



Tubridgi Gas Storage Project

Well Construction Activities

ENVIRONMENT PLAN PUBLIC SUMMARY

E-PLN-019
Rev 5
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1. Introduction

1.1 Background

The purpose of this Environment Plan (EP) is to provide detailed information relating to the Tubridgi Gas Field located in the licence area of Production Licence (L9) and the proposed well activities associated with testing of the reservoir for potential gas storage. The EP has been prepared by DDGT Pty Ltd (ABN 46 611 027 948) as the title holder of L9 for submission to the Department of Mines and Petroleum (DMP), in accordance with the *Petroleum and Geothermal Energy Resources (Environment) Regulations 2012*.

DDG Development Group Nominees Pty Ltd purchased the Tubridgi Gas Plant and associated pipelines (Tubridgi Lateral [PL16] and Ashburton West Lateral [PL19]) and the Griffin Export Facility (GEF) from BHP Billiton Petroleum (Australia) Pty Ltd and BHP Petroleum (Ashmore Operations) Pty Ltd in 2012. DDGT Pty Ltd became the titleholder in August 2016.

In the current phase of the project, DDGT Pty Ltd (DDGT) proposes to evaluate the potential of the Tubridgi Gas Field under Production License L9 for its suitability as a gas storage reservoir forming part of the Tubridgi Gas Storage Project (TGS). This requires the drilling, completion and testing of up to ten potential gas storage wells and the installation of buried flow lines connecting six to the GEF (Well Construction Activities).

The controls within this EP are designed to work in conjunction with the Ashburton West Facilities (ASW) Environment Plan, previously approved by the Department of Mines and Petroleum (DMP) as Ashburton West Facilities will be used in some capacity for accommodation and temporary gas tie-in activities related to this project.

This stand-alone EP is designed to cover all aspects of field-based activities to be undertaken in this phase of the project.

1.2 Proponent

DDGT Pty Ltd (ABN 46 611 027 948) is the title holder of L9 for submission to the Department of Mines and Petroleum (DMP), in accordance with the *Petroleum and Geothermal Energy Resources (Resources Management Administration) Regulations 2015*. DDGT Pty Ltd (DDGT) is the title holder and is 100% owned by DUET, an ASX-listed infrastructure fund.

DDGT is the Licence Holder and Nominated Operator and exercises all rights and retains all obligations associated with the L9 Production Licence. DDGT relies on the services of DBNGP (WA) Nominees Pty Ltd (DBP), the owner of the DBNGP, for the provision of labour and equipment to undertake its business. In this regard DDGT adopt all DBP policies and procedures across the operation of its business.

Public enquiries regarding the Tubridgi Gas Storage Project may be directed to DDGT via:

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PO Box Z5267

Perth, St Georges Terrace WA 6831

Telephone: +61 8 9223 4300

landmanagement@dbp.net.au

1.3 Objective

The objective of this EP is to identify and assess environmental aspects associated with the planned well construction and evaluation activities and establish suitable controls so as to eliminate or minimise these risks to a level that is low, negligible or reduced to as low as is reasonably practical (ALARP).

Additionally, the EP aims to establish performance objectives and measurement criteria for the ongoing monitoring of environmental performance during the construction phase of the project.

1.4 Scope

The scope of this EP includes all activities associated with the planned well construction activities, specifically:

- Management of existing access tracks;
- Construction of access track extensions to the planned well-sites;
- Clearing and stabilisation of well-sites;
- Construction of sump for containment of drilling fluids and cuttings;
- Installation of surface structural conductor with water drilling rig;
- Equipment delivery to and consolidation at well sites and staging area;
- Temporary expansion and operation of Tubridgi Camp facility;
- Construction and operation of a temporary Drill Camp facility;
- Drilling and completion of storage wells;
- Installation of flowlines and compression equipment for injection testing;
- Injection and production flow testing operations including some possible flaring of produced gas;
- Suspension of wells;
- Demobilisation of temporary drilling and testing equipment;
- Ongoing monitoring of wells via downhole data acquisition equipment.

The scope of this EP does not include activities associated with the TGSP Facilities construction (to be predominately undertaken at the existing Griffin Export Facility). These works will be managed under the Tubridgi Gas Storage Project Facilities Construction Environment Plan (TGSP Facilities CEP).

The L9 Production Licence location is roughly bounded by:

Point	Longitude	Latitude	Easting	Northing
1	114.75000	-21.75000	267,304.56	7,593,150.46
2	114.75000	-21.83333	267,439.15	7,583,922.04
3	114.91667	-21.83333	284,671.99	7,584,164.52
4	114.84900	-21.75015	277,546.56	7,593,279.78
5	114.91526	-21.70540	284,334.43	7,598,329.14



Figure 1-1 Overview Map of Ashburton West

2. Environmental Management Framework

2.1 Policy

DDGT and DDG adopt all DBP policies and procedures across the operation of its business.

DBP has a corporate culture which strives for Health, Safety and Environment (HSE) excellence driven by a corporate commitment to protect people and the environment. Central to this is the DBP HSE Policy which is signed and endorsed by its CEO. This is supported by a statement of commitment signed by the DBP Executive Team, and a set of core principles, called Zero Harm Principles, which are aimed at establishing principles for undertaking activities that have been assessed as having the highest risk to DBP and its workforce.

The DBP HSE Policy is reviewed annually, or when there is a significant change to the organisation or its activities, to ensure that the policy remains comprehensive and current. Employees are consulted during the review process through a number of mechanisms, including HSE Committees.

2.2 Structure and Responsibility

All staff are responsible for the environmental performance of their activities and for reporting any environmental hazards and incidents. Environmental responsibilities for staff and contractors are contained within position descriptions, relevant procedures and work instructions.

2.3 Legislation

Key environmental legislation and other requirements that may apply to TGS are presented in Table 2-1 below.

Table 2-1 Associated Environmental Legislation and Other Requirements

Commonwealth Legislation	<ul style="list-style-type: none"> ▪ Aboriginal and Torres Straits Islander Heritage Protection Act 1984 ▪ Environmental Protection and Biodiversity Conservation Act 1999 ▪ Endangered Species Protection Act 1992 ▪ National Greenhouse and Energy Reporting Act 2007 ▪ Native Title Act 1993
Western Australian Legislation and Associated Regulations	<ul style="list-style-type: none"> ▪ Aboriginal Heritage Act 1972 ▪ Agriculture and Related Resources Protection Act 1976 ▪ Biosecurity and Agriculture Management Act 2007 ▪ Bushfires Act 1954 ▪ Conservation and Land Management Act 1984 ▪ Contaminated Sites Act 2003 ▪ Contaminated Sites Regulations 2006 ▪ Dampier to Bunbury Pipeline Act 1997 ▪ Environmental Protection Act 1986 ▪ Environmental Protection Regulations 1987 ▪ Environmental Protection (Abrasive Blasting) Regulations 1998 ▪ Environmental Protection (Controlled Waste) Regulations 2004 ▪ Environmental Protection (NEPM-NPI) Regulations 1998 ▪ Environmental Protection (Noise) Regulations 1997 ▪ Environmental Protection (Unauthorised Discharges) Regulations 2004 ▪ Dangerous Goods Safety Act 2004 ▪ Health Act 1911 ▪ Heritage of Western Australia Act 1990 ▪ Land Administration Act 1997 ▪ Litter Act 1979 ▪ Local Government Act 1995 ▪ Local Government (Miscellaneous Provisions) Act 1960 ▪ Main Roads Act 1930 ▪ Petroleum Pipelines Act 1969

	<ul style="list-style-type: none"> ▪ Petroleum and Geothermal Energy Resources Act 1967 ▪ Petroleum Pipelines (Environment) Regulations 2012 ▪ Petroleum and Geothermal Energy Resources (Environment) Regulations 2012 ▪ Planning and Development Act 2005 ▪ Rights in Water and Irrigation Act 1914 ▪ Rights in Water and Irrigation Regulations 2000 ▪ Soil and Land Conservation Act 1945 ▪ Planning and Development Act 2005 ▪ Waterways Conservation Act 1976 ▪ Wildlife Conservation Act 1950 ▪ Wildlife Conservation Regulations 1970 ▪ National Environment Protection Measures ▪ Natural Heritage Trust of Australia Act 1997
Agreements	<ul style="list-style-type: none"> ▪ Japan Australia Migratory Birds Agreement or JAMBA; ▪ Chinese Australia Migratory Birds Agreement or CAMBA; ▪ Republic of Korea Australia Migratory Birds Agreement or ROKAMBA; ▪ Convention on the Conservation of Migratory Species
Standards	<ul style="list-style-type: none"> ▪ AS2885 Pipelines - Gas and liquid petroleum ▪ AS1940:2004 The storage and handling of flammable and combustible liquids ▪ AS1697 Installation and maintenance of steel pipe systems for gas ▪ AS1692:2006 Tanks for flammable and combustible liquids ▪ AS3780:1994 The storage and handling of corrosive substances ▪ AS2507 :1984 The storage and handling of pesticides
Codes	<ul style="list-style-type: none"> ▪ Australian Pipeline Industry (APIA) Code of Environmental Practice ▪ Australian Dangerous Goods Code ▪ ANZECC (1992) Guidelines for Fresh and Marine Water Quality ▪ DMP Chemical Disclosure Guidelines (2013)

3. Existing Environment

The objective of this section is to provide a description of the existing natural, social and cultural environment that may be affected by activities at Tubridgi Gas Field.

3.1 Natural Environment

3.1.1 Climate

Tubridgi Gas Field is located in a sub-tropical arid zone with temperatures varying slightly throughout the region, mainly due to distance from the coast and elevation. Typical temperatures for the site(s) can be taken from Onslow, which has a mean monthly maximum of 35°C in January to March and 25°C in July (Figure 3-1). Corresponding mean monthly minimums are 24°C and 12°C (BOM, 2016).

Mean evaporation figures are very high, often exceeding 300 mm/month in summer and varying between 150 and 200 mm/month during winter. Humidity is relatively high with maximum mean monthly relative humidity being approximately 45% in November and 61% in June.

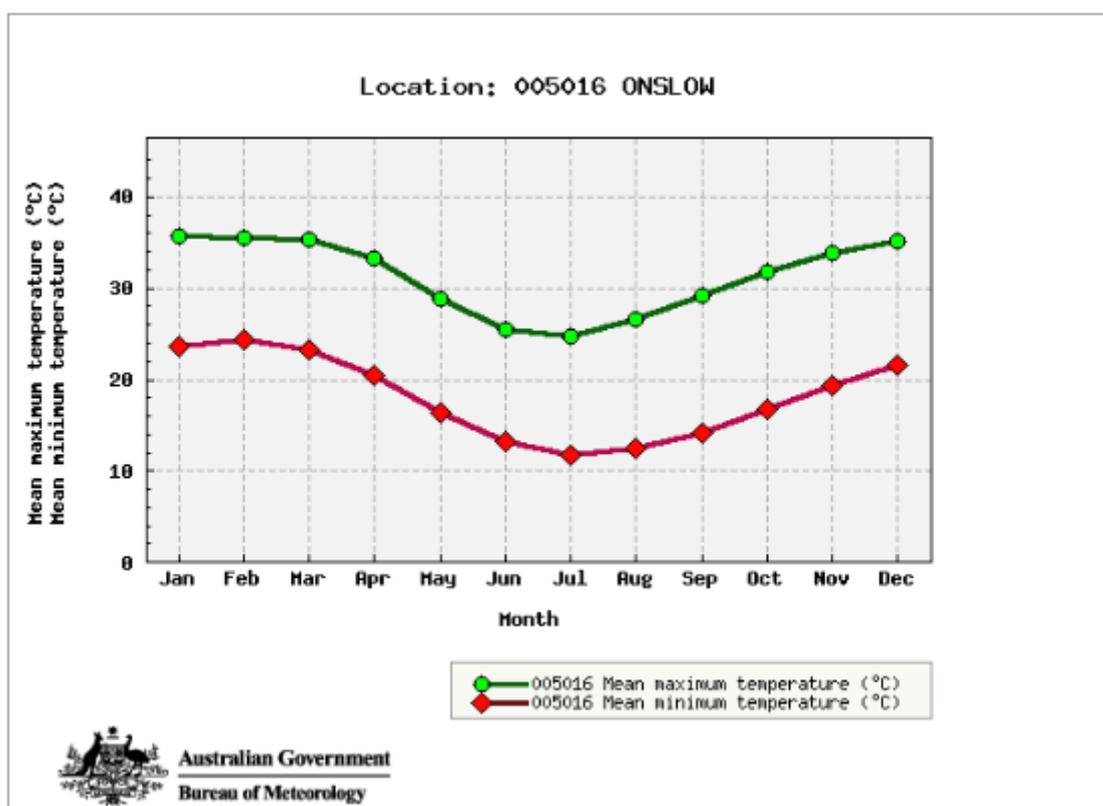


Figure 3-1 Onslow Temperature 1981 to 2010

Figure 3-2 depicts rainfall data for the nearest meteorological station in Onslow. Rainfall is generally low and erratic, with mean monthly rainfalls ranging from 0.8 mm in October to 52.2 mm in February. The average annual total rainfall for Onslow is 272.6 mm (BOM, 2016).

The summer season is characterised by prolonged dry periods created by anti-cyclonic activities to the south. Thunderstorms may develop as a result of convective activity, with tropical cyclones occurring regularly in the area. Tropical cyclones often produce large amounts of rainfall, which may result in widespread flooding and isolation (BOM, 2016).

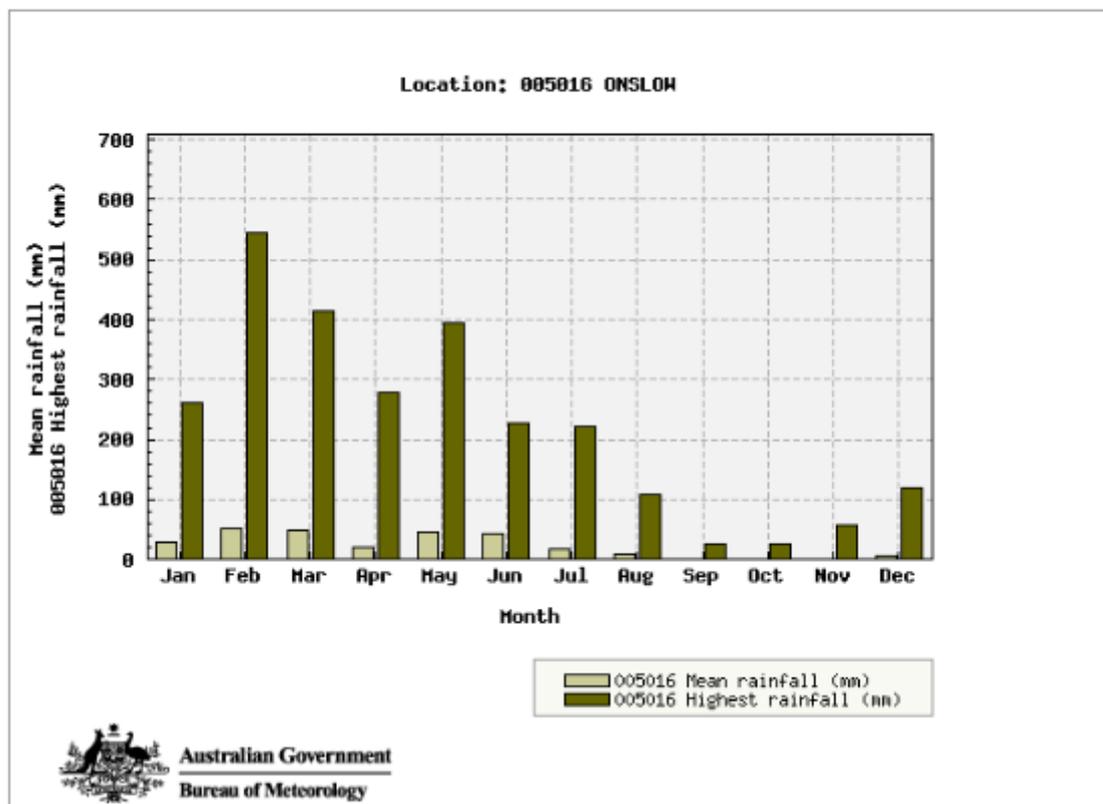


Figure 3-2 Onslow Rainfall 1981 to 2010

During winter, moderate to strong south easterlies and easterlies prevail, whilst in summer, moderate southerly and westerly winds dominate. Spring and autumn tend to be transitional periods during which both summer and winter winds can occur. Periods of light winds, that is, less than 11 km/hr prevail for approximately 43% of the year (BHP, 2006).

The region experiences on average two cyclones per year during December to April. Cyclones typically approach from the north east and either remain offshore or turn southwards to cross the mainland coast between Dampier and the North West Cape. Winds associated with cyclonic events usually exceed approximately 22 m/s.

3.1.2 Geology

The Tubridgi Gas Field is located within the Coastal Plain geomorphic province, which extends inland from the coast for approximately 90 km (Payne *et al.*, 1988). This region is characterised by extensive sandy plains with north-west or north trending longitudinal dunes, broad claypans and circular grassy depressions. Natural relief across the province rarely exceeds 40 m above the surrounding plains and occurs in the form of dune crests and isolated hills (Payne *et al.* 1988).

The Tubridgi Gas Field is located in an area containing sediments of the Quaternary Period (Worley Engineering, 1990). Quaternary alluvium, colluvium and Aeolian sand covers most of the area, however, several outcrops of lower cretaceous sedimentary rocks, Proterozoic granite and metamorphic rocks occur in isolated areas. The following geologic units are located at the site:

- Sand dunes and residual sand plains (comprising quartz sand);
- Clay pans with sand dunes (comprising clay, silt, sand and gravel);
- Alluvial materials (comprising clay, silt, sand and gravel partly calcreted); and
- Colluvium materials (comprising poorly sorted clay, silt, sand and gravel) (Soil and Rock Engineering, 1990).

Soils are generally red-brown with poorly developed profiles. Soils are commonly alkaline as a result of accumulation of sodium and calcium ions at shallow depths (Astron, 1993, Payne *et al.*, 1988).

Rangeland surveys carried out indicate soils on the Onslow Coastal Plain tend to be low in nitrogen and phosphorous (Payne *et al.*, 1988). Management of ASS is detailed in Section 6.11 of this plan.

The proposed TGS2 well is located within 2km of the coast line, a sand dune formation (Vegetation Community ID1) will be impacted through clearing for an access track and a well site. While minor impacts will occur due to the construction of the well sites and access tracks these will targeted for a high percentage of rehabilitation (75%) and frequently monitored for any impacts (i.e. increased erosion) both within and beyond the construction footprint.

3.1.3 Flora

A Level 1 flora and vegetation survey of the proposal area was undertaken by Mattiske Consulting Pty Ltd (Mattiske) in May 2016 (Mattiske 2016).

Flora

The proposal area is located in the Carnarvon Botanical District of the Eremaean Botanical Province (Beard 1990). Within the Carnarvon Botanical District, the proposal area is located in the Cape Yannerie Coastal Plain Unit (Beard 1975).

A total of 46 vascular plant taxa from 41 genera and 21 families were recorded by Mattiske (2016) within a survey area that encompassed the proposal area. The majority of the taxa recorded were from Fabaceae (12 taxa), Poaceae (8 taxa) and Chenopodiaceae (three taxa). No taxa recorded during the current survey represented extensions to their currently known range (Mattiske 2016).

Threatened and Priority flora

No Threatened or Priority flora species pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950* (WA) (WC Act) or as listed by the Department of Parks and Wildlife (Parks and Wildlife) were recorded within the proposal area (Mattiske 2016).

Mattiske (2016) assessed one Priority flora species as being likely to occur in the proposal area and another as possibly occurring in the proposal area. These species were:

- *Eremophila forresti* subsp. *viridis* (Priority 3): Likely to occur
- *Triumfetta echinata* (Priority 3): Possible occurrence.

Vegetation communities

The proposal area intersects Beard (1975) vegetation association 676 (Succulent Steppe; Samphire), which has 97.4% of its pre-European extent remaining (Mattiske 2016).

Mattiske (2016) defined and mapped four vegetation communities within the proposal area. The vegetation community for each test well site and proposed access tracks, including area of vegetation to be impacted are described below.

Table 3-1-1 Vegetation communities in the proposal area (Mattiske 2016)

Code	Habitat	Description	Location	Area to be impacted (ha)
C2	Claypans and Clayey Plains	<i>Tecticornia</i> spp. low sparse chenopod shrubland with <i>Sporobolus mitchellii</i> , <i>Eriachne helmsii</i> low isolated tussock grasses	TGS 1	1.80
ID1	Inland Sand Dunes	<i>Grevillea stenobotrya</i> low sparse shrubland over <i>Acacia stellaticeps</i> mid open shrubland over <i>Triodia epactia</i> hummock grassland	TGS 2	1.60
IP8	Inland Sand and Clayey Plains	<i>Eucalyptus victrix</i> low isolated trees over <i>Acacia tetragonophylla</i> , <i>Acacia synchronicia</i> tall isolated shrubs with <i>Acacia stellaticeps</i> , <i>Acacia coriacea</i> subsp. <i>coriacea</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> low sparse shrubland	TGS 3	1.85

Code	Habitat	Description	Location	Area to be impacted (ha)
		over <i>Triodia epactia</i> mid hummock grassland with <i>Eulalia aurea</i> , <i>Eragrostis eriopoda</i> , <i>*Cenchrus ciliaris</i> low sparse tussock grassland		
IF4	Inland Floodplains and Depressions	<i>Eucalyptus victrix</i> low open woodland over <i>Acacia synchronicia</i> , <i>Acacia tetragonophylla</i> , <i>Scaevola spinescens</i> tall sparse shrubland over <i>Sporobolus mitchellii</i> , <i>Eriachne helmsii</i> , <i>Eulalia aurea</i> low open tussock grassland		0.14

The following figure details the well site locations and the vegetation communities that would be impacted.

Vegetation condition and weeds

Vegetation condition throughout the proposal area was recorded by Mattiske (2016) as excellent. Introduced flora species (weeds) were recorded throughout the proposal area; however, these were in low density such that native species structure and composition were unaltered. Cattle movement and grazing was prevalent across the survey area, but at low intensity (Mattiske 2016).

Three weeds were recorded within the Mattiske (2016) survey area: **Prosopis pallida*, **Cenchrus ciliaris* (Buffel Grass) and **Vachellia farnesiana* (Mimosa Bush). **Prosopis pallida* is a Declared Pest (Plant) pursuant to the *Biosecurity and Agriculture Management Act 2007* (WA) and has a legal status of Prohibited (s12) and a control category of C2 (Eradication) across Western Australia (DAFWA 2016). At the regional scale, **Prosopis pallida* has a medium environmental weed rating. One individual was recorded at one location by Mattiske (2016). Buffel Grass was recorded throughout the area surveyed by Mattiske (2016). This species occurs throughout the Carnarvon bioregion and has a low environmental weed ranking. Mimosa Bush was recorded at three locations surveyed by Mattiske (2016). This species occurs throughout the Carnarvon bioregion and has a low environmental weed ranking.

Threatened and Priority Ecological Communities

No Threatened or Priority Ecological Communities were recorded or inferred to occur within the proposal area (Mattiske 2016).

Conservation Reserves

The Cane River Conservation Park is the closest gazetted conservation reserve to the proposal area. The Park is located approximately 70 km south-east of the proposal area.

3.1.4 Fauna

A number of fauna surveys have been undertaken throughout the history of activities at the ASW locality. The most recent survey work was undertaken comprised a Level 1 Reconnaissance survey conducted in association with the construction of the WAWP and extending across the majority of the Tubridgi Gas Field footprint (Ninox, 2013).

Fauna habitat mapping was based on vegetation community mapping undertaken by Mattiske (2013). Four fauna habitats were identified within the proposal area including (Ninox 2013):

- Chenopod shrublands (vegetation community C2)
- Shrubs over spinifex on sand (Vegetation community ID1)
- *Eucalyptus* over shrubs and grasses on clay (Vegetation community IF4)
- *Eucalyptus* and shrubs over spinifex and buffel grass on clay (Vegetation community IP8).

All of the fauna habitats mapped in the proposal area are widespread throughout the Carnarvon region.

Conservation significant avian species identified to have a moderate to high likelihood of occurring within the area include:

- Eastern Great Egret (*Ardea modesta*)
- Rainbow Bee-eater (*Merops ornatus*)
- Fork-tailed Swift (*Apus pacificus*)
- Barn Swallow (*Hirundo rustica*)
- Oriental Pratincole (*Glareola maldivarum*)
- Common Sandpiper (*Actitis hypoleucos*)
- Red-necked Stint (*Calidris ruficollis*)
- Red Knot (*Calidris tenuirostris*)
- Lesser Sand Plover (*Charadrius mongolus*)
- Bar-tailed Godwit (*Limosa lapponica*)
- Lesser-crested Tern (*Sterna bengalensis*)
- Caspian Tern (*Sterna caspia*)
- White-winged Black Tern (*Sterna leucoptera*)
- Greater Sand Plover (*Charadrius leschenaultia*)
- Grey-tailed Tattler (*Tringa brevipes*)
- Peregrine Falcon (*Falco peregrinus*)
- Oriental Plover (*Charadrius veredus*)
- Ruddy Turnstone (*Arenaria interpres*)
- Sharp-tailed Sandpiper (*Calidris acuminata*)
- Eastern Curlew (*Numenius madagascariensis*)
- Whimbrel (*Numenius phaeopus*)
- Wood Sandpiper (*Tringa glareola*)
- Common Greenshank (*Tringa nebularia*)
- Roseate Tern (*Sterna dougalli*)
- Common Tern (*Sterna hirundo*)
- Sanderling (*Calidris alba*)
- White-bellied Sea-eagle (*Haliaeetus leucogaster*)

Based on the assessment provided in Table 3-2 below, the occurrence of conservation significant fauna in the Tubridgi footprint is unlikely, with the exception of the Little North-western Mastiff Bat and the Woma.

Table 3-2 Conservation significant mammals and reptiles recorded or potentially occurring within the construction footprint

Species	Protection Status	Preferred Habitat (Ninox 2013)	Potential Occurrence
Northern Quoll (<i>Dasyurus hallucatus</i>)	<u>State:</u> Schedule 1 under WC Act Commonwealth: Vulnerable	In the Pilbara, the Northern Quoll has most commonly been recorded in habitats comprising rocky hills, mesas, plateaux, major drainage lines and granite fields.	<u>Unlikely:</u> No record of this species was made during Biota's survey of the Wheatstone project Area; however, two records from the vicinity of Onslow were listed on the DPaW NatureMap search. The species was also listed on the DotE Protected Matters Report search. However, there does not appear to be any suitable habitat within the Survey Corridor.
Greater Bilby (<i>Macrotis lagotis</i>)	<u>State:</u> Schedule 1 under WC Act Commonwealth: Vulnerable	Habitat suitable for the Greater Bilby is primarily mulga shrublands on stony plains and along the lower slopes of ranges, in sandplains and in sand dune systems. A determining factor in the suitability of Greater Bilby habitat is the lack of ground cover, allowing for high mobility during foraging.	<u>Unlikely:</u> This species was listed on the results of the DotE Protected Matters Report; however, there are no records of this species in the vicinity of the Survey Corridor and little suitable habitat is present.
Pilbara Leaf-nosed Bat –	<u>State:</u>	The Pilbara Leaf-nosed Bat is restricted to relatively deep subterranean roosts that are able to provide a warm, humid	<u>Unlikely:</u> This species was listed on the results of the DotE Protected Matters Report; however, no suitable roosting sites were

Species	Protection Status	Preferred Habitat (Ninox 2013)	Potential Occurrence
unnamed Pilbara form <i>(Rhinonictoris aurantia)</i>	Schedule 1 under WC Act Commonwealth: Vulnerable	microclimate that enable them to limit energy and water loss. Such naturally occurring subterranean structures providing suitable conditions are uncommon in the Pilbara; however, abandoned underground mines are known to be utilised by the species.	apparent within the Survey Corridor and there are no records of this species in the general area.
Little North-western Mastiff Bat <i>(Mormopterus loriae cobourgiana)</i>	<u>State:</u> Priority 1 DPaW protected fauna.	The Little North-western Mastiff Bat is primarily restricted to mangrove forests and adjacent areas of monsoon forest along larger waterways.	<u>Moderate:</u> This species was not listed in the results of the DPaW Nature Map search; however, it was recorded by Biota in 2010 in mangroves. Aerial foraging may occur within the Survey Corridor in the vicinity of the Ashburton River where large trees may attract their invertebrate prey.
Western Pebblemound Mouse <i>(Pseudomys chapmani)</i>	<u>State:</u> Priority 4 DPaW protected fauna	The Western Pebble-mound Mouse is usually recorded by the presence of the large pebble mounds that it constructs. These mounds are only built in areas where suitable sized pebbles for their construction are present; usually on the gentler slopes of rocky ranges. The vegetation in these locations generally consists of spinifex with emergent eucalypts and scattered shrubs.	<u>Unlikely:</u> This species was listed in the results of the DPaW NatureMap search with a single record from 2005 in the coastal area just south of Onslow. There is no suitable habitat within the Survey Corridor.
Olive Python <i>(Liasis olivaceus barroni Pilbara)</i>	<u>State:</u> Schedule 1 under WC Act <u>Commonwealth:</u> Vulnerable	The Pilbara Olive Python is known to inhabit areas where prey species congregate. The species has been observed primarily in proximity to pools in creeks or rocky ranges.	<u>Unlikely:</u> This species was listed in the results of the DPaW NatureMap search; however, there is no suitable habitat within the Survey Corridor.
Salt-water Crocodile <i>(Crocodylus porosus)</i>	<u>State:</u> Schedule 1 under WC Act <u>Commonwealth:</u> Listed as Marine	The Salt-water Crocodile ranges between oceanic, tidal and riverine habitats, with a preferred nesting habitat within isolated freshwater swamps that are not influenced by tidal movement of water.	<u>Unlikely:</u> This species was listed in the results of the DPaW NatureMap search with a single record from 2008 just south-west of Onslow. The species may be present where the Survey Corridor crosses the Ashburton river crossing.
Woma <i>(Aspidites ramsayi)</i>	<u>State:</u>	The Woma has been found in a range of habitats including woodlands, heaths and	<u>Low to Moderate:</u> There are no records of this species in the vicinity of the Survey Corridor; however,

Species	Protection Status	Preferred Habitat (Ninox 2013)	Potential Occurrence
	Schedule 4 under WC Act	shrublands. The species is known to shelter during the day in abandoned reptile and/or mammal burrows, hollow logs or thick vegetation.	suitable habitat is present including shrublands and open woodlands.

In total, eight species of introduced, feral or stock mammals are known to occur in the general area. These include one rodent (House Mouse), three carnivores (Wild/Domestic Dog, Fox and Cat) and four herbivores (Horse, European Cattle, Goat and Rabbit).

3.1.5 Hydrology and Hydrogeology

The nearest permanent fresh water body is the Ashburton River, which predominantly runs parallel to the associated pipelines, situated approximately 10 km to the east.

The Ashburton River is an intermittent stream that travels in a northwest direction and meanders through extensive flood plains between Nanutarra and Onslow (Payne et al. 1988). It is characterised by long dry periods and with irregular significant flow events resulting from high intensity rainfall events. The magnitude of stream flow is predominantly determined by the Average Rainfall Interval (ARI) of the rainfall events. During summer months, flooding and storm surge associated with cyclonic activity may cause flooding of much of the Coastal Plain. Major flows occur in the Ashburton River every one to three years. River flows predominantly occur during the wet season (October to March) and are typically short lived (Chevron 2010). The region usually experiences a dry season during the months March to September.

The flood plain is underlain by shallow, saline to hyper-saline groundwater that displays levels of dissolved metals above marine guideline criteria values (ANZECC), commensurate with accumulation of salt in the local groundwater environment and the high groundwater salinity.

Shallow hydrological investigations beneath the local area indicate the localised subsurface groundwater flow also occurs in a south easterly direction, generally following surface contours (Astron Environmental, 1996). Monitoring data indicates that the groundwater at the site is relatively saline, which is likely to be the natural state of the groundwater, due to high salinities expected in coastal low-lying areas (GHD, 2011). Salinities of up to 35,000 mg/L (as Total Dissolved Solids (TDS)) have been recorded with most bores generally having a salinity of between 5,000 and 25,000 mg/L (GHD, 2011). Any runoff from Tubridgi is likely to drain south east along the topographic contours of the calcrete rise.

The most recent groundwater monitoring event (URS, 2013) identified groundwater elevations at ASW between 4.035 and 6.003 metres below ground level.

Studies by Woodward Clyde Pty Ltd (1993) and Astron Environmental (unpublished data 1995 (a), (b) and (c)) suggest that there is fresh water located within the coastal dune areas, which is restricted to small reserves, that is, "lenses above more saline water". These lenses are replenished during recharge periods, with the salinity of these lenses fluctuating seasonally, which is primarily due to rainfall and evaporation.

3.1.6 Contamination

DDGT, while understanding there were previous rehabilitation works conducted on contaminated land at the Tubridgi Gas Plant does not expect any contamination across the project area. To support this GHD was commissioned to undertake a due diligence, preliminary site investigation report on Urala Station in 2015 finding no contamination along known flowlines (across the Tubridgi Gas Field) old wellheads or other signs of contamination that are impacted by the project. One site was located at the old Griffin Export Facility and this is being managed under the ASW EP.

DDG also had GHD undertake a gas leak survey in 2016. This included flow lines, known fault areas, the plugged and abandoned wells and areas near the Ashburton River. This survey found no evidence of any gas leak from the gas reservoir at any of these locations.

3.1.7 Previous disturbance

The Tubridgi Gas Field has had previous work completed through 1990-2005 when production was ceased. Previous disturbance included the installation of the Griffin Pipeline, Tubridgi well installation, flow line installation and access tracks. While the previous wells have been plugged and abandoned, the flowlines are currently pressurised (Nitrogen gas) and left in situ as is the Griffin Pipeline.

3.2 Social and Economic

The Tubridgi Gas Field is located in the Shire of Ashburton Local Government Area, which spans approximately 105,647 km² and has a population of approximately 10,001 (ABS, 2013). Onslow is the closest major town (approximately 31 km north-east of Tubridgi Gas Field) and the major industries include mining, pastoralism and fishing.

The proposed TGS wells are located within the Pastoral Region of Western Australia, located on Urala Station, which was established in 1912 and covers approximately 55,988 ha. The station is used predominantly for grazing sheep.

DDG is the current holder of Urala Station Pastoral Lease (2016) with an onsite Station Manager who has been on site for approximately 30 years. This allows for uninterrupted access to the site from a landholder perspective. Urala homestead is the closest sensitive receptor, located 0.96 km from TGS2 as the closest wellsite.

Access to site does include crossing Minderoo Station and stakeholder engagement with Minderoo and the Shire of Ashburton has been undertaken in regards to traffic management and potential impacts or simultaneous operations during the proposed project timeline. The outcome of this was that DDGT committed to ensuring that access roads used by the project are maintained to the current or better standard.

3.3 Cultural Environment

DDG has conducted a review of the 1998 Thalanyji Consent determination (reference number WAD6113), as it covers the easement and lease areas subject to the Tubridgi and GEF facilities. This assessment concluded that these facilities and associated easements are listed as exclusions and therefore not subject to Native Title.

In addition, the Thalanyji and Minderoo Indigenous Land Use Agreement (ILUA) (Reference number W12009/024) dated 2011 outlines that the easements and leases on Minderoo are specifically excluded (as per the consent determination) from the agreement.

Previous cultural heritage surveys have been undertaken in the area, however in consultation with the local Traditional Owners (Thalanyji) a further survey may be conducted in regards to ethnographical and archaeological aspects in the project area.

Immediately prior to any clearing activities, Traditional Owner Monitors or an Anthropologist shall inspect the area to ensure no cultural heritage items or areas are impacted. If any artefacts are found requirements under the *Aboriginal Heritage Act 1972* shall be implemented.

4. Activity Description

4.1 Objective

The objective of this section is to describe the activities to be conducted and the general equipment required to construct and test the planned TGS wells. These planned activities are summarised as follows:

- Remediation of existing access tracks;
- Construction of access track extensions to the planned well-sites;
- Clearing and stabilisation of well-sites;
- Construction of sump for containment of drilling fluids and cuttings;
- Installation of surface structural conductor with water drilling rig;
- Equipment deliver to and consolidation at staging area;
- Operation of Tubridgi Camp facility;
- Drilling and completion of storage wells;
- Installation of flowlines and compressor for injection testing;
- Injection and production flow testing operations including flaring of produced gas;
- Suspension of wells;
- Demobilisation of temporary drilling and testing equipment;
- Ongoing monitoring of well data.

A more detailed description of these activities and the related equipment is provided in the subsequent sections.

The proposed maximum disturbance footprint involved in the works is outlined in Table 4-1 below. All vegetation clearing shall be conducted under existing Part IV approvals issued by the EPA under the Environmental Protection Act 1986.

Table 4-1 Indicative breakdown of maximum vegetation disturbance footprint

Details	Clearing Footprint (ha)
Installation of up to ten production wells and associated construction activities (access tracks etc)	14
Construction of permanent flow lines	19
<i>TOTAL</i> Disturbance Footprint	33
<i>TOTAL</i> Proposed Rehabilitation Footprint	30
<i>TOTAL</i> Permanent Disturbance	3

4.2 Civil Works

4.2.1 Phase one works - Access Tracks

DDG will be utilizing existing access tracks on Urala Station to access the new planned well locations. DDG will maintain the existing tracks in consultation with the Station Manager on Urala lease as well as any required maintenance on access tracks used in consultation with Minderoo Station and the Shire of Ashburton

A short section of new access track extension will be required for each of the nine wells. Access track extensions will be to a maximum of 10m wide and reduced where possible to ~6m for single vehicle traffic.

Access tracks shall be formed to enable drainage of rain water to immediately surrounding low lying areas and to minimise any impact on localised drainage.

4.2.2 Phase one works - Well Site Preparation

Well sites will be cleared and prepared for each of the planned wells. Clearing for well-sites will be limited to that required to safely conduct well operations and allow heavy vehicle/road trains to safely unload and turn-around. Existing cleared or barren locations will be used if possible.

Within the wellsite the following infrastructure will be established:

- Levelled and stabilised area for rig carrier and critical equipment;
- Cuttings sump, lined, for drilling fluid returns, cement returns and cuttings;
- Closed loop flare system for well testing activities only;
- Bunded or self-bunded storage for bulk chemicals, diesel storage and refuelling;
- Small office and contingency accommodation facilities including site office, crib room, 4 bedrooms and ablutions unit;
- Helicopter landing area on access road for emergency evacuation.

Note: To provide further contingency, construction of an additional cuttings sump may be constructed at a location already cleared for ongoing operational purposes at the ASW/GEF.

Well sites will be levelled with a gentle grade to enable storm water to drain away from the site. Stabilisation of certain areas will be done as required with gravel, road base, cement blend or polymer as required. Any areas stabilized will be marked to ensure rehabilitation process (eg ripping) is undertaken to break up soil in these areas prior to remediation with topsoil.

Well sites will also include storage stockpiles for vegetation, topsoil and subsoil for use in rehabilitation.

4.2.3 Phase one works - Structural Conductor and Cellar Installation

Once the access road and well-site have been prepared and surveyed, a water well drilling contractor will mobilise equipment and materials for installation of the structural conductor. This conductor hole will be drilled to ~40m. A 340mm (13-3/8") steel conductor will be run into the well and grouted to surface with cement.

The cellar will then be excavated and a steel cellar structure will be installed to an approximate depth of 2.5m.

