Do not give anything by mouth to an unconscious person.Seek immediate medical attention. Do not leave victim unattended.
Eye	Hold eyelids open and flush with a steady, gentle stream of water for at least 15 minutes. Seek immediate medical attention.
Skin	In case of contact, immediately wash with plenty of soap and water for at least 5 minutes. See medical attention if irritation develops or persists. Remove contaminated clothing and shoes. Clean contaminated clothing and shoes before re-use.
Inhaled	Remove victim from immediate source of exposure and assure that the victim is breathing. If breathing is difficult, administer oxygen, if available. If victim is not breathing, administer CPR (cardio-pulmonary resuscitation). Seek immediate medical attention.
Advice to Doctor	Treat symptomatically based on judgement of doctor and individual reactions of patient.
Medical Conditions Aggravated by Exposure	No information available on medical conditions aggravated by exposure to this product.

5. FIRE FIGHTING MEASURES

General Measures	Clear fire area of all non-emergency personnel. Stay upwind. Keep out of low areas. Eliminate ignition sources. Move fire exposed containers from fire area if it can be done without risk.
Flammability Conditions	Product is a non-flammable solid.
Extinguishing Media	In case of fire, use appropriate extinguishing media most suitable for surrounding fire conditions. Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Fire and Explosion Hazard	Non-Combustible.
Hazardous Products of Combustion	Carbon oxides, Sodium oxides.
Special Fire Fighting Instructions	Do NOT allow fire fighting water to reach waterways, drains or sewers. Store fire fighting water for treatment.
Personal Protective Equipment	Fire fighters should wear a positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots and gloves).
Flash Point	No Data Available
Lower Explosion Limit	No Data Available
Upper Explosion Limit	No Data Available
Auto Ignition Temperature	No Data Available
Hazchem Code	No Data Available

6. ACCIDENTAL RELEASE MEASURES

General Response Procedure	Avoid accidents, clean up immediately. Slippery when spilt. Eliminate all sources of ignition. Increase ventilation. Avoid generating dust. Stop leak if safe to do so. Isolate the danger area. Use clean, non-sparking tools and equipment.
Clean Up Procedures	Contain and sweep/shovel up spills with dust binding material or use an industrial vacuum cleaner. Transfer to a suitable, labelled container and dispose of promptly. Large spills should be handled according to a predetermined plan.
Containment	Stop leak if safe to do so. Isolate the danger area.
Decontamination	Decontaminate tools and equipment following clean up. Clean up residual material by washing area with water.
Environmental Precautionary Measures	Do NOT let product reach drains or waterways. If product does enter a waterway, advise the Environmental Protection Authority or your local Waste Management.
Evacuation Criteria	Evacuate all unnecessary personnel.
Personal Precautionary Measures	Personnel involved in the clean up should wear full protective clothing as listed in section 8.

7. HANDLING AND STORAGE

Handling	Ensure an eye bath and safety shower are available and ready for use. Observe good personal hygiene practices and recommended procedures. Wash thoroughly after handling. Take precautionary measures against static discharges by bonding and grounding equipment. Avoid contact with eyes, skin and clothing. Do not inhale product dust.
Storage	Store in a cool, dry, well-ventilated area. Keep containers tightly closed when not in use. Inspect regularly for deficiencies such as damage or leaks. Protect against physical damage. Store away from incompatible materials as listed in section 10. Protect from direct sunlight, moisture and static discharges. This product is not classified dangerous for transport according to The Australian Code for the Transport of Dangerous Goods By Road and Rail.
Container	Store in original packaging as approved by manufacturer.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

General	No exposure standard has been established for this product by the Safe Work Australia (SWA). However, the exposure standard for dust not otherwise specified is 10mg/m3 (for inspirable dust) and 3mg/m3 (for respirable dust). NOTE: The exposure value at the TWA is the average airborne concentration of a particular substance when calculated over a normal 8 hour working day for a 5 day working week. These exposure standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.
Exposure Limits	No Data Available
Biological Limits	No information available on biological limit values for this product.
Engineering Measures	A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Adequate ventilation should be provided so that exposure limits are not exceeded.
Personal Protection Equipment	RESPIRATOR: Air –purifying (half-mask / full-face) respirator with cartridges / canister approved for use against dusts, mists and fumes (AS1715/1716). EYES: Protective glasses or goggles should be worn when this product is being used (AS1336/1337). HANDS: Wear suitable impervious elbow-length gloves (AS2161). CLOTHING: Long-sleeved protective clothing and safety footwear (AS3765/2210).
Special Hazards Precaustions	Thoroughly launder protective clothing before storage or re-use. Advise laundry of nature of contamination when sending contaminated clothing to laundry.
Work Hygienic Practices	No Data Available

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Solid
Appearance	Granular Solid
Odour	Odourless
Colour	White
pH	11.3 1% solution
Vapour Pressure	No Data Available
Relative Vapour Density	No Data Available
Boiling/Melting Point	No Data Available
Solubility	217 g/l °C
Freezing Point	No Data Available
Specific Gravity	2.53
Flash Point	No Data Available
Auto Ignition Temp	No Data Available
Evaporation Rate	No Data Available
Bulk Density	No Data Available
Corrosion Rate	No Data Available
	400 °C

Decomposition Temperature	
Density	No Data Available
Specific Heat	No Data Available
Molecular Weight	No Data Available
Net Propellant Weight	No Data Available
Octanol Water Coefficient	No Data Available
Particle Size	No Data Available
Partition Coefficient	No Data Available
Saturated Vapour Concentration	No Data Available
Vapour Temperature	No Data Available
Viscosity	No Data Available
Volatile Percent	No Data Available
VOC Volume	No Data Available
Additional Characteristics	No Data Available
Potential for Dust Explosion	No Data Available
Fast or Intensely Burning Characteristics	No Data Available
Flame Propagation or Burning Rate of Solid Materials	No Data Available
Non-Flammables That Could Contribute Unusual Hazards to a Fire	No Data Available
Properties That May Initiate or Contribute to Fire Intensity	No Data Available
Reactions That Release Gases or Vapours	No Data Available
Release of Invisible Flammable Vapours and Gases	No Data Available

10. STABILITY AND REACTIVITY

Chemical Stability	Product is stable under normal conditions of use, storage and temperature.
Conditions to Avoid	Extreme Heat; Hygroscopic. Protect from moisture, Mixing of acid and sodium carbonate solutions could cause carbon dioxide evolution.
Materials to Avoid	Aluminum Fluorine Humid Air Moisture Sulfuric Acid Acids Magnesium Phosphorus Pentoxide.
Hazardous Decomposition Products	Decomposition Temperature: 400 Deg C. Decomposition product: Carbon dioxide.
Hazardous Polymerisation	This product is unlikely to react or decompose under normal storage conditions. However, if you have any doubts, contact the supplier for advice on shelf life properties. The product will not undergo polymerisation reactions.

11. TOXICOLOGICAL INFORMATION

General Information

Acute Eye Irritation: Toxicological Information and Interpretation
Eye – Eye Irritation, 25 mg/Kg, Rabbit. Severely Irritating; Muscle contraction or spasticity.

Acute Skin Irritation: Toxicological Information and Interpretation
Skin – 500 mg/24 hour Skin Irritation, Rabbit. Mildly irritating.

Acute Dermal Toxicity
LD50. Rabbit: >2,000 mg/kg

Acute Inhalation Toxicity: Toxicological Information and Interpretation
LD50 – Lethal Concentration. 50% of Test Species, 2,300 mg/cu m/2hr, rat.

Acute Oral Toxicity: Toxicological Information and Interpretation
LD50 – Lethal Dose. 50% of Test Species, 4,090 mg/kg, rat.

	Chronic Toxicity This product does not contain any substances that are considered by OSHA, NTP, IARC or ACGIH to be “probably” or “suspected” human carcinogens
EyeIrritant	May cause severe irritation, redness, or swelling.
Ingestion	May cause gastrointestinal irritation, nausea, vomiting, or diarrhea.
Inhalation	May cause upper respiratory tract, lung, and irritation to mucus membranes.
SkinIrritant	May cause itching, redness, or swelling.
Carcinogen Category	0

12. ECOLOGICAL INFORMATION

Ecotoxicity	Toxicity Toxicity to fish LC50 - Lepomis macrochirus (Bluegill) - 300 mg/l - 96 h Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia magna (Water flea) - 265 mg/l - 48 h
Persistence/Degradability	No information available on persistence/degradability for this product.
Mobility	No information available on mobility for this product.
Environmental Fate	Do NOT let product reach waterways, drains and sewers.
Bioaccumulation Potential	No information available on bioaccumulation for this product.
Environmental Impact	No Data Available

13. DISPOSAL CONSIDERATIONS

General Information	Dispose of in accordance with all local, state and federal regulations. All empty packaging should be disposed of in accordance with Local, State, and Federal Regulations or recycled/reconditioned at an approved facility. Rinse containers before disposal.
Special Precautions for Land Fill	Contact a specialist disposal company or the local waste regulator for advice.

14. TRANSPORT INFORMATION

ADG Code Non-Dangerous Goods according to the criteria of the Australian Dangerous Goods Code (ADG Code).

Air

IATA

Proper Shipping Name	SODA ASH DENSE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

Land

Australia: ADG

Proper Shipping Name	SODA ASH DENSE
Class	No Data Available

Subsidiary Risk(s)	No Data Available
	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

Malaysia: NZS5433

Proper Shipping Name	SODA ASH DENSE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

New Zealand: NZS5433

Proper Shipping Name	SODA ASH DENSE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

Papua New Guinea:

Proper Shipping Name	SODA ASH DENSE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

United States of America: US DOT

Proper Shipping Name	SODA ASH DENSE
Class	No Data Available
Subsidiary Risk(s)	No Data Available
	No Data Available
UN Number	No Data Available
Hazchem	No Data Available
Pack Group	No Data Available
Special Provision	No Data Available

Sea

IMDG

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

15. REGULATORY INFORMATION

General Information No Data Available

EPA (New Zealand)

Hazardous Substances and New Organisms Act (HSNO)