4.2.4 Phase two works - Flowline Installation

Flowlines shall be installed on successful completion of the test process. This includes the installation of flowlines to the GEF Plants as the location of the compressors and test gas tie-ins.

Flowlines are proposed to be installed within the existing L9 area (to reduce additional disturbance) with extensions out to each of the well locations. The extensions shall either be temporary (above ground) or permanent depending on suitability of the ground, project feasibility, existing infrastructure and in consultation with the landholder.

Flowlines shall be installed through a trenching program to bury the flowline. Management of vegetation, trenches, stockpiles and rehabilitation are all covered in Section 6. Depth of flowlines (buried depth) will be minimised to reduce level of disturbance and soil stockpiling requirements.

4.3 Well Construction Operations

The following well construction operations are planned to be conducted:

4.3.1 Initial Rig and Equipment Mobilisation

Prior to commencing drilling operations the drilling rig, related equipment and bulk materials for all wells will be mobilized to location. Existing cleared areas at the Griffin Export Facility (GEF) will be used for short-term consolidation and storage of equipment and materials.

The drilling rig and related equipment will be set-up on the well-site at TGS#1 and pre-commissioned in readiness for drilling operations to commence. A comprehensive pre-start HSE audit will be conducted on the rig. A pre-start process/inspection will also be conducted prior to any work commencing on the subsequent well locations.

On completion of each well the equipment at each location will be demobilized and relocated to the next well pad. This includes all materials storage, drilling rig, power generation, minor accommodation, storage tanks and waste receptacles.

4.3.2 Drilling, Completion and Well Testing Operations

The following drilling and completion operations will be conducted on each well using the Drilling Rig for the planned wells:

- Drill out shoe of structural conductor.
- Drill 311mm (12-1/4") hole;
- Run and cement 244mm (9-5/8") casing string;
- Install wellhead;
- Install and test BOP and casing;
- Drill out 244mm (9-5/8") shoe track and conduct FIT;
- Drill 216mm (8-1/2") vertical hole
- Conduct wireline logs;
- Run and cement 178mm (7") premium casing string with fibre optic cable installed on outside;
- Clean out casing string;
- Run cement evaluation log;
- Install oriented TCP perforating guns;
- Run 3-1/2" completion with permanent downhole gauges;
- Test completion;
- Rig down drilling rig;
- Rig up temporary compression and flowline equipment to each wellhead;
- Rig up temporary well testing equipment;
- Conduct gas injection and production testing operations for each of the storage wells;
- Rig down all temporary testing equipment.

A detailed Well Management Plan will be prepared and approved by the Department of Mines and Petroleum, Petroleum Resources Division prior to commencement of these activities.

4.3.3 Drilling Rig

Drilling and completion operations will be conducted with a small footprint, carrier-mounted drilling unit. Operations will be conducted on a 24hr/day, 7 day/week basis with two rig crews totaling ~16 persons.

Company representatives will supervise the operations. The Company Representative and Rig Manager will be accommodated at the well-site during drilling activities.

4.3.4 Drilling and Cementing Chemicals

All chemicals and other substances envisaged to be used downhole (for planned and contingent operations) during the Activity are fully disclosed in accordance with Regulation 15(9) of the *Petroleum and Geothermal Energy Resources (Environment) Regulations 2012 (WA)* and Chemical Disclosure Guidelines (DMP 2013) (Appendix E)

All drilling muds and chemicals prior to use shall be stored in self-bunded containers and managed through controls in Section 6.10 and Section 6.12

All MSDS shall be kept on site with a master register (Appendix F).

Cuttings and any drilling muds removed shall be managed through a cuttings sump located at each well location (Section 4.3.6)

4.3.5 Water Source

Water for drilling operations will be sourced from the Ashburton River and trucked to location. An approved Surface Water Licence is in place for construction water use. Predicted water requirements are predicted to not to exceed 1,000kL. Any additional water shall be sourced from Onslow through a third party contract to supply potable water for the camp.

Amounts of water required for each well site is approximately 160kL. The proposed storage tanks on site is a 318kL (or 2000bbl) which will be used for the creation of the drilling mud and cement but will only be used at half capacity to allow additional storage capacity for dewatering or other activities.

4.3.6 Drilling Fluid Treatment and Cuttings Management

Drilling mud (active) and mud mix tanks shall be onsite to provide the drilling mud for the operation. This includes two storage containers with associated flow lines to and from the well. Storage tanks are self-contained and lined to prevent leakage.

Drilling fluid hole volumes and subsequent cuttings generated are relatively small due to the shallow depth of the wells and small hole sizes.

Drill cuttings returned from the well will be managed as follows:

- Cuttings will be suspended in drilling fluids and returned from the well via the riser, bell nipple and flowline;
- Fluids will pass across the shaker systems which will remove the majority of the cuttings from the drilling fluid;
- These cuttings will be transferred from the shakers into the cuttings sump via a slide with catchment tray;
- The drilling fluid will then be treated with a centrifuge to remove small cuttings and low gravity solids. These solids will also be directed to the cuttings sump.
- Approximately 80-90% of the drilling fluid is captured for reuse with excess fluid directed to the sump for evaporation

Cuttings and excess drilling fluids will be contained within the cuttings sump which will be constructed as follows:

- Sump will be excavated to a depth of ~1m to remain above the water table;
- Sides will be elevated approximately 75% above ground level;
- Sump will be lined with loam prior to installation of HPDE liner;
- Sump is designed for evaporation of drilling fluids and capture of any cuttings;
- Sump has been designed to ensure there is 500mm of freeboard as recommended in Department of Water WQPN 39 to minimise potential for overflow in extreme rainfall events;
- Cuttings sump contents will be sampled for Contaminants of Potential Concern (COPC) at completion of drilling operations.

4.3.7 Emissions During Flow Testing

During the flow testing operations it is intended to utilise only gas that is intersected as part of the well construction. Gas, if unsuitable for reuse, will then be flared via a temporary flare tower. This will be a trailer mounted, 45ft flare unit with remote activated propane pilot.

4.4 Hazardous Substances and Waste Management

4.4.1 Diesel

During the planned activities diesel will be required to fuel the drilling rig, ancillary and third party equipment, Tubridgi camp, and the compression facilities during well testing activities. Bulk diesel (max 40kL) will be stored on location at the well site locations in self-bunded diesel storage tanks.

A refueling trailer will be used to refuel the self-contained light towers and small gen-sets located around the well site. All small gen-sets shall have secondary containment

A dedicated bunded refueling station will be set up for fueling mobile plant and equipment including third party equipment.

Refueling and onsite diesel management will be conducted in accordance with Section 6.12.

4.4.2 Hydraulic Oils and Engine Oils

Hydraulic oil and engine oils will be provided in 1000L IBCs or 160-200L drums and will be stored in dedicated bunds. This will include waste oil whilst on location.

Waste oils and hydraulic fluid will be disposed of by an approved contractor to a certified waste facility.

4.4.3 Potentially Hazardous Chemicals

Chemicals required for downhole fluids and cementing will be stored and segregated in accordance with the MSDS requirements. Potentially hazardous chemicals such as biocide, acids and corrosion inhibitor will be stored in bunded areas at the well site.

The bulk of non-hazardous chemicals will be transported to and from site and stored on dedicated tautliner curtain-sided trailers at site for the duration of the campaign.

4.4.4 On Site Waste Segregation

Waste generated during operations is categorized as general waste, putrescible waste and industrial waste. Septic waste is dealt with in the following section. Where possible and in consultation with Shire of Ashburton (Onslow Landfill) recycling bins may also be made available.

At the well-site dedicated waste skip and wheelie bins labelled appropriately will be provided for each of these waste streams. Skip bins will have lids or mesh covers to ensure waste remains within the bins and to minimise or reduce potential fauna access and entrapment.

Waste skips will be collected regularly by a licensed contractor and disposed of at appropriate certified waste management facilities.

4.4.5 Septic Waste Management – At Well-site

During these activities a small accommodation and ablution facility will be located at the well-site at which operations are being conducted. This is to ensure the Rig Manager is on site at all times. These will consist of the following:

- 4 bed accommodation unit;
- Office Unit;
- Ablution block with waste water treatment system;
- Mini hospital/first aid room.

On-site septic waste will be treated with the in-built waste water treatment system.

Grey-water will be discharged via a temporary sprinkler system. The sprinkler outlet will be set-up immediately off the cleared well-site taking into account the local landforms and water run-off. The

sprinkler head will be protected from fauna via a temporary fence. This area will form part of the daily inspection to ensure no adverse impact are occurring, this includes water ponding or erosion.

Black waste will be pumped out for disposal by a licensed waste disposal contractor at a licensed waste disposal facility.

4.5 Accommodation and Amenities

4.5.1 Accommodation

A permanent accommodation is located in the south western corner of the GEF. It is intended to use this facility to support personnel involved in the Well Activities.

The accommodation facilities at ASW include:

- Self-contained accommodation units
- Kitchen and lounge facilities
- Water and electricity supply

These facilities have been refurbished to ensure compliance with the Building Code and other relevant requirements to ensure the facilities are habitable, such as:

- Smoke detectors, fire extinguishers and fire alarms;
- Power generation with emergency lighting provisions and RCD protection; and
- Structural design meets Region D requirements in accordance with AS/NZS 1170.2.

DDGT propose that additional capacity can be added to this existing facility using areas previously cleared for construction and use in the area. This camp shall include an 80 bed facility, camp kitchen and crib room as well as a recreation room and located mainly within Lot 226 at the ASW Facilities. Clearing amounts were minimised by using areas within the current compound and targeting areas of previous disturbance. Management controls for the camp are in line with the controls within this EP with any additional waste (sewage) disposal to be directly removed by a licensed waste contractor and not discharged onsite.

4.5.2 Additional accommodation – Drilling Camp

To facilitate additional personnel during drilling operations, a temporary camp site is proposed onsite near the ASW facilities. This site has been identified through consultation with the Urala Station Manager and sited in the upper landscape to reduce the risk of inundation during any storms.

The camp specifications are:

- 56 bed (twin share rooms)
- 50kl potable water storage
- Freezer, cool room and dry storage room
- Ablution and Laundry block
- Fuel storage (4kL)
- Sewage system (20kL)

Management controls for the camp are in line with the controls within this EP with any additional waste (sewage) disposal to be directly removed by a licensed waste contractor and not discharged onsite.

4.5.3 Power

Power is generated from a transportable diesel generator installed within the GEF in a bunded containment facility. Diesel is sourced from an existing diesel fuel storage tank located within a purpose built, bunded concrete pad. Fuel deliveries for use by the accommodation facilities shall be managed through bunded area controls to prevent spills.

4.5.4 Water

Potable water is stored in five (5) 30,000L water storage tanks at ASW Accommodation Facilities. The storage capacity is sufficient for the accommodation capacity at ASW Facilities accommodation units plus additional units and an emergency contingency amount. Water is currently carted in by trucks.

4.5.5 Wastewater at Main Camp

The sewage system is a single phase BioMAX system and has a capacity up to 9000L/day.. The nearest environmental sensitivity to the system is the Ashburton River located approximately 12km to the east.

The system consists of 5 sealed, interlined cement tanks:

1. Anaerobic chamber - anaerobic treatment
2. Aerobic chamber - aerobic treatment
3. Clarification chamber - sludge settlement and removal
4. Disinfection chamber - contact with chlorine
5. Pump out chamber - discharge to disposal system

The effluent from the sewage system is clear and odourless and discharged through a filter to a dripper irrigation system.

4.6 Post-campaign Rehabilitation

4.6.1 Well Status

On completion of the planned activities, all wells will be suspended pending approval and progression of the gas storage project. The wells will be isolated at surface with wellhead valves closed and secured.

Security fencing will be installed around each wellhead to keep fauna away from wellhead and cellars. Cellar grating will be installed as a further barrier to fauna.

4.6.2 Well Site Rehabilitation

Well sites shall be rehabilitated as required to meet operational requirements. Full rehabilitation may not occur until full production project implementation has occurred. It is expected that at the completion of the well activities outlined in this EP approximately 75% of the well site shall be targeted for rehabilitation depending on operational need. This rehabilitation will focus on ensuring the management of the cuttings sump to ensure any risk of contamination is minimised and restores natural land forms and promote vegetation regrowth similar to the adjacent area.

Full rehabilitation of well sites include the reduction to an approximate 10m x 10m fenced compound around the well head and access track (at 5m width) remaining with all other areas being rehabilitated. Flowlines shall also be rehabilitated and where possible existing pastoral station tracks shall be used for access which in some location shall allow for 100% rehabilitation. Where an access track is required an approximate 75% of the flowline shall be rehabilitated.

Where topsoil and vegetation stockpiles remain during well suspension, these will be periodically checked to ensure health, this includes inspection, fauna use, localised drainage and erosion control measures.

4.6.3 Drill Fluid and Cuttings Disposal

On completion of each well, drilling fluids remaining in the surface mud tanks will be dumped to the sump. This shall be managed to ensure the 500mm freeboard remains to manage and rainfall events in line with DoW WQPN 39. The liquids associated with these fluids will evaporate off in an estimated 4-6 week period. The low gravity solids and cuttings will settle at the base of the sump. These sumps shall be inspected daily during drilling operations and on a weekly basis to ensure controls remain effective once the drill rigs have been demobilised from the project. Onslow has a high evaporation rate and as such evaporation is seen as the best way to remove the fluids from the mud compounds.

Once testing (NATA accredited laboratory) has verified that the levels of Contaminants of Potential Concern (COPC) are within stated acceptable levels (Refer Table 4-3) then the following procedure will be undertaken:

- Remaining liquids will be pumped across the well-site to facilitate further rapid evaporation;
- No release of cuttings outside of the well site footprint;
- Soil shall be sampled for either in-situ use in rehabilitation or removal by a controlled waste contractor;
- The liner will be cut and removed from the sump and disposed of at a suitable waste management facility;
- Sides of the sump and topsoil shall be used to cover over soil by at least 30cm.
- The soil will be compacted and slightly mounded to prevent ponding.

In event that the tested COPC levels exceed the limits defined in Table 4-3, the DMP Petroleum Environment Branch will be notified in writing of the exceedance details and a proposal for alternative cuttings disposal will be prepared for approval.

Table 4-2 Contaminants of Potential Concern threshold limits

COPC	Cuttings		Fluids	
	Unit	Onsite Management	Unit	Onsite Management
Arsenic	mg/kg	100 [#]	mg/L	0.5 [^]
Barium	mg/kg	15,000 [#]	mg/L	0.01 [∞]
Chloride	mg/kg	30,000 [#]	mg/L	30,000
Chromium VI	mg/kg	100 [#]	mg/L	0.05 [∞]
Copper	mg/kg	1,000 [#]	mg/L	1 [^]
Lead	mg/kg	300 [#]	mg/L	0.1 [^]
Nickel	mg/kg	600 [#]	mg/L	1 [^]
Benzene	mg/kg	1 [*]	mg/L	0.001 [∞]
Toluene	mg/kg	3 [*]	mg/L	0.8 [∞]
Ethylbenzene	mg/kg	5 [*]	mg/L	0.3 [∞]

*Environmental Investigation Levels: Assessment Levels for Soil, Sediment and Water (DEC 2010)

Health Investigation Levels – A: Assessment Levels for Soil, Sediment and Water (DEC 2010)

[^] Stock Water: Australian and New Zealand guidelines for fresh and marine water quality (ANZECC 2000)

[∞] Health Values: Australian Drinking Water Guidelines Version 3.2 (NHMRC and NRMCC 2011)

5. Implementation Strategy

Specific control measures have been developed to direct, review and manage activities so that environmental impacts and risks are continually being reduced to ALARP.

To monitor the effectiveness of control measures in the management of the environmental impacts and risks, targeted monitoring commitments have been specified where relevant.

The below sections set out the key control measures established to manage risks identified during the ERA.

5.1 Soil and Sediment

- Vehicle access shall be restricted to access tracks and stable ground. Additional care shall be taken near waterways and drainage lines.
- If erosion is identified to be associated with DDG activities it shall be rectified. If required, erosion and sediment control structures shall be installed, such as sediment traps or drainage controls to prevent a reoccurrence.
- Windrows shall not block surface water flows or re-direct flows resulting in erosion and sedimentation.
- Topsoil, subsoil and vegetation disturbed during earthworks shall be stockpiled separately such that the soil profile may be maintained during backfilling (i.e. topsoil returned to the top).
- Soil shall not be stockpiled where it has the potential to result in sedimentation of land or surface water (e.g. on slopes that drain immediately to a watercourse). Topsoil containment measures e.g. berms and sediment fencing shall be used as necessary.
- Topsoil and subsoil shall be stockpiled where it can be easily recovered and will not be lost by wind/water erosion.
- Following back fill and respreading, topsoil shall be ripped to prevent compaction.
- Prior to dewatering, a comprehensive assessment of the potential environmental impacts shall be undertaken in accordance with WQPN #13 – Dewatering at Construction Sites (DoW, 2012)
- Disposal of dewatering to surface waters shall not be undertaken

5.2 Flora

- Vegetation clearing shall be kept to the minimum amount necessary to allow access or approved works.
- Cleared vegetation, topsoil and subsoil shall be stockpiled separately in a manner which facilitates respreading or salvaging and avoids damage to adjacent live vegetation (e.g. trees shall be felled onto the corridor away from standing timber).
- Vehicles shall remain on established access tracks, unsealed roads, and sealed roads at all times, except in case of emergency and/or pipeline inspections that require vehicle access off the established routes.
- Areas of vegetation disturbance not required for future operational use shall be rehabilitated through re-spreading and ripping of salvaged topsoil.
- Access shall be restricted in areas subject to rehabilitation.
- Records shall be kept to document the details of clearing conducted in order to facilitate reporting in accordance with relevant approvals.
- In areas where rehabilitation is not achieving coverage of vegetation and density of weeds similar to that of the surrounding undisturbed vegetation, an external specialist shall be engaged to identify strategies for improvement.
- Vegetation shall not be burned.

5.3 Weed and pathogens

- As far as practicable construction work will be scheduled for the drier periods during which the risk of mud and seed retention to machinery, vehicles and boots is decreased.
- When sourcing soil, priority shall be given to materials sourced from the immediate area.
- The transport of soil shall be avoided where practicable.
- Any imported soil shall be certified as free of weed and pathogens. Records shall be maintained regarding the origin and the destination of imported soil.
- Targeted weed management shall be undertaken as required to promote control of existing populations. This shall involve opportunistic treatment with herbicides. Records shall be retained to demonstrate implementation e.g. date, size and location of area treated.
- All herbicides shall be applied strictly in accordance with the directions on the label.

- Prosopis sp (Mesquite) shall be avoided, where possible during all clearing to prevent the spread of any seed. Where encountered clean down protocols shall be in place.
- Prosopis sp. (Mesquite) areas identified in adequate density shall be identified on the Environmental Line List (ELL) and clean on entry procedures shall apply.
- All plant and equipment entering site shall be certified weed and seed free prior to mobilisation.
- All vehicles shall undergo clean down requirements prior to leaving site when topsoil is present (i.e. clearing and rehabilitation activities). Requirements shall be managed as per the Clean on Entry Procedure. (E-PRO-014)
- Any residue of wet wash downs shall be contained and stored for disposal by a licensed operator.

5.4 Bushfire

- All equipment shall comply with relevant fire safety standards (e.g. use of exhaust spark inhibitors).
- Defective machinery shall be shut down until the defect is rectified and the machine made safe for operations.
- Machinery and vehicles not in use shall be parked in areas of low fire risk (e.g. not parked over shrubs, tall grass or cleared vegetation residue).
- Vehicles shall be regularly checked to ensure that combustible material such as grass and debris does not build up in critical areas where ignition could occur.
- Firebreaks shall be maintained at facility sites as appropriate
- All vehicles shall be fitted with a dry chemical powder fire extinguisher. Sizes may vary from 2.5 kg to 9 kg dependent upon the vehicle size.
- To prevent an accidental ignition of possible hazardous concentrations of flammable vapour or gas, appropriate precautions must be taken, including the display of suitable signs to indicate the extent of any hazardous areas and/or situations.
- Where flammable or combustible chemicals are required to be stored on-site, appropriate fire-fighting equipment shall be available. Incompatible chemicals shall not be stored together.
- The following is prohibited in hazardous areas:
 - smoking
 - the presence of matches, lighters and naked flame
 - the access of any sources of ignition to the area (eg. spark-ignition engines, motor vehicles etc.).

5.5 Fauna

- Vehicles shall remain on established access tracks, unsealed roads, and sealed roads at all times, except in case of emergency that require vehicle access off the established tracks.
- Vehicle speeds shall not exceed 60 km per hour within the well site access tracks; 80km per hour on unsealed roads; 10 km per hour within facility compounds.
- As far as practicable, restrict driving to within daylight hours and avoid driving at dusk and dawn.
- Fauna shall not be fed and direct contact with fauna shall be avoided.
- Pets shall be prohibited on site
- All excavations (including trenches) left open overnight shall be equipped with exit ramps every 1200m and fauna shelters every 50m (i.e. hessian bags).
- All excavations left open overnight shall be inspected for trapped fauna within 3 hours of sunrise.
- All excavations shall be filled as soon as practicable.
- Translocation of fauna shall be immediate, to suitable habitat at a suitable distance from disturbance and done in a manner to minimise stress to the animal.
- Trained fauna handlers holding a relevant licence under the Wildlife Conservation Regulations 1950, issued specifically for the purposes of fauna capture and release shall be available at all times during trenching to respond to fauna interactions.

- The occurrence of water in trenches shall be managed by taking action to avoid the development of any individual water bodies longer than 100 m in length. Use of soil 'islands' or floating refuges is an acceptable method of managing effective water body lengths.
- Where a trench contains water and is not dewatered, the trench shall not remain open for longer than 7 days.
- Records shall be kept of all trapped or injured fauna interactions to document the date, location, species, habitat, and any notes such as the form of encounter and details regarding release.
- All flowlines shall be capped at end of shifts and while in storage to prevent fauna entry
- All sumps shall include fauna egress controls (i.e. nets, ramps)

5.6 Cultural Heritage

- All personnel working on or near an Aboriginal site shall be made aware of their responsibilities under the Aboriginal Heritage Act 1972.
- Clearing activities shall include Traditional Owner representatives to inspect the site prior to clearing operations being conducted
- Identified sites near construction activities identified for protection shall be clearly demarcated for avoidance
- Any flagging and fencing used to identify and protect heritage sites shall be removed post construction.
- If a previously unidentified cultural site is identified, the following must be undertaken:
 - stop all work within 30 m of potential Heritage site
 - report the location and nature of the site to the Senior Advisor – Environment and Heritage
 - establish a 30 m buffer around the site, outside which work may continue.
- All personnel shall be inducted regarding the cultural significance of Tubridgi Gas Field.

5.7 Land users

- Use of internal farm tracks or private roads must be with the agreement of individual landowners and lessees.
- Except in case of emergency or urgent maintenance, the landowner shall be notified at least 24 hours before access is required.
- Except in case of emergency or urgent maintenance, Residents and landowners will be notified a minimum of 7 days prior to commencing earthworks.
- All fences and markers shall be left intact and as they were found.
- Crossing points for stock and vehicle access shall be maintained as agreed with landowner.
- Waterholes and bores used for watering stock are not to be polluted or depleted. Water pipes shall be avoided and not driven over.
- Other infrastructure (e.g. pumps, windmills, stock enclosures) are not to be disturbed.

5.8 Air emissions

- The planned release of gas shall be minimised.
- Gas shall be tested for potential reintroduction to DBNGP
- Whenever possible, planned gas releases shall be conducted during meteorological conditions that facilitate rapid dispersion of the gas.
- Residents, landowners and appropriate authorities shall be advised of a pending major venting operation prior to undertaking the activity.
- Appropriate dust emission controls shall be applied during operation as necessary. This includes during civils operations (dust suppression) and as part of erosion controls for soil stockpiles.

5.9 Noise

- Equipment shall be selected in consideration of its noise emissions. Where practicable, equipment should be selected that is likely to result in the lowest noise impact whilst still completing the required task.
- Equipment shall be fitted with appropriate noise abatement devices (e.g. mufflers, silencers and screens) and maintained in good working order.

- Local residents will be informed of potential noise from construction activities prior to the commencement of activities.
- Where practicable, excessively noisy activities shall be scheduled for periods that are less likely to result in a noise nuisance (i.e. daytime). This decision should be made in consultation with the residents.

5.10 Surface and Ground Water

- Maintenance of mobile equipment and vehicles shall not be conducted within 200 m of any permanent surface water body.
- Any storage of hydrocarbons within 200m of a waterway shall be within a lined, bunded area and inspected every two days.
- Any use of pumps within 200m of a waterway shall be monitored at all times while in operation.
- With the exception of groundwater monitoring events, approval will be sought from DoW or relevant landholder prior to abstraction of groundwater from any bores or artificial water sources.
- Pressure monitoring of drilling fluid shall be undertaken continually to prevent loss of control of fluids.
- Drilling fluids and muds shall be stored in a dedicated cutting sump for drying (evaporation) and testing prior to either onsite or offsite disposal.
- Dewatering controls shall include testing of water prior to disposal.
- Addition of chemicals 'downhole' shall be supplied to DMP for approval prior to any use (Appendix E) as according to the Chemical Disclosure Guidelines (DMP)
- The dewatering product shall be identified for reuse as cement and drilling mud additive in the first instance, followed by dust suppression where possible.
- Disposal of dewatering product shall be conducted in a manner that standing water does not remain present for a period of more than three days. Discharge to ground should include the use of diffusers and filters.
- Records of dewatering shall be kept including date, location (UTM, datum), volume, field sampling results and any treatment conducted.

5.11 Acid Sulphate Soils

- Maintain a GIS Environmental Database to present the DEC ASS Risk Map.
- Prior to excavation to a depth greater than 3m or excavation of a total of 100 m³; or dewatering, consult the GIS Environmental Database and characterise the ASS risk ranking of the proposed disturbance site.
- Within areas of a moderate – high risk of ASS, conduct an ASS investigation prior to conducting the works if those works will either disturb more than 100m³ of soil or require dewatering.
- Within areas of a low – moderate risk of ASS, conduct an ASS investigation prior to conducting the works if those works will either involve lowering of the water table or extend beyond 3 m below the natural ground surface.
- If evidence of ASS is found post excavation, sampling and treatment shall be undertaken prior to any backfill operations.

5.12 Hazardous Materials Storage and Handling

- All sites shall maintain a Material Safety Data Sheet Register and the MSDS for all stored hazardous materials shall be readily accessible.
- All chemicals used during operations shall be transported, stored, handled and disposed of in accordance the requirements of the relevant legislation and industry standards.
- A licensed contractor shall be sourced for the transport of Dangerous Goods where required.

- Hazardous materials shall be stored in containment facilities (e.g. bunded areas, leak proof trays) designed to hold 110% of the capacity of the largest container or 25% of the total, whichever is greater and be impervious to prevent the release of spilt substances to the environment.
- Chemical use shall be minimised where practicable.
- All equipment refuelling shall be undertaken within a bunded area or include the use of a drip tray or portable bund where required.
- Hazardous materials are to be provided, stored and maintained in a sealed condition, without leaks.

- Refueling tanks, lines, hoses, pumps, couplings, valves and associated equipment are to be provided and maintained in good working order.
- A drip tray will be used at all times when re-fueling or lubricating.
- Major servicing of plant and equipment shall be undertaken off-site

5.13 Spill response

- Appropriate spill response equipment, including containment and recovery equipment, shall be available on site and in vehicles undertaking work where there is the potential for fuel or chemical spillage.
- Spills shall be stopped at the source as soon as practicable.
- All spills must be addressed immediately in accordance with the Spill Response Procedure (E-PRO-016).
- Spilt material shall be recovered as soon as possible, using appropriate equipment.
- All contaminated material must be removed and disposed of at a licensed facility.
- All sumps shall have a freeboard minimum of 500mm to allow for rainfall during the project.
- All bunds shall be cleaned out prior to rainfall events to minimise potential contamination sources. Material removed shall be treated as contaminated and disposed of by a licensed contractor.

5.14 Waste management

- All waste shall be disposed of in accordance with signage and site specific procedures. If unsure consult your supervisor.
- All waste shall be disposed of in dedicated, labelled and lidded bins
- Do not overfill waste bins.
- All waste will be transported to a licensed waste disposal facility.
- All general wastes, including materials such as wood, vegetation, rags, paper and putrescible waste shall be stored in dedicated waste bins and properly disposed of at a Shire or other approved waste facility.
- Good housekeeping shall be maintained at all times.
- Downhole chemicals shall be managed through the Chemical Disclosure and MSDS provided to DMP (Appendix E and F)
- Chemical drums shall be disposed of at a licenced waste facility.
- Drilling mud, prior to use will be stored in self bunded containers
- Disposal of any chemical shall be in compliance with approved industry codes of practice, relevant safety guidelines and Australian Standards.
- Scrap metal includes pipe, structural steel and metal off-cuts, etc. Scrap metal shall be disposed of or delivered for recycling to an approved facility or may be returned to the Jandakot Depot for later disposal.
- Sewage shall be treated onsite prior to disposal via spray irrigation or pumped to a septic tank where sludge is retained for collection and offsite disposal by a licenced contractor.
- Waste from temporary ablutions shall be collected for offsite disposal by a licensed contractor. Unless treated for disposal as above

5.15 Rehabilitation

Rehabilitation will be required to revegetate areas cleared for construction purposes that are not required for ongoing operational use. The project will have a two phase rehabilitation program. The first phase will consist of rehabilitation of the well sites (approximately 75%) with the second phase being left to ensure full production and storage project areas are available for the potential next stage of the project. The second stage will rehabilitate all other areas with a firebreak and fenced off area approximately 28m x 22m around each well head remaining and the access tracks rehabilitated to a 5m width.

- All waste materials (e.g. pegs, sump lining) and equipment shall be removed from the construction areas once drilling operations are completed.
- All flagging and bunting installed for other than environmental or safety reasons shall be removed from the construction areas once backfilling and tie-ins are completed.
- Small amounts of rocks and stones generated by the construction process shall be distributed evenly over the right-of-way. Where larger volumes of such material have been produced, consideration shall be given to its removal from site.

- All temporary gates shall be removed (unless required for operational reasons) and the fence reinstated to at least as good as the pre-construction condition. Gates removed from the fence line shall be returned.
- Any infrastructure disturbed during construction shall be restored to the landholder's satisfaction.
- Photos shall be taken to document the site conditions prior to disturbance and upon remediation.
- Public roads and tracks used during construction shall be returned to their pre-construction state, or to a condition agreed to with the landholder.
- Areas that were subject to high traffic movements or other compaction processes during construction shall be ripped to a depth of 30 cm prior to respreading topsoil.
- Salvaged topsoil shall be respread across the rehabilitation area, followed by salvaged vegetation.

6. Environmental Management System

This chapter describes the documented systems and processes of the Environmental Management System (EMS) used for the safe operation of Tubridgi Gas Field project. Implementation of DBP's EMS ensures that hazards are identified and assessed to eliminate or minimise the risk to the environment to a level that is As Low As Reasonably Practical (ALARP) throughout operation at Tubridgi Gas Field.

6.1 Induction and Training

DDG requires all staff and contractors to undertake an environmental awareness induction prior to commencement of works at Tubridgi Gas Field. The environmental awareness induction is targeted to educate staff and contractors regarding DDG's environmental objectives and their individual responsibilities for environmental management. The environmental awareness induction covers off on the following key topics:

- Flora
- Fauna
- Weeds and pathogens
- Acid sulphate soils
- Cultural heritage
- Community and landholders
- Spill response and
- Waste management

The induction additionally ensures that all personnel are capable of implementing the JHA process to identify and manage risks.

All visitors receive a site-specific induction appropriate in length and content for the type of work being undertaken.

Employees will be trained and provided with appropriate resources to ensure compliance with environmental laws, codes and standards and company policies. These additional specific training needs are addressed on an as needs basis. DDG will maintain a record of training for all personnel.

Project awareness and training specific to roles may include:

- First Aid
- Fire Fighting
- Spill Response Awareness
- Dangerous Goods Awareness
- Driving and Remote Worker Awareness

6.2 Incident Management

It is a mandatory requirement for any personnel working for or on behalf of DDG to respond to all hazards and events that have affected or have the potential to adversely affect the environment.

Examples of such events include: odour emissions, accidental gas releases (e.g. leaks), fuel spillage, excessive noise incidents, chemical spills or a complaint from a neighbour.

6.2.1 External Reporting

DDG shall ensure that all relevant parties are informed of any significant incident verbally within two hours and then in writing within three days.

A Significant Environmental Incident is an event which:

- may but does not necessarily result in any permanent damage to the environment but requires the use of additional personnel or contractors external to the site and additional remediation equipment; or
- the regulatory authority deems as notifiable; or
- is likely to result in wide spread public complaints and anger.

6.3 Emergency Preparedness and Response

DBP has three tiers of emergency and crisis response: Incident, Emergency and Crisis. The Emergency Response Plan (ERP) provides for an Emergency Management Team (EMT) and an Incident Management Team (IMT) who are responsible for managing emergencies and minor incidents.

The Project Emergency Response Plan specifies the assignment of particular responsibility and provisions for project related emergency response requirements and interfaces with the DBP ERP.

The Crisis Management Plan (CMP) establishes the Crisis Management Team (CMT) which is responsible for managing Crisis events, being those that are likely to be associated with personnel, public safety, supply, pipeline license or reputation issues.

In the event that an emergency deteriorates and can no longer be managed effectively by the Emergency Management Team the CMT would be activated.

Rig and well management shall be in place to prevent blow out of wells including blow out protectors installed and sensors to monitor well pressure.

6.3.1 Emergency Response Plan

The emergency response processes (including storage of emergency response equipment) have been designed to effectively respond to all foreseeable emergency events as identified in various risk assessments (e.g. FSA, HAZOPs, HAZIDs and JHA's) and from DBP experience on other assets including the DBNGP.

The Emergency Response Plan (ERP) is in place to manage events and emergencies so as to limit the consequences of such events so as to:

- Minimise or eliminate any danger or risk to individuals or to the environment;
- Minimise or eliminate any risk to the business; and
- Ensure that TGS is returned efficiently to a safe condition with minimum impact the environment.

6.3.2 Emergency Training

All field emergency response personnel are trained and competent in Senior First Aid/Remote Area First Aid, Fire Fighting and Defensive Driving. The performance of the tasks associated with Emergency Procedures for the pipeline and associated facilities are an extension of normal work practices and as such the personnel are trained on a regular basis to perform those tasks. Personnel also conduct competency based training in the completion of emergency response through the annual emergency exercises. A environmental drill will be held within the first four weeks of mobilisation to test the emergency response practices onsite.

Emergency exercises are conducted annually to assess the emergency response capabilities of the various teams by providing exercises at levels up to and including crisis. The level of escalation may vary from one exercise to another. All exercises include at least activation of the IMT and EMT.

The key roles in the response and recovery processes are the Incident Commander (General Manager System Design and Operations or delegate) and Incident Controller (General Manager Maintenance or delegate).

6.4 Monitoring

In accordance with Section 33 of the Regulations, DDG shall conduct monitoring of the emissions and discharges defined in Table 6-1.

The Quarterly Emissions and Discharge Report shall consolidate the results of all monitoring for submission to the DMP as specified in Table 6-1.

Table 6-1 Overview of monitoring of emissions

Equipment/ Activity	Emission	Monitoring	Reporting
Venting / flaring	Fugitive gas emission	Monitoring of flow volumes through the compressors and production test kits.	Results are recorded and reported quarterly to DMP.
Pipeline / flowline maintenance and Testing	Purged Nitrogen	Acknowledging the inert and ubiquitous nature of this gas, monitoring is not proposed.	NA
Vehicles	Diesel combustion	Diesel purchases shall be monitored using DBPs SAP accounts system.	Direct purchasing values shall be used to calculate emissions of CO ₂ equivalents in accordance with the NGER Measurement Determination 2008 and reported quarterly.
Accommodation septic system	Treated Waste Water	Acknowledging the low operating capacity of this plant no monitoring of effluent is conducted.	The volume of waste water discharge shall be estimated based on equipment specifications and reported quarterly.
Waste Disposal	Waste – All types	Monitoring and recording of the type and volume of all waste collected for disposal shall be undertaken.	The total volume for each waste stream collected from site shall be reported quarterly.
Spills	Chemical or hydrocarbon	Any spills will be captured as an event and reported as required.	Event Reports to include volume of spills, type and reported to DMP as required

6.5 Inspections and Audits

During construction daily HSE inspections shall be undertaken by the S&T Coordinator. Weekly environmental specific inspections shall also take place to ensure maintenance of access tracks, signs of erosion and stockpile health. Pre-mobilisation and prestart checks will also be conducted on plant and machinery (especially ground disturbance vehicles) with prestarts being conducted daily prior to use.

An audit shall be undertaken by the Project HSE Advisor within 4 weeks of mobilisation.

6.5.1 Pre-construction inspections

The drilling rig will undergo a specific inspection in relation to operations and HSE requirements prior to the commencement of drilling at each well location. This ensures that correct mobilization processes are in place for each movement of the rig and includes secondary containment, waste storage areas, hazardous goods management and sump construction.

6.5.2 EP Review and Compliance Audit

Tubridgi Gas Storage Well activities shall be subject to an environmental compliance audit during construction to ensure that the systems and controls detailed within this EP are both adequate and implemented, and also identify opportunities for improvement.

6.6 Consultation

The purpose of consultation is to:

- Obtain appropriate input into the ongoing improvement of this EP;
- Keep key stakeholders up to date with activities at Tubridgi Gas Field;
- Ensure timely response to landholder issues; and
- Maintain dialogue with regulatory authorities, including local councils.

Consultation with key regulatory stakeholders including the Department of Planning (DoP), DMP, OEPA, the DER and Department of Water (DoW) may be undertaken as the need arises to ensure that operations are managed in accordance with relevant statutory requirements.

Through recent acquisition of Tubridgi Gas Field and Urala Station, DDG has engaged in the below consultation with key regulators:

- EPA during transfer of proponency for MS 308, 309 and 112. Consultation with the EPA is ongoing regarding annual compliance reporting requirements.
- DMP through development of this project and the interaction of this plan to the *Environmental Management Plan Ashburton West Facilities*.

Through recent construction activities for the AOGP and this project, consultation has been undertaken with regulators in regards to approval requirements, landholders and native title claimants. Table 6-2 provides an overview of this consultation.

Consultation and communication with relevant landholders, regulatory authorities, Aboriginal and other interest groups and the general public will be ongoing as part of TGS operation activities. The schedule and key messages to be included in the consultation program is governed by the Land Management Plan. All contact with stakeholders will be recorded in the Land Management System (LMS). The Land Management department, Senior HSE Advisor and Corporate Affairs department are responsible for the development and distribution of corporate awareness publications to communicate the details of our environmental commitments to key stakeholders. All other relevant details about land use, foreign crossings, landholder concerns and issues are to be recorded on the LMS for future reference and reporting.

DDG target annual consultation with all landholders. In the past 12 months, due to the recent acquisition activities, DDG has been engaged in regular contact with all landholders intersected by L9. This consultation has provided an opportunity for the landowners to advise DDG of their land use requirements and future expectations and has also provided DDG an opportunity to disseminate information about Tubridgi Gas Field and promote awareness of all risks and emergency protocols. This ongoing process is designed to decrease the risk of third party incidents and to encourage ownership of the activities around the pipeline.