Approval Code: HSR003265

Poisons Schedule (Aust) 5

AICS Name Carbonic acid, disodium salt

16. OTHER INFORMATION

Related Product Codes SODCAL1000, SOCABR1000, SOCABR1100, SOCABR2000, SOCARB1000, SOCARB1001, SOCARB1002, SOCARB1003, SOCARB1004, SOCARB1005, SOCARB1006, SOCARB1007, SOCARB1008, SOCARB1009, SOCARB1010, SOCARB1011, SOCARB1012, SOCARB1013, SOCARB1014, SOCARB1015, SOCARB1016, SOCARB1017, SOCARB1018, SOCARB1019, SOCARB1100, SOCARB1101, SOCARB1102, SOCARB1103, SOCARB1104, SOCARB1105, SOCARB1200, SOCARB1201, SOCARB1202, SOCARB1300, SOCARB1500, SOCARB1501, SOCARB1600, SOCARB2000, SOCARB2500, SOCARB2501, SOCARB2502, SOCARB2503, SOCARB2504, SOCARB2505, SOCARB2600, SOCARB3000, SOCARB4000, SOCARB4600, SOCARB4700, SOCARB4701, SOCARB4800, SOCARB4900, SOCARB5000, SOCARB5001, SOCARB5100, SOCARB5200, SOCARB5201, SOCARB5300, SOCARB5400, SOCARB5500, SOCARB5501, SOCARB5600, SOCARB5700, SOCARB5800, SOCARB5900, SOCARB6000, SOCARB6001, SOCARB6100, SOCARB6200, SOCARB7000, SOCARB7001, SOCARB8000, SOCARB8001, SOCARB8002, SOCARB8100, SOCARB8101, SOCARB9000, SODCAB1000, SODCAB1001, SODCAB1002, SODCAB1003, SODCAB1004, SODCAB1005, SODCAB1006, SODCAB1100, SODCAB1101, SODCAB1102, SODCAB1103, SODCAB1104, SODCAB1105, SODCAB1106, SODCAB1200, SODCAB2600, SODCAB2700, SODCAB2800, SODCAB2900, SODCAB3000, SODCAB3100, SODCAB3200, SODCAB3300, SODCAB3400, SODCAB3500, SODCAB3600, SODCAB3700, SODCAB3800, SODCAB3900, SODCAB4000, SODCAB4100, SODCAB4200, SODCAB4300, SODCAB5500, SODCAB5800, SODCAB5801, SODCAB5900, SODCAB6000, SODCAB6001, SODCAB6100, SODCAB7000, SODCAB7500, SODCAB7600, SODCAB8000, SODCAB8800, SODCAB9000, SODCAB9500, SODCAB9600, SODCAR0500, SODCAR0501, SODCAR0502, SODCAR0503, SODCAR1000, SODCAR1001, SODCAR1002, SODCAR1003, SODCAR1004, SODCAR1005, SODCAR1006, SODCAR1007, SODCAR1008, SODCAR1009, SODCAR1100, SODCAR2000, SODCAR2001, SODCAR3000, SODCAR3001, SODCAR3100, SODCAR3300, SODCAR3400, SODCAR3500, SODCAR4000, SODCAR5000, SODCAR5001, SODCAR5500, SODCAR7000, SODCAR7500, SODCAR9000, SODCAR9500, SOCARF1000, SOCARF1001, SOCARF2500, SOCARF5000, SOCARF5001, SOCARF5100, SOCARF5200, SOCARF9900, SOCARB9500, SOCARB1807, SOCARB1808, SOCARB1809, SOCARB1810, SOCARB1811, SOCARB1812, SOCARB1813, SOCARB1814, SOCARB1815, SOCARB1816, SOCARB1817, SOCARB1818, SOCARB9990, SOCARB5510, SODCAB2901, SOCARB9200, SODCAB6010, SODCAB5910, SOCARB1150, SOCARB6500, SOCARB6501, SODCAB6500, SODCAB6501, SODCAR6500, SOCARB5601, SODCAB1107, SOCARB6600, SOCARB6601, SODCAB6600, SODCAB6601, SOCARB1700, SOCARB1106, SOCARB9600, SODCAB6605, SODCAB1210, SOCARB5602, SOCARB5605, SOCARB0215, SOCARB2515, SOCARB0005, SOCARF5002, SOCARB5110, SOCARB5401, SODCAB6015, SOCARB1650

Revision 3

Revision Date 29 Dec 2014

< Less Than
> Greater Than

Key/Legend

AICS Australian Inventory of Chemical Substances
atm Atmosphere
CAS Chemical Abstracts Service (Registry Number)
cm² Square Centimetres
CO2 Carbon Dioxide
COD Chemical Oxygen Demand
deg C (°C) Degrees Celcius
EPA (New Zealand) Environmental Protection Authority of New Zealand
deg F (°F) Degrees Farenheit
g Grams
g/cm³ Grams per Cubic Centimetre
g/l Grams per Litre
HSNO Hazardous Substance and New Organism
IDLH Immediately Dangerous to Life and Health
immiscible Liquids are insoluable in each other.
inHg Inch of Mercury
inH2O Inch of Water
K Kelvin
kg Kilogram
kg/m³ Kilograms per Cubic Metre
lb Pound
LC50 LC stands for lethal concentration. LC50 is the concentration of a material in air which causes the death of 50% (one half) of a group of test animals. The material is inhaled over a set period of time, usually 1 or 4 hours.
LD50 LD stands for Lethal Dose. LD50 is the amount of a material, given all at once, which causes the death of 50% (one half) of a group of test animals.
ltr or **L** Litre
m³ Cubic Metre
mbar Millibar
mg Milligram
mg/24H Milligrams per 24 Hours
mg/kg Milligrams per Kilogram
mg/m³ Milligrams per Cubic Metre
Misc or **Miscible** Liquids form one homogeneous liquid phase regardless of the amount of either component present.
mm Millimetre
mmH2O Millimetres of Water
mPa.s Millipascals per Second
N/A Not Applicable
NIOSH National Institute for Occupational Safety and Health
NOHSC National Occupational Heath and Safety Commission
OECD Organisation for Economic Co-operation and Development
Oz Ounce
PEL Permissible Exposure Limit
Pa Pascal
ppb Parts per Billion
ppm Parts per Million
ppm/2h Parts per Million per 2 Hours
ppm/6h Parts per Million per 6 Hours
psi Pounds per Square Inch
R Rankine
RCP Reciprocal Calculation Procedure
STEL Short Term Exposure Limit
TLV Threshold Limit Value
tne Tonne
torr Millimetre of Mercury
TWA Time Weighted Average
ug/24H Micrograms per 24 Hours
UN United Nations
wt Weight

HALLIBURTON

SAFETY DATA SHEET
STOPPIT®

according to Regulation (EC) No. 453/2010

Revision Date: 05-Mar-2018 **Revision Number:** 21
Preparation Date 05-Mar-2018 **Internal ID Code** HM007395