Table 6-2 Overview of consultation

Stakeholder	Date of Consultation	Items Discussed/proposed to be discussed	Outcomes
Commonwealth, State and Local Government			
Office of the Environmental Protection Authority (OEPA)	May, June 2016 ongoing	High level overview of TGS provided	Confirmation from OEPA that proposed works can operate under MS112 approval.
Department of Mines and Petroleum (DMP)	April, May and June 2016 ongoing	High level overview of activity provided via presentation in person	Recognition of pending Environment Plan for assessment, included in recent site visit for ASW Audit
Department of Water	2014	Water abstraction Licencing	Water abstraction licenses in place (surface water and groundwater)
Department of Health	2016	Potable water monitoring requirements and reporting	Micobiological testing regime and water cartage requirements for management of Chlorine.

Stakeholder	Date of Consultation	Items Discussed/proposed to be discussed	Outcomes
Shire of Ashburton	April 2013, Nov 2015, 2016	High level overview of activity provided	<ul style="list-style-type: none"> ▪ Shire has a full awareness ▪ Approvals relating to road use and construction matters ▪ Camp Approvals ▪ Ongoing use of roads for project and traffic management planning
Native Title Claimant group			
Thalanyji	July 2013, 2014, 2015, 2016	Agreement reached on NT and Heritage processes and protocols	Consultation, involvement and engagement continues
Local Landowners and Other Stakeholders			
Leaseholders for:			
Minderoo Station – Crown Lease 56/1967	May 2016	Access arrangements	Access agreement reached
Urala Station – Crown Lease 330/1967.	April 2013, 2014, 2015, 2016	Access arrangements	DDG becomes leaseholder of Urala Station June 2016. Station Manager consultation for use of access tracks and well locations (June 2016), Prior to this an access arrangement was in place with BHPB and included a high level of consultation with the Station Manager
Urala Station – Crown Lease	Dec 2012 – June 2016	Sale of Urala Station	Sale of Urala Station by BHPB to DDG (2016)

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Appendix A HSE Policy



Our Policy

Health, Safety & Environment

DBP aspires to excellence for HSE performance by creating and maintaining a culture of **ZERO HARM**.

We are committed to:-

- Providing a safe and healthy workplace, free of occupational injuries and illness;
- Providing effective and appropriate Fitness for Work processes;
- Creating a culture that puts HSE first through leadership, consultation, participation, training and development;
- Conducting our business in a way that protects, or enhances, community, safety, amenity and the natural environment;
- Recording, measuring and acting to improve our HSE Performance;
- Providing effective, caring injury management processes to support employee rehabilitation; and
- As a minimum requirement, complying with all laws and regulations for the protection of our people and the environment.

Wherever we operate, we strive to achieve our goals through:

- Identifying, assessing, controlling and recording hazards and risks;
- Setting, monitoring and communicating meaningful performance measures to employees and stakeholders;
- Actively identifying and implementing opportunities to improve HSE outcomes, including developing awareness programs to maintain a culture of ZERO HARM;
- Providing appropriate training;
- Establishing and maintaining comprehensive HSE management systems, compliant with ISO14001 and AS/NZS 4801; and
- Proactive participation in business, community and government programs to enhance community health and safety, and environmental sustainability.

In developing and pursuing our high standards in HSE performance we value:

- Recognising and rewarding innovation in HSE;
- Forums to communicate safety processes, initiatives and issues to all employees and contractors; and
- Leadership and accountability at all levels in the organisation to promote a ZERO HARM culture.

We believe we are all responsible for HSE performance and that all hazards can be controlled. In particular:

- No business objective will take priority over Health, Safety and the Environment;
- We are all individually accountable and empowered to ensure our actions protect ourselves, fellow workers, the public and the environment;
- Management and supervisors provide visible leadership and adequate resources to ensure that leading workplace standards are implemented and maintained; and
- The Board ensures there is a disciplined approach to the identification and management of risks across the business.

It is a requirement that all employees, contractors and visitors comply with the requirements of this policy and our HSE management standards at all times.

STUART JOHNSTON
Chief Executive Officer
January 2016



Statement of Commitment

DBP Management is committed to achieving **ZERO HARM**

Our commitment is to –

- Provide a safe and healthy workplace, free of occupational injuries and illness;
- Create a culture that puts Health, Safety and the Environment first and ensuring that no other business objective will take priority over Health, Safety and the Environment;
- Support a culture that empowers our workforce to say “**Stop**” when they determine that their safety or that of their colleagues, the asset or the environment might be compromised;
- Conduct our business in a way that protects, or enhances, community, safety, amenity and the natural environment;
- Record, measure and take action to improve our HSE Performance; and
- Comply with all legal obligations as the minimum requirement for our Health, Safety and Environmental standards.

We believe we are all accountable and empowered to ensure our actions protect ourselves, fellow workers, the public, the environment and our assets.

Our commitment will be achieved by -

- Providing visible leadership and adequate resources to ensure that leading workplace standards are implemented and maintained;
- Ensuring there is a disciplined approach to the identification and management of risks across all activities undertaken within DBP;
- Supporting effective and proactive communication including through staff consultation forums; and
- Communicating, complying and enforcing the Zero Harm Principles to ensure that they remain current and appropriate to the business.

Stuart Johnston
Chief Executive Officer

James Smith
General Manager Maintenance

Tawake Rakai
General Manager System Design & Operations

Anthony Cribb
General Manager Corporate Services

Jon Cleary
General Manager Commercial

Michael Allen
Chief Financial Officer

Sharon Kershaw
General Manager HR Training & Administration

Appendix B Environmental Aspects and Impacts Risk Register

Bow Tie Format

ID	Inherent	Residual	ALARP	Title	Project
Risk 0270	Intermediate	Low	Not rated	1.1 Introduction/ spread of exotic species	Environmental Plan
Risk 0271	Low	Negligible	Not rated	1.2 Disturbance of conservation significant flora species during planning and preparation	Environmental Plan
Risk 0272	Low	Negligible	Not rated	1.3 Disturbance of conservation significant fauna species during planning and preparation	Environmental Plan
Risk 0273	Negligible	Negligible	Not rated	1.4 Disturbance of environmentally sensitive areas (ESA) including conservation significant fauna habitat	Environmental Plan
Risk 0274	Low	Negligible	Not rated	1.5 Alteration of surface water during planning.	Environmental Plan
Risk 0275	Low	Negligible	Not rated	1.6 Disturbance of cultural heritage site/s or object/s during planning and preparation	Environmental Plan
Risk 0286	Intermediate	Low	Not rated	2.10 Major spill (>80 L) of dangerous goods (diesel fuel only)	Environmental Plan
Risk 0287	Low	Negligible	Not rated	2.11 Disruption of local landholders or other stakeholders	Environmental Plan
Risk 0276	Intermediate	Low	Not rated	2.1 Introduction / spread of weed species	Environmental Plan
Risk 0277	Low	Negligible	Not rated	2.2 Disturbance of conservation significant flora species during construction of Access Tracks, Well Site and Camp Site and Mobilisation	Environmental Plan
Risk 0278	Low	Negligible	Not rated	2.3 Disturbance of conservation significant fauna species during construction of Access Tracks, Well Site and Camp Site and Mobilisation	Environmental Plan
Risk 0281	Low	Negligible	Not rated	2.4 Fauna access to open excavations	Environmental Plan
Risk 0280	Low	Negligible	Not rated	2.5 Disturbance of conservation significant flora species, ESA and/or cultural heritage site/s or object/s during construction	Environmental Plan
Risk 0282	Low	Negligible	Not rated	2.6 Alteration of surface water flow during Construction of Access Tracks, Well Site and Camp Site and Mobilisation	Environmental Plan
Risk 0283	Negligible	Negligible	Not rated	2.7 Soil disturbance	Environmental Plan
Risk 0284	Intermediate	Low	Not rated	2.8 Ignition of a bush fire during construction	Environmental Plan
Risk 0285	Low	Negligible	Not rated	2.9 Minor spill (< 80 L) of dangerous goods	Environmental Plan
Risk 0288	Low	Negligible	Not rated	3.1 Disturbance of conservation significant flora species, ESA and/or cultural heritage site/s or object/s at camp site	Environmental Plan

camp site

Risk	0289	Low	Negligible	Not rated	3.2 Disturbance of conservation significant fauna species during camp site operation including Mobile Camp	Environmental Plan
Risk	0290	Intermediate	Low	Not rated	3.3 Ignition of a bush fire at camp site	Environmental Plan
Risk	0291	Low	Negligible	Not rated	3.4 Minor spill (< 80 L) of dangerous goods at the camp site	Environmental Plan
Risk	0292	Low	Negligible	Not rated	3.5 Major spill (>80 L) of dangerous goods at the camp site	Environmental Plan
Risk	0293	Low	Negligible	Not rated	3.6 Litter generation at camp site	Environmental Plan
Risk	0294	Low	Negligible	Not rated	3.7 Discharge of a untreated sewage	Environmental Plan
Risk	0295	Low	Negligible	Not rated	3.8 Excessive noise and/or vibrations	Environmental Plan
Risk	0305	Low	Negligible	Not rated	4.10 Ignition of a bush fire during drilling operations	Environmental Plan
Risk	0306	Negligible	Negligible	Not rated	4.11 Excessive noise and/or vibrations	Environmental Plan
Risk	0307	Negligible	Negligible	Not rated	4.12 Light Impacting Fauna	Environmental Plan
Risk	0308	Negligible	Negligible	Not rated	4.13 Visual Amenity	Environmental Plan
Risk	0309	Low	Negligible	Not rated	4.14 Disturbance or damage to infrastructure and services	Environmental Plan
Risk	0310	Low	Negligible	Not rated	4.15 Litter generation during drilling operations	Environmental Plan
Risk	0311	Low	Negligible	Not rated	4.16 Unplanned discharge of grey water or sewage	Environmental Plan
Risk	0312	Negligible	Negligible	Not rated	4.17 Third party access	Environmental Plan
Risk	0333	Negligible	Negligible	Not rated	4.18 Excessive Noise at Urala Homestead	Environmental Plan
Risk	0296	Low	Negligible	Not rated	4.1 Disturbance of conservation significant flora species, ESA and/or cultural heritage site/s or object/s during drilling operations	Environmental Plan
Risk	0297	Low	Negligible	Not rated	4.2 Disturbance of fauna including conservation significant fauna species	Environmental Plan
Risk	0298	Extreme	Low	Not rated	4.3 Well Control Event	Environmental Plan
Risk	0299	Intermediate	Low	Not rated	4.4 Inadequate structural integrity of the well	Environmental Plan
Risk	0300	Low	Negligible	Not rated	4.5 Unplanned discharge of drilling cuttings	Environmental Plan
Risk	0301	Intermediate	Negligible	Not rated	4.6 Unplanned discharge of drilling mud or drilling mud constituents	Environmental Plan
Risk	0302	Low	Negligible	Not rated	4.7 Minor spill (< 80 L) of dangerous	Environmental Plan

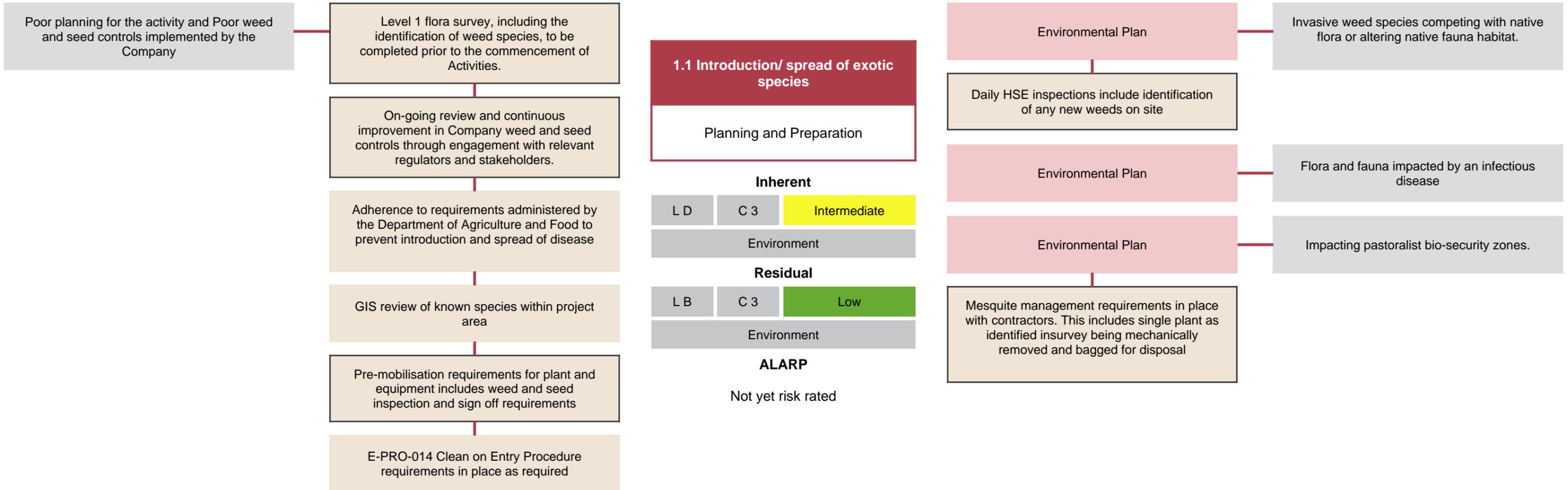
	Low	Negligible	Not rated		
				4.7 Minor spill (< 80 L) of dangerous goods or hazardous substance during drilling phase	Environmental Plan
Risk 0303	Intermediate	Low	Not rated	4.8 Major spill (>80 L) of dangerous goods or hazardous substance during drilling phase	Environmental Plan
Risk 0304	Low	Negligible	Not rated	4.9 Non-routine gas flaring	Environmental Plan
Risk 0313	Low	Negligible	Not rated	5.1 Inadequate demobilisation	Environmental Plan
Risk 0314	Intermediate	Negligible	Not rated	5.2 Inadequate rehabilitation	Environmental Plan

Causes

Preventative Controls

Recovery Controls

Consequences



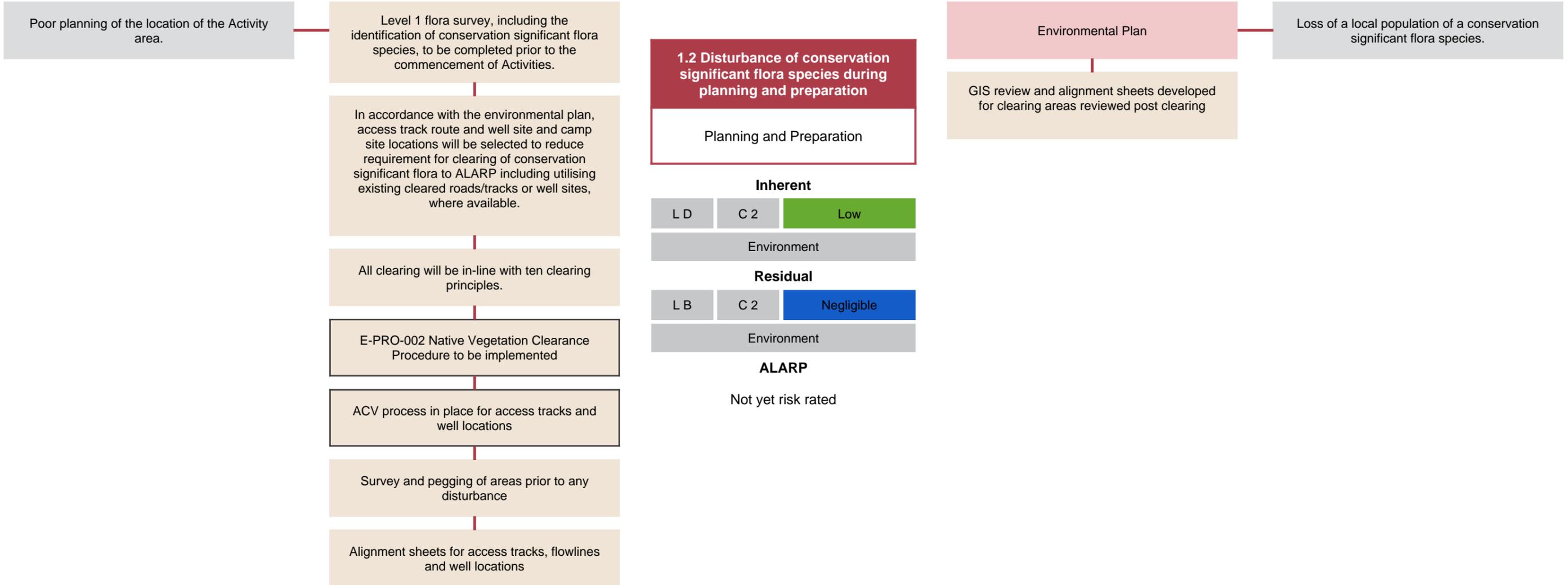
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



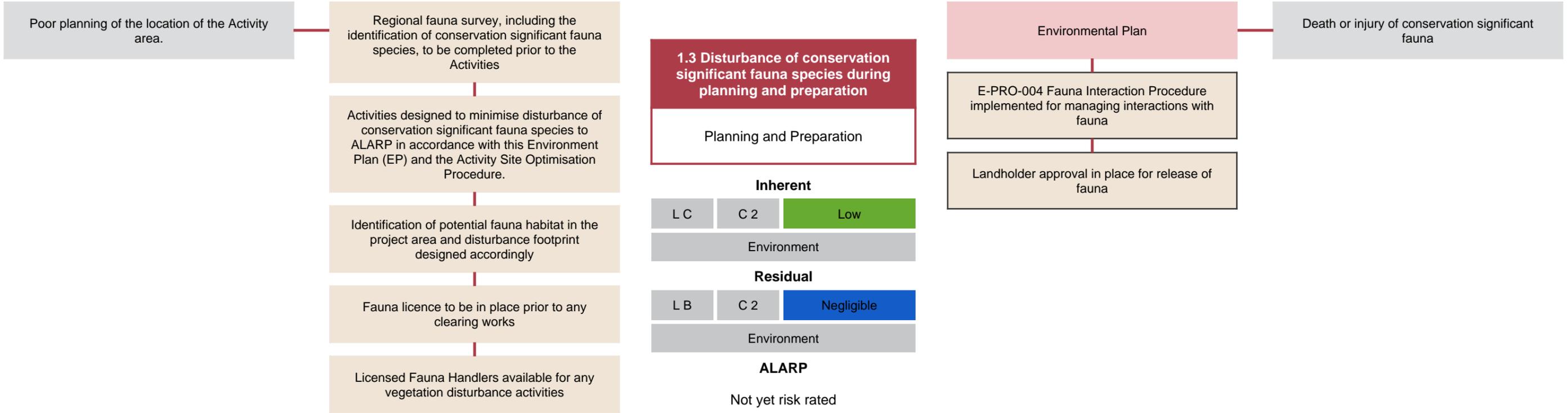
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences

Poor planning of the location of the Activity area

No ESA's identified within the Activity area. Activities designed to minimise disturbance of these areas to ALARP in accordance with this EP and the Activity Site Optimisation Procedure.

Archaeological and ethnographic survey to identify heritage area with Traditional Owners

Conduct a Heritage Risk Assessment survey

1.4 Disturbance of environmentally sensitive areas (ESA) including conservation significant fauna habitat

Planning and Preparation

Inherent

L B	C 2	Negligible
Environment		

Residual

L A	C 2	Negligible
Environment		

ALARP

Not yet risk rated

Environmental Plan

Loss of environmental values associated with ESA.

Environmental Plan

Loss of conservation significant fauna habitat.

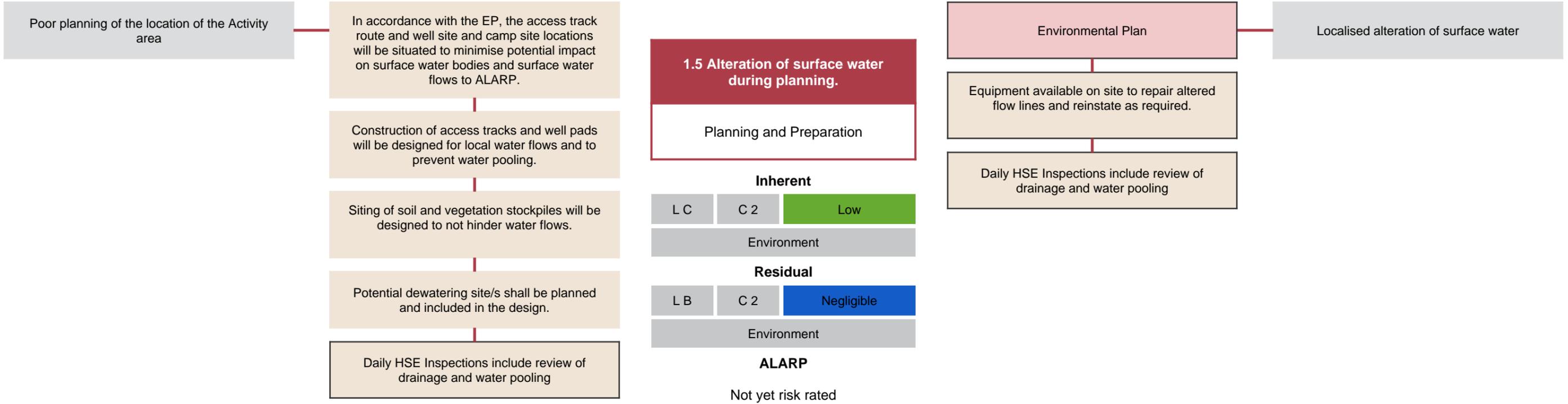


Causes

Preventative Controls

Recovery Controls

Consequences



Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences

Poor planning of the location of the Activity area

Liaison with the relevant Traditional Owner group on significant cultural heritage sites, including site access conditions, during planning of the Activities.

Prior to commencement of the Activities, search of Aboriginal Heritage Inquiry System maintained by WA Department of Aboriginal Affairs for aboriginal heritage sites.

Potential identification of heritage places and objects through a formal heritage survey process undertaken by Traditional Owners and facilitated by an anthropologist independent of the Company.

Activities designed to avoid heritage areas in accordance with the Activity Site Optimisation Procedure.

Traditional owner Monitors shall be utilized prior to the clearing activity.

Cultural heritage of local area and requirements included in the HSE induction.

1.6 Disturbance of cultural heritage site/s or object/s during planning and preparation
 Planning and Preparation

Inherent

L B	C 3	Low
Environment		

Residual

L A	C 3	Negligible
Environment		

ALARP
 Not yet risk rated

Environmental Plan

If artefacts are found, work shall cease, the area will be demarcated as per requirements of the Aboriginal Heritage Act 1972

Damage to cultural heritage site/s or object/s



Causes

Preventative Controls

Recovery Controls

Consequences

Weeds or weed contaminated materials transported on vehicles or equipment and weeds or weed contaminated materials transported on personnel.

Prior to entering the Activity area, earthmoving machinery, equipment and personnel will be checked for weeds or weed contaminated materials in accordance with the EP: - Earthmoving machinery and equipment will be inspected and cleaned prior to mobilisation.

Gravel sourced from an external supplier will be certified as weed and pathogen free.

Identification of location for potential clean down stations onsite and implemented as required.

Weed and seed requirement included in HSE induction.

E-PRO-014 Clean on Entry Procedure requirements in place as required

Washdown / brushdown capability available on site

Vehicle pre-start checks.

Specific controls in place for the management of mesquite, including mechanical removal of single plants encountered, bagged and disposed of through licensed waste contractor

2.1 Introduction / spread of weed species
Construction of Access Tracks, Well Site and Camp Site and Mobilisation

Inherent

LC	C 3	Intermediate
Environment		

Residual

LB	C 3	Low
Environment		

ALARP
Not yet risk rated

Environmental Plan

Invasive weed species competing with native flora or altering native fauna habitat.



Causes

Preventative Controls

Recovery Controls

Consequences

Unplanned clearing of conservation significant flora species and uncontrolled vehicle or personnel access.

Clearing for the access track, well site and camp site will be undertaken in accordance with the specifications in the CWP. The PIC to ensure no additional clearing is undertaken throughout the Activities.

Vehicle and personnel access limited to the well site, camp site and access track to prevent disturbance outside of the Activity area.

An HSE Induction for operational personnel including conservation significant species within the Activity area

E-PRO-002 Native Vegetation Clearance Procedure to be implemented

Authority to Clear Vegetation (ACV) permit process in place for wellsite and access track clearing

Access track surveyed alignment sheets implemented throughout construction program

2.2 Disturbance of conservation significant flora species during construction of Access Tracks, Well Site and Camp Site and Mobilisation

Construction of Access Tracks, Well Site and Camp Site and Mobilisation

Inherent

L D	C 2	Low
Environment		

Residual

L B	C 2	Negligible
Environment		

ALARP

Not yet risk rated

Environmental Plan

Inspection and audit process to review clearing areas including Daily Inspections of flowline, access track and wellsite construction against survey and alignment sheets

Loss of a local population of a conservation significant flora species.



Causes

Uncontrolled vehicle or personnel access and vehicles travelling at high speeds and vehicles travelling at dawn or dusk or in times of poor visibility.

Preventative Controls

- Construction to be limited to daylight hours to mitigate any potential impacts on nocturnal species
- In accordance with the Traffic Management Plan (TMP): - Vehicles driving on station roads will be limited to 80 km/h
- In accordance with the Traffic Management Plan (TMP) to: - Vehicles driving on well access tracks will be limited to 60km/h
- In accordance with the Traffic Management Plan (TMP) to: - No driving at night except in an emergency.
- Traffic Management Plan
- Fauna Licence to be in place for managing any interactions with fauna
- Trained and Competent operator.

Recovery Controls

- Environmental Plan
- Licensed Fauna Handler available for managing fauna interactions as required

Consequences

Death or injury of conservation significant fauna

2.3 Disturbance of conservation significant fauna species during construction of Access Tracks, Well Site and Camp Site and Mobilisation

Construction of Access Tracks, Well Site and Camp Site and Mobilisation

Inherent		
LC	C 2	Low
Environment		
Residual		
LB	C 2	Negligible
Environment		
ALARP		
Not yet risk rated		

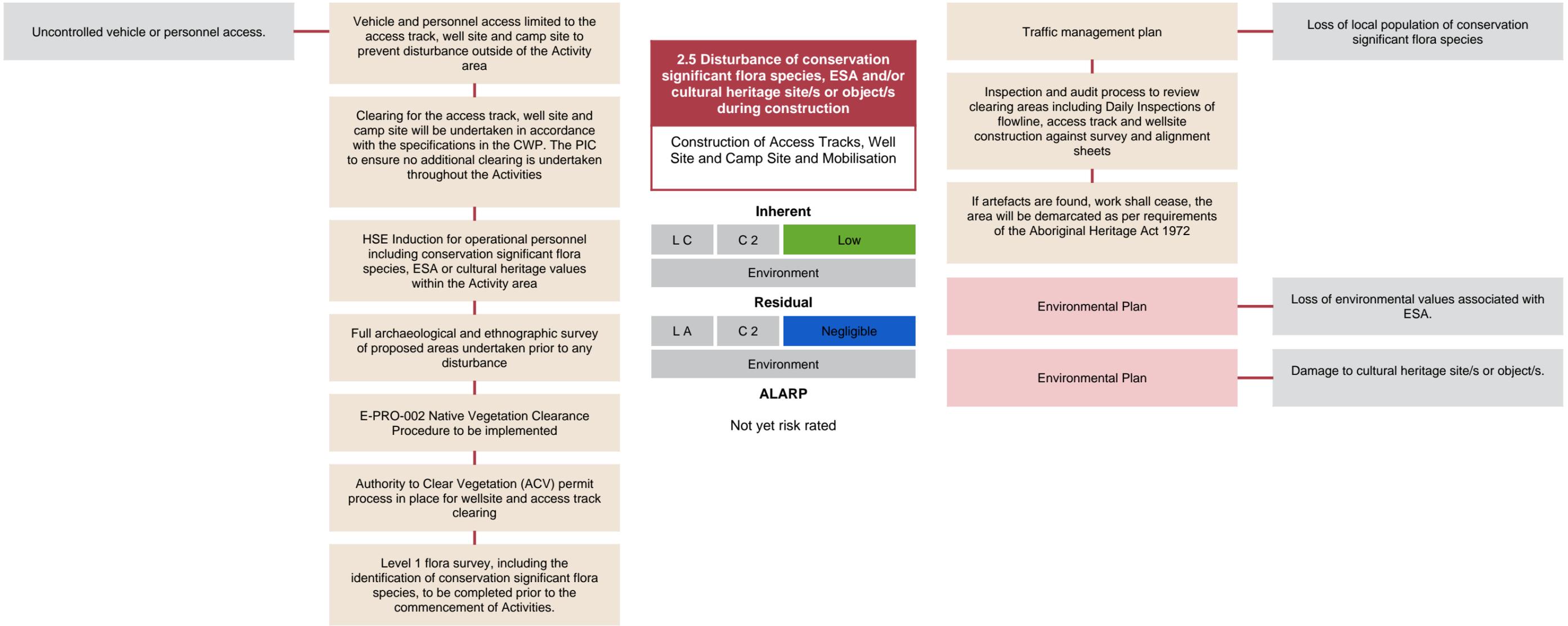


Causes

Preventative Controls

Recovery Controls

Consequences



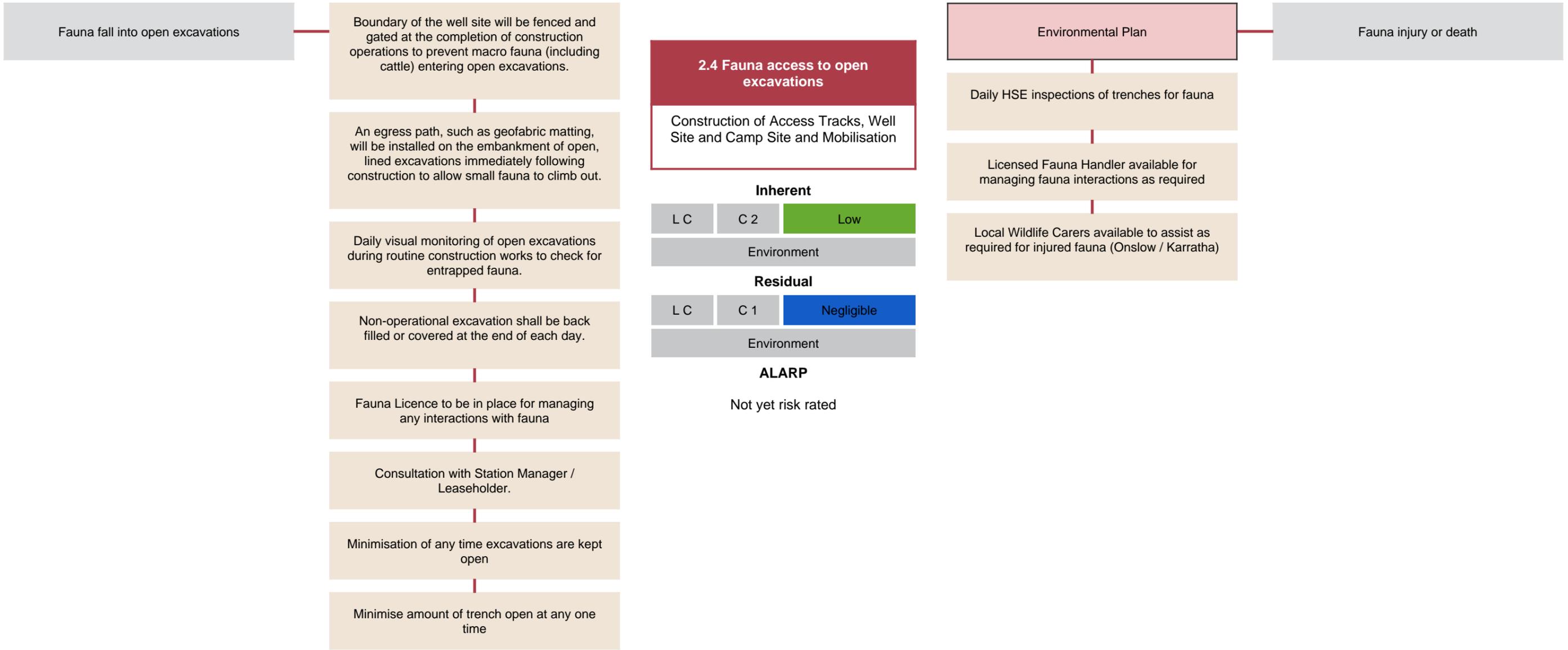
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Risk/Event Description
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In Place Control
Critical Control
Critical In Place Control

Causes

Preventative Controls

Recovery Controls

Consequences



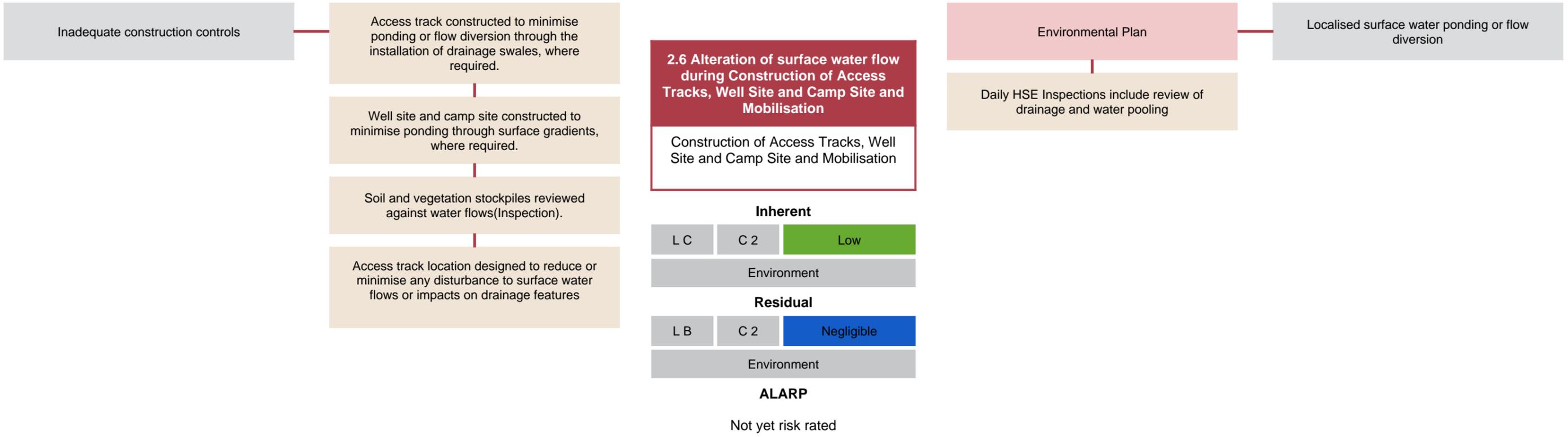
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



2.6 Alteration of surface water flow during Construction of Access Tracks, Well Site and Camp Site and Mobilisation

Construction of Access Tracks, Well Site and Camp Site and Mobilisation

Inherent

LC	C 2	Low
Environment		

Residual

LB	C 2	Negligible
Environment		

ALARP
Not yet risk rated

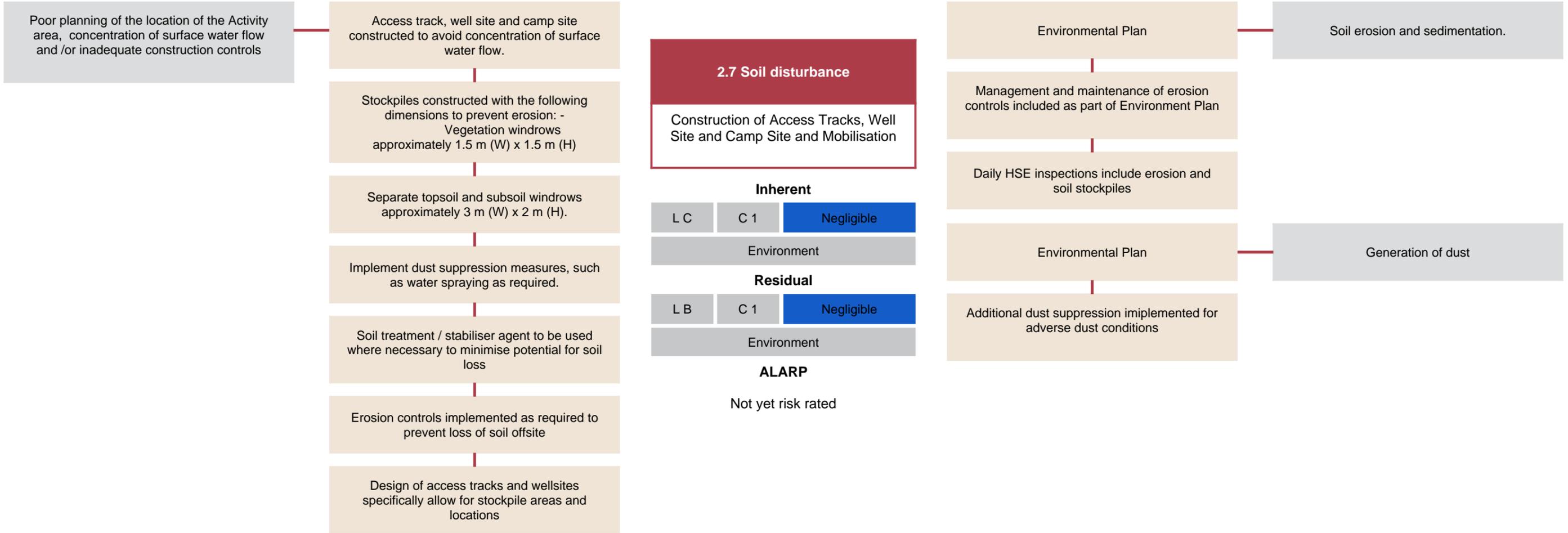
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



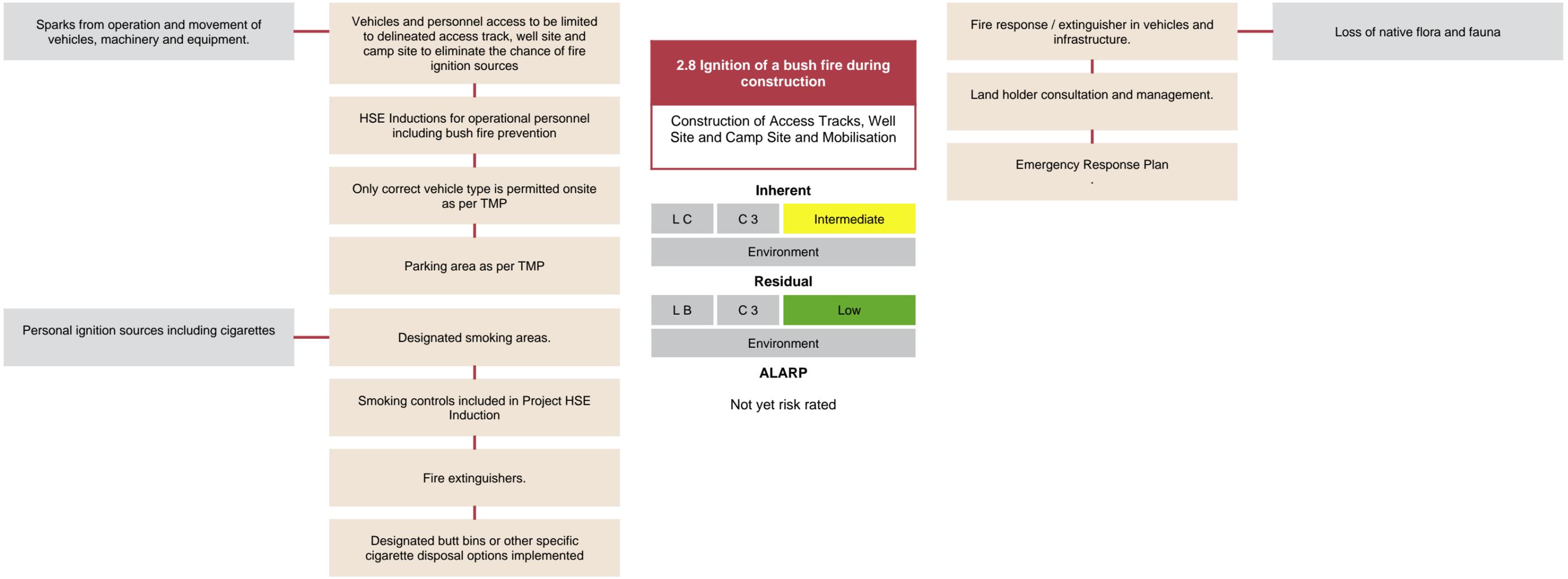
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Causes