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

1.1. Product Identifier

Product Name STOPPIT®
Internal ID Code HM007395

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

Recommended Use Lost Circulation Material
Sector of uses SU2 - Mining, (including offshore industries)
Product category(ies) PC20 - Products such as pH-regulators, flocculants, precipitants, neutralization agents, other unspecific
Process categories PROC 26 - Handling of solid inorganic substances at ambient temperature

1.3. Details of the supplier of the safety data sheet

Halliburton Energy Services
Halliburton House, Howemoss Place
Kirkhill Industrial Estate
Dyce
Aberdeen, AB21 0GN
United Kingdom
+44 1224 776888

www.halliburton.com

For further information, please contact
E-mail Address: fdunexchem@halliburton.com

1.4. Emergency telephone number

+44 8 08 189 0979 / 1-760-476-3961
Global Incident Response Access Code: 334305
Contract Number: 14012

Emergency telephone - Article 45 - (EC)1272/2008	
Turkey	Ulusal Zehir Danisma Merkezi (UZEM) :114 Acil Saglik Hizmetleri : 112
Europe	**112**
Bulgaria	Bulgarian poison centre: +359 2 915-44-09 or +359 2 915-43-46
Croatia	Centar za kontrolu otrovanja (CKO): (+385 1) 23-48-342 (Poison Control Center (PCC) - Institute for Medical Research and Occupational Health)
Cyprus	00357 22 88 7171
Denmark	Poison Control Hotline (DK): +45 82 12 12 12
France	ORFILA (FR): + 01 45 42 59 59
Germany	Poison Center Berlin (DE): +49 030 30686 790
Italy	Poison Center, Milan (IT): +39 02 6610 1029
Netherlands	National Poisons Information Center (NL): +31 30 274 88 88 (NB: this service is only available to health professionals)
Norway	Poisons Information (NO):+ 47 22 591300
Poland	Poison Control and Information Centre, Warsaw (PL): +48 22 619 66 54; +48 22 619 08 97
Portugal	CIAV - Centro de Informação Antivenenos (Portuguese Poison Centre): + 351 213 303 271
Romania	+40 21 318 36 06
Spain	Poison Information Service (ES): +34 91 562 04 20
United Kingdom	NHS Direct (UK): +44 0845 46 47

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Regulation (EC) No 1272/2008

Carcinogenicity	Category 1A - H350

2.2. Label Elements

Hazard Pictograms

Signal Word: **Danger**

Hazard Statements:
H350i - May cause cancer by inhalation

Precautionary Statements:
P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P308 + P313 - IF exposed or concerned: Get medical advice/attention
P405 - Store locked up
P501 - Dispose of contents/container to an approved waste disposal plant

Contains

Substances	**CAS Number**
Crystalline silica, quartz	14808-60-7

2.3. Other Hazards

This mixture contains no substance considered to be persistent, bioaccumulating nor toxic (PBT).
This mixture contains no substance considered to be very persistent nor very bioaccumulating (vPvB).

SECTION 3: Composition/information on ingredients

3.2. Mixtures Mixture

Substances	EINECS	CAS Number	PERCENT (w/w)	EU - CLP Substance Classification	REACH Reg. No
Crystalline silica, quartz	238-878-4	14808-60-7	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)	No data available

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

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin Wash with soap and water. Get medical attention if irritation persists.

Ingestion Under normal conditions, first aid procedures are not required.

4.2. Most important symptoms and effects, both acute and delayed
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

4.3. Indication of any immediate medical attention and special treatment needed
Notes to Physician Treat symptomatically

SECTION 5: Firefighting measures

5.1. Extinguishing media
Suitable Extinguishing Media
All standard fire fighting media
Extinguishing media which must not be used for safety reasons
None known.

5.2. Special hazards arising from the substance or mixture
Special exposure hazards in a fire
Not applicable

5.3. Advice for firefighters
Special protective equipment for firefighters
Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Use appropriate protective equipment. Avoid creating and breathing dust. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.
See Section 8 for additional information

6.2. Environmental precautions
Prevent from entering sewers, waterways, or low areas.

6.3. Methods and material for containment and cleaning up
Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

6.4. Reference to other sections
See Section 8 and 13 for additional information.

SECTION 7: Handling and storage

7.1. Precautions for safe handling
This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet. Avoid contact with eyes, skin, or clothing.
Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities
Store away from acids. Store in a cool, dry location. Store locked up. Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container. Product has a shelf life of 60 months.

7.3. Specific end use(s)
Exposure scenario No information available
Other Guidelines No information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure Limits

Substances	CAS Number	EU	UK	Netherlands	France
Crystalline silica, quartz	14808-60-7	Not applicable	TWA: 0.1 mg/m³	TWA: 0.075 mg/m³	TWA: 0.1 mg/m³

Substances	CAS Number	Germany	Spain	Portugal	Finland
Crystalline silica, quartz	14808-60-7	Not applicable	TWA: 0.05 mg/m³	TWA: 0.025 mg/m³	TWA: 0.05 mg/m³

Substances	CAS Number	Austria	Ireland	Switzerland	Norway
Crystalline silica, quartz	14808-60-7	TWA: 0.15 mg/m³	0.1 mg/m³ TWA (respirable dust)	TWA: 0.15 mg/m³	TWA: 0.3 mg/m³ TWA: 0.1 mg/m³ STEL: 0.9 mg/m³ STEL: 0.3 mg/m³

Substances	CAS Number	Italy	Poland	Hungary	Czech Republic
Crystalline silica, quartz	14808-60-7	Not applicable	TWA: 2 mg/m³ TWA: 0.3 mg/m³ TWA: 4.0 mg/m³ TWA: 1.0 mg/m³	TWA: 0.15 mg/m³	TWA: 0.1 mg/m³

Substances	CAS Number	Denmark	Romania	Croatia	Cyprus
Crystalline silica, quartz	14808-60-7	TWA: 0.3 mg/m³ TWA: 0.1 mg/m³	TWA: 0.1 mg/m³	TWA: 0.1 mg/m³	Not applicable

Substances	CAS Number	Bulgaria	Turkey
Crystalline silica, quartz	14808-60-7	TWA: 0.07 mg/m³	Not applicable

Derived No Effect Level (DNEL) No information available

Worker

General Population

Predicted No Effect Concentration (PNEC) No information available.