Preventative Controls

Recovery Controls

Consequences



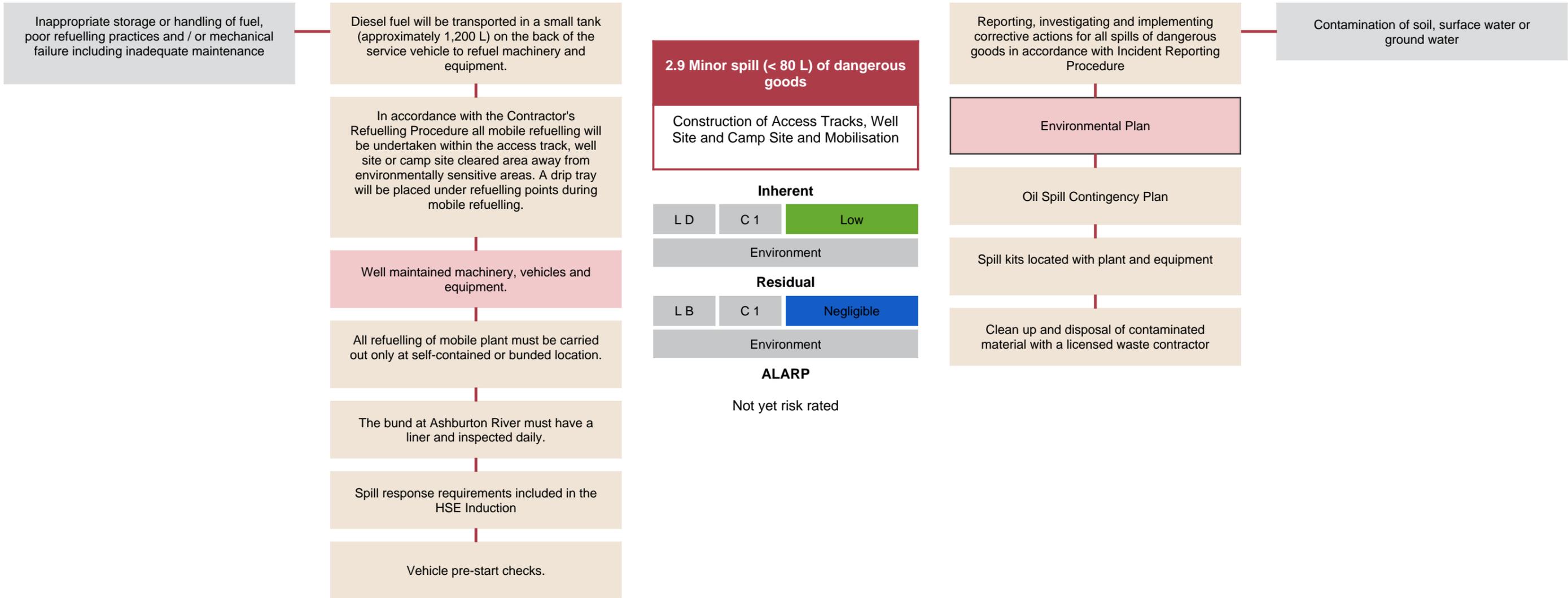
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



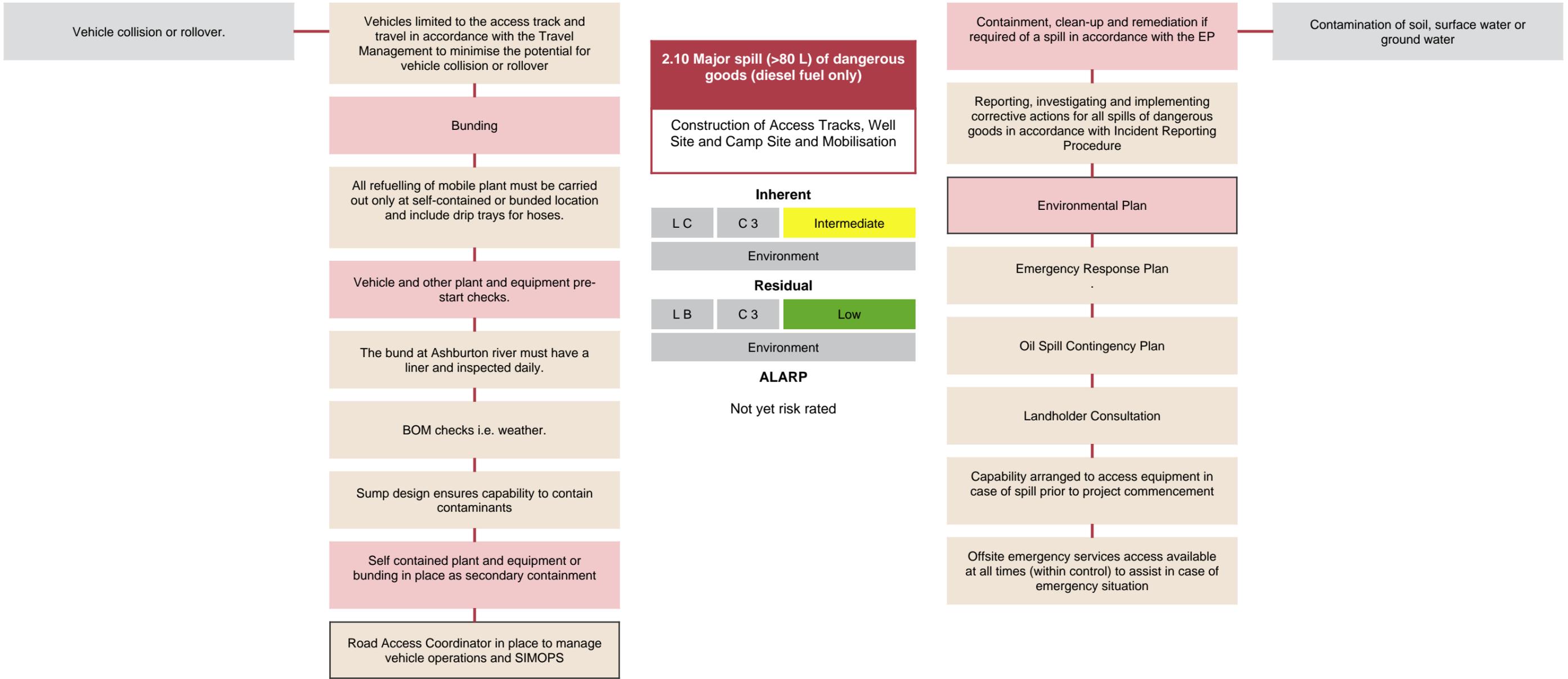
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Risk/Event Description
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In Place Control
Critical Control
Critical In Place Control

Causes

Preventative Controls

Recovery Controls

Consequences



Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Transport of vehicles and machinery including public roads and access tracks on pastoral lands and Inadequate consultation regarding the Activities.

Preventative Controls

- On-going consultation with local landholders and other stakeholders regarding the Activities including regular notice/updates until completion of the Activities
- Vehicles will comply with Traffic Management Plan (TMP) which includes speed limits.
- Vehicle activity will be limited to designated access routes and operational areas
- Fauna management and awareness in HSE induction.
- Full archaeological and ethnographic survey of proposed areas undertaken prior to any disturbance
- Construction limited to daylight hours to minimise impacts to landholders and other stakeholders
- Signage and fencing

2.11 Disruption of local landholders or other stakeholders

Construction of Access Tracks, Well Site and Camp Site and Mobilisation

Inherent		
LD	C 1	Low
Environment		
Residual		
LC	C 1	Negligible
Environment		

ALARP
Not yet risk rated

Recovery Controls

- Environmental Plan
- Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure
- Environmental Plan
- Landholder Consultation

Consequences

- Inconvenience to local landholders and other stakeholders
- Disturbance of stock

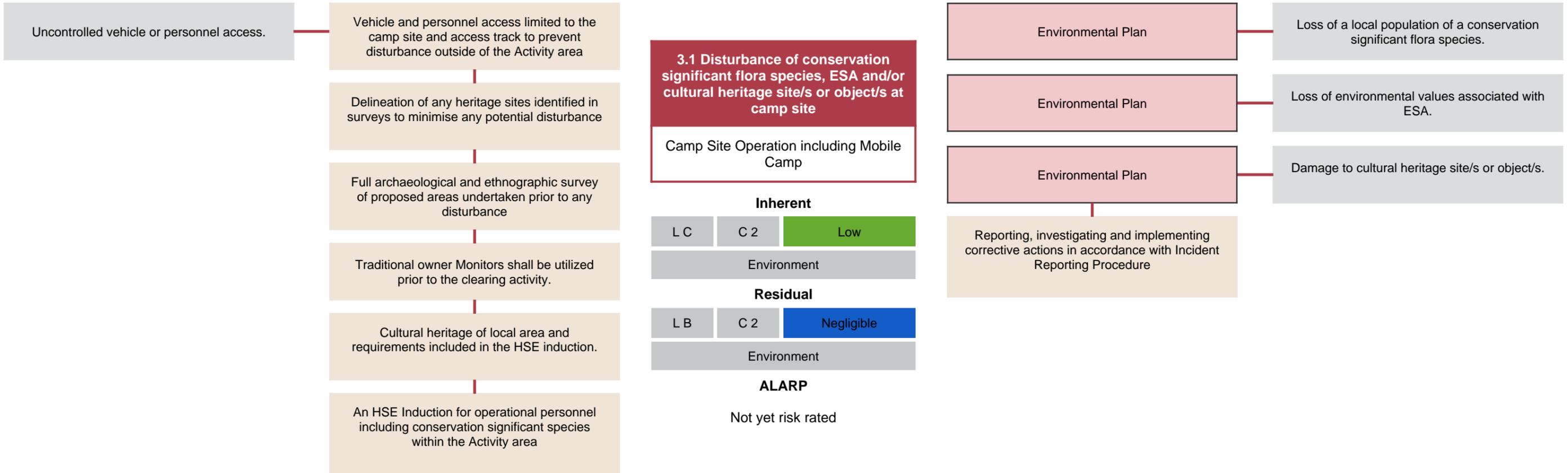


Causes

Preventative Controls

Recovery Controls

Consequences



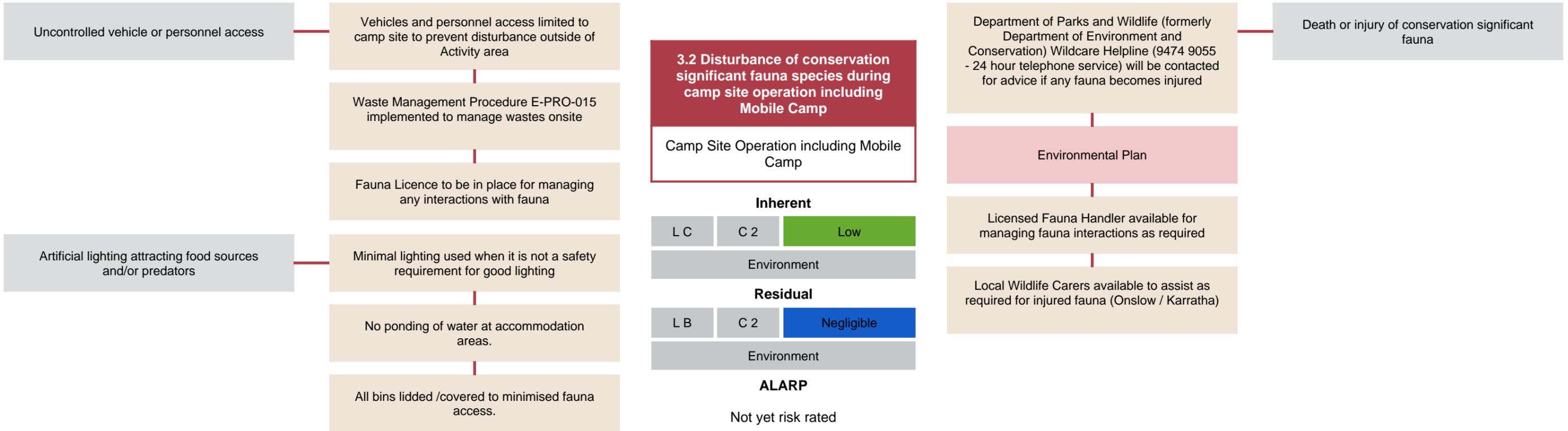
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In Place Control
Critical Control
Critical In Place Control

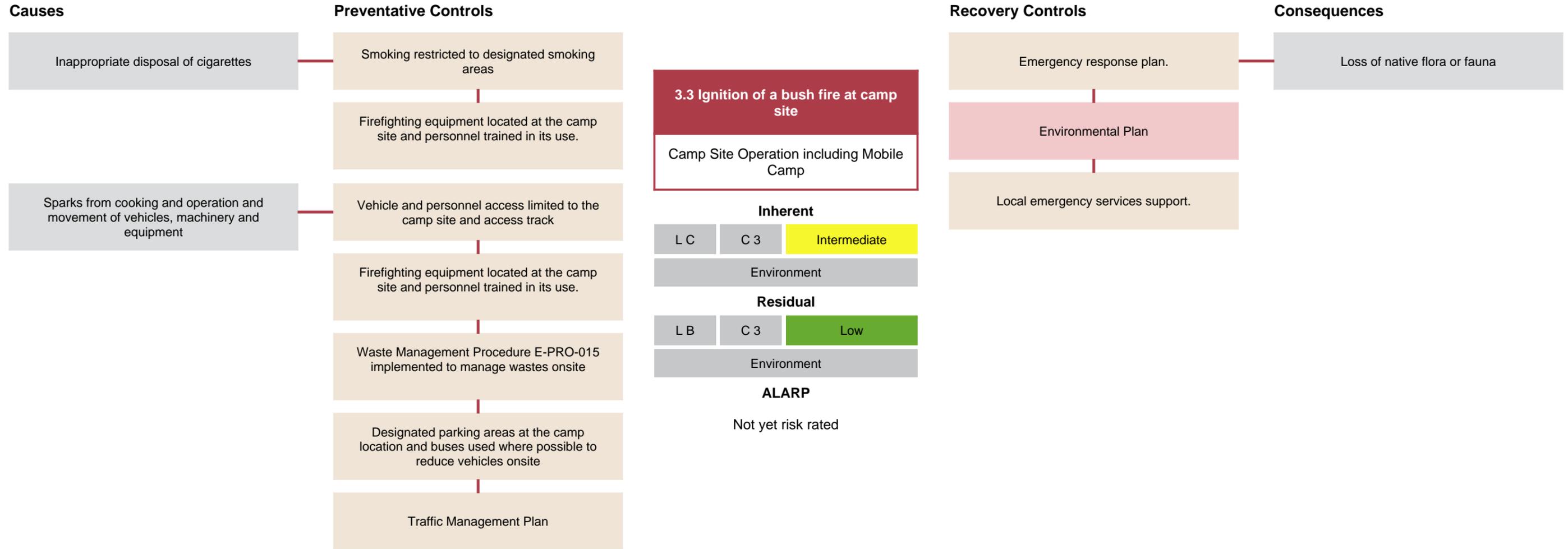
Causes

Preventative Controls

Recovery Controls

Consequences





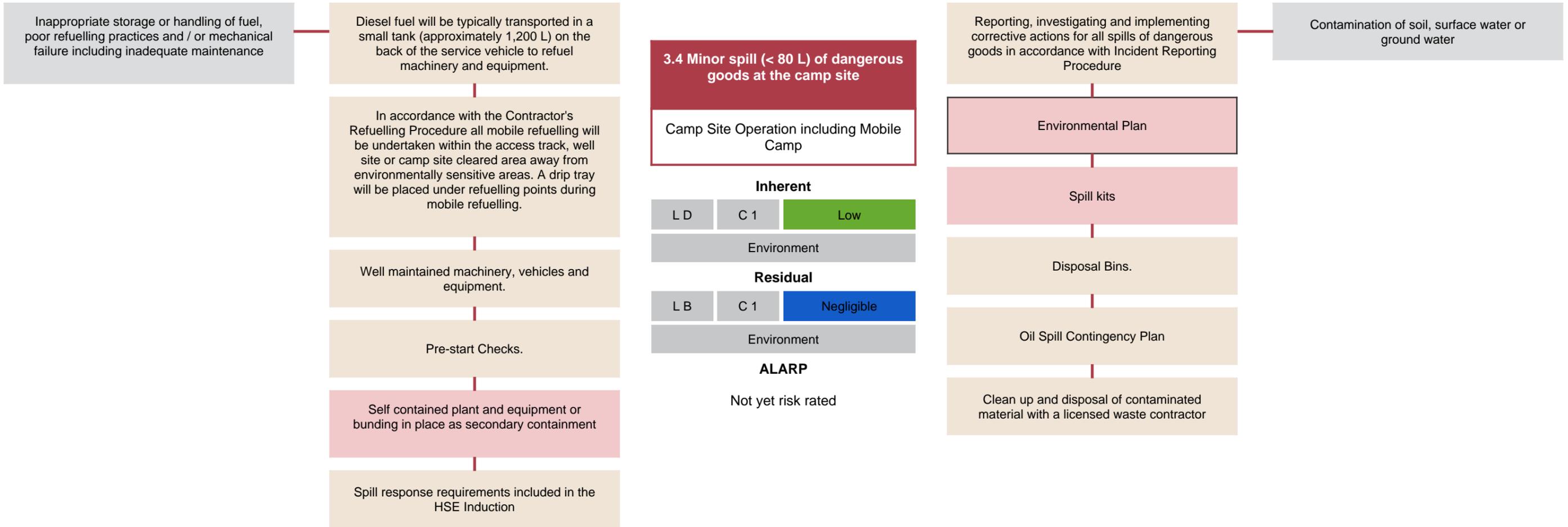
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



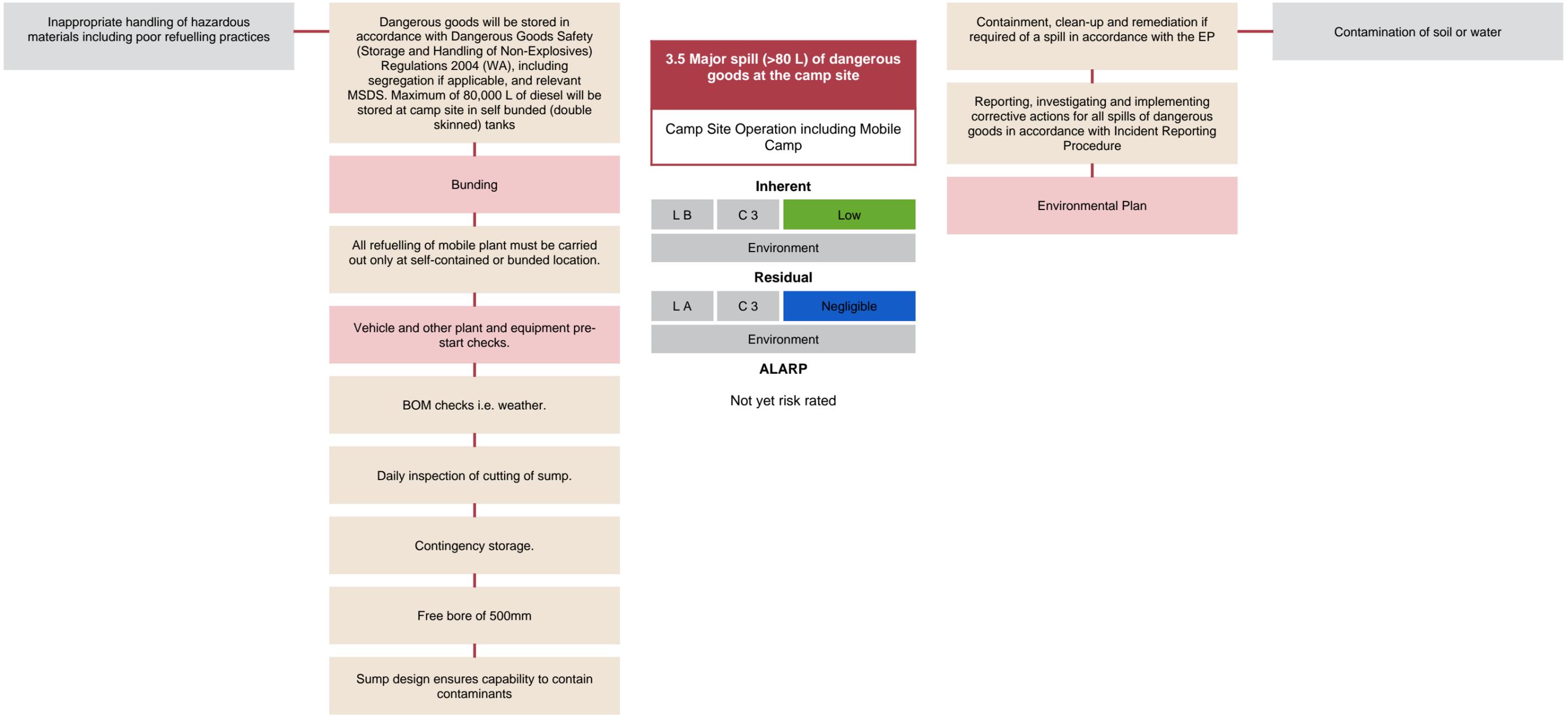
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Causes

Preventative Controls

Recovery Controls

Consequences



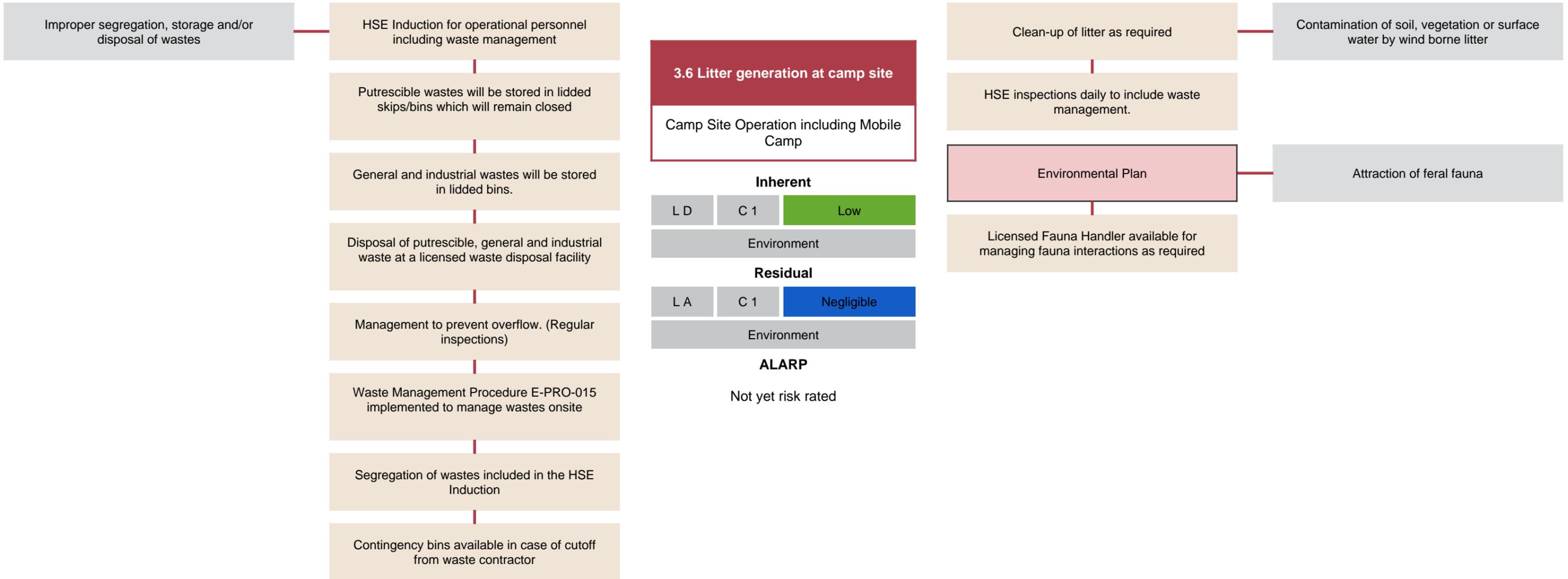
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Risk/Event Description
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In Place Control
Critical Control
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Causes

Preventative Controls

Recovery Controls

Consequences



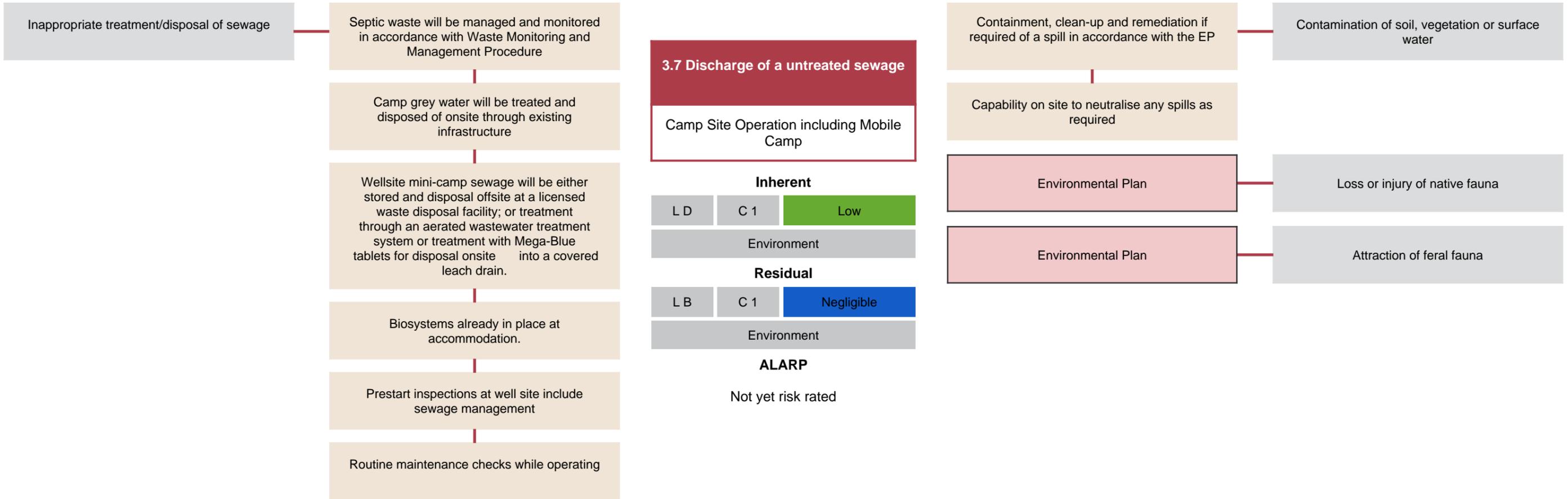
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



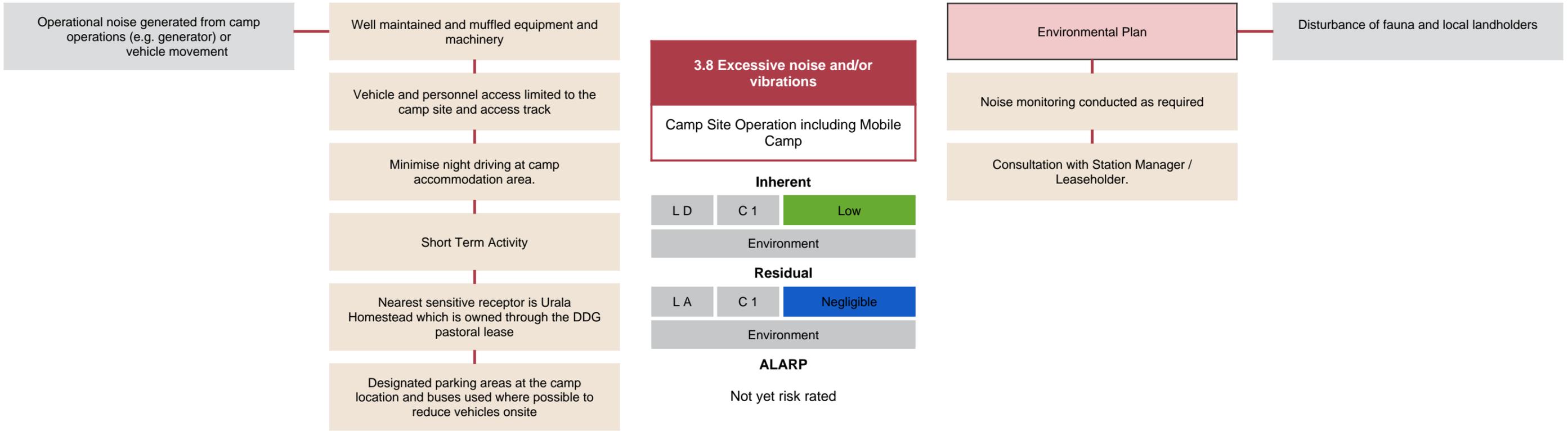
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



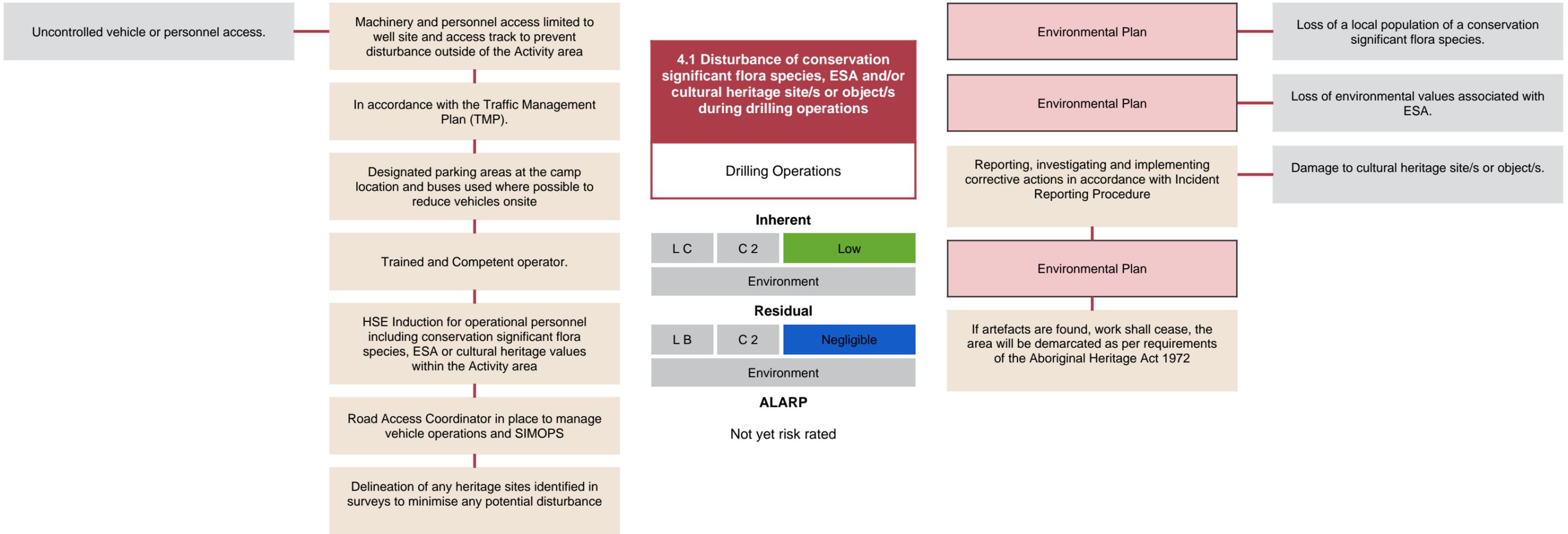
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



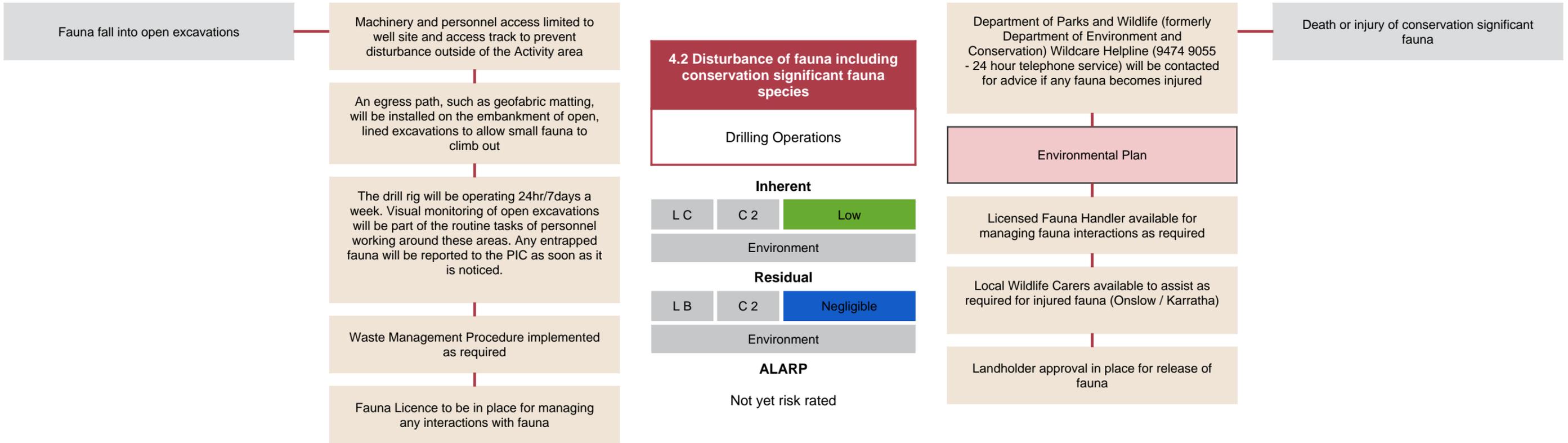
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Causes

Preventative Controls

Recovery Controls

Consequences



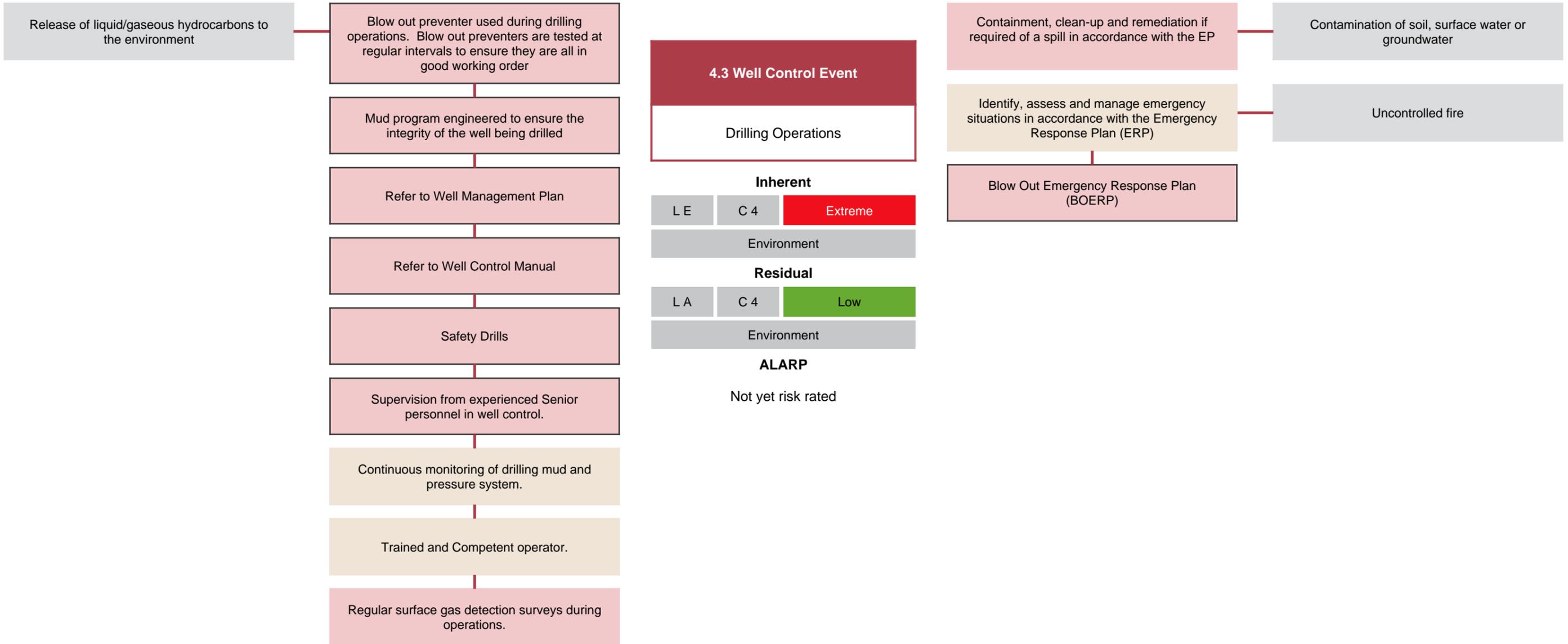
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Risk/Event Description
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In Place Control
Critical Control
Critical In Place Control

Causes

Preventative Controls

Recovery Controls

Consequences



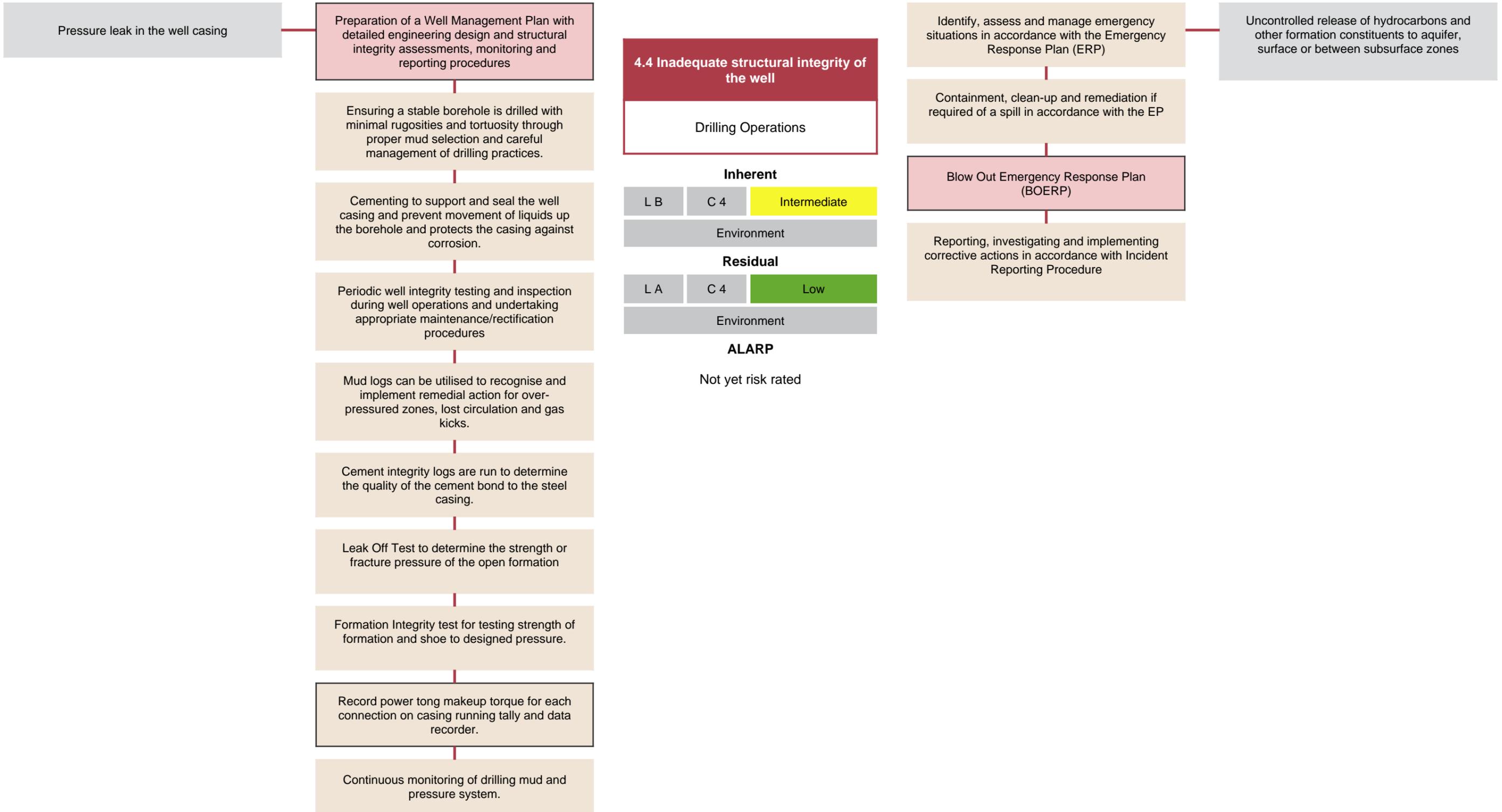
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Risk/Event Description
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In Place Control
Critical Control
Critical In Place Control

Causes

Preventative Controls

Recovery Controls

Consequences



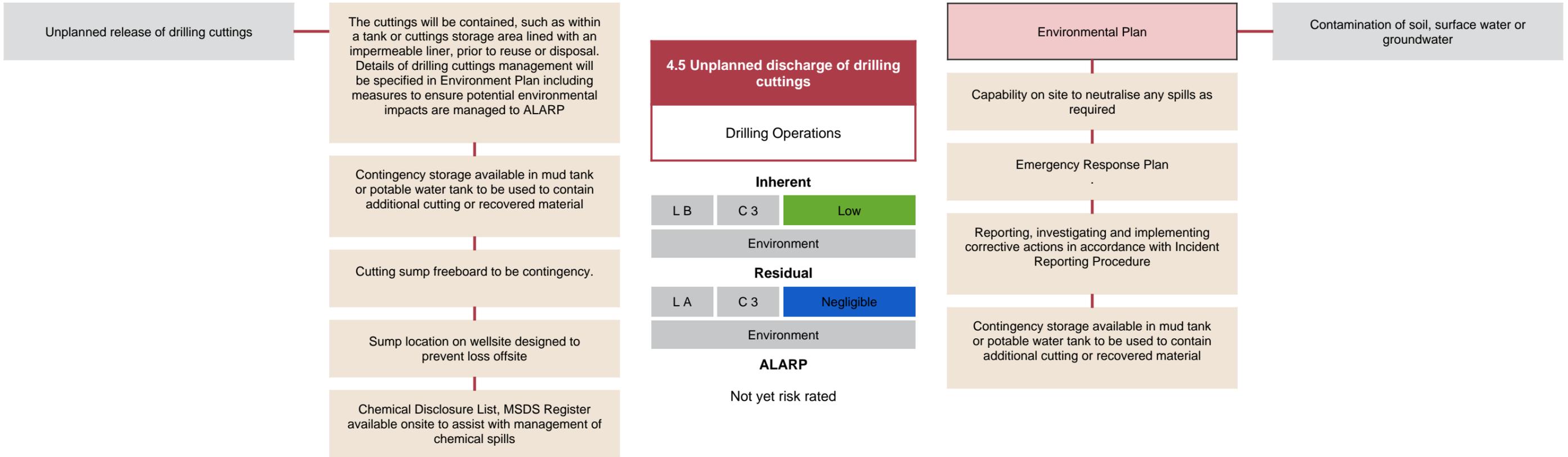
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Causes

Preventative Controls

Recovery Controls

Consequences



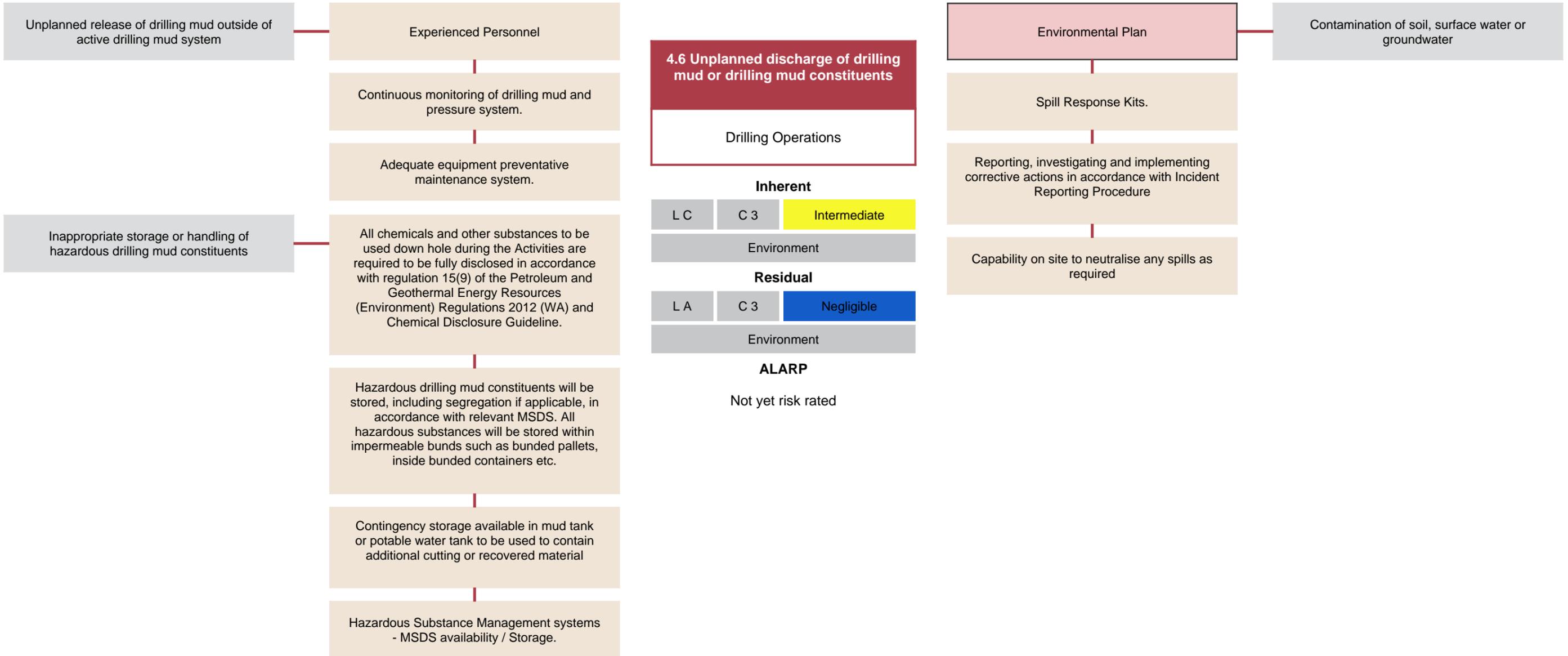
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Inappropriate storage or handling of fuel, poor refuelling practices and / or mechanical failure including inadequate maintenance

Preventative Controls

Dangerous goods will be stored in accordance with Dangerous Goods Safety (Storage and Handling of Non-Explosives) Regulations 2004 (WA), including segregation if applicable, and relevant MSDS. Maximum of 40,000 L of diesel will be stored at well site in self bunded (double skinned) tanks. Oil and lubricants will be stored in a bunded and covered area such as bunded pallet covered with a tarp

Vehicle and mobile equipment refuelling will be undertaken at designated refuelling areas in accordance with the approved contractor's Refuelling Procedure. The refuelling area will be located within an impermeable lined and bunded area. This Procedure provides specific requirements regarding refuelling operations including, but not limited to, the requirement for refuelling and fuel transfer operations to be manned at all times and spill kits located at the designated refuelling areas

Hazardous substances will be stored, including segregation if applicable, in accordance with relevant MSDS. All hazardous substances will be stored within impermeable bunds such as bunded pallets, inside bunded containers etc.

Well maintained machinery, vehicles and equipment.

All refuelling of mobile plant must be carried out only at self-contained or bunded location.

4.7 Minor spill (< 80 L) of dangerous goods or hazardous substance during drilling phase

Drilling Operations

Inherent

LD	C 1	Low
Environment		

Residual

LC	C 1	Negligible
Environment		

ALARP

Not yet risk rated

Recovery Controls

Reporting, investigating and implementing corrective actions for all spills of dangerous goods and hazardous substances in accordance with Incident Reporting Procedure

Environmental Plan

Containment, clean-up and remediation if required of a spill

Spill kits

Clean up and disposal of contaminated material with a licensed waste contractor

Consequences

Contamination of soil, surface water or ground water

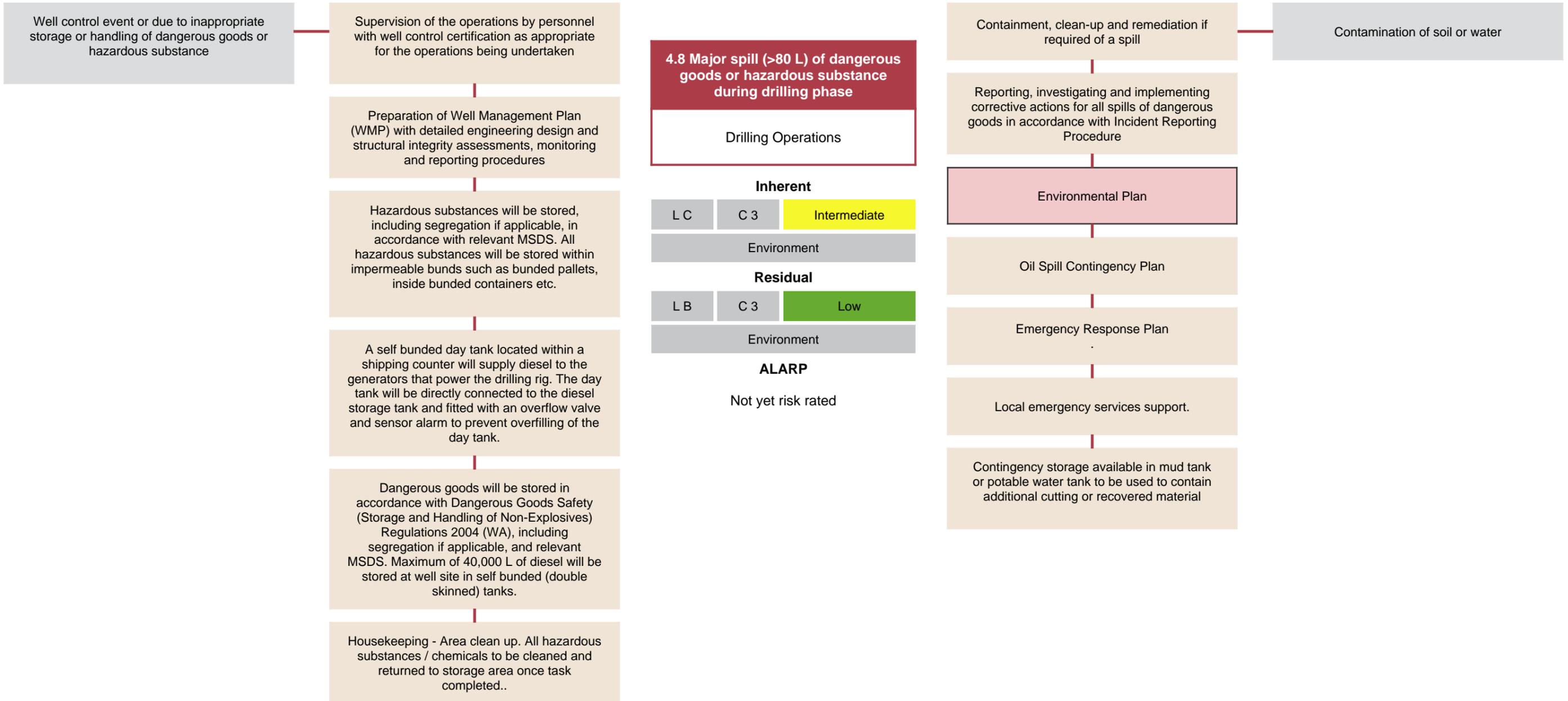


Causes

Preventative Controls

Recovery Controls

Consequences



4.8 Major spill (>80 L) of dangerous goods or hazardous substance during drilling phase

Drilling Operations

Inherent

LC	C 3	Intermediate
Environment		

Residual

LB	C 3	Low
Environment		

ALARP

Not yet risk rated

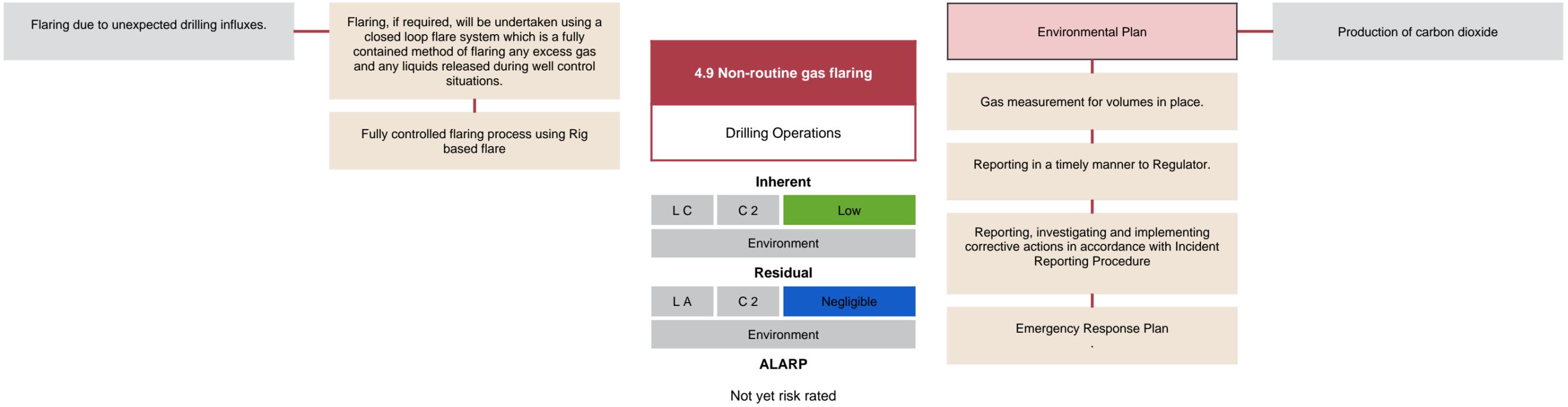
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



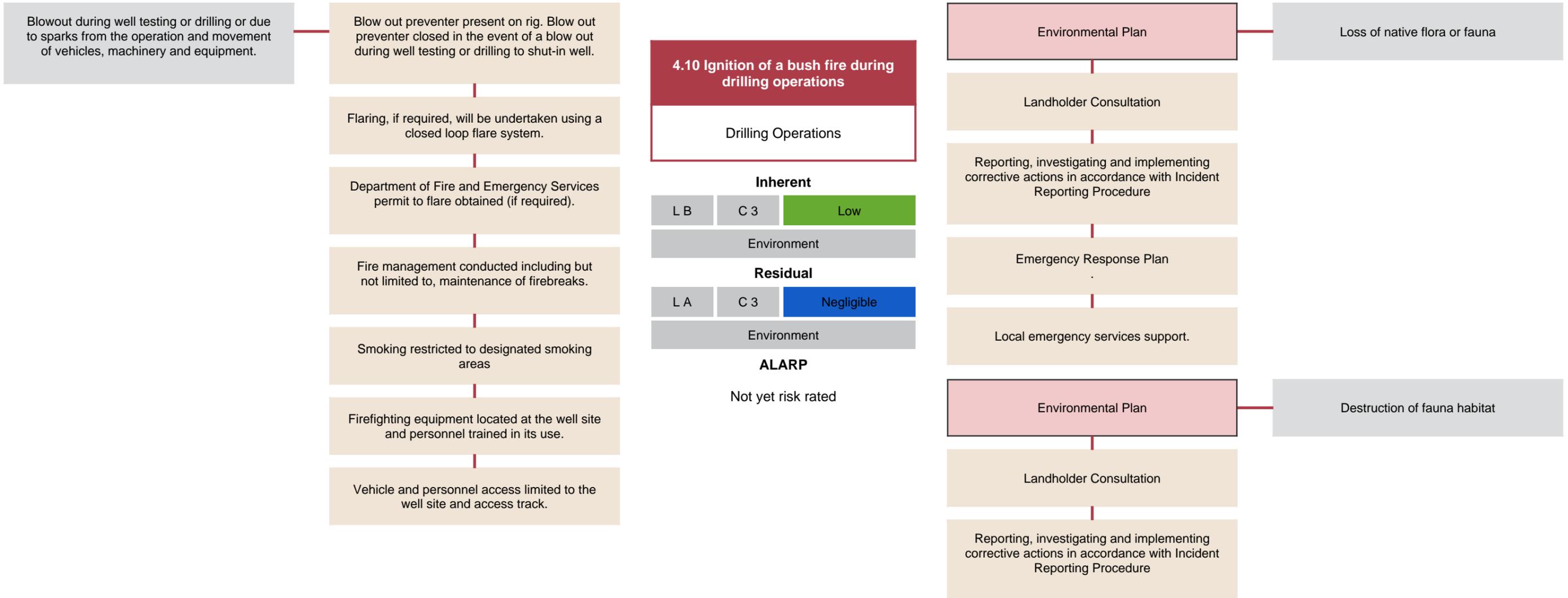
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



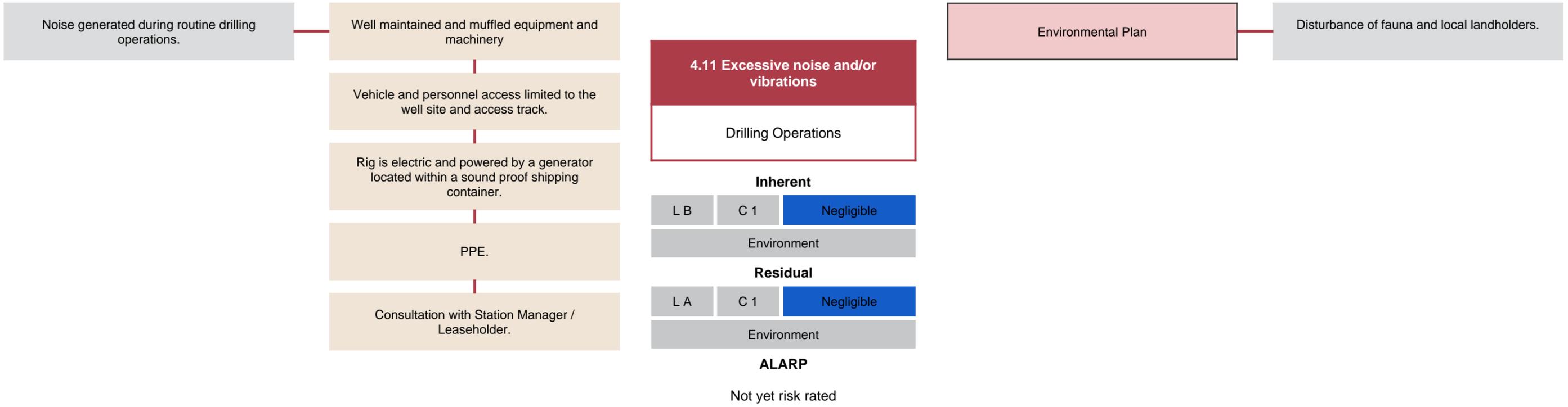
Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences



Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences

Facility lighting required for safety during 24 hour operations.

At the well site only the rig is lit. This is situated at the centre of the well pad and light levels from the perimeter of the well site are reported to be very low (ambient levels).

No lighting is required around the perimeter of the well site.

Orientation of rig lighting directed away from coast and Urala Homestead

4.12 Light Impacting Fauna
Drilling Operations

Inherent

LB	C 1	Negligible
Environment		

Residual

LA	C 1	Negligible
Environment		

ALARP

Not yet risk rated

Environmental Plan

Land holder consultation and management.

Disturbance of fauna and local landholders.



Causes

Preventative Controls

Recovery Controls

Consequences



4.13 Visual Amenity		
Drilling Operations		
Inherent		
LB	C 1	Negligible
Reputation		
Residual		
LA	C 1	Negligible
Environment		
ALARP		
Not yet risk rated		

Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Causes

Preventative Controls

Recovery Controls

Consequences

Unknown infrastructure.

Consultation with relevant utility authorities for identification of the locations of existing buried cables, lines, pipes, roads, water mains or other infrastructure will be undertaken prior to commencement of Activities.

ASW Services check prior to any installations.

Hand digging protocols within 1m any pipeline / flowline.

Landholder consultation re: - water pipelines and access track use.

4.14 Disturbance or damage to infrastructure and services
Drilling Operations

Inherent
L D C 1 Low
Environment

Residual
L B C 1 Negligible
Environment

ALARP
Not yet risk rated

Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure

Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure

STOP work for any marking tape.

Disruption of services to local residents

Damage to existing infrastructure

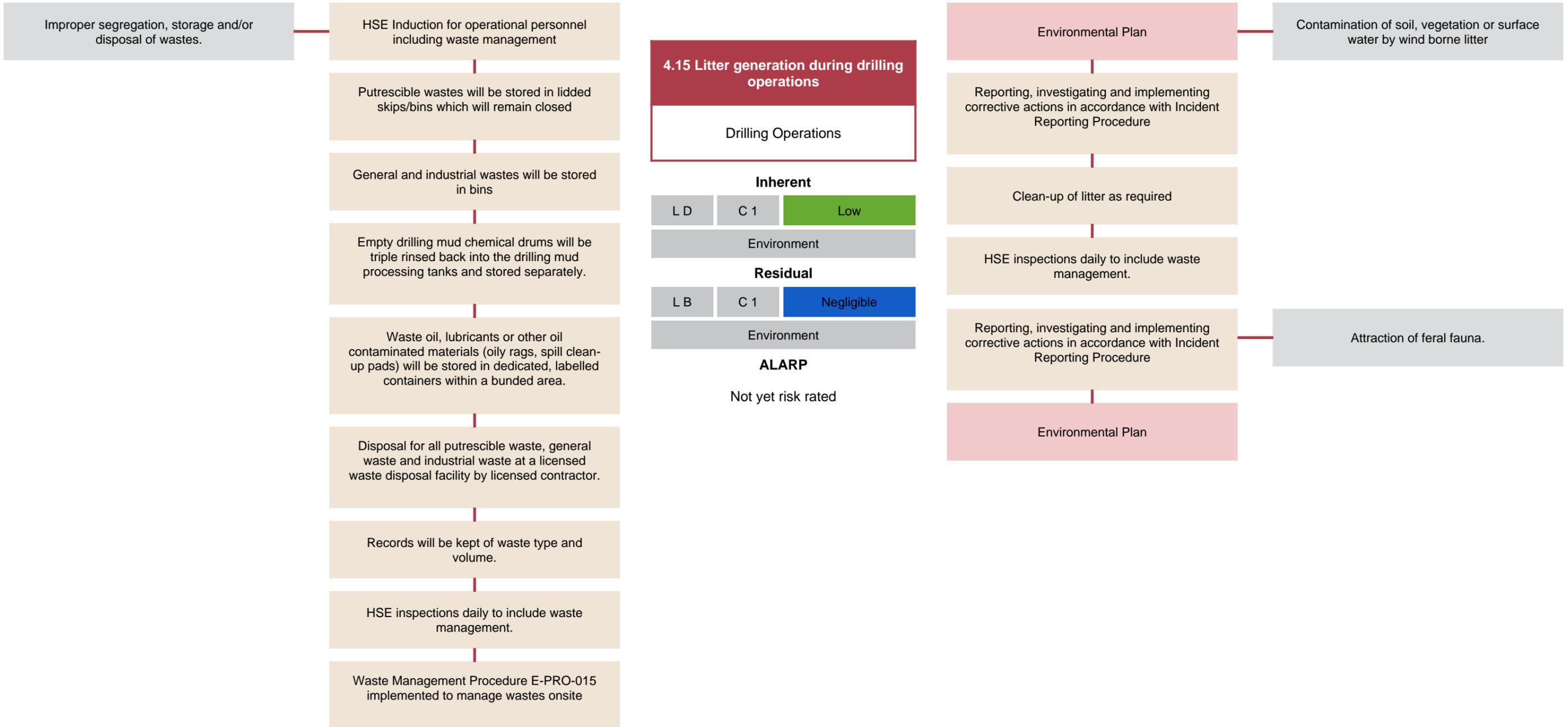


Causes

Preventative Controls

Recovery Controls

Consequences



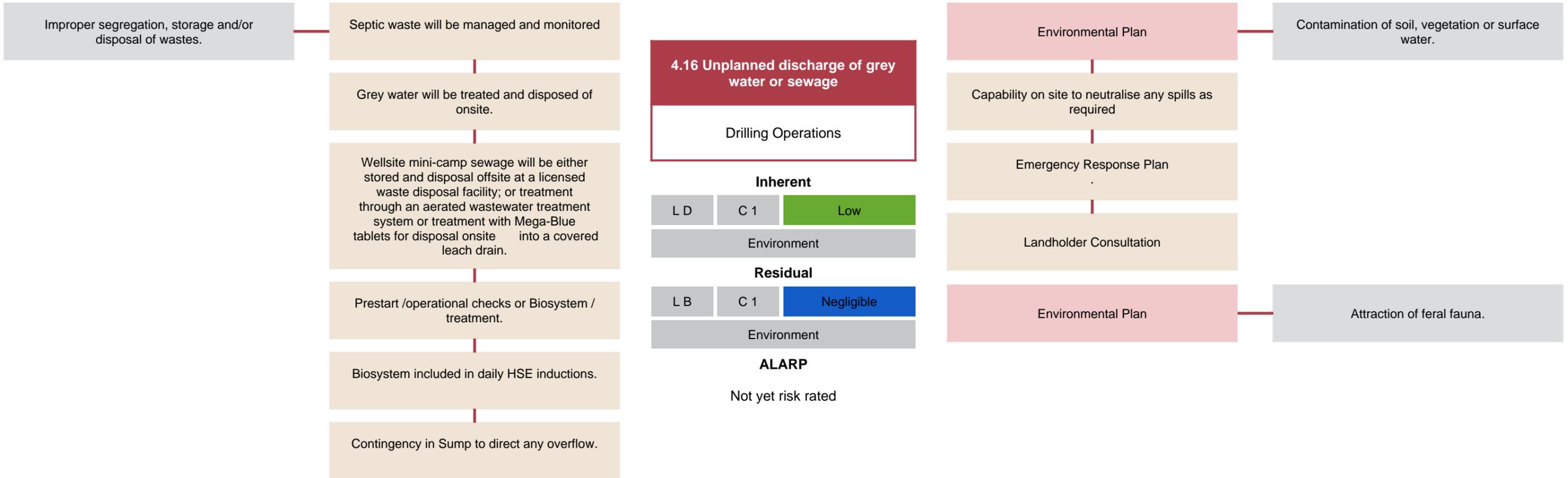
Risk/Event
Risk/Event Description
Not In Place Control
In Place Control
Critical Control
Critical In Place Control

Causes

Preventative Controls

Recovery Controls

Consequences



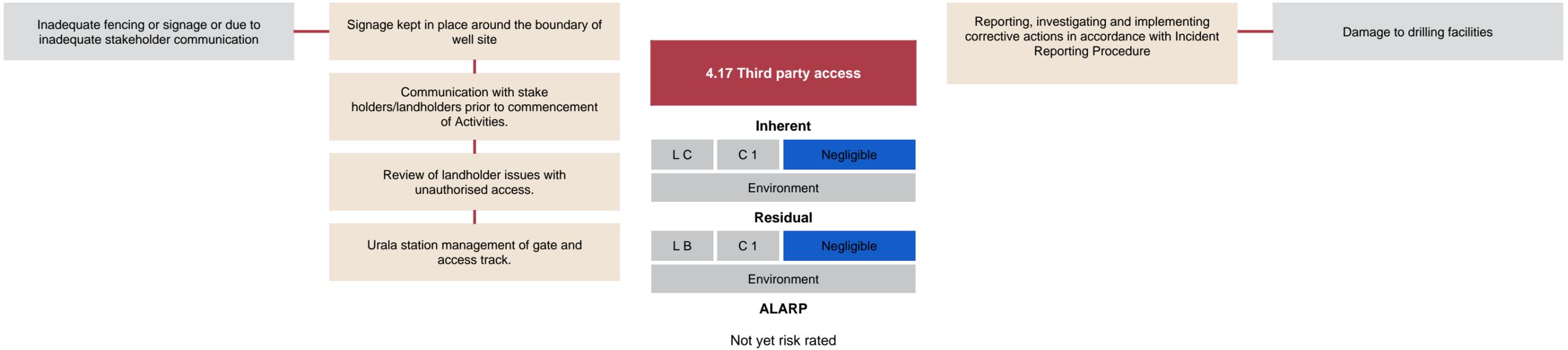
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Causes

Preventative Controls

Recovery Controls

Consequences



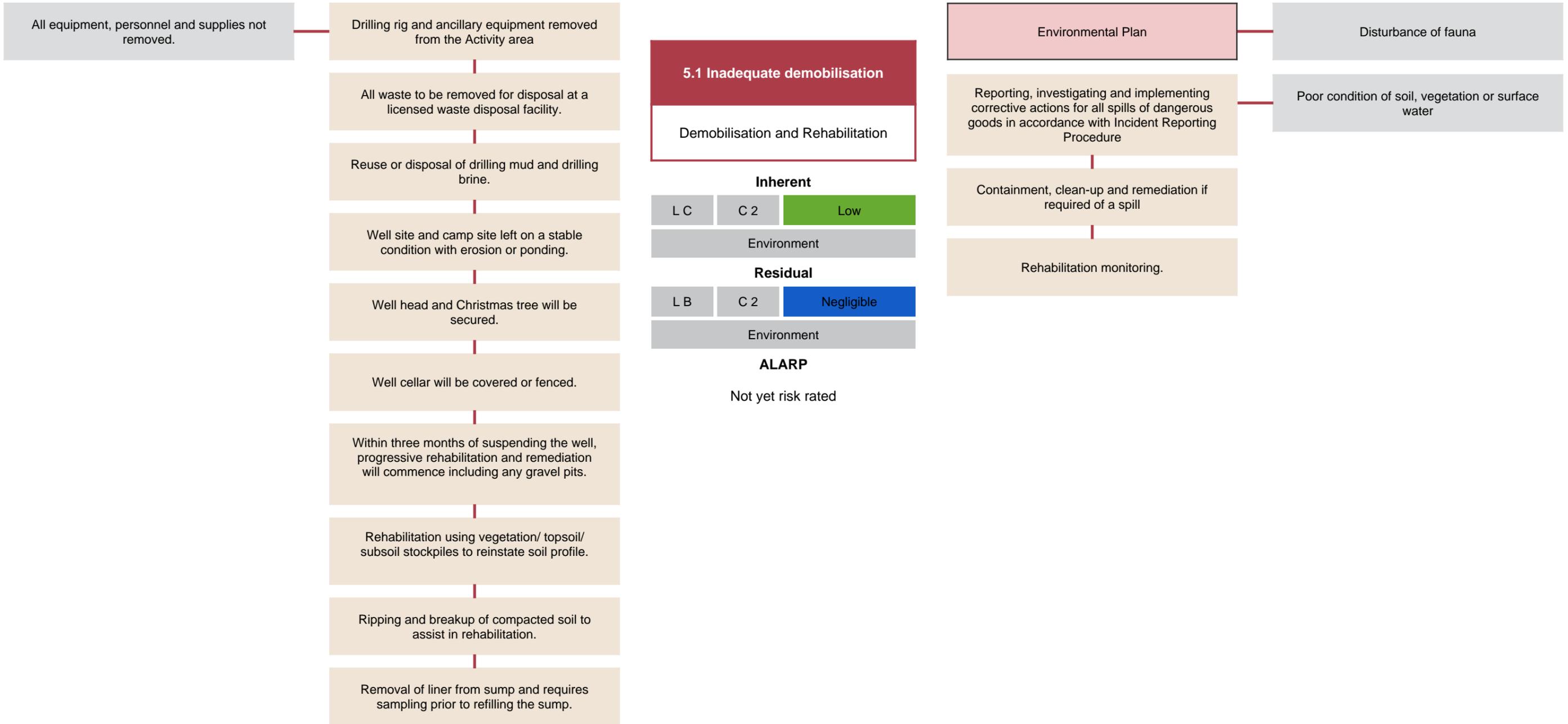
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Causes

Preventative Controls

Recovery Controls

Consequences



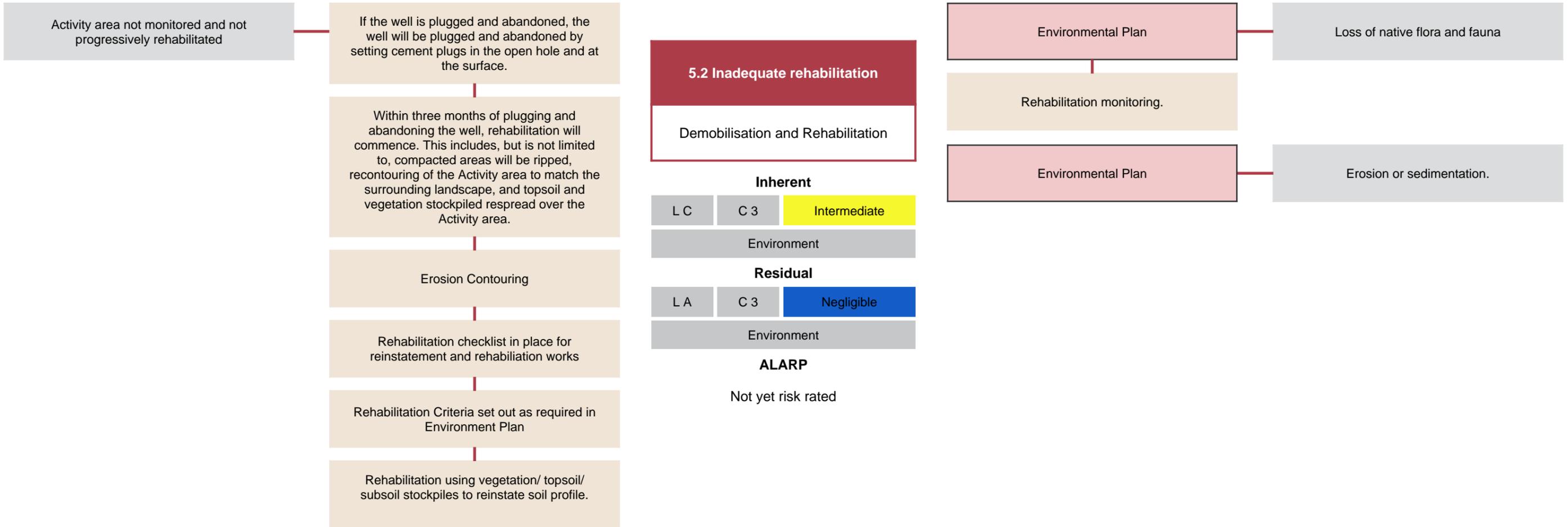
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Causes

Preventative Controls

Recovery Controls

Consequences



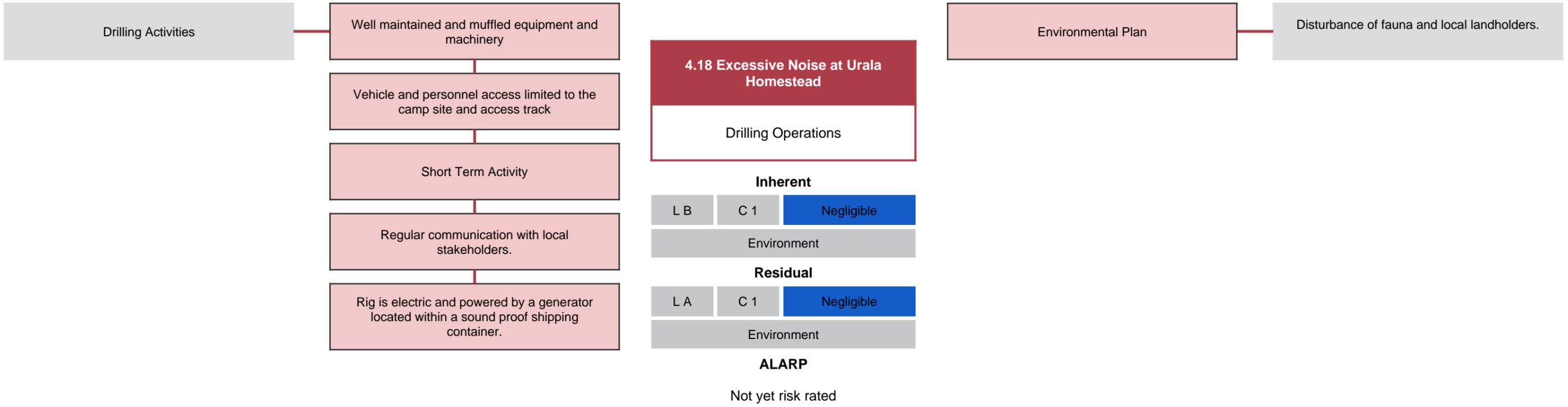
Risk/Event
Risk/Event Description
Not In Place Control
In Place Control
Critical Control
Critical In Place Control

Causes

Preventative Controls

Recovery Controls

Consequences



Risk/Event	Risk/Event Description	Not In Place Control	In Place Control	Critical Control	Critical In Place Control
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Appendix C Oil Spill Contingency Plan

ZERO HARM

Tubridgi Gas Storage Project Oil Spill Contingency Plan

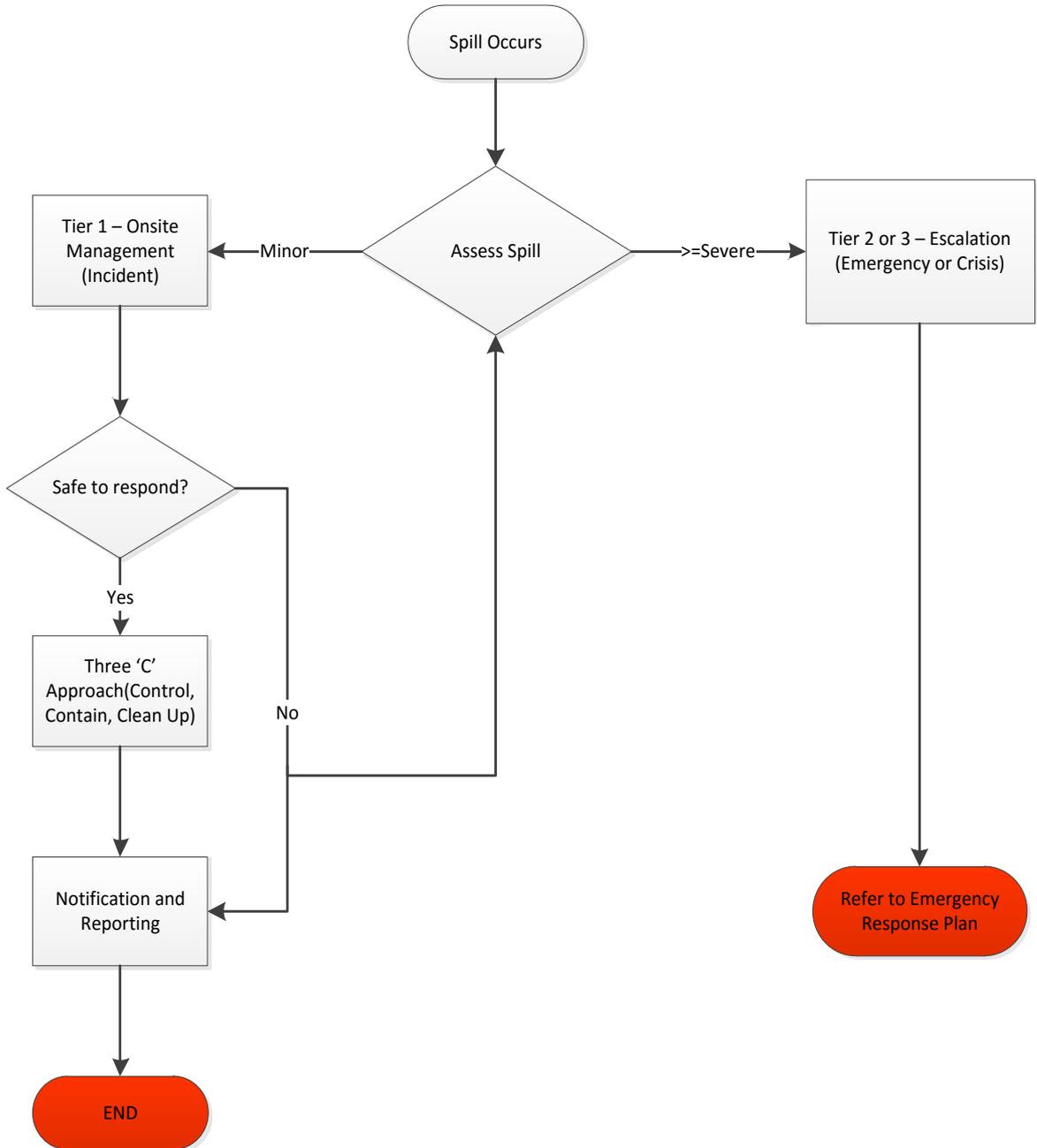
Rev #	Date	Prepared By	Reviewed By	Approved By	Description
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Spill Response – Immediate Response Process



PURPOSE

The purpose of the Tubridgi Gas Storage Project (TGS) Oil Spill Contingency Plan (OSCP) is to establish the roles, responsibilities and procedure required to be implemented in the event of a significant oil spill to the environment during operational activities at TGS. This will also link to the Ashburton West (ASW) Facilities OSCP included as part of the ASW Environment Plan.