8.2. Exposure controls

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

Personal protective equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Respiratory Protection Wear a NIOSH certified, European Standard EN 149 (FFP2/FFP3), AS/NZS 1715, or equivalent respirator when using this product.

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

Environmental Exposure Controls Do not allow material to contaminate ground water system

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical State: Solid Powder
Odor: Odorless
Color: Brown
Odor Threshold: No information available

Property Remarks/ - Method	Values
pH:	No data available
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	Non-flammable
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	2
Water Solubility	No data available
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information
VOC Content (%) No data available

SECTION 10: Stability and reactivity

10.1. Reactivity
Not expected to be reactive.
10.2. Chemical stability
Stable
10.3. Possibility of hazardous reactions
Will Not Occur
10.4. Conditions to avoid
None anticipated
10.5. Incompatible materials
Strong acids.
10.6. Hazardous decomposition products
Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C). Carbon monoxide and carbon dioxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects
Acute Toxicity

Inhalation Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).

Eye Contact May cause mechanical irritation to eye.
Skin Contact None known.
Ingestion None known.

Chronic Effects/Carcinogenicity Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a

progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2). There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Crystalline silica, quartz	14808-60-7	> 15000 mg/kg (human)	No data available	No data available

Substances	CAS Number	Skin corrosion/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin

Substances	CAS Number	Serious eye damage/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the eye

Substances	CAS Number	Skin Sensitization
Crystalline silica, quartz	14808-60-7	No information available.

Substances	CAS Number	Respiratory Sensitization
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	Mutagenic Effects
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
Crystalline silica, quartz	14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure.

Substances	CAS Number	Reproductive toxicity
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	STOT - single exposure
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure

Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Crystalline silica, quartz	14808-60-7	Not applicable

SECTION 12: Ecological information

12.1. Toxicity

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Crystalline silica, quartz	14808-60-7	EC50 (72 h) =440 mg/L (Selenastrum capricornutum)(similar substance)	LL0 (96 h) =10000 mg/L (Danio rerio)(similar substance)	No information available	LL50 (24 h) >10000 mg/L (Daphnia magna)(similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Crystalline silica, quartz	14808-60-7	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Crystalline silica, quartz	14808-60-7	No information available

12.5. Results of PBT and vPvB assessment

This mixture contains no substance considered to be persistent, bioaccumulating nor toxic (PBT). This mixture contains no substance considered to be very persistent nor very bioaccumulating (vPvB).

Substances	PBT and vPvB assessment
Crystalline silica, quartz	Not applicable

12.6. Other adverse effects

Endocrine Disruptor Information
This product does not contain any known or suspected endocrine disruptors

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Disposal methods Bury in a licensed landfill according to federal, state, and local regulations.
Contaminated Packaging Follow all applicable national or local regulations.

SECTION 14: Transport information

IMDG/IMO

UN Number Not restricted
UN proper shipping name: Not restricted
Transport Hazard Class(es): Not applicable

Packing Group:	Not applicable
Environmental Hazards:	Not applicable

ADN

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group	Not applicable
Environmental Hazards:	Not applicable

ADR/RID

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group	Not applicable
Environmental Hazards:	Not applicable

IATA/ICAO

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

14.1. UN Number Not restricted

14.2. UN proper shipping name: Not restricted

14.3. Transport Hazard Class(es): Not applicable

14.4. Packing Group Not applicable

14.5. Environmental Hazards: Not applicable

14.6. Special Precautions for User None

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable

SECTION 15: Regulatory information

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

International Inventories

EINECS (European Inventory of Existing Chemical Substances)	This product, and all its components, complies with EINECS
US TSCA Inventory	All components listed on inventory or are exempt.
Canadian Domestic Substances List (DSL)	All components listed on inventory or are exempt.

Legend
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

Germany, Water Endangering Classes (WGK) WGK 0: Generally not water endangering.

Take note of Directive 92/85/EEC regarding maternity protection or stricter national regulations, where applicable.
Take note of Directive 94/33/EC on the protection of young people at work or stricter national regulations, where applicable.

List of the carcinogenic, mutagenic and toxic for reproduction substances SZW
Crystalline silica, quartz

15.2. Chemical safety assessment
No information available

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3
H350 - May cause cancer
H350i - May cause cancer by inhalation
H372 - Causes damage to organs through prolonged or repeated exposure if inhaled

Key or legend to abbreviations and acronyms used in the safety data sheet
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
ErC50 – Effective Concentration growth rate 50%
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL0 – Lethal Loading 0%
LL50 – Lethal Loading 50%
MARPOL – International Convention for the Prevention of Pollution from Ships
mg/kg – milligram/kilogram
mg/L – milligram/liter
NIOSH – National Institute for Occupational Safety and Health
NOEC – No Observed Effect Concentration
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
PC – Chemical Product category
PEL – Permissible Exposure Limit
ppm – parts per million
PROC – Process category
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
STEL – Short Term Exposure Limit
SU – Sector of Use category

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID
OSHA
ECHA C&L

Revision Date: 05-Mar-2018
Revision Note
SDS sections updated: 2

This safety data sheet complies with the requirements of Regulation (EC) No. 2015/830

Disclaimer Statement
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End of Safety Data Sheet

APPENDIX VI

Peer Review

Sustainable Minerals Institute
Sir James Foots Building
Cnr College and Staff House Road
St Lucia QLD 4072 Australia

Acting Director
Professor Rick Valenta

CRICOS PROVIDER NUMBER 00025B

8 December 2023

Senex Energy Ltd
Level 30, 180 Ann Street
Brisbane
QLD 4001

Attn: Steve Fox

Independent Peer Review of Chemical Risk Assessments – Tier 1 and Tier 2 Chemicals

Professor Barry Noller, Principal Research Fellow, Centre For Mined Land Rehabilitation, Sustainable Minerals Institute, The University of Queensland has been commissioned by Senex Energy Ltd to undertake an independent peer review of Tier 1, and Tier 2 Chemical Risk Assessments that have been completed by Klohn Crippon Berger, on behalf of Senex.