BACKGROUND

DDGT Pty Ltd is the nominated operator of Production Licence 9 (L9) which consists of the Tubridgi Gas Field.

SCOPE

This procedure applies to all DDGT, DDG and contractor operations/activities occurring under the Tubridgi Gas Storage Project.

The scope of this procedure applies to all significant oil spills that impact the environment and occur during operation of ASW. A significant oil spill includes any loss of containment event in which greater than 500 L of oil is released (or 80 L if surface water is the receiving medium).

This procedure should be read in conjunction with the following key documents:

- Tubridgi Gas Storage Environment Plan (E-PLN-019)
 - Tubridgi Gas Storage Well Management Plan (TBC)
 - Ashburton West Asset Management Plan (ASW-501-0702-01);
 - DBP Maintenance Plan (TEB-001-0026-01); and
 - DBP Emergency Response Plan (TEB-003-0021-01).
 - DBP Hazardous Materials Storage and Handling Procedure (S-PRO-016)
-

RISK CHARACTERISATION

Key sources and locations of bulk oil storage and handling are discussed in Table 1 to identify the maximum credible spill scenario for each source.

It is noted that acknowledging the low relative risk associated with storage of minor volumes in locations with no proximity to any permanent surface water body, detailed oil spill modelling was not deemed warranted and has not been undertaken.

Table 1 Key sources and locations of bulk oil storage and handling

Source	Incident	Location	Oil	Volume
Bulk Storage Tank (2 x 20kL)	Leak from connections, liner	Well site location	Diesel	Approximately 40 kL
Bulk Storage Tank	Rupture	GEF / Drill Camp	Diesel	Approximately 35 kL / 50kl
Mobile Refuelling Truck	Rollover/collision	All	Diesel	Approximately 1.2 kL
Bulk fuel delivery	Rollover/collision	All	Diesel	Approximately 20 kL
Downhole chemicals	Uncontrolled chemicals lost downhole	Well (downhole)	Chemicals	<205L
Hydrocarbons in gas mixture	Uncontrolled containment of fluids at flare stack	Flare stack	Hydrocarbons	<10L
Water Pump	Spill to waterway	Ashburton River	Diesel	220L

The likelihood of the bulk storage tank at the GEF being ruptured is considered to be negligible on the grounds that the tank is double-skinned and stored in an area away from mobile plant movements. The bulk storage of 50kL at the Drill Camp are include as part of a self-contained skid. Vehicle movements shall not occur near the skid and daily checks will be in place to review the skid and identify any issues. A pre-mobilisation check, including pressure check of the vessel will take place prior to mobilisation to site.

The likelihood of the bulk storage tanks at the well sites leaking is low however this risk does exist and suitable controls will be implemented. This includes premobilisation inspections, daily inspections of connections and containment controls. Spill kit equipment is covered in the next section.

Two scenarios considered in this document is the potential roll-over or collision of a refuelling truck for either bulk fuel or mobile service utility. One is by a third party and one internal. This risk of collision internally is deemed to be low due the very low levels of traffic (project traffic only), traffic management plan and high visibility on the access tracks in the project area.

External deliveries shall include travel on Onslow Road, Twickham Rd and Old Onslow Road. These roads are inspected prior to authorisation of fuel truck travel for suitable condition. This also includes and river crossings or other issues.

Once on Twickham Road traffic concerns are minimal but fauna (mainly cattle concerns) continue. To reduce this risk all fuel related travel will only be in daylight hours and speed restrictions will be in place.

Potential for a spill to the Ashburton River is considered as a potential source. The water pump is self contained and secondary containment in terms of a plastic lined earth bund will also be used to prevent a spill to water. Risk of maximum spill is 220L so very low risk.

Downhole chemical management is through a raft of preventative controls including prior approval before chemical is on site, approval as a downhole chemical and management of onsite storage. As

these are stored in low volumes the potential for a large loss downhole is unlikely. Labelling and storage shall be addressed through the daily HSE Inspections and Weekly Environmental Inspections.

Data from previous wells constructed in the area demonstrate that the gas is low in condensate or liquid hydrocarbon composition. Therefore the risk of uncontrolled contamination at the temporary flare stacks is low. Produced water will be separated out from the gas prior to any flaring to prevent any potential loss at the flare stack.

EQUIPMENT

The Well Engineering Manager shall fit all bulk storage facilities, mobile refuelling trucks and hydraulic plant with spill response equipment that is appropriate for the effective management and clean-up of the likely material type and maximum volume spilled.

At a minimum this shall include:

- 12 (8cm x 3M) Absorbent Socks
- 180 (40 x 50cm) Absorbent Pads
- 4 (30 x 35cm) Absorbent Cushions
- 5 Disposal Sacks and Ties
- Minor PPE including chemical gloves
- Access to a shovel (either with spill kit or onsite)

Each spill kit shall have a dedicated Spill Kit Component List to detail the minimum equipment requirements within that kit. The spill kit shall also have basic instruction on the use of the spill equipment included.

Spill response equipment shall be stored within dedicated, labelled and mobile containers. Signage shall be installed to indicate the location of spill response equipment. Concise and specific instructions for use (typically provided by the manufacturer) should be stored with the equipment.

All personnel shall be responsible for ensuring replenishment of materials consumed. Additionally, the Well Engineering Manager shall be responsible for ensuring that housekeeping inspections are undertaken of all spill kits to ensure they contain all items identified on the Spill Kit Component List and are not damaged.

There is additional mechanical equipment (graders, dozers) available either through the station manager at Urala Homestead or through contractors at Onslow. These may be mobilised if a large level spill occurs.

TRAINING

All personnel shall be made of aware of the requirements of this OSCP through awareness training and induction to the project.

Personnel shall at a minimum be trained in the use of PPE that is supplied with the spill kits to ensure knowledge of and effective use.

Personnel shall undergo additional training as per role requirements. This may include dangerous goods handling or further developed incident response training.

Drills shall be held on the OSCP to ensure that this plan is tested and to build awareness of the process during the project. The OSCP shall be tested at least once during the project (40 days) and if ongoing then at a minimum once annually.

SAFETY

Personal safety must be continually assessed whilst undertaking any actions of spill response. Although prompt response is an important part of reducing potential contamination – personal safety is always the primary consideration.

In the event of a spill, the spilled material must be identified through consultation with the MSDS to assess the spill site for potential risks to personnel (either aware or unaware of the spill). These may include:

- Fire and explosion: *Identify and control any potential sources of ignition*
- Inhalation of fumes: *Try to enter the area from upwind and consider/beware of areas with limited ventilation*
- Skin irritation due to direct contact with the spilled material: *Source the correct PPE to prevent exposure to eyes and skin*
- Slips and trips due to altered surface conditions

Exclusion zones must be established and additional support requested to manage safety risks where necessary. Once the area has been deemed to be safe, the source of the spill must be controlled (turned off/closed/etc. if applicable), and the spread of the spill contained to prevent extensive contamination. Clean-up activities should only commence once control and containment measures are implemented and effective. See Section 8 for further procedural detail.

The situation must be continually monitored until resolved. Project risk management processes (e.g. Take 5 and JHA) should be used to address any new risks as they are identified.

SPILL CLASSIFICATION

Key parameters that determine spill classification include volume (actual spill and maximum possible spill), substance (i.e. diesel) and receiving environment (sealed, unsealed, surface water). All assessment assumptions must be qualified.

The location of the spill should be clearly understood, including distance to the closest Environmentally Sensitive Area and, in particular, proximity to the coast and potential for migration.

The Escalation section details the specific levels of response that would be activated dependant the classification of the spill.

COMMUNICATION AND COORDINATION

Once a significant spill is identified, it should be immediately reported in accordance with the Emergency Response Plan. Initial spill classification information should be communicated with any assumptions qualified for further follow up as required.

All Significant Incidents are to be reported immediately to the DDG Licensee's Representative (Well Site PIC), who will report to the DBP General Manager System Design and Operations (GM SDO) and the DBP Transportation Services Control Centre.

The GM SDO shall ensure all significant spills are communicated to the DMP verbally as soon as practicable and within 2 hrs of identification via the DMP 24 hr Emergency Reporting Line (0419 960 621).

All other key stakeholders (e.g. landowners) should be identified and notified as soon as practicable dependent upon the location and scale of the spill.

PROCEDURE

a. Control

Identify the source of the spill. If safe to do so, control the spill directly at the source to stop further ongoing release of the material. Appropriate spill control measures shall vary on a case by case basis (dependent upon the source) but may involve closing a valve, isolating a pump or temporarily plugging the point of rupture.

b. Contain

Spill containment should be undertaken to surround the spill and prevent further migration. Additionally, containment barriers should be established around areas of environmental significance such as drains or waterways to provide a second layer of protection.

For spills on hard stand areas, use absorbent booms to encapsulate the spill, ensuring that boom joins are overlapping to create a continuous barricade. Cable ties may be used where necessary to fix joins in place. Alternatively, establish an earthen bund around the spill to mitigate lateral migration.

Truck rollovers may require external assistance, dependant on location or earthmoving equipment shall be required for larger containment controls such as earth bunds and to protect waterways.

c. Clean Up

Once spilled material has been contained and the threat of environmental harm minimised, the contaminated material shall be removed for secure storage and offsite disposal by a licenced contractor. Recovery methods of free liquid may include:

- Absorbent pads to soak up large pools of spilled material on hardstand areas and surface layers on ponded material.
- Pumps installed at the low point in any spill containment area
- Mixing with particulate (such as Global Peat) to absorb residual liquid

Collection of contaminated material shall be within dedicated impermeable containers such as storage drums.

If storage tanks on site lose containment capability or a large spill occurs then the same three C process would be utilised just on a larger scale and with escalation as required in terms of the Tier Level of the Spill. .

A licenced contractor with a vacuum truck to excavate all contaminated material may be required. Additional equipment shall be used by the site Incident Controller to control and contain the spill. This includes earthmoving equipment (for earthen bunds) and licensed waste controllers. All contaminated soils shall be removed to prevent further contamination or movement through soil.

All residual soils shall be sampled and analysed for total residual hydrocarbons to validate the retention of uncontaminated material only. If a substance other than hydrocarbons is known to have been involved in the spill, sampling range shall increase to ensure additional parameters are analysed and tested for.

All contaminated material shall be disposed of by a licenced contractor in accordance with the Waste Management Procedure (E-PRO-015). If soil is contaminated with a chemical other than hydrocarbons this shall be managed with the licensed contractor to ensure that it is disposed of at a licensed waste facility able to receive the contaminated material.

Dependent upon the scale or duration of the clean-up effort, temporary fencing should be considered to prevent public and wildlife inadvertently accessing the area and becoming exposed to health risks.

OFFSITE RESPONSE

In the event of a spill during road transport or offsite during transit DDGT would work with the Transport Contractor in terms of containment and recovery of material in a rollover scenario.

Minor spills would be able to be managed by the operator but larger spills that require greater response are included below.

In response to a rollover this would include engaging emergency services such as DFES and SES to assist with containment and additional transport requirements would be mobilised to assist with the containment and recovery of any materials. This would include equipment such as sucker / vacuum trucks, additional storage trucks, waste disposal trucks (licensed and approved) and other equipment as required.

Containment of a spill would be down to the incident controller (third party if offsite or emergency services involved). However identification of environmentally sensitive receptors and protection of these areas would be of early consideration and priority of protection.

If additional concerns or equipment is required eg earthmoving equipment, this could be mobilised from site or through the civils contractor depending on location.

ESCALATION

In linking with the Emergency Response Plan (ERP), spill volumes, potential impacts and environmental sensitive receptors all play a part in terms of escalation.

A spill can be escalated at any stage by the PIC or Rig Manager that would look at activation of the Emergency Response Plan and required notifications.

Escalation would be dependant against specific levels of response

Level 1 Emergency

A Level 1 Emergency as an incident or event which occurs at a site or in relation to campaign operations and is controlled and managed at the wellsite. This includes Incidents which do not result in an emergency situation arising.

For Level 1 Emergencies a detailed incident report will be generated and where appropriate an incident investigation team will conduct a detailed investigation. The requirement for investigation is determined by the severity of the incident or event.

Level 2 Emergency

A Level 2 Emergency is an event which has occurred at site or in relation to campaign operations and may require external assistance to manage, control or contain. Response to a Level 2 Emergency will be coordinated by the DDG Emergency Management Team with support from the well-site and T7 Emergency Response Team and on completion of the response a detailed investigation will be undertaken.

Level 3 Emergency

A Level 3 Emergency is an event which has occurred at site which has the potential to escalate to a point of serious impact to DDG and/or T7 business continuity. Response to an emergency which escalates to Level 3 or has the potential to do so will be coordinated by the DDG Crisis Management Team with support from the DDG and T7 EMTs and the wellsite.

REVIEW

Implementation of this Spill Response Procedure should be tested (**spill drill**) within the first 4 weeks of bulk fuel storage on site. Additionally, testing shall be conducted should the document be amended and at a minimum once annually. Such testing shall include the execution of drills to ensure adequacy, applicability and capability to respond to the likely maximum spill scenario. Testing of the TGS OSCP shall be the responsibility of the Well Engineering Manager.

This document shall be updated to reflect any necessary corrections identified through such testing and review.

OVERVIEW

- 1) Is the spill significant? (i.e. greater than 500 L to land or 80 L to surface water)
- 2) Emergency Response Plan enacted – DMP Alerted Emergency response co-ordinator to qualify key parameters including volume, medium and receiving environment
- 3) Emergency response co-ordinator to mobilise resources necessary to respond to spill (contain the spill and clean up impacted material)
- 4) Emergency response co-ordinator to investigate cause of spill
- 5) Environmental Advisor to investigate suitability of site clean-up and requirement for remediation works

RESPONSIBILITIES

Role	Responsibilities
All Personnel	<ul style="list-style-type: none"> • Identify and respond to oil spills as required • Familiarity with escalation and notification procedures as set out in this plan and the emergency response plane
DBP General Manager Maintenance	<ul style="list-style-type: none"> • Act as Incident Controller • Ensure resources are made available to assist in response to spills
DDG Well PIC	<ul style="list-style-type: none"> • Act as Onsite Incident Controller • Support the enactment of the Emergency Response Plan in the provision of resources to respond to significant oils spills as necessary • Ensure implementation and adherence to DDG Emergency Response protocols as required • Notify the DBP General Manager System Design and Operations
DBP General Manager System Design and Operations	<ul style="list-style-type: none"> • Ensure regulatory notification as required • Act as Incident Commander
Transportation Services Control Centre (TSCC or Gas Control)	<ul style="list-style-type: none"> • Coordinate emergency notification process • Activate Emergency or Crisis Management Team as required • Manage gas systems as required

CONTACT DIRECTORY

Notification	Whom	Contact Details
Gas Control	TSCC	1800 019 919 in emergency
DMP	Petroleum Division / Environment	Petroleum.environment@dmp.wa.gov.au Or online submission
DER	Pollution Hotline	DER Pollution Hotline 1300 784 782
Local Council	Shire of Ashburton	9184 6001 After hours 0408 086 789
DFES	Onslow Volunteer Emergency Service	000 in emergency 08 9184 6555
SES	Emergency number	132 500 in emergency
Police	Onslow Station	000 in emergency Onslow 08 9159 9100
Airport	Onslow Airport	9153 2000 A/H 0487 654 272

Appendix D Mattiske Consulting Level 1 Flora Survey 2016

LEVEL 1 FLORA AND VEGETATION SURVEY
OF THE TUBRIDGI
GAS WELLS SURVEY AREA

Prepared for

DBP

Prepared by

Mattiske Consulting Pty Ltd

May 2016

DBP1606/14/2016



Mattiske Consulting Pty Ltd

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1. SUMMARY

Mattiske Consulting Pty Ltd was commissioned in May 2016 by DBP to undertake a Level 1 flora and vegetation survey of three proposed drill pads and associated access tracks located within the Tubridgi Gas Wells survey area, Figure 1. A total of seven sites were surveyed within the three drill pad buffer areas.

A total of 46 vascular plant taxa representative of 41 plant genera and 21 plant families were recorded within the survey area. The majority of the taxa recorded were representative of the Fabaceae (12 taxa), Poaceae (8 taxa) and Chenopodiaceae (3 taxa) families.

No Declared Threatened or Priority Flora species were recorded within the survey area.

No Threatened or Priority Ecological Communities were recorded or inferred to occur within the survey area.

No taxa recorded within the survey represented range extensions from current known locations.

A total of three introduced (exotic) taxa were recorded within the survey area. Of these, one taxon, **Prosopis pallida* is a Declared Plant species pursuant to section 37 of the *Agriculture and Related Resources Protection Act (1976)*. One plant was recorded within the TGS Injector 3 buffer zone.

To improve mapping reliability and continuity, current data were compared and contrasted with previous flora and vegetation studies undertaken in the local area. Subsequently, four vegetation communities were delineated within the survey area. TGS Injector 1 buffer comprised *Tecticornia* spp. low sparse shrubland with mixed perennial tussock grasses on clay pans (C2 community). TGS Injector 2 buffer comprised tall sparse shrubs including *Grevillea stenobotrya* over mixed low shrubs including *Acacia stellaticeps* over *Triodia epactia* hummock grassland (ID1 community). TGS Injector 3 buffer zone comprised two communities with low natural relief dominated by sparse *Acacia* spp. shrubs over *Triodia epactia* hummock grassland, and low-lying areas dominated by *Eucalyptus victrix* low open woodland over sparse *Acacia* spp. shrubs over mixed perennial tussock grasses (community IF4).

Vegetation within the survey area was generally in excellent condition. Below average rainfall in months preceding the survey resulted in the absence of annual species and poor condition of perennial grasses and herbs, however, native vegetation structure persisted. Weed densities and cattle grazing were not recorded at levels high enough to appreciably reduce vegetation condition.

For the purposes of a Level 1 flora and vegetation survey, more than adequate data was collected to define and assess the presence, extent and significance of vegetation communities within the survey area. Recorded taxa were widespread throughout the region and delineated vegetation communities were common and widespread throughout the local area. Percentage impact to pre-European vegetation associations and Rangeland Land Systems was low.



Tubridgi Gas Wells
 Project Area



0 4km
 Scale 1:250,000
 MGA94 (Zone 50)
 CAD Ref: g2215_DBP_f01.dgn
 Date: June 2016 Rev: A A4

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**Tubridgi Gas Wells
Locality**

Figure:

1

2. INTRODUCTION

Mattiske Consulting Pty Ltd was commissioned in May 2016 by DBP to undertake a Level 1 flora and vegetation survey of three proposed drill pads and their associated access tracks; these three areas will henceforth be collectively referred to as the Tubridgi Gas Wells survey area.

2.1 Location and Scope of Proposal

The Tubridgi Gas Wells survey area is located just to the south of the Urala Station Homestead and approximately 3 km north-west of the Tubridgi Gas Processing Plant (Figure 1).

The survey area lies in the Carnarvon Botanical District region of the Eremaean Botanical Province (Beard, 1990). More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographic Regionalisation for Australia (IBRA), with the project area situated within the Carnarvon Bioregion and Cape Range subregion (Department of Environment, 2016c).

The aim of the current survey was to define botanical values present within three proposed drill pads and associated access tracks. A buffer was placed around each proposed drill pad and then extended out to the nearest existing track. Buffer areas were as follows: TGS1 = 19.271 ha, TGS2 = 26.298 ha and TGS3 = 42.677. Therefore, it is recognised that mapped extents exceed what would actually be impacted by clearing associated with the establishment of drill pads and access tracks.

2.2 Climate

Climate of the survey area is typically sub-tropical with rainfall ranging from 250 – 300 mm per annum along the coastal plain. Rainfall is highly variable, although there is a pronounced summer peak associated with north-west monsoons. Tropical cyclones typically occur between January and March which can result in the average annual rainfall being exceeded in one event (Payne and Tille, 1992).

The Onslow Airport recording station provided the nearest and most complete climatic data for the survey area. Rainfall was well below average in both the short and long-term period preceding the field survey. Below average rainfall has been indicative of the broader Pilbara coastal region, naturally resulting in unfavourable conditions for annual species.

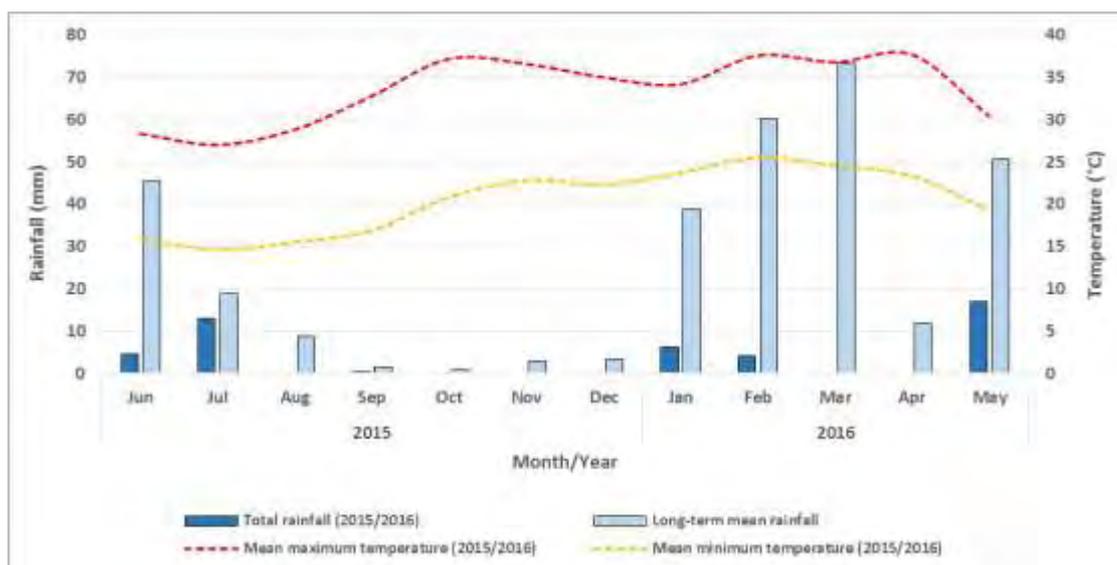


Figure 2: Rainfall and temperature data for the Onslow Airport recording station. Long-term mean rainfall (1940 - 2016) and monthly total rainfall and mean maximum and minimum temperature data for the year preceding the current field survey (Bureau of Meteorology, 2016).

2.3 Western Australia's Flora – A Legislative Perspective

The legislative protection of flora within Western Australia is principally governed by three Acts. These are:

- The *Wildlife Conservation Act 1950*;
- The *Environmental Protection Act 1986*; and
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The unique flora of Western Australia is potentially under threat due to historical clearing practices associated with agricultural, mining and human habitation activities. As a consequence of these historical clearing practices a number of flora species have become threatened or have the potential to become threatened as their habitat is impacted by human activity. In addition, some areas of the State have been affected by past clearing practices such that entire ecological communities are under threat. The following sections describe these threatened and priority flora and ecological communities, and outline the legislative protection afforded to them.

At the State level, the *Wildlife Conservation Act 1950* provides for taxa of native flora (and fauna) to be specially protected because they are subject to identifiable threats. Protection of these taxa has been identified as being warranted because they may become extinct, are threatened, or are otherwise in need of special protection. Ecological communities that are deemed to be threatened are afforded protection under the *Environmental Protection Act 1986*. Listings of threatened species and communities are reviewed annually by the Western Australian Threatened Species Scientific Committee (TSSC), which is a body appointed by the Minister for the Environment and supported by the Department of Parks and Wildlife. The TSSC reviews threatened and specially protected flora (and fauna) listings on an annual basis. Recommendation for additions or deletions to the listings of specially protected flora (and fauna) is made to the Minister for the Environment by the TSSC, via the Director General of the Department of Parks and Wildlife, and the WA Conservation Commission. Under Schedule 1 of the *Wildlife Conservation Act 1950*, the Minister for the Environment may declare a class or description of flora to be threatened flora throughout the State, by notice published in the *Government Gazette* (Department of Parks and Wildlife 2016c).

At the Commonwealth level, under the *Environment Protection and Biodiversity Conservation Act 1999*, a nomination process exists, to list a threatened species or ecological community. Additions or deletions to the lists of threatened species and communities are made by the Minister for the Environment, on advice from the Federal Threatened Species Scientific Committee. *Environment Protection and Biodiversity Conservation Act 1999* lists of threatened flora and ecological communities are published on the Department of the Environment website (2016a; 2016b).

2.3.1 Threatened and Priority Flora

Flora within Western Australia that is considered to be under threat may be classed as either threatened flora or priority flora. Where flora has been gazetted as threatened flora under the *Wildlife Conservation Act 1950*, it is an offence "to take" such flora without the written consent of the Minister. The *Wildlife Conservation Act 1950* states that "to take" flora includes to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means.

Priority flora constitute species which are considered to be under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Such species are considered to potentially be under threat, but do not have legislative protection afforded under the *Wildlife Conservation Act 1950*. The Department of Parks and Wildlife categorises priority flora according to their conservation priority, using four categories, P1 to P4, to denote the conservation priority status of such species, with P1 listed species being the most threatened, and P4 the least (Department of Parks and Wildlife 2016b). Priority flora species are regularly reviewed, and may have their priority status changed when more information on the species becomes available. Appendix A1 sets out definitions of both threatened and priority flora.

At the Commonwealth level, under the *Environment Protection and Biodiversity Conservation Act 1999*, threatened species can be listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent, by the Commonwealth Minister for the Environment. Refer to Appendix A2 for a description of each of these categories of threatened species. Under the *Environment Protection and Biodiversity Conservation Act 1999*, a person must not take an action that has or will have

a significant impact on a listed threatened species without approval from the Commonwealth Minister for the Environment, unless those actions are not prohibited under the Act.

The current *Environment Protection and Biodiversity Conservation Act 1999* list of threatened flora may be found on the Department of the Environment (2016a) website.

2.3.2 Threatened and Priority Ecological Communities

An ecological community is defined as a naturally occurring biological assemblage that occurs in a particular type of habitat composed of specific abiotic and biotic factors. At the State level, ecological communities may be considered as threatened once they have been identified as such by the Western Australian Threatened Ecological Communities Scientific Advisory Committee. A threatened ecological community (TEC) is defined, under the *Environmental Protection Act 1986*, as an ecological community listed, designated or declared under a written law or a law of the Commonwealth as threatened, endangered or vulnerable. There are four State categories of TECs: presumed totally destroyed (PD); critically endangered (CR); endangered (EN); and vulnerable (VU) (Department of Environment and Conservation 2010). A description of each of these categories of TECs is presented in Appendix A3. Gazetted TECs are listed by the Department of Parks and Wildlife (2016c).

At the Commonwealth level, some Western Australian TECs are listed as threatened, under the *Environment Protection and Biodiversity Conservation Act 1999*. Under this Act, a person must not take an action that has or will have a significant impact on a listed TEC without approval from the Commonwealth Minister for the Environment, unless those actions are not prohibited under the Act. A description of each of these categories of TECs is presented in Appendix A4. The current *Environment Protection and Biodiversity Conservation Act 1999* list of TECs can be located on the Department of the Environment (2016b) website.

Ecological communities identified as potentially threatened, but not listed as TECs can be classified as priority ecological communities (PECs). While PECs are considered threatened, insufficient data prevents a thorough evaluation of their conservation status. Therefore, PECs are categorised according to their conservation priority, using five categories, P1 to P5, with P1 being the most threatened and P5 the least (Department of Environment and Conservation 2010). Appendix A5 sets out definitions of PECs. A list of the current PECs can be viewed at the Department of Parks and Wildlife (2016e) website.

2.3.3 Clearing of Native Vegetation

Under the *Environmental Protection Act 1986*, the clearing of native vegetation requires a permit to do so, from the Department of Environment and Conservation or the Department of Mines and Petroleum, unless that clearing is exempted under specific provisions listed in Schedule 6 of the Act, or are prescribed in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Under the *Environmental Protection Act (1986)*, **"native vegetation" means indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation.** Under the *Environmental Protection Act 1986*, **Section 51A, "clearing" means the killing or destruction of, the removal of, the severing or ringbarking of trunks or stems of, or the doing of any other substantial damage to, some or all of the native vegetation in an area, and includes the draining or flooding of land, the burning of vegetation, the grazing of stock, or any other act or activity, that causes any of the aforementioned consequences or results.**

Under the *Environmental Protection Act 1986*, ten principles are set out, under which native vegetation should not be cleared. These principles state that native vegetation should not be cleared, if:

- a. it comprises a high level of biological diversity;
- b. it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia;
- c. it includes, or is necessary for the continued existence of, threatened flora;
- d. it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community;
- e. it is significant as a remnant of native vegetation in an area that has been extensively cleared;
- f. it is growing in, or in association with, an environment associated with a watercourse or wetland;
- g. the clearing of the vegetation is likely to cause appreciable land degradation;

-
- h. the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area;
 - i. the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water; or
 - j. the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

The *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, under Regulation 5, sets out prescribed clearing actions that do not require a clearing permit, as defined in Section 51C of the *Environmental Protection Act 1986*.

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, under Regulation 6 – **“Environmentally sensitive areas” are defined as “the area covered by vegetation within 50 m of threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the threatened flora is located”.**

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* - Regulation 6 (Environmentally sensitive areas), the area covered by a threatened ecological community, is similarly considered an Environmentally sensitive area and therefore non-permitted, unless Ministerial approval is granted.

2.4 Declared (Plant) Pest Organisms

The *Biosecurity and Agriculture Management Act 2007*, Section 22, makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to this Act, a declared pest is defined as a prohibited organism (Section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under section 26 (1) of the *Biosecurity and Agriculture Management Act 2007*, a person who finds a declared plant pest must report, in accordance with subsection (2), the presence or suspected presence of the declared pest to the Director General or an inspector of the Department of Agriculture and Food Western Australia.

Under the *Biosecurity and Agriculture Management Regulations 2013*, declared plant pests are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Appendix A6). According to section 30 (3) of the *Biosecurity and Agriculture Management Act 2007*, the owner or occupier of land, or a person who is conducting an activity on the land, must take the prescribed control measures to control the declared pest if it is present on the land.

The current listing of declared pest organisms and their control category is available on the Western Australian Organism List (WAOL), at the Biosecurity and Agriculture Management website of the Department of Agriculture and Food Western Australia (Department of Agriculture and Food 2016).

2.5 Local and Regional Significance

Flora or vegetation may be locally or regionally significant in addition to statutory listings by the State or Federal Government.

In regards to flora; species, subspecies, varieties, hybrids and ecotypes may be significant other than as threatened flora or priority flora, for a variety of reasons, including:

- a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species;
- relic status
- anomalous features that indicate a potential new discovery;
- being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- the presence of restricted subspecies, varieties, or naturally occurring hybrids;
- local endemism/a restricted distribution; and

-
- being poorly reserved (Environmental Protection Authority 2004).

Vegetation may be significant because the extent is below a threshold level and a range of other reasons, including:

- scarcity;
- unusual species;
- novel combinations of species;
- a role as a refuge;
- a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species;
- being representative of the range of a unit (particularly, a good local and/or regional example of a **unit in "prime" habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range**);
- a restricted distribution (Environmental Protection Authority 2004).

Vegetation communities are locally significant if they contain Priority Flora species or contain a range extension of a particular taxon outside of the normal distribution. They may also be locally significant if they are very restricted to one or two locations or occur as small isolated communities. In addition, vegetation communities that exhibit unusually high structural and species diversity are also locally significant.

Vegetation communities are regionally significant where they are limited to specific landform types, are uncommon or restricted plant community types within the regional context, or support populations of threatened Flora.

Determining the significance of flora and vegetation may be applied at various scales, for example, a vegetation community may be nationally significant and governed by statutory protection as well as being locally and regionally significant.

3. OBJECTIVES

Aims of the current survey were to undertake a Level 1 flora and vegetation assessment of the Tubridgi Gas Wells survey area; specifically:

- Collect and identify vascular plant species present;
- Collect and identify Declared Threatened and Priority vascular plant species;
- Review the conservation status of vascular plant species recorded by reference to current literature and current listings by the Department of Parks and Wildlife (2016b) and plant collections held at the Western Australian State Herbarium (DPaW 2016g), and listed by the Department of Environment (2016a) under the *Environmental Protection and Biodiversity Conservation Act 1999*;
- Record information regarding the GPS co-ordinates and number of plants for any known or potential Declared Threatened Flora and Priority Flora located during the survey;
- Undertake the flora survey to standards outlined in Guidance Statement 51 (Environmental Protection Authority 2004);
- Define and map native vegetation communities;
- Provide details on the condition of vegetation;
- Review and detail the local and regional significance of vegetation, with specific reference to Rangeland Land Systems and Pre-European mapping; and
- Prepare a report summarising the findings.

4. METHODS

Prior to the field survey, a desktop search for Declared Threatened and Priority flora and Threatened and Priority Ecological Communities that have the potential to occur within the survey area was undertaken using Florabase and NatureMap (40 km radius; Department of Parks and Wildlife 2016c; 2016g).

Assessment of flora and vegetation was undertaken by two experienced Botanists from Mattiske Consulting Pty Ltd on the 16th and 17th of May 2016. Representative 50 x 50 m quadrats were established and surveyed within each proposed drill pad buffer area. A total of seven sampling sites were selected using both high resolution aerial photographic maps of the survey area and field-based selection (Appendix B). All geographical coordinates cited in this report were based on the GDA94 datum. A targeted threatened and priority flora search was also undertaken within each drill pad buffer area via a thorough foot traverse. The survey was undertaken in accordance with recommendations made in Guidance Statement 51 (Environmental Protection Authority 2004).

Flora and vegetation was described and sampled systematically at each survey site, and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were recorded:

- GPS location;
- topography;
- percentage and type of litter cover;
- soil type and colour;
- percentage of bare ground;
- outcropping rocks and their type;
- notes on disturbance, vegetation condition and tree density;
- site photograph;
- time since fire; and
- number, height and percentage cover of species.

All plant specimens collected during the field surveys were dried and fumigated in accordance with the requirements of the Western Australian Herbarium. Plant species were identified through comparisons with pressed specimens housed at the Western Australian Herbarium. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the Department of Parks and Wildlife (2016c; 2016g).

4.1 Statistical Analysis and Vegetation Mapping

PRIMER v6 (Plymouth Routines in Multivariate Ecological Research) statistical analysis software was used to analyse species-by-site data and discriminate survey sites on the basis of their species composition (Clarke and Gorley, 2006). To down weight the relative contributions of quantitatively dominant species a 4th root transformation was applied to the data set. Computation of similarity matrices was based on the Bray-Curtis similarity measure. Data were analysed using a series of multivariate analysis routines including Hierarchical Clustering (CLUSTER), Similarity Percentages (SIMPER) and SIMPROF analysis.

To increase replication and thus improve confidence in delineating individual vegetation communities, current survey data were compared and contrasted with Mattiske Pty Ltd (2013) using a combination of descriptive and multivariate analysis (e.g. Multi-Dimensional Scaling and Analysis of Similarity). As a result, contiguous vegetation descriptions and mapping to those presented in Mattiske Pty Ltd (2013) were produced.

4.2 Vegetation Descriptions

Vegetation descriptions were based on **Alpin's (1979) modification of the vegetation classification system** of Specht (1970), to align with the National Vegetation Information System. Vegetation communities were described at the association level of the NVIS classification framework, as defined by the Executive Steering Committee for Australian Vegetation Information (ESCAVI, 2003).

4.3 Survey Limitations and Constraints

An assessment of the survey against a range of factors which may have had an impact on the outcomes of the present survey was made (Table 1). Based on this assessment, the present survey has not been subject to constraints which would affect the thoroughness of the survey, and the conclusions which have been formed.

Table 1: Potential flora and vegetation survey limitations for the survey area

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	Not a constraint: Adequate background information was sourced to provide detailed contextual information for the current project. Supplementary material was utilised to compare and contrast current data with that of previous work in the locality including but not limited to Rangeland Land System surveys, Beard (1975) mapping and previous work undertaken by botanical consultancies.
Scope (i.e. what life forms, etc., were sampled).	Not a constraint: Vascular flora was the focus of the survey. These were thoroughly sampled.
Proportion of flora collected and identified (based on sampling, timing and intensity).	Not a constraint: It was estimated that approximately 60% of the flora potentially present within the survey area were sampled (Choa, 2004; Colwell, 2006; Clarke and Gorley, 2006). Though seemingly low, this result was expected as each of the three small buffer zones comprised a different vegetation community. Furthermore, vegetation within the buffer zones was largely homogenous and therefore auto replicating was not appropriate. Adequate sampling was undertaken to differentiate and define vegetation communities present within the survey area.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	Not a constraint: Sites were selected using both high resolution aerial photography and field based selections. Given the small size of buffers and homogenous vegetation within, selection and replication was considered more than adequate to define vegetation community boundaries.
Mapping reliability.	Not a constraint: Adequate coverage of the area was made during the present survey. High quality aerial maps were used for both the survey work and subsequent vegetation community mapping. To improve mapping reliability and continuity within the small area, current data were compared and contrasted with Mattiske Consulting 2013.
Timing, weather, season, cycle.	Potential constraint: Well below average rainfall was recorded in the locality, and indeed the greater coastal Pilbara region, over the past year. As a result, annual species were absent and perennial grasses were in poor health. Despite this, adequate species information (communities defined by perennial species) was gathered to define vegetation communities present in the survey area. There were no interruptions to field work due to weather or timing issues.
Disturbances (fire flood, accidental human intervention, etc.).	Not a constraint: The survey area is located within lands managed by Urala Station. Evidence of cattle grazing and soil compaction via herd movement was observed, however, this did not adversely affect species richness.
Intensity (in retrospect, was the intensity adequate).	Not a constraint: Survey intensity was considered to have been thorough. Buffer zones were small and thus only a limited number of sites were established. Furthermore each buffer zone comprised largely homogenous vegetation. To improve mapping reliability current data were compared and contrasted with of Mattiske Consulting Pty Ltd (2013).
Resources (i.e. were there adequate resources to complete the survey to the required standard).	Not a constraint: Resources, in terms of time, equipment, support and personnel were adequate to undertake and complete the survey.
Access problems (i.e. ability to access survey area).	Not a constraint: Tracks established and maintained by Urala Station provided easy access to the survey area.
Experience levels (e.g. degree of expertise in plant identification to taxon level).	Not a constraint: Botanists have undertaken previous surveys in the wider area and were familiar with the flora and vegetation. Specimens that were unable to be identified in the Mattiske herbarium were taken to the Western Australian Herbarium for positive identification.

5. RESULTS

5.1 Desktop Survey

5.1.1 Geology and Soils

The survey area is situated within Coastal Plains Geomorphic Province which covers some 15, 370 km² (Payne *et al.*, 1988). Quarternary alluvium, colluvium and aeolian sands dominate the province, with small outcroppings of lower Cretaceous sedimentary rocks, Proterozoic granite and metamorphic rocks occurring further to the east. The province is characterised by extensive sandy plains with north-west or north trending longitudinal dunes, broad claypans and circular grassy depressions. Natural relief across the province rarely exceeds 40 m above the surrounding plains and occurs in the form of dune crests and isolated hills (Payne *et al.*, 1988). The Coastal Plains Soil Region dominates the Coastal Plains Geomorphic Province and consists of eight broad units (Payne *et al.*, 1988). These being skeletal soils, stony plains, sandy plains, sand dunes, drainage floors, claypans, swamps and depressions, and coastal mud flats.

5.1.2 Rangeland Land Systems

Rangeland Land Systems mapping prepared by the Western Australian Department of Agriculture and Food provides and inventory and condition survey of lands in the Ashburton River Catchment (Payne *et al.*, 1988) and Pilbara (Van Vreeswyk *et al.*, 2004) at a 1: 50 000 scale. These surveys describe the biophysical characteristics of each region and subsequently divide each region into land systems; land systems being defined as repeating patterns of topography, soils and vegetation (Heddl *et al.*, 1980).

Table 2: Rangeland Land Systems of the Tubridgi Gas Wells survey area: total extent, extent of survey area and percentage impact

Land System	Total Extent of Land System (ha)	TGS Injector	Extent of Survey Area (ha)	% Impact
Onslow	86704.8	1	19.271	0.022
		2	26.298	0.030
		3	42.677	0.492
		Total	88.246	0.102

The survey area is located within the Onslow Land System as described by Payne *et al.* (1988) and Van Vreeswyk *et al.* (2004). Total extent of this land system mapped in Western Australia, extent of survey area and percentage impact data is presented in Table 2. A description of the Onslow land system is provided below:

Onslow Land System (2010n)

The Onslow land system comprises seven land units:

1. Sandplains: Hummock grasslands of *Triodia pungens* with isolated *Acacia* spp. shrubs, also patches of **Cenchrus ciliaris*.
2. Dunes: Hummock grasslands of *Triodia pungens* with isolated to scattered shrubs such as *Crotalaria cunninghamii* and patches of **Cenchrus ciliaris*.
3. Clay plains: Hummock grasslands of *Triodia longiceps*, patchy tussock grasslands with *Eragrostis xerophila* and sparse chenopod shrubs including *Atriplex* spp. Patchy *Sporobolus virginicus* grasslands with *Tecticornia* spp. low shrubs.
4. Saline flats: Scattered low shrublands of *Tecticornia* spp. and/or *Frankenia* spp. with variable amounts of *Sporobolus virginicus*. Highly saline parts usually contain no vegetation.

5. Narrow drainage floors: Tussock grasslands or grassy woodlands with *Sporobolus virginicus*, *Eragrostis xerophila*, *Chrysopogon fallax*, *Eulalia aurea* and *Eucalyptus victrix*.
6. Depressions: Variable tussock grasslands, mostly *Sporobolus virginicus* and *Eriachne benthamii* with fringing margins of *Eucalyptus victrix*.
7. Claypans: No vegetation.

5.1.3 Interim Biogeographic Regionalisation of Australia (IBRA)

The Interim Biogeographic Regionalisation for Australia (IBRA) currently recognises 89 bioregions and 419 subregions (Department of Environment, 2016c). The survey area is located within the Carnarvon (CAR) Bioregion, specifically within the Cape Range subregion (CAR1).

Carnarvon (CAR) Bioregion

Cape Range subregion (CAR1): Rugged tertiary limestone ranges and extensive red Aeolian dunefields, quaternary coastal beach dunes and mud flats. *Acacia* shrublands (e.g. *Acacia bivenosa*) over *Triodia* spp. occur on limestone and red dunefields, *Triodia* hummock grasslands with sparse *Eucalyptus* trees and shrubs on the Cape Range. Tidal mudflats of the Exmouth Gulf support extensive mangroves while the eastern hinterlands comprise a mosaic of saline alluvial plains with samphire and saltbush low shrublands (Kendrick and Mau, 2002).

5.1.4 Historical Mapping of Beard

Beard (1975) broadly mapped vegetation of the Pilbara at a scale of 1: 1, 000, 000. The survey area is located within the Carnarvon Botanical District region of the Eremaean Botanical Province, as defined by Beard (1975, 1990).

The Carnarvon Botanical District is divided into nine physiographic units with the survey area situated within the Cape Yinnarie Coastal Plain Unit (Beard, 1975). The Cape Yinnarie Coastal Plain consists of three recognised topographic/soil units namely pediplains and hills on siltstones and other marine rocks with predominately hard alkaline red soils; extensive plains with occasional rocky hills inland with acidic, neutral and alkaline red earths, coastal claypans with non-cracking clays and; shoreline-parallel dunes with red sands.

Beard (1975) broadly described the vegetation of the Cape Yinnarie Coastal Plain as being bordered by mangrove (primarily *Avicennia marina*) vegetation on the coastline and intertidal zones; hinterlands of predominately bare hypersaline mudflats, though samphire (*Tecticornia* spp.) communities occasionally occur and; shrub steppe on sandhills dominated by *Triodia* spp. and *Acacia* spp. interspersed with small claypans. Specifically, the survey area is situated within Beard (1975) vegetation association 676 – *succulent steppe; samphire*. Table 3 provides a brief description, area figures, percentage impact and priority status for this association.

Table 3: Beard (1975) vegetation associations of the Tubridgi Gas Wells survey area: pre-European extent, total current extent, extent of survey area, percentage impact and priority status.

Beard Vegetation Association	Vegetation Description*	Total Pre-Euro Extent (ha)	Total Current Extent (ha)	TGS Injector	Extent of Survey Area (ha)	% Impact	Priority*
676	Succulent Steppe; samphire.	29189.9	28441.5	1	19.271	0.068	H
				2	26.298	0.092	
				3	42.677	0.150	
				Total	88.246	0.310	

*Kendrick and Mau, 2002.

5.1.5 Previous Flora and Vegetation Studies in the Locality

Four relevant botanical surveys have been conducted in the locality of the current survey area by Astron (2009), Biota (2010), Mattiske Pty Ltd (2013) and Mattiske Consulting Pty Ltd (2014). A brief summary of major findings for each of the aforementioned reports has been provided. Astron (2009) described and mapped vegetation of the BHPB Macedon Gas Development. A total of 310 vascular plants representing 47 families and 125 genera were recorded across three survey periods. No Declared Threatened or Priority Flora were recorded. No Threatened or Priority Ecological Communities were inferred to occur within the survey area. One species *Desmodium filiforme* represented a range extension. A total of 30 vegetation sub-formations and associations were described. Vegetation condition ranged from excellent on limestone dune formations to degraded in *Prosopis* spp. dominated shrublands. Vegetation types recorded within the survey area were typical for the region and were found adjacent to, and in areas beyond the survey area. This survey was undertaken on the southern side of the main Wheatstone operations access road and adjacent to the proposed Horizon (Onslow) Power Station.

Biota (2010) described and mapped vegetation of the Wheatstone Study Area. This report incorporates data from other surveys conducted by Onshore Environmental Consultants (OEC; 2008, 2009a, b), Astron Environmental Services (2009) and RPS Environment and Planning (2009). A total of 418 native taxa representative of 168 genera and 58 families were recorded. One species listed under the Commonwealth EPBC Act 1999 was recorded, namely *Eleocharis papillosa* (VU). At the state level *Eleocharis papillosa* is listed as Priority 3 species. No Threatened or Priority Ecological Communities were inferred to occur within the survey area. No Declared Threatened Priority species were recorded and five Priority species were recorded these being *Abutilon* sp. Onslow (F. Smith s.n. 10/9/61) (P1), *Atriplex flabelliformis* (P3), *Eleocharis papillosa* (P3), *Eremophila forrestii* subsp. *forrestii* (P3) and *Triumfetta echinata* (P3). A total of 25 vegetation sub-associations were identified within the survey area. Five vegetation sub-associations were identified as holding elevated local conservation value (not formal), these being the inland sand dune communities ID1 and ID2, samphire shrubland community C3, cracking clay grassland community CP1 and Mangal communities.

Mattiske Pty Ltd (2013) undertook a level 1 flora and vegetation survey of the CS2 – Tubridgi – Wheatstone Gas Pipeline Project Area in April 2013. A total of 116 standard 50 x 50 m sites were surveyed along the 109.6 km long survey area. A total of 139 vascular plant taxa, representative of 80 plant genera and 28 plant families were recorded within the survey area. The majority of the taxa recorded were representative of the Poaceae (30 taxa), Fabaceae (26 taxa), Amaranthaceae (10 taxa), Chenopodiaceae (9 taxa) and Malvaceae (9 taxa) families. No Threatened or Priority Ecological Communities were inferred to occur within the survey area. No Declared Threatened Flora species were recorded within the survey area. Two Priority 3 Flora species (*Eremophila forrestii* subsp. *viridis* and *Grevillea subterlineata*) were recorded within the survey area. Thirty vegetation communities were delineated and mapped across the survey area. Vegetation was generally in very good to excellent condition, with factors such as weed density (particularly *Cenchrus ciliaris*), clearing and vehicle movement and cattle movement and grazing observed as primary causes of decreasing vegetation condition.

Mattiske Consulting Pty Ltd was commissioned in April 2014 by LogiCamms on behalf of DBP to undertake a Level 1 flora and vegetation survey of the Ashburton North Gas Pipeline (ANGP) Project Area. A total of 17 sites were surveyed along the 9 km long survey area. A total of 54 vascular plant taxa which are representative of 39 plant genera and 18 plant families were recorded within the survey area. The majority of the taxa recorded were representative of the Fabaceae (15 taxa), Poaceae (8 taxa) and Malvaceae (6 taxa) families. No Declared Threatened Flora species were recorded within the survey area. Two Priority 3 Flora species (*Eremophila forrestii* subsp. *viridis* and *Triumfetta echinata*) were recorded within the survey area. Both species were associated with the inland dune communities ID2 and ID3 and had previously been recorded in the locality. No Threatened or Priority Ecological Communities occurred or were inferred to occur within the survey area. Three introduced (exotic) taxa were recorded within the survey area. Of these, one taxon, *Prosopis pallida* is a Declared Pest (Plant) species pursuant to the *BAM Act* according to the Department of Agriculture and Food. The survey area traversed *Acacia Triodia* dominated inland sand dune (ID2 and ID3) and clayey plain communities (CP1, CP4 and CP6), interspersed with bare clay pans (C1) and samphire dominated saline claypans and flood-out zones (C4). Vegetation was generally in excellent to pristine condition, with factors such as weed density (particularly *Prosopis pallida* and *Vachellia farnesiana*), vehicle and cattle movement and grazing observed as primary causes of decreasing vegetation condition.

5.1.6 Threatened and Priority Ecological Communities

The Pilbara and Carnarvon bioregions both contain two Threatened Ecological Communities namely Carnarvon: Camerons Cave Troglitic Community - P1 and Cape Range Remipede Community - P; Pilbara: Themeda Grasslands - VU and Ethel Gorge aquifer stygobiont community- VU. None of these are known to occur in close proximity and are thus highly unlikely to occur within the survey area. There are thirty known Priority Ecological Communities in the Pilbara bioregion; however none of these are known to occur in close proximity to the survey area. The closest of which, Peedamulla Marsh vegetation complex (P1) and Tanpool land system (P1), occur approximately 80 km to the east of the survey area. The restricted nature of these two communities makes their occurrence within the survey area highly unlikely.

5.1.7 Declared Threatened and Priority Flora

No Threatened Flora species pursuant to Schedule 1 of the *Wildlife Conservation Act 1950* and as listed by the Department of Parks and Wildlife (2016b) were recorded within the bounds of the desktop search (within 40 km of the survey area; Table 4). A total of seven Priority Flora species as listed by the Department of Parks and Wildlife (2016g) were identified by the desktop search as having potential to occur within the survey area. This included two Priority 1, four Priority 3 and one Priority 4 flora species (Table 4). One of these species, *Eleocharis papillosa*, is also listed under the *Environment Protection Biodiversity Conservation Act 1999* (Department of Environment 2016a).

Eleocharis papillosa (P3) (dwarf desert spike-rush) is listed as a Priority 3 (poorly known) taxa in Western Australia (DPaW 2016a) and as Vulnerable under the *Environment Protection Biodiversity Conservation Act 1999* (Department of Environment 2016a). It is a small erect perennial sedge, typically less than 10 cm high (TSSC 2010). The above-ground parts grow in response to inundation or flooding, and subsequently die back to tubers (TSSC 2010). It flowers brown in November, and is found in ephemeral (temporary) wetlands, predominantly freshwater and semi-saline swamps, red clay over granite, open clay flats, and claypans (TSSC 2010; DPaW 2016a).

Table 4: Priority flora species with potential to occur within the Tubridgi Gas Wells survey area

SCC = State Conservation Code (Appendix A1); FCC = Federal Conservation Code (Appendix A1); Likelihood of occurrence rating based on location and extent of current records, and preferred habitat.

SPECIES	FAMILY	SCC	FCC	DESCRIPTION	LIKELIHOOD
<i>Abutilon</i> sp. Onslow (F. Smith s.n. 10/9/61)	Malvaceae	P1	-	Prostrate perennial herb to 0.1 m high, producing yellow flowers. Known to occur on flat, stony plains.	Unlikely
<i>Abutilon</i> sp. Pritzelianum (S. van Leeuwen 5095)	Malvaceae	P1	-	Tall shrub to 2 m high, producing yellow flowers in August. Known to occur on red/brown sandy loams.	Unlikely
<i>Carpobrotus</i> sp. Thevenard Island (M. White 050)	Aizoaceae	P3	-	Prostrate, succulent perennial herb, producing cream flowers in August. Known to occur on coarse white sand dune tops.	Unlikely
<i>Eleocharis papillosa</i>	Cyperaceae	P3	VU	Annual herb to 0.1 m high, producing brown flowers in November. Known to occur on red clay flats and claypans.	Unlikely
<i>Eremophila forrestii</i> subsp. <i>viridis</i>	Scrophulariaceae	P3	-	Multi-branched shrub, to 1 m high, producing pink-cream flowers in August. Known to occur on red sands.	Likely
<i>Triumfetta echinata</i>	Malvaceae	P3	-	Prostrate shrub, to 0.3 m high, producing yellow flowers in July and August. Known to occur on red sandy soils.	Possible
<i>Goodenia nuda</i>	Goodeniaceae	P4	-	Erect to ascending herb to 0.5 m high, producing yellow flowers from April to August.	Unlikely

5.1.8 Conservation Significant Wetlands

Three wetlands of national importance occur within the Ashburton River Catchment (Drainage Basin No. 6), none of which occur in close proximity to the survey area. No Ramsar listed wetlands occur in close proximity to the survey area (DoE, 2016d).

5.1.9 Conservation Reserves

Approximately 8.3% of the Carnarvon Bioregion is vested in various forms of conservation tenure, with approximately 2.2% of the Cape Range subregion being reserved (Kendrick and Mau, 2002). Of particular note within the Cape Range subregion is the Cape Range National Park, Bundegi and Jurabi Conservation Parks, Ningaloo Marine Park and Barrow Island nature Reserve. The aforementioned conservation vested lands occur in the broader Cape Range subregion and as such bear no direct relevance to the current survey. The Cane River Conservation Park is the closest gazetted conservation reserve to the survey area. The Cane River Conservation Park is located some 70 km south-east of the survey area, and as such has no direct relevance to current survey.

5.2 Field Survey

Seven sites were established and surveyed during the Level 1 flora and vegetation assessment of the Tubridgi Gas Wells survey area. The number of sites reflected the small size of drill pad buffers and homogenous nature of vegetation at the local scale. Refer to Appendix B for a list of the geographic locations for each survey site.

5.2.1 Flora

A total of 46 vascular plant taxa representative of 41 plant genera and 21 plant families were recorded within the survey area. The majority of the taxa recorded were representative of the Fabaceae (12 taxa), Poaceae (8 taxa) and Chenopodiaceae (3 taxa) families (Appendix C).

5.2.2 Threatened and Priority Flora

No Declared Threatened or Priority Flora species pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950* [WA] and as listed by the Department of Parks and Wildlife (2016a) were recorded within the survey area.

5.2.3 Threatened and Priority Ecological Communities

No Threatened or Priority Ecological Communities as defined by the Department of Parks and Wildlife (2016e) and the *Environment Protection and Biodiversity Conservation Act 1999* were recorded or inferred to occur within the survey area.

5.2.4 Taxa with Extensions to their Range

No taxa recorded during the current survey represented extensions to their currently known range.

5.2.5 Introduced (Exotic) Plant Species

A total of three introduced (exotic) taxa were recorded within the survey area (Appendix C). Of these, one taxon, **Prosopis pallida* is a Declared Pest (Plant) pursuant to the *BAM Act* according to the Department of Agriculture and Food (2016).

**Prosopis pallida* has a legal status of Prohibited (s12) and a control category of C2 (Eradication) across the state of Western Australia (Table 5; Appendix A5). At the regional scale, this species has a medium environmental weed rating (Table 6). One individual was recorded within TGS3_A (Table 5).

Table 5: Geographic locations and status of **Prosopis pallida* recorded within the Tubridgi Gas Wells survey Area

Species	Legal Status	Control Category	Site	Geographic Location (GDA94; Zone 50K)	
				Easting (mE)	Northing (mN)
* <i>Prosopis pallida</i>	s12	C2	TGS3_A	275805	7589325

Table 6 identifies weed management priorities for weed species identified within the survey area. The *Environmental Weed Strategy for WA* (DPaW, 2013, currently under review) assesses and rates weeds in terms of their environmental impact on biodiversity using the same criteria as those used in the *National Weed Strategy* (ARMCANZ, 1997). These ratings have been applied to weed species identified within the survey area to determine weed management priorities. The environmental weed ranking system is outlined as follows:

- Very High – Objective is eradication;
- High – Objective is eradication or control to reduce;
- **Medium** – Objective is control to reduce or containment;
- Low – Objective is containment at key sites only; and
- **Negligible** – no action to be undertaken but may include monitoring only.

**Cenchrus ciliaris* was recorded within all three buffer zones, this species occurs throughout the Pilbara and has a low environmental weed ranking (Table 6). **Vachellia farnesiana* was recorded in TGS1_A, TGS3_B and TGS3_C, with the highest densities occurring within the TGS3 buffer zone. **V. farnesiana* occurs throughout the Pilbara and has a low environmental weed ranking (Table 6).

Table 6: Summary management details of weed species recorded within the Tubridgi Gas Wells survey area

Weed Species	Environmental Weed Ranking ¹	Management Action ¹	Comments ²
* <i>Prosopis</i> spp. (Mesquite)	Medium	D, E, F, G - Protect priority sites - Targeted control to reduce infestations at priority sites - Contain regional spread - Reduce regional infestations	Widespread shrub or small tree found in rangelands, disturbed commons and along rivers from Derby south to Carnarvon. * <i>Prosopis</i> spp. are a recognised problem near the coast between Onslow and Karratha.
* <i>Cenchrus ciliaris</i> (Buffel grass)	Low	D - Protect priority sites	Widespread weed of roadsides, creek lines, river edges and most vegetation types in the Pilbara.
* <i>Vachellia farnesiana</i> (Mimosa bush)	Low	D, E - Protect priority sites - Targeted control to reduce infestations at priority sites	A widespread weed of roadsides, creeks, rivers, and disturbed floodplains from the Kimberley to Carnarvon. This species tends to be restricted to silty flats, but may spread under more favourable moisture conditions

¹ DPaW (2013; currently under review); ² Hussey *et al.*, (1997).

5.2.6 Statistical Analysis

Similarity Profile Analysis (SIMPROF) identified three significantly associated groups of quadrats ($P_i = 10.03$; $p = <0.001$). TGS3_C was then separated from TGS3_A and TGS3_B in view of clear structural and 'site' differences that were not reflected by compositional analysis. As a result, four vegetation communities were delineated within the survey area.

Comparative analysis (qualitative and quantitative) was undertaken to compare and contrast vegetation units delineated in Mattiske (2013) with current survey sites. TGS1_A and TGS1_B both showed moderate correlations with sites assigned to the pre-defined C2 community; each comprising dominant *Tecticornia* spp. shrubland with mixed tussock grasses such as *Eriachne helmsii*. TGS2_A and TGS2_B showed moderate to strong correlations with sites assigned to the pre-defined ID1 community; each comprising dominant *Grevillea stenobotrya* shrubland over mixed low shrubs such as *Acacia stellaticeps* over *Triodia epactia* hummock grassland. TGS3_A and TGS3_B showed moderate to strong correlations with sites assigned to the pre-defined IF4 community; each comprising open woodland of *Eucalyptus victrix* over mixed tall shrubs including *Acacia tetragonophylla* and *Acacia synchronicia* over mixed tussock grasses. TGS3_C showed a moderate correlation with sites assigned to the pre-defined IP8 community; each comprising isolated *Eucalyptus victrix* and *Acacia* spp. over *Triodia epactia* hummock grassland.

A summary of species by site data and species by vegetation community are detailed in Appendices D and E, respectively. A photographic record and further details of each survey site is detailed in Appendix F. A dendrogram of the seven survey sites with assigned vegetation communities is depicted in Appendix G.

5.2.7 Vegetation

Four vegetation communities were defined and mapped within the survey area (see Appendix G and Figure 3). Further vegetation community descriptions, condition, soils and landform and representative photographs are detailed in Appendix F. Vegetation communities are summarised below.

Claypans and Clayey Plains:

C2: *Tecticornia* spp. low sparse chenopod shrubland with *Sporobolus mitchellii*, *Eriachne helmsii* low isolated tussock grasses.

Inland Sand Dunes:

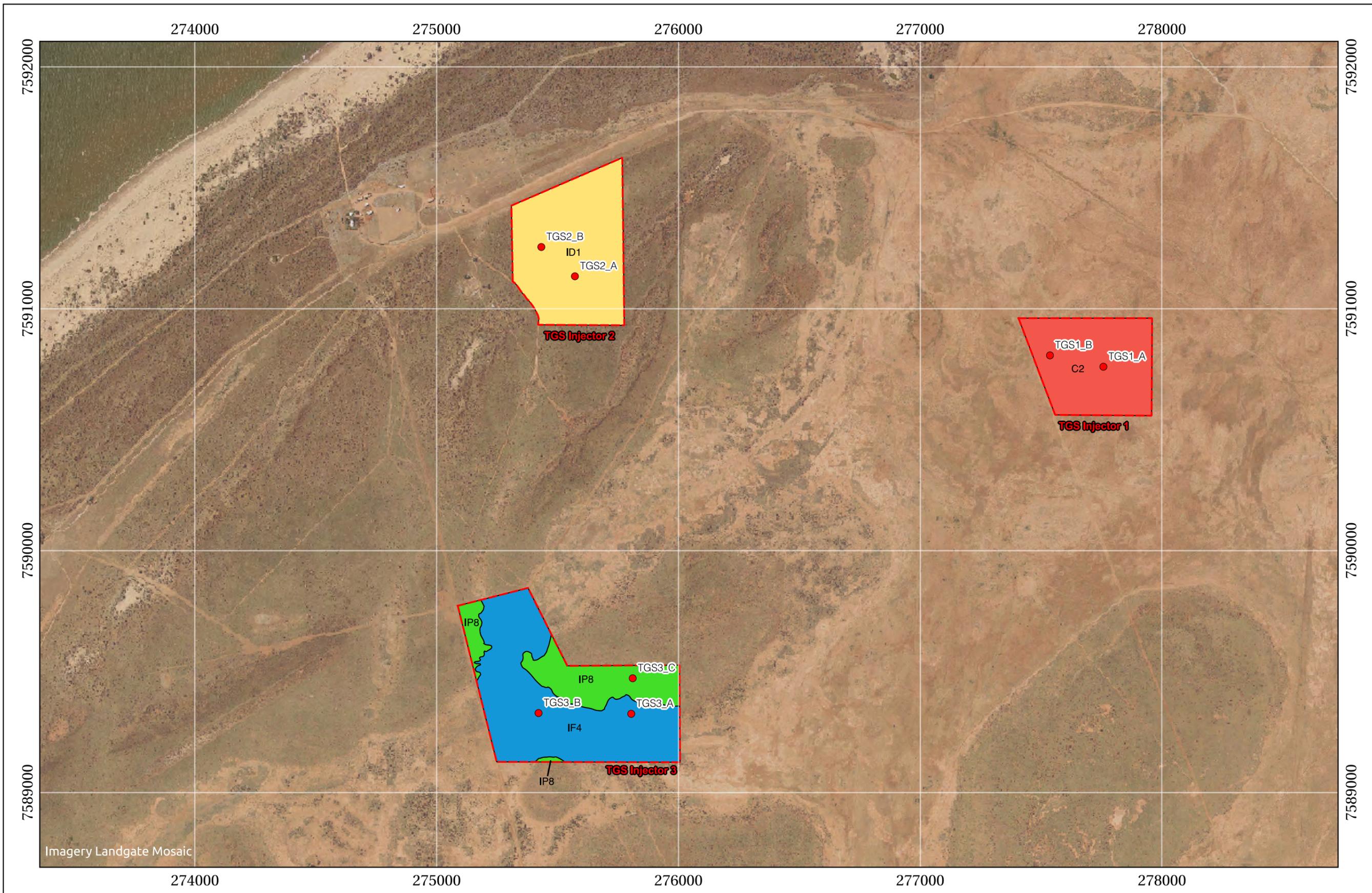
ID1: *Grevillea stenobotrya* low sparse shrubland over *Acacia stellaticeps* mid open shrubland over *Triodia epactia* hummock grassland.

Inland Sand and Clayey Plains:

IP8: *Eucalyptus victrix* low isolated trees over *Acacia tetragonophylla*, *Acacia synchronicia* tall isolated shrubs with *Acacia stellaticeps*, *Acacia coriacea* subsp. *coriacea*, *Senna artemisioides* subsp. *oligophylla* low sparse shrubland over *Triodia epactia* mid hummock grassland with *Eulalia aurea*, *Eragrostis eriopoda*, **Cenchrus ciliaris* low sparse tussock grassland.

Inland Floodplains and Depressions:

IF4: *Eucalyptus victrix* low open woodland over *Acacia synchronicia*, *Acacia tetragonophylla*, *Scaevola spinescens* tall sparse shrubland over *Sporobolus mitchellii*, *Eriachne helmsii*, *Eulalia aurea* low open tussock grassland.



Imagery Landgate Mosaic

Legend

- Survey Sites
- TGS Injector Buffer

Vegetation Mapping Code

- C2
- ID1
- IF4
- IP8

Prepared for:



Prepared by:




0 150 300 m
Scale 1:15,000
MGA94 (Zone 50)

Tubridgi Gas Wells
Vegetation

Figure:
3

5.2.8 Area Coverage of Vegetation Communities

The total area mapped and percentage cover for each delineated vegetation community in the current survey are shown in Table 7. In addition, the extent of each vegetation community mapped by Mattiske Consulting Pty Ltd (MCPL, 2013) has been shown for reference.

The three TGS buffer zones each comprised different vegetation communities. This was a reflection of the local landscape where coastal clay pans, undulating consolidated dunes and drainage ways form a broad mosaic. The TGS1 buffer area comprised solely of the C2 vegetation community (19.271 ha); a community that accounted for approximately 22% of the total mapped area. The TGS2 buffer area comprised solely of the ID1 vegetation community (26.298 ha); a community that accounted for approximately 30% of the total mapped area. The TGS3 buffer area comprised two vegetation communities namely IP8 (12.134 ha) and IF4 (30.543 ha); these communities accounted for approximately 14% and 35% of the total mapped area, respectively.

Table 7: Area coverage of each vegetation community type within the Tubridgi Gas Wells survey Area

Vegetation Community	Extent of vegetation community mapped by MCPL (2013)	Total extent within current area (ha)	Percentage of current survey area
C2	20.03	19.271	21.828
ID1	83.17	26.298	29.801
1P8	282.20	12.134	13.750
IF4	78.16	30.543	34.611
	Total	88.246	100

5.2.9 Vegetation Condition

Vegetation condition within each of the three buffer areas was recorded as excellent. Therefore, it was considered unnecessary to produce a vegetation condition map depicting one single condition rating for each area. Weeds such as **Cenchrus ciliaris* and **Vachellia farnesiana* were recorded throughout the survey area, however, densities were not such that native species structure and/or composition was altered. Cattle movement and grazing was prevalent across the survey area, but at low intensities.

6. DISCUSSION AND CONCLUSION

Mattiske Consulting Pty Ltd was commissioned in May 2016 by DBP to undertake a Level 1 flora and vegetation survey of three proposed drill pads and their associated access tracks. A buffer was placed around each proposed drill pad and then extended out to the nearest existing track. Buffer areas were as follows: TGS1 = 19.271 ha, TGS2 = 26.298 ha and TGS3 = 42.677. Therefore, it is recognised that mapped extents exceed what would actually be impacted by clearing associated with the establishment of drill pads and access tracks. Seven sites were surveyed in total, with the number of sites reflecting the small size of drill pad buffers and homogenous nature of vegetation at the local scale.

A total of 46 vascular plant taxa representative of 41 plant genera and 21 plant families were recorded within the survey area. The majority of the taxa recorded were representative of the Fabaceae (12 taxa), Poaceae (8 taxa) and Chenopodiaceae (3 taxa) families.

Following a thorough foot-traverse of each buffer area, no Declared Threatened or Priority Flora species pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950* [WA] and as listed by the Department of Parks and Wildlife (2016a) were recorded.

No Threatened or Priority Ecological Communities were recorded or inferred to occur within the survey area.

Reservation priorities of ecosystems as identified by Kendrick and Mau (2002) assign each Beard vegetation association an appropriate management scenario, these being High, Medium or Low. Reservation priorities are primarily determined by CAR principles, these broadly being to effectively and efficiently develop and integrate regional conservation strategies which provide for the establishment and management of conservation reserves and complementary management of adjoining areas. Assignments of management scenarios highlight reservation priorities for each sub-region, in this case the Cape Range sub-region. The level of reservation priority for each vegetation association is determined by factors including: comprehensiveness, communities recognised by an agreed national scientific classification system; adequacy, maintenance of ecological viability and integrity of populations, species and communities and; representativeness, inclusion of vegetation in reserves should reasonably reflect the biotic diversity of the communities.

The survey area is located within Beard (1975) vegetation association 676 (succulent steppe; samphire), which is considered to be of high priority status (Kendrick and Mau, 2002). A significant bias of vegetation associations being assigned a high priority status is lack of representation in DPaW managed estate. Given the broad nature of Beard vegetation associations it is unlikely that this association is locally restricted, or indeed, is restricted to the Cape Range sub-region. This coupled with a very low percentage impact figure (0.310%) makes it unlikely that proposed works will reduce the adequacy and/or representativeness of vegetation association 676 across the landscape.

Four vegetation communities were delineated within the survey area. TGS Injector 1 buffer comprised typical coastal claypan vegetation with scattered *Tecticornia indica* and *Frankenia ambita* shrubs interspersed with tussock grasses including *Eriachne helmsii* and *Chrysopogon fallax* (C2). TGS Injector 2 buffer comprised typical consolidated inland dune vegetation with sparse shrubs including *Grevillea stenobotrya*, *Acacia sericophylla*, *Crotalaria cunninghamii*, *Hibiscus brachychaenus* and *Gyrostemon ramulosus* over low shrubs including *Acacia stellaticeps* and *Scaevola sericophylla* over *Triodia epactia* hummock grassland (ID1). TGS Injector 3 buffer comprised two communities with areas of low natural relief dominated by sparse shrubs including *Acacia stellaticeps*, *Acacia sclerosperma*, *Acacia synchronicia* and *Rhagodia eremaea* over *Triodia epactia* hummock grassland. Low-lying areas and broad drainage zones were dominated by sparse to isolated *Eucalyptus victrix* over sparse shrubs including *Acacia tetragonophylla*, *Acacia synchronicia*, *Acacia sericophylla* and **Vachellia farnesiana* over mixed tussock grasses including **Cenchrus ciliaris*, *Eriachne helmsii*, *Eragrostis xerophylla* and *Chrysopogon fallax*.

Three introduced (exotic) taxa were recorded within the survey area. Of these, one taxon, **Prosopis pallida* is a Declared Pest (Plant) pursuant to the *BAM Act* according to the Department of Agriculture and Food (2016). **P. pallida* was recorded once within TGS3_3 and has a legal status of Prohibited (s12) and a control category of C2 (Eradication) across the state of Western Australia. **Cenchrus ciliaris* and **Vachellia farnesiana* were ubiquitous across the survey area, both species have a low environmental weed ranking (Table 8).

Vegetation within the survey area was generally in excellent condition. Weed densities and cattle grazing were not recorded at levels high enough to appreciably reduce vegetation condition. Efforts should be made maintain this by means of:

- Ground disturbance and clearing of vegetation should be limited to that which is essential;
- maintain standard vehicle hygiene practices to minimise the risk of spreading introduced (exotic) weeds;
- retain and stockpile topsoil for use in the later rehabilitation of tracks and other areas cleared in the process of expansion;
- maintain existing drainage systems, i.e. do not allow access tracks etc. to disrupt or divert historic water flow patterns. Where drainage systems are interrupted by earthworks, the use of culverts to assist in maintaining natural water flow patterns should be implemented;
- avoid driving vehicles across undisturbed ground; and
- the creation of new tracks should be restricted to that which is absolutely necessary, ensuring equipment blades are set above ground level to minimise disturbance to topsoil, rootstock and to reduce soil erosion.

For the purposes of a Level 1 flora and vegetation, more than adequate data was collected to define and assess the presence, extent and significance of vegetation communities within the three small drill pad buffer zones. Recorded taxa were widespread throughout the region and delineated vegetation communities were common and widespread throughout the local area. Percentage impact to pre-European vegetation associations and Rangeland Land Systems was low.