Professor Barry Noller has over 40 years experience in human health and environmental risk assessment in Australia. Professor Noller holds a PhD in environmental chemistry and is a Fellow of the Royal Australian Chemical Institute, Royal Society of Chemistry and International Union of Pure and Applied Chemistry. A CV for Professor Noller is included in Attachment A.

A Chemical Risk Assessment Framework (CRAF), prepared by Senex Energy Ltd (dated 6 December 2023) has been provided for use in the peer review process. The CRAF provides the framework for the chemical risk assessment process, specifically the classification of chemicals as Tier 1, Tier 2, Tier 3, and Tier 4, and the requirements that need to be addressed in the chemical risk assessment completed for each classification level. The CRAF includes check lists for use in the peer review of the chemical risk assessments.

The peer review completed by Professor Noller relate to chemicals classified as Tier 1 and Tier 2 chemicals and considered to be low risk. The levels of assessment required are summarised as follows:

- Tier 1 assessment, which includes chemicals of low concern that are not persistent or bioaccumulative and are of low toxicity where a hazard assessment and screening level assessment is required. A Tier 1 assessment also requires the development of a toxicological profile, which is presented in a chemical document.

- Tier 2 assessment, which includes chemicals of potential concern that are not persistent or bioaccumulative where a hazard assessment and qualitative assessment with a screening level assessment for acute toxicity with description of long term toxicity having long lasting effects. A Tier 2 assessment also requires the development of a toxicological profile having both qualitative and quantitative risk assessments.

The peer review process has been undertaken as follows:

- Undertake a detailed review of the Tier 1 chemical documents, in line with the classification criteria and checklists provided in the CRAF. Review comments, along with and relevant notes, have been documented in the peer review checklists. The review process has included checking that the classification of the Tier 1 chemicals is appropriate, and if there is the basis for the classification to be revised to Tier 2.
- For chemicals where the classification is revised from Tier 1 to Tier 2, the new Tier 2 chemical risk assessments have been reviewed along with all other Tier 2 assessment. It is noted that three chemical reviews (2,2-dibromo-3-nitrilopropionamide, chromium (6+) and petroleum gas oil) were reclassified as Tier 2 as part of this process.
- Undertake a detailed review of the Tier 2 chemical documents and qualitative risk assessments, in line with the classification criteria and checklists provided in the CRAF. Review comments, along with any relevant notes, have been documented in the peer review checklists. The review process has included checking that the classification of the Tier 2 chemicals is appropriate, and if there is a basis for the classification to be revised to Tier 3.
- The Tier 1 and Tier 2 chemical risk assessments were revised by Senex Energy Ltd to address the review comments provided.
- Revisions to the Tier 1 and Tier 2 chemical risk assessments were further reviewed to ensure that the revisions adequately addressed the comments provided.

The peer review has evaluated Tier 1 and Tier 2 chemical risk assessments for the chemicals listed in Attachment B. Peer review checklists have been provided to Senex Energy Ltd that detail the review process undertaken for each of these chemicals.

Based on the peer review completed for all of Tier 1 and Tier 2 chemical risk assessments reviewed (as listed in Attachment B), the following is concluded:

- All chemicals are correctly categorised as Tier 1 or Tier 2 chemicals.
- All chemical risk assessments have been prepared appropriately, in accordance with the requirements of the CRAF, and provide an evaluation of each chemical consistent with current scientific knowledge.
- Risks relevant to the use of Tier 1 and Tier 2 chemicals have been appropriately assessed.

Yours Sincerely,

Barry N Noller (PhD)
Principal Research Fellow
Centre For Mined Land Rehabilitation
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Attachment A : CV for Professor Barry Noller

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CURRICULUM VITAE

Professor Barry Noller

B.Sc. MChem. Ph.D. F.R.A.C.I., F.R.S.C., F.F.A.C.S., F.I.U.P.A.C.

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Professional Profile

Professor Noller is a graduate of the University of NSW (BSc1971, MChem1973) and the University of Tasmania (PhD 1978). He was Research Fellow Australian National University (1978-1980), Senior Research Scientist at the Alligator Rivers Region Research Institute, Jabiru, Northern Territory (1980-1990), Principal Environmental Chemist for the Northern Territory Department of Mines and Energy (1990-1998) and 1998-2006 Professor Noller was Deputy Director of the National Research Centre for Environmental Toxicology (ENTOX), the University of Queensland. From 2006-2023 Professor Noller has been Principal Research Fellow in the Centre for Mined Land Rehabilitation at the University of Queensland with a focus on peak contamination issues of significance to human health and ecological/environment.

Qualifications

1978	Doctor of Philosophy	University of Tasmania
1972	Master of Chemistry	University of New South Wales
1970	Bachelor of Science	University of New South Wales

Professor Noller worked and published in the field of environmental chemistry and industrial toxicology for the past 45 years and has presented >452 conference papers and published >226 refereed papers covering processes and fates of trace substances in the environment, particularly in tropical environmental systems with special reference to risk management associated with the bioavailability of toxic elements in mine and other industrial wastes including waters. He has undertaken detailed studies for both human health and ecological risks of arsenic on metal speciation of solid mine waste materials using synchrotron induced X-ray analysis and has developed speciation-based toxicity models for mine closure purposes.

Professor Noller's professional activities undertaken at four different centres have covered processes and fates of trace substances including arsenic, cadmium, lead, uranium, and other metals in the environment, particularly in tropical environmental systems with special reference to risk management associated with their application and studies of the bioavailability of toxic elements in mine wastes, waters and in air. He was appointed in 2007 as Principal Author of the Australian Government Sustainable Leading Practice Development Program for the Mining Industry Handbook on Cyanide Management. Professor Noller was leader of the Lead Pathways Study conducted for Xstrata Copper at Mt Isa, Queensland 2007-2012. Professor Noller has conducted several peer reviews and has been an expert witness for cases heard in NSW, Victoria, Queensland and Papua New Guinea. Professor Noller has been a National Association of Testing Authorities (NATA) Assessor (Water Analysis and Environmental Materials) from 198l-present and a Member Environment Technical Group NATA, 1985 - 2014. He was appointed by NATA as a Technical Expert (Environmental Testing) of the Chemical Accreditation Advisory Committee 25 November 2014 for 5 years and Chair NH&MRC Committee of Targeted Research into Pre- and Poly-Fluroalkylated Substances in 2018.

Professor Noller has had an extensive involvement with professional activities in Australia and the Asia Pacific region. He was President Royal Australian Chemical Institute 1995-1996 and was a representative and executive member of the Federation of Asian Chemical Societies 1986-2005 and attended 42 EXCO meetings. He held the positions of Secretary-General 1989-1991, Co-ordinator of Projects 1991-1999, President-Elect 1999-2001 and President 2001-2003. Professor Noller is Chair of the International Advisory Committee and has steered the progression of the Asian Symposium for Medicinal Plants and Spices (ASOMPS) on behalf of UNESCO. The first ASOMPS conference was held in 1961 at Peshawar, Pakistan. Professor Noller has coordinated ASOMPS IX Hanoi 24-28 September 1998 Hanoi, Vietnam, ASOMPS 18-23 November 2000 Dhaka, Bangladesh, ASOMPS XI 27-31 October 2003 Kunming, China, ASOMPS XII 13-18 November 2006 Padang, Indonesia, ASOMPS XIII 3-6 November 2008 Hyderabad, India, ASOMPS XIV (Golden Jubilee) 9-12 December 2013 Karachi, Pakistan, ASOMPS XV 6-8 December 2017, Manila, Philippines, ASOMPS XVI 12-14 December 2018, Colombo, Sri Lanka, ASOMPS XVII 18-19 August 2021, Putrajaya, Malaysia, and ASOMPS XVIII 5-8 October 20231, Bandung, Indonesia. Professor Noller is: Fellow RACI (1989), RSC (UK) (1992), FACS (2005) and IUPAC (2012). Professor Noller was elected as Fellow FACS in 2005 and Fellow IUPAC in 2012. He is also a Fellow of the Royal Society of Chemistry since 1991. He is a member of SETAC Australasia, The Geochemical Society, Clean Air Society of Australia and NZ, and International Water Association.

Awards/Distinctions

2017	Clean Air Award Queensland Branch Clean Air Society Australia & New Zealand (CASANZ)
2016	The 29th Mukarram Hussain Khundkar Memorial Lecture 2016 (Invited Presentation 24 March 2016) Department of Chemistry, University of Dhaka, Dhaka, Bangladesh.
2012	Fellow IUPAC
2006	Medal Environment Division, Royal Australian Chemical Institute
2005	Fellow Federation of Asian Chemical Societies
2003	Medal for Contribution to Development of Science and Technology in Vietnam VUSTA
1999	Citation Royal Australian Chemical Institute
1991	Fellow, Royal Society of Chemistry
1989	Fellow, Royal Australian Chemical Institute

Previous Appointments

Dates	Position	Institution/Employer
2008-2022	Principal Research Fellow	Centre for Mined Land Rehabilitation
2006-2008	Honorary Research Consultant	Centre for Mined Land Rehabilitation
1998-2006	Deputy Director & Principal Research Fellow	National Research Centre for Environmental Toxicology
1995-1998	Principal Environmental Chemist	Department of Mines and Energy, Darwin, NT
1990-1995	Senior Environmental Chemist	Department of Mines and Energy, Darwin, NT

1984-1990	Senior Research Scientist	Alligator Rivers Region Research Institute, Jabiru, NT
1980-1984	Research Scientist	Alligator Rivers Region Research Institute, Jabiru, NT
1978-1980	Research Fellow	Research School of Chemistry, ANU
1977-1980	Full time PhD Candidate	University of Tasmania
1973-1977	Tutor in Chemistry	University of Tasmania
1972	Full time MChem Candidate	University of NSW
1971-1972	Chemist	Mobil Oil Aust. Ltd., Technical Services, Sydney
1964-1971	Trainee Chemist	Mobil Oil Aust. Ltd., Technical Services, Sydney

Involvements with Aquatic and Terrestrial Ecology Management (Floodplains, open forest and creek systems, mine sites and leases)

Research studies at Jabiru , Kakadu National Park Northern Territory with the Supervising Scientist (1980-1990). Several studies were conducted on the effects of mine-derived and natural impacts on aquatic species and ecotoxicity studies, including fish kills.

Project studies in the Northern Territory, New South Wales and Queensland with mining companies (1990-current).

Effects on wildlife and domesticated animals (cattle), aquatic species and ecotoxicity studies. Effects of cyanide on bird populations at or near gold mines in Northern Australia. Dynamics of migratory birds, including Gouldian finches, accessing tailings dams at gold mines that contained cyanide. Development of safe level of cyanide to protect birds and other terrestrial species.

Aquatic toxicity studies of effects of heavy metal, acid mine drainage, salinity and other substances in freshwater and marine ecosystems utilising test species covering different trophic levels.
Selection of test aquatic species that use selection of species that reflect effects on species within the aquatic ecosystems, downstream of large mining operations, EIS requirements for ecotoxicity studies, species sensitive distributions for water release and aquatic species diversity. Leichhardt River at Mt Isa, Mt Leyshon downstream to Burdekin River, Kidston mine, Croydon mines, Duralie Coal Mine NSW.

McArthur River Mine, NT. Independent peer reviews previously completed for MRM (Waste Discharge Licence site specific trigger value reviews (Feb 2019 and April 2021) and the Adaptive Management Plan (March 2021) and Bing Bong Environmental Management Plan (October 2021) reviews), Moolarben Coal Mine, NSW, Wilpinjong Coal Mine, NSW.

Selected publications and reports (to December 2023 >226 Refereed papers;>452 Conference presentations).

Book

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Woffenden, Mark, Noller, Barry (Principal Author), Noonan, Kirrily, Breuer, Paul, Cooper, Peter and Donato, David (2008). Cyanide management: Leading practice sustainable development program for the mining industry. Canberra, A.C.T., Australia: Dept. of Industry, Tourism and Resources, 2008. ISBN 0 642 72593 4. pp 1 – 99.

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Refereed papers

Henderson, Fiona H M, Noller, Barry N, Komarova, Tatiana, (2022) Utilizing Lead Isotope Tracing to Investigate Sustainable Agriculture Practice in the Burdekin Catchment, Australia. International Journal of Environmental and Rural Development. 13(1) 123-129.

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Turull M., Komarova, T., Noller, B., Fontàs, C. and Díez, S. (2018) Evaluation of mercury in a freshwater environment impacted by an organomercury fungicide using diffusive gradient in thin films. Science of the Total Environment 621 1475-1484..

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Tinggi, U., Sadler, R., Ng, J., Noller, B. and Seawright, A. (2016) Bioavailability study of arsenic and mercury in traditional Chinese medicines (TCM) using an animal model after a single dose exposure. Regulatory Toxicology and Pharmacology 76 51-56.

Komarova, T.V., Iwai, C.B., Somparn, A., Tokhun N., Mueller, J., Kennedy, I. and Noller, B., (2015) Pesticide Distribution in the Namphong River NE Thailand Arising from Land Use and Other Practices. Oral presentation. IJERD – International Journal of Environmental and Rural Development. 6(1) 175-180.

Du Y, Kopittke PM, Noller BN, James SA, Harris HH, Xu ZP, Li P, Mulligan DR, Huang L. (2015) In situ analysis of foliar zinc absorption and short-distance movement in fresh and hydrated leaves of tomato and citrus using synchrotron-based X-ray fluorescence microscopy, Annals of Botany 115 41-53.

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Attachment B: Tier 1 and Tier 2 chemicals evaluated

Table B1: Tier 1 chemicals

Chemical Name	CAS No.
Boric Acid	10043-35-3
Calcium chloride	10043-52-4
Calcium Sulfate Dihydrate	10101-41-4
Triethanolamine	102-71-6
2-Ethyl-1-hexanol	104-76-7
Ethylene Glycol	107-21-1
Glyoxal	107-22-2
Diethanolamine,	111-42-2
2-Butoxyethanol	111-76-2
1-Octanol	111-87-5
Ammonium Sulfate 2-(2-butoxyethoxy)ethanol	112-34-5
Xanthan gum	11138-66-2
triethylamine	121-44-8
Bentonite	1302-78-9
Calcium Oxide	1305-78-8
Potassium hydroxide	1310-58-3
Sodium Hydroxide	1310-73-2
Limestone	1317-65-3
Kaolin	1332-58-7
Sodium Silicate solution	1344-09-8
Wollastonite (Ca(Sio3))	13983-17-0
Monoethanolamine	141-43-5
Crystalline silica (impurity)	14808-60-7
Dipropylene glycol	25265-71-8
Polypropylene Glycol	25322-69-4
Polyethylene glycol diacrylate	26570-48-9
Hexanedioic acid, compd. with 1,6-hexanediamine (1:1) Molecular Formula	3323-53-3
Calcium Carbonate	471-34-1
s-Triazine-1,3,5-triethanol	4719-04-4
Sodium Carbonate	497-19-8
Tetrakis (Hydroxymethyl)Phosphonium Sulfate	55566-30-8
Nitrogen containing Polysaccharide	56780-58-6
Potassium Carbonate	584-08-7
Cocoamidopropyl betaine	61789-40-0
Polyethylene Glycol Monotallate	61791-00-2
Hydrotreated Light Distillate	64742-47-8
Hydraulic Silicate Cement	65997-15-1
Methanol	67-56-1
Potassium Chloride	7447-40-7
Ammonium Persulfate	7727-54-0
Water Ultrapur	7732-18-5
Sodium Acid Pyrophospate	7758-16-9

Polyacrylamide	9003-5-8
Corn Starch	9005-25-8

Table B2: Tier 2 chemicals

Chemical Name	CAS No.
2,2-dibromo-3-nitrilopropionamide	10222-01-2
N,N'-methylenediacrylamide	110-26-9
Gluteraldehyde	111-30-8
1-Decanol	112-30-1
Ethylenediaminetetra (methylenephosphonic acid)	1429-50-1
2-Acrylamido-2-methyl-1-propanesulfonic acid	15214-89-8
Chromium (6+)	18540-29-9
Stearic Acid	57-11-4
Polycarboxylic acid, sodium salt	62601-60-9
Petroleum Gas Oil	64741-44-2
Granulated Blast Furnace Slag	65996-69-2
Ethoxylated C6-C10 Alcohol	68037-05-8
Coal Fly Ash	68131-74-8
Paraffin (hard)	8002-74-2
Cellulose	9004-34-6