7. ACKNOWLEDGEMENTS

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8. LIST OF PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

Name	Position	Project Involvement	Flora Collection Permit
Dr E.M. Mattiske	Managing Director & Principal Ecologist	Planning, Management & Reporting	n/a
Dr J. Cargill	Senior Ecologist	Planning, fieldwork, data interpretation, mapping and report preparation	SL011719
Mr B. Ellery	Taxonomist	Field work and plant identification	SL011710
Mr r. Dharmarajan	Experienced Botanist	Report preparation	n/a

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APPENDIX A1: DEFINITION OF THREATENED AND PRIORITY FLORA SPECIES (Department of Parks and Wildlife 2016c)

Conservation Code	Category
T	<p>Threatened Flora (Declared Rare Flora – Extant)</p> <p>"Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the <i>Wildlife Conservation Act 1950</i>).</p> <p>Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:</p> <ul style="list-style-type: none"> • CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild • EN: Endangered – considered to be facing a very high risk of extinction in the wild • VU: Vulnerable – considered to be facing a high risk of extinction in the wild."
P1	<p>Priority One – Poorly Known Species</p> <p>"Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes."</p>
P2	<p>Priority Two – Poorly Known Species</p> <p>"Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes."</p>
P3	<p>Priority Three – Poorly Known Species</p> <p>"Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them."</p>
P4	<p>Priority Four – Rare Threatened and other species in need of monitoring</p> <p>"a. Rare - Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>b. Near Threatened - Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>c. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy."</p>
P5	<p>Priority Five – Conservation Dependent Species</p> <p>"Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years."</p>

APPENDIX A2: DEFINITION OF THREATENED FLORA SPECIES (*Environment Protection and Biodiversity Conservation Act 1999*)

Category Code	Category
Ex	<p>Extinct</p> <p>Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.</p>
ExW	<p>Extinct in the Wild</p> <p>Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.</p>
CE	<p>Critically Endangered</p> <p>Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.</p>
E	<p>Endangered</p> <p>Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.</p>
V	<p>Vulnerable</p> <p>Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.</p>
CD	<p>Conservation Dependent</p> <p>Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.</p>

APPENDIX A3: DEFINITION OF THREATENED ECOLOGICAL COMMUNITIES (Department of Parks and Wildlife 2016d)

Category Code	Category
PTD	<p>Presumed Totally Destroyed</p> <p>An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies:</p> <ul style="list-style-type: none"> (i) records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or; (ii) all occurrences recorded within the last 50 years have since been destroyed.
CE	<p>Critically Endangered</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria:</p> <ul style="list-style-type: none"> (i) The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; (ii) The current distribution is limited ie. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the immediate future.
E	<p>Endangered</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria:</p> <ul style="list-style-type: none"> (i) The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; (ii) The current distribution is limited ie. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the short term future.
V	<p>Vulnerable</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria:</p> <ul style="list-style-type: none"> (i) The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; (ii) The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; (iii) The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

APPENDIX A4: DEFINITION OF THREATENED ECOLOGICAL COMMUNITIES (Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*)

Three categories exist for listing threatened ecological communities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Listing Category	Explanation of Category
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

APPENDIX A5: DEFINITION OF PRIORITY ECOLOGICAL COMMUNITIES (Department of Parks and Wildlife 2016d)

Category Code	Category
P1	<p>Poorly-known ecological communities</p> <p>Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.</p>
P2	<p>Poorly-known ecological communities</p> <p>Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.</p>
P3	<p>Poorly known ecological communities</p> <p>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</p> <p>(iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.</p>
P4	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p>
P5	<p>Conservation Dependent ecological communities</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

APPENDIX A6: CATEGORIES AND CONTROL OF DECLARED (PLANT) PESTS IN WESTERN AUSTRALIA (Department of Agriculture and Food 2016) (*Biosecurity and Agriculture Management Regulations 2013*)

Control Category	Control Measures
<p style="text-align: center;">C1 (Exclusion)</p> <p>‘(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented’</p> <p>Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.</p>	<p>In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.</p>
<p style="text-align: center;">C2 (Eradication)</p> <p>‘(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible’</p> <p>Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.</p>	<p>In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.</p>
<p style="text-align: center;">C3 (Management)</p> <p>‘(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to —</p> <p>(i) alleviate the harmful impact of the declared pest in the area; or (ii) reduce the number or distribution of the declared pest in the area; or (iii) prevent or contain the spread of the declared pest in the area.’</p> <p>Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.</p>	<p>In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary</p> <p>to —</p> <p>(a) alleviate the harmful impact of the declared pest in the area for which it is declared; or (b) reduce the number or distribution of the declared pest in the area for which it is declared; or (c) prevent or contain the spread of the declared pest in the area for which it is declared.</p>

APPENDIX A8: DEFINITION OF VEGETATION CONDITION SCALE (Keighery 1994)

Condition Rating	Description
Pristine (1)	Pristine or nearly so, no obvious sign of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback, grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX B: GPS LOCATION OF SITES FOR THE TUBRIDGI GAS WELLS SURVEY AREA, 2016

SURVEY SITE	DATUM	GDA94	
		EASTING	NORTHING
TGS1_A	50K	277758	7590760
TGS1_B		277537	7590807
TGS2_A		275572	7591134
TGS2_B		275433	7591255
TGS3_A		275805	7589325
TGS3_B		275734	7589234
TGS3_C		275811	7589472

APPENDIX C: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE TUBRIDGI
GAS WELLS SURVEY AREA, 2016

Note: * denotes introduced species;

FAMILY	SPECIES
Marsileaceae	<i>Marsilea hirsuta</i>
Poaceae	* <i>Cenchrus ciliaris</i> <i>Chrysopogon fallax</i> <i>Eragrostis ?eriopoda</i> <i>Eragrostis xerophila</i> <i>Eriachne helmsii</i> <i>Sporobolus</i> sp. <i>Triodia epactia</i> <i>?Urochloa occidentalis</i>
Proteaceae	<i>Grevillea stenobotrya</i>
Chenopodiaceae	<i>Enchylaena tomentosa</i> <i>Rhagodia eremaea</i> <i>Tecticornia indica</i> subsp. <i>leiostachya</i>
Amaranthaceae	<i>Ptilotus</i> sp.
Gyrostemonaceae	<i>Gyrostemon ramulosus</i>
Lauraceae	<i>Cassytha ?capillaris</i>
Fabaceae	<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> <i>Acacia sericophylla</i> <i>Acacia stellaticeps</i> <i>Acacia synchronicia</i> <i>Acacia tetragonophylla</i> <i>Crotalaria cunninghamii</i> subsp. <i>cunninghamii</i> * <i>Prosopis pallida</i> <i>Senna artemisioides</i> subsp. <i>helmsii</i> <i>Senna glutinosa</i> subsp. <i>chatelainiana</i> <i>Sesbania cannabina</i> <i>Tephrosia rosea</i> var. <i>clementii</i> * <i>Vachellia farnesiana</i>
Euphorbiaceae	<i>Adriana tomentosa</i> var. <i>tomentosa</i>
Malvaceae	<i>Hibiscus brachychlaenus</i> <i>Sida rohlenae</i> subsp. <i>rohlenae</i>
Elatinaceae	<i>Bergia perennis</i> subsp. <i>exigua</i>
Frankeniaceae	<i>Frankenia ambita</i>
Myrtaceae	<i>Eucalyptus victrix</i> <i>Verticordia forrestii</i>

APPENDIX C: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE TUBRIDGI
GAS WELLS SURVEY AREA, 2016

Note: * denotes introduced species;

FAMILY	SPECIES
Convolvulaceae	<i>Cressa australis</i> <i>Evolvulus alsinoides</i>
Boraginaceae	<i>Heliotropium</i> sp.
Lamiaceae	<i>Quoya loxocarpa</i>
Solanaceae	<i>Solanum lasiophyllum</i>
Plantaginaceae	<i>Stemodia</i> sp. Onslow (A.A. Mitchell 76/148)
Cucurbitaceae	<i>Cucumis ?variabilis</i>
Goodeniaceae	<i>Scaevola sericophylla</i> <i>Scaevola spinescens</i> ?Goodeniaceae sp.
Asteraceae	<i>Centipeda minima</i> subsp. <i>macrocephala</i> ?Gnephosis sp. <i>Pterocaulon sphacelatum</i>

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE
WITHIN THE TUBRIDGI GAS WELLS SURVEY AREA, 2016

Note: * denotes introduced species

Species	Sites						
	TGS1_A	TGS1_B	TGS2_A	TGS2_B	TGS3_A	TGS3_B	TGS3_C
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>							X
<i>Acacia sericophylla</i>			X	X	X	X	X
<i>Acacia stellaticeps</i>			X	X			X
<i>Acacia synchronicia</i>					X	X	X
<i>Acacia tetragonophylla</i>					X	X	X
<i>Adriana tomentosa</i> var. <i>tomentosa</i>			X				
<i>Bergia perennis</i> subsp. <i>exigua</i>	X	X					
<i>Cassytha</i> ? <i>capillaris</i>				X			
* <i>Cenchrus ciliaris</i>		X	X	X	X	X	X
<i>Centipeda minima</i> subsp. <i>macrocephala</i>	X	X					
<i>Chrysopogon fallax</i>	X	X			X	X	X
<i>Cressa australis</i>	X	X					
<i>Crotalaria cunninghamii</i> subsp. <i>cunninghamii</i>			X	X			
<i>Cucumis</i> ? <i>variabilis</i>			X	X			
<i>Enchylaena tomentosa</i>			X		X		
<i>Eragrostis</i> ? <i>eriopoda</i>			X	X			
<i>Eragrostis xerophila</i>	X					X	
<i>Eriachne helmsii</i>	X	X			X	X	
<i>Eucalyptus victrix</i>					X		
<i>Evolvulus alsinoides</i>				X			
<i>Frankenia ambita</i>	X	X					
? <i>Gnephosis</i> sp.	X						
?Goodeniaceae sp.			X	X			
<i>Grevillea stenobotrya</i>			X				
<i>Gyrostemon ramulosus</i>			X				
<i>Heliotropium</i> sp.							X
<i>Hibiscus brachychlaenus</i>			X				
<i>Marsilea hirsuta</i>	X	X					
* <i>Prosopis pallida</i>					X		
<i>Pterocaulon sphacelatum</i>			X	X			
<i>Ptilotus</i> sp.					X	X	
<i>Quoya loxocarpa</i>			X				
<i>Rhagodia eremaea</i>			X		X	X	X
<i>Scaevola sericophylla</i>			X	X			X
<i>Scaevola spinescens</i>						X	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>					X		
<i>Senna glutinosa</i> subsp. <i>chatelainiana</i>			X	X			
<i>Sesbania cannabina</i>						X	X
<i>Sida rohlenae</i> subsp. <i>rohlenae</i>			X	X			
<i>Solanum lasiophyllum</i>			X	X	X		
<i>Sporobolus</i> sp.		X					
<i>Stemodia</i> sp. Onslow (A.A. Mitchell 76/148)			X				
<i>Tecticornia indica</i> subsp. <i>lelostachya</i>	X	X					

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE
WITHIN THE TUBRIDGI GAS WELLS SURVEY AREA, 2016

Note: * denotes introduced species

Species	Sites						
	TGS1_A	TGS1_B	TGS2_A	TGS2_B	TGS3_A	TGS3_B	TGS3_C
<i>Tephrosia rosea</i> var. <i>clementii</i>			X				
<i>Triodia epactia</i>			X	X			X
? <i>Urochloa occidentalis</i>	X	X					
* <i>Vachellia farnesiana</i>	X					X	X
<i>Verticordia forrestii</i>			X				

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES BY VEGETATION COMMUNITY
FOR THE TUBRIDGI GAS WELLS SURVEY AREA, 2016

Note: * denotes introduced species

SPECIES	Vegetation Community			
	C2	ID1	IF4	IP8
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>				X
<i>Acacia sericophylla</i>		X	X	X
<i>Acacia stellaticeps</i>		X		X
<i>Acacia synchronicia</i>			X	X
<i>Acacia tetragonophylla</i>			X	X
<i>Adriana tomentosa</i> var. <i>tomentosa</i>		X		
<i>Bergia perennis</i> subsp. <i>exigua</i>	X			
<i>Cassytha</i> ? <i>capillaris</i>		X		
* <i>Cenchrus ciliaris</i>	X	X	X	X
<i>Centipeda minima</i> subsp. <i>macrocephala</i>	X			
<i>Chrysopogon fallax</i>	X		X	X
<i>Cressa australis</i>	X			
<i>Crotalaria cunninghamii</i> subsp. <i>cunninghamii</i>		X		
<i>Cucumis</i> ? <i>variabilis</i>		X		
<i>Enchylaena tomentosa</i>		X	X	
<i>Eragrostis</i> ? <i>eriopoda</i>		X		
<i>Eragrostis xerophila</i>	X		X	
<i>Eriachne helmsii</i>	X		X	
<i>Eucalyptus victrix</i>			X	
<i>Evolvulus alsinoides</i>		X		
<i>Frankenia ambita</i>	X			
? <i>Gnephosis</i> sp.	X			
?Goodeniaceae sp.		X		
<i>Grevillea stenobotrya</i>		X		
<i>Gyrostemon ramulosus</i>		X		
<i>Heliotropium</i> sp.				X
<i>Hibiscus brachychlaenus</i>		X		
<i>Marsilea hirsuta</i>	X			
* <i>Prosopis pallida</i>			X	
<i>Pterocaulon sphacelatum</i>		X		
<i>Ptilotus</i> sp.			X	
<i>Quoya loxocarpa</i>		X		
<i>Rhagodia eremaea</i>		X	X	X
<i>Scaevola sericophylla</i>		X		X
<i>Scaevola spinescens</i>			X	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>			X	
<i>Senna glutinosa</i> subsp. <i>chatelainiana</i>		X		
<i>Sesbania cannabina</i>			X	X
<i>Sida rohlenae</i> subsp. <i>rohlenae</i>		X		
<i>Solanum lasiophyllum</i>		X	X	
<i>Sporobolus</i> sp.	X			
<i>Stemodia</i> sp. Onslow (A.A. Mitchell 76/148)		X		
<i>Tecticornia indica</i> subsp. <i>leiostachya</i>	X			
<i>Tephrosia rosea</i> var. <i>clementii</i>		X		
<i>Triodia epactia</i>		X		X
? <i>Urochloa occidentalis</i>	X			
* <i>Vachellia farnesiana</i>	X		X	X
<i>Verticordia forrestii</i>		X		

APPENDIX F: SUMMARY DETAILS OF SURVEY SITES ESTABLISHED WITHIN THE TUBRIDGI
GAS WELLS SURVEY AREA, 2016

Site: TGS1_A

Date: 16/05/16

Personnel: JC/BE

GPS location: (GDA94, zone 50K): 277758 mE, 7590760 mN

Community: MCPL_C2



Soil: Clay

Soil Notes: Claypan. Shallow cracking brown and slightly saline clays

Topography: Flat

Outcropping: None

Aspect: N/A

Age since fire: 10 +

Condition: Excellent

Litter cover % : 0.01

Litter type: Twigs

Bare ground % : 85

Field description: *Tecticornia* spp., *Frankenia ambita* low sparse shrubland over *Chrysopogon fallax*, *Eriachne helmsii* open tussock grasslands.

Species	Ht (cm)	% A
<i>Bergia perennis</i> subsp. <i>exigua</i>	10	0.01
<i>Centipeda minima</i> subsp. <i>macrocephala</i>	15	0.01
<i>Chrysopogon fallax</i>	110	0.3
<i>Cressa australis</i>	20	0.01
<i>Eragrostis xerophila</i>	40	1.8
<i>Eriachne helmsii</i>	50	4.5
<i>Frankenia ambita</i>	15	0.05
? <i>Gnephosis</i> sp.	15	0.01
<i>Marsilea hirsuta</i>	15	0.05
<i>Tecticornia indica</i> subsp. <i>leiostachya</i>	30	0.5
? <i>Urochloa occidentalis</i>	40	0.02
* <i>Vachellia farnesiana</i>	60	0.1

* Denotes introduced (exotic) species

APPENDIX F: SUMMARY DETAILS OF SURVEY SITES ESTABLISHED WITHIN THE TUBRIDGI
GAS WELLS SURVEY AREA, 2016

Site: TGS1_B

Date: 16/05/16

Personnel: JC/BE

GPS location: (GDA94, zone 50K): 277537 mE, 7590807 mN

Community: MCPL_C2



Soil: Clay

Soil Notes: Claypan. Shallow cracking brown and slightly saline clays

Topography: Flat

Outcropping: None

Aspect: N/A

Age since fire: 10 +

Condition: Excellent

Litter cover % : 0.01

Litter type: Twigs

Bare ground % : 80

Field description: *Tecticornia* spp., *Frankenia ambita* low sparse shrubland over *Chrysopogon fallax*, *Eriachne helmsii* open tussock grasslands.

Species	Ht (cm)	% A
<i>Bergia perennis</i> subsp. <i>exigua</i>	10	0.01
<i>Cenchrus ciliaris</i>	30	0.05
<i>Centipeda minima</i> subsp. <i>macrocephala</i>	20	0.03
<i>Chrysopogon fallax</i>	75	0.5
<i>Cressa australis</i>	15	0.01
<i>Eriachne helmsii</i>	40	5
<i>Frankenia ambita</i>	20	0.1
<i>Marsilea hirsuta</i>	15	0.08
<i>Sporobolus</i> sp.	30	0.1
<i>Tecticornia indica</i> subsp. <i>leiostachya</i>	35	0.6
? <i>Urochloa occidentalis</i>	30	0.05

* Denotes introduced (exotic) species

APPENDIX F: SUMMARY DETAILS OF SURVEY SITES ESTABLISHED WITHIN THE TUBRIDGI
GAS WELLS SURVEY AREA, 2016

Site: TGS2_A

Date: 16/05/16

Personnel: JC/BE

GPS location: (GDA94, zone 50K): 275572 mE, 7591134 mN

Community: MCPL_ID1



Soil: Sandy Loam

Soil Notes : Low consolidated dune with deep
orange/brown sandy loam

Topography: Flat

Outcropping: None

Aspect: N/A

Age since fire: 10 +

Condition: Excellent

Litter cover % : 0.1

Litter type: Twigs and leaves

Bare ground % : 40

Field description: *Acacia sericophylla*, *Gyrostemon ramulosus*, *Grevillea stenobotrya* mid sparse shrubs over
Acacia stellaticeps and *Scaevola sericophylla* low shrubland over *Triodia epactia* hummock
grassland.

Species	Ht (cm)	% A	Species	Ht (cm)	% A
<i>Acacia sericophylla</i>	250	10	<i>Hibiscus brachychlaenus</i>	150	0.01
<i>Acacia stellaticeps</i>	50	3	<i>Pterocaulon sphacelatum</i>	40	0.01
<i>Adriana tomentosa</i>	95	0.01	<i>Quoya loxocarpa</i>	55	0.5
var. <i>tomentosa</i>			<i>Rhagodia eremaea</i>	80	0.04
* <i>Cenchrus ciliaris</i>	40	2.4	<i>Scaevola sericophylla</i>	50	0.1
<i>Crotalaria cunninghamii</i>	180	0.2	<i>Senna glutinosa</i> subsp. <i>chatelainiana</i>	150	0.05
subsp. <i>cunninghamii</i>			<i>Sida rohlenae</i> subsp. <i>rohlenae</i>	80	0.02
<i>Cucumis ?variabilis</i>	CL	0.01	<i>Solanum lasiophyllum</i>	40	0.08
<i>Enchylaena tomentosa</i>	50	0.05	<i>Stemodia</i> sp. Onslow	25	0.01
<i>Eragrostis ?eriopoda</i>	45	0.01	(A.A. Mitchell 76/148)		
?Goodeniaceae sp.	60	0.05	<i>Tephrosia rosea</i> var. <i>clementii</i>	60	0.01
<i>Grevillea stenobotrya</i>	180	0.2	<i>Triodia epactia</i>	40	48
<i>Gyrostemon ramulosus</i>	200	0.8	<i>Verticordia forrestii</i>	140	0.02

* Denotes introduced (exotic) species

APPENDIX F: SUMMARY DETAILS OF SURVEY SITES ESTABLISHED WITHIN THE TUBRIDGI
GAS WELLS SURVEY AREA, 2016

Site: TGS2_B

Date: 16/05/16

Personnel: JC/BE

GPS location: (GDA94, zone 50K): 275433 mE, 7591255 mN

Community: MCPL_ID1



Soil: Sandy Loam

Soil Notes : Low consolidated dune with deep
orange/brown sandy loam

Topography: Flat

Outcropping: None

Aspect: N/A

Age since fire: 10 +

Condition: Excellent

Litter cover % : 0.2

Litter type: Twigs and leaves

Bare ground % : 25

Field description: *Acacia sericophylla*, *Crotalaria cunninghamii*, *Grevillea stenobotrya* mid sparse shrubs over
Acacia stellaticeps and *Scaevola sericophylla* low shrubland over *Triodia epactia* hummock
grassland and * *Cenchrus ciliaris* tussock grassland.

Species	Ht (cm)	% A
<i>Acacia sericophylla</i>	200	1.8
<i>Acacia stellaticeps</i>	55	20
<i>Cassythia ?capillaris</i>	CL	0.02
* <i>Cenchrus ciliaris</i>	40	0.5
<i>Crotalaria cunninghamii</i> subsp. <i>cunninghamii</i>	80	0.02
<i>Cucumis ?variabilis</i>	20	0.01
<i>Eragrostis ?eriopoda</i>	35	0.01
<i>Evolvulus alsinoides</i>	15	0.01
?Goodeniaceae sp.	50	0.02
<i>Pterocaulon sphacelatum</i>	25	0.01
<i>Scaevola sericophylla</i>	30	0.05
<i>Senna glutinosa</i> subsp. <i>chatelainiana</i>	100	0.01
<i>Sida rohlenae</i> subsp. <i>rohlenae</i>	90	0.01
<i>Solanum lasiophyllum</i>	35	0.01
<i>Triodia epactia</i>	40	60

* Denotes introduced (exotic) species

APPENDIX F: SUMMARY DETAILS OF SURVEY SITES ESTABLISHED WITHIN THE TUBRIDGI
GAS WELLS SURVEY AREA, 2016

Site: TGS3_A

Date: 16/05/16

Personnel: JC/BE

GPS location: (GDA94, zone 50K): 275805 mE, 7589325 mN

Community: MCPL_IF4



Soil: Sandy Loam

Soil Notes: Red clayey loam with areas of shallow cracking
in more open areas.

Topography: Flat

Outcropping: None

Aspect: N/A

Age since fire: 10 +

Condition: Excellent

Litter cover % : 1

Litter type: Twigs and leaves

Bare ground % : 60

Field description: *Eucalyptus victrix* low open woodland over *Acacia* spp. mid sparse shrubland over low open tussock grassland.

Species	Ht (cm)	% A
<i>Acacia sericophylla</i>	210	2
<i>Acacia synchronicia</i>	150	0.5
<i>Acacia tetragonophylla</i>	200	1.8
* <i>Cenchrus ciliaris</i>	40	0.05
<i>Chrysopogon fallax</i>	50	0.08
<i>Enchylaena tomentosa</i>	110	0.1
<i>Eriachne helmsii</i>	40	2
<i>Eucalyptus victrix</i>	450	15
* <i>Prosopis pallida</i>	50	0.05
<i>Ptilotus</i> sp.	20	0.01
<i>Rhagodia eremaea</i>	150	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	30	0.02
<i>Solanum lasiophyllum</i>	15	0.01

* Denotes introduced (exotic) species

APPENDIX F: SUMMARY DETAILS OF SURVEY SITES ESTABLISHED WITHIN THE TUBRIDGI
GAS WELLS SURVEY AREA, 2016

Site: TGS3_B

Date: 16/05/16

Personnel: JC/BE

GPS location: (GDA94, zone 50K): 275734 mE, 7589234 mN

Community: MCPL_ IF4



Soil: Clay loam

Soil Notes : Brown to orange clayey loam and some areas
shallow cracking clay

Topography: Flat

Outcropping: None

Aspect: N/A

Age since fire: 10 +

Condition: Excellent

Litter cover % : 10

Litter type: Twigs and leaves

Bare ground % : 20

Field description: *Acacia spp.*, *Scaevola spinescens*, **Vachellia farnesiana* mid sparse shrubland over mixed
tussock grassland. Note: isolated *E. victrix* common, but outside of plot.

Species	Ht (cm)	% A
<i>Acacia sericophylla</i>	200	0.8
<i>Acacia synchronicia</i>	150	0.5
<i>Acacia tetragonophylla</i>	220	2.5
* <i>Cenchrus ciliaris</i>	40	0.2
<i>Chrysopogon fallax</i>	60	0.05
<i>Eragrostis xerophila</i>	40	0.2
<i>Eriachne helmsii</i>	50	8
<i>Ptilotus sp.</i>	40	0.01
<i>Rhagodia eremaea</i>	80	0.02
<i>Scaevola spinescens</i>	160	0.4
<i>Sesbania cannabina</i>	160	0.2
* <i>Vachellia farnesiana</i>	180	0.6

* Denotes introduced (exotic) species

APPENDIX F: SUMMARY DETAILS OF SURVEY SITES ESTABLISHED WITHIN THE TUBRIDGI
GAS WELLS SURVEY AREA, 2016

Site: TGS3_C

Date: 16/05/16

Personnel: JC/BE

GPS location: (GDA94, zone 50K): 275811 mE, 7589472 mN

Community: MCPL_IP8



Soil: Sandy loam

Soil Notes : Orange to brown on low rolling consolidated
dune

Topography: Low US

Outcropping: None

Aspect: N/A

Age since fire: 10 +

Condition: Excellent

Litter cover % : 0.05

Litter type: Twigs and leaves

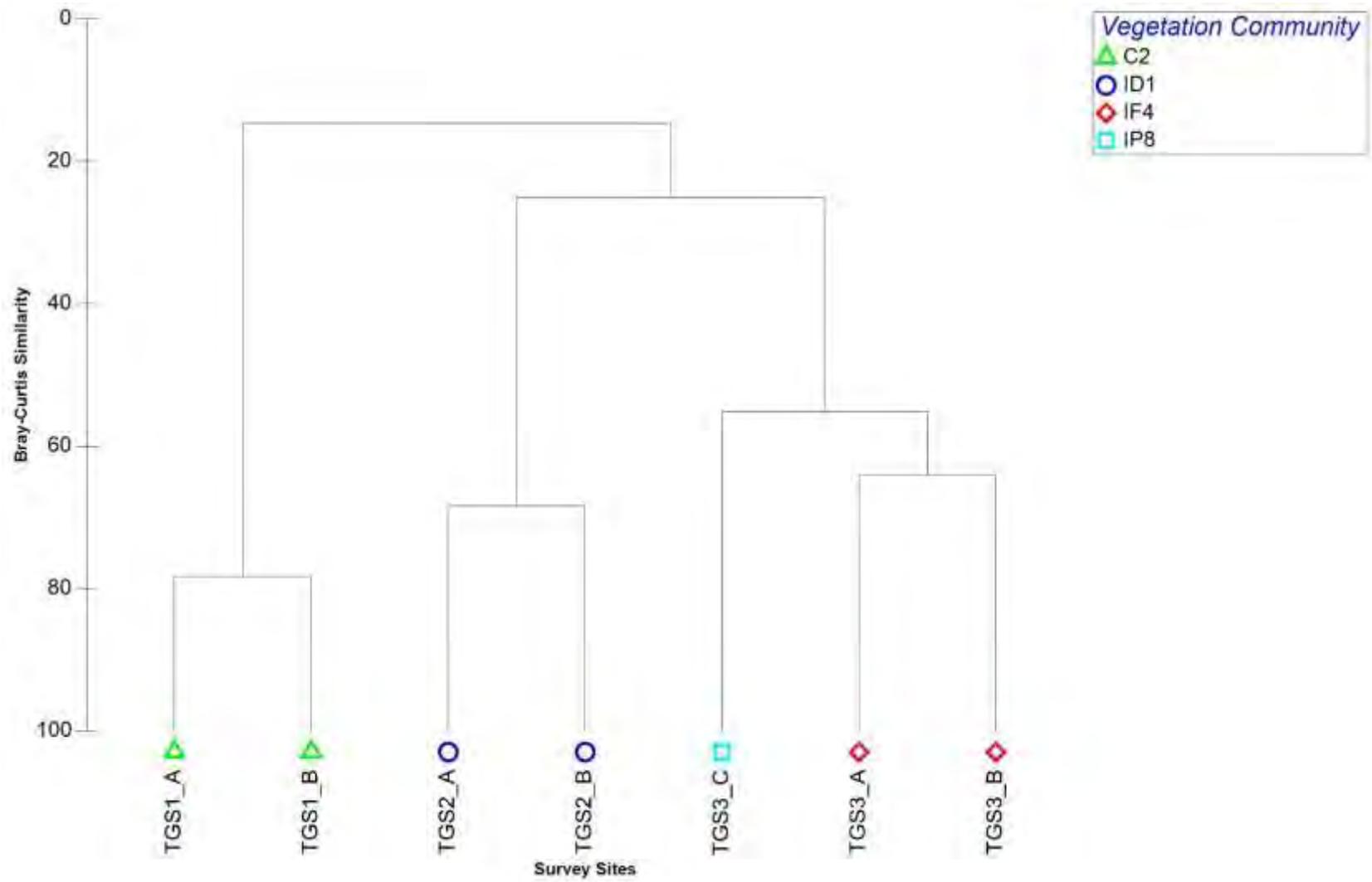
Bare ground % : 50

Field description: *Acacia* spp. low sparse shrubland over sparse low mixed shrubs over *Triodia epactia*
hummock grassland and **Cenchrus ciliaris* tussock grassland.

Species	Ht (cm)	% A
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>	180	0.5
<i>Acacia sericophylla</i>	180	0.8
<i>Acacia stellaticeps</i>	80	0.1
<i>Acacia synchronicia</i>	110	0.2
<i>Acacia tetragonophylla</i>	180	0.5
* <i>Cenchrus ciliaris</i>	50	2.5
<i>Chrysopogon fallax</i>	60	0.05
<i>Heliotropium</i> sp.	20	0.01
<i>Rhagodia eremaea</i>	70	0.02
<i>Scaevola sericophylla</i>	40	0.01
<i>Sesbania cannabina</i>	190	0.01
<i>Triodia epactia</i>	40	45
* <i>Vachellia farnesiana</i>	100	0.2

* Denotes introduced (exotic) species

APPENDIX G: HIERARCHICAL CLUSTER DENDROGRAM OF SITES SURVEYED WITHIN THE TUBRIDGI GAS WELLS SURVEY AREA, 2016



Appendix E Chemical Disclosure List



A. SYSTEM DETAILS:	
OPERATOR:	DDGT
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	Slurry 1: 12.5ppg Lead
TOTAL VOLUME OF SYSTEM (m ³):	1

B. PRODUCT LIST, Cont'd					
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info	MSDS Attached
Fresh water	Ashbourne River	Mix water	48.6380%	N/A	N/A
Cement - Class G	Halliburton	Cement	46.4715%	<p>CONSTITUENT 1 ($\leq 100\%$): After hardening with water or moister, cement presents no ecotoxicity risks. (Source: IUCLID 2000) Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 ($\leq 10\%$): Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p>	Yes

Econolite Liquid	Halliburton	Cement Additive Stabiliser	4.6200%	<p>CONSTITUENT 1 (≤60%): Freshwater Acute Algae Toxicity 72h EC50: > 345 mg/L (Scenedesmus subspicatus) [ECHA]; Freshwater Acute Crustacean Toxicity 48h EC50: 1700 mg/L (Daphnia magna) [OECD SIDS]; Freshwater Acute Fish Toxicity 96h LC50: 1108 mg/L (Danio rerio) [OECD SIDS]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable. CONSTITUENT 2 (≤60%): No Hazard</p>	Yes
NF-6	Halliburton	Reduces air entrainment into cement slurry	0.0382%	<p>Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: > 1000 mg/L (Acartia tonsa) [Halliburton Funded Study]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];</p>	Yes
Calcium Chloride	Halliburton	Excellerator	0.2323%	<p>CONSTITUENT 1 (≤10%): Freshwater Acute Algae Toxicity 72h EC50: 2900 mg/L (Pseudokirchneriella subcapitata) [ECHA]; Freshwater Acute Crustacean Toxicity 48h LC50: 1285 mg/L (Daphnia magna) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 4630 mg/L (Pimephales promelas) [ECHA]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable. CONSTITUENT 2 (≤100%): Freshwater Acute Algae Toxicity 96h EC50: 2430 mg/L (Navicula seminulum) [US EPA ECOTOX]; Freshwater Acute Crustacean Toxicity 48h EC50: 402.6 mg/L (Daphnia magna) [US EPA ECOTOX]; Freshwater Acute Fish Toxicity 96h LC50: 9675 mg/L (Lepomis macrochirus) [IUCLID]; Bioaccumulation: Substance is inorganic - bioaccumulation is not</p>	Yes

			applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.	
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C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
Mix Water	NA	48.64%
Portland cement	65997-15-1	42.26%
Water in Product	7732-18-5	4.205%
Sodium silicate	1344-09-8	2.521%
Crystalline silica, quartz	14808-60-7	2.113%
Calcium Chloride, dihydrate	10035-04-8	0.2112%
Rape Oil	8002-13-9	0.03474%
Sodium Chloride	7647-14-5	0.01056%
Monopropylene glycol monooleate	1330-80-9	0.003474%
Aluminium stearate	637-12-7	0.001737%
Sorbitan, monopalmitate	26266-57-9	0.001737%

A. SYSTEM DETAILS:	
OPERATOR:	DDGT
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	Slurry 2, 15.8ppg Tail 9 5/8" CSG
TOTAL VOLUME OF SYSTEM (m ³):	1

B. PRODUCT LIST, Cont'd					
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info	MSDS Attached
Fresh water	Ashbourne River	Mix water	20.0717%	N/A	N/A
Cement - Class G	Halliburton	Cement	66.1432%	<p>CONSTITUENT 1 ($\leq 100\%$): After hardening with water or moisture, cement presents no ecotoxicity risks. (Source: IUCLID 2000) Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 ($\leq 10\%$): Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p>	Yes

Gascon 469		Cement Additive Stabiliser	3.8754%	<p>CONSTITUENT 1 ($\leq 1\%$): Effect concentrations in the aquatic environment are attributable to a change in pH value Freshwater Acute Crustacean Toxicity 48h EC50: 40.4 mg/L (Ceriodaphnia sp.) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 125 mg/L (Gambusia affinis) [OECD SIDS]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 ($\leq 60\%$): Freshwater Acute Algae Toxicity 72h EC50: 440 mg/L (Selenastrum capricornutum) [IUCLID; LOLI]; Freshwater Acute Crustacean Toxicity 48h EC50: 7600 mg/L (Ceriodaphnia dubia) [IUCLID; LOLI]; Freshwater Acute Fish Toxicity 96h LC50: 5000 mg/L (Brachydanio rerio) [IUCLID; LOLI]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 3 ($\leq 100\%$): No Hazard</p>	Yes
HR-6L	Halliburton	Cement Retarder	3.5527%	<p>CONSTITUENT 1 ($\leq 100\%$): No Hazard</p> <p>CONSTITUENT 2 ($\leq 60\%$): Marine Water Acute Algae Toxicity 72h EC50: 301 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: 1261 mg/L (Acartia tonsa) [Halliburton Funded Study]; Bioaccumulation Log Pow: < 0 [Halliburton Funded Study];</p>	Yes
CFR-3L	Halliburton	Friction Reducer	2.0611%	<p>Marine Water Acute Algae Toxicity 72h EC50: > 3300 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: 1687 mg/L (Acartia tonsa) [Halliburton Funded Study]; Freshwater Acute Fish Toxicity 48h LC50: 7478 mg/L (Aphyosemion bivittatum) [SKW Trostberg];</p>	Yes

				Bioaccumulation Log Pow: < 0 [Halliburton Funded Study]; Marine Water Biodegradation 28d: 0% [Halliburton Funded Study];	
Halad-413L	Halliburton	Fluid Loss Additive	3.9108%	Marine Water Acute Algae Toxicity 72h EC50: 1102 mg/L (Skeletonema costatum) [OSPAR]; Marine Water Acute Crustacean Toxicity 48h LC50: > 2000 mg/L (Acartia tonsa) [OSPAR]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [OSPAR]; Bioaccumulation Log Kow: < 3.5 [Halliburton Funded Study]; Marine Water Biodegradation 28d: 6 % [Halliburton Funded Study];	Yes
NF-6	Halliburton	Reduces air entrainment into cement slurry	0.0544%	Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: > 1000 mg/L (Acartia tonsa) [Halliburton Funded Study]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];	Yes
Calcium Chloride	Halliburton	Accelerator	0.3307%	CONSTITUENT 1 (≤10%): Freshwater Acute Algae Toxicity 72h EC50: 2900 mg/L (Pseudokirchneriella subcapitata) [ECHA]; Freshwater Acute Crustacean Toxicity 48h LC50: 1285 mg/L (Daphnia magna) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 4630 mg/L (Pimephales promelas) [ECHA]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable. CONSTITUENT 2 (≤100%): Freshwater Acute Algae Toxicity 96h EC50: 2430 mg/L (Navicula seminulum) [US EPA ECOTOX]; Freshwater Acute Crustacean Toxicity 48h EC50: 402.6 mg/L (Daphnia magna) [US EPA ECOTOX]; Freshwater Acute Fish Toxicity 96h LC50: 9675 mg/L (Lepomis macrochirus) [IUCLID]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.	Yes

C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
Mix Water	NA	20.072%
Portland cement	65997-15-1	59.169%
Water in Product	7732-18-5	11.254%
Crystalline silica, quartz	14808-60-7	2.958%
Silica, amorphous - fumed	7631-86-9	2.080%
Sodium Lignosulfonate	8061-51-6	1.907%
Sulfurous acid, monosodium salt, polymer with formaldehyde and acetone	40104-76-5	1.106%
Humic acids, sodium salts, polymers with N,N-dimethyl-2-propenamide, sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1) and 2-propenenitrile, sodium bisulfite-terminated	473268-27-8	1.050%
Calcium Chloride, dihydrate	10035-04-8	0.296%
Rape Oil	8002-13-9	0.0487%
Sodium hydroxide	1310-73-2	0.0347%
Sodium Chloride	7647-14-5	0.0148%
Monopropylene glycol monooleate	1330-80-9	0.00487%
Sorbitan, monopalmitate	26266-57-9	0.00243%
Aluminium stearate	637-12-7	0.00243%

A. SYSTEM DETAILS:	
OPERATOR:	DDGT
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	Slurry 3, 15.4ppg, 7-in CSG
TOTAL VOLUME OF SYSTEM (m ³):	1

B. PRODUCT LIST, Cont'd					
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info	MSDS Attached
Fresh water	Ashbourne River	Mix water	22.0274%	N/A	N/A
Cement - Class G	Halliburton	Cement	58.9983%	<p>CONSTITUENT 1 (≤100%): After hardening with water or moisture, cement presents no ecotoxicity risks. (Source: IUCLID 2000) Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 (≤10%): Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p>	Yes

Gascon 469		Cement Additive Stabiliser	3.4568%	<p>CONSTITUENT 1 ($\leq 1\%$): Effect concentrations in the aquatic environment are attributable to a change in pH value Freshwater Acute Crustacean Toxicity 48h EC50: 40.4 mg/L (Ceriodaphnia sp.) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 125 mg/L (Gambusia affinis) [OECD SIDS]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 ($\leq 60\%$): Freshwater Acute Algae Toxicity 72h EC50: 440 mg/L (Selenastrum capricornutum) [IUCLID; LOLI]; Freshwater Acute Crustacean Toxicity 48h EC50: 7600 mg/L (Ceriodaphnia dubia) [IUCLID; LOLI]; Freshwater Acute Fish Toxicity 96h LC50: 5000 mg/L (Brachydanio rerio) [IUCLID; LOLI]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 3 ($\leq 100\%$): No Hazard</p>	Yes
CFR-3L	Halliburton	Friction Reducer	0.3062%	<p>Marine Water Acute Algae Toxicity 72h EC50: > 3300 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: 1687 mg/L (Acartia tonsa) [Halliburton Funded Study]; Freshwater Acute Fish Toxicity 48h LC50: 7478 mg/L (Aphyosemion bivittatum) [SKW Trostberg]; Bioaccumulation Log Pow: < 0 [Halliburton Funded Study]; Marine Water Biodegradation 28d: 0% [Halliburton Funded Study];</p>	Yes
Halad-413L	Halliburton	Fluid Loss Additive	3.4882%	<p>Marine Water Acute Algae Toxicity 72h EC50: 1102 mg/L (Skeletonema costatum) [OSPAR]; Marine Water Acute Crustacean Toxicity 48h LC50: > 2000 mg/L (Acartia tonsa) [OSPAR]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [OSPAR];</p>	Yes

				Bioaccumulation Log Kow: < 3.5 [Halliburton Funded Study]; Marine Water Biodegradation 28d: 6 % [Halliburton Funded Study];	
NF-6	Halliburton	Reduces air entrainment into cement slurry	0.2428%	Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: > 1000 mg/L (Acartia tonsa) [Halliburton Funded Study]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];	Yes
Latex 3000	Halliburton	Cement Expanding Additive	4.3997%	CONSTITUENT 1 (≤ 60%): Acute Fish Toxicity LC50 96h: >1000 mg/L (Cyprinodon variegatus) CONSTITUENT 2 (≤ 60%): No Hazard CONSTITUENT 3 (≤ 0.1%): Acute Fish Toxicity 48h LC50: > 1,000 mg/L [Catalyst Partners SDS]; CONSTITUENT 4 (≤ 0.1%): Acute Fish Toxicity 96 h LC50: 4.02 mg/L (Fathead minnow [Pimephales promelas]); Acute Crustacean Toxicity 48 h EC50: 4.7 mg/L (Daphnia magna); Acute Algae Toxicity 72 h EC50: 4.9 mg/L (Selenastrum capricornutum); Source: OECD SIDS CONSTITUENT 5 (≤ 0.1%): Acute Fish Toxicity 24 h LC50: 71.5 mg/L (Lagodon rhomboides); Acute Crustacean Toxicity 96h EC50: 34.8 mg/L (Daphnia magna); Bioaccumulation BCF: 13	Yes
WellLife 734	Halliburton	Cement Enhancer	0.5901%	Is a fine rigid fibrous material (glass fibre), which is chemically inert. Glass fibers are not soluble in water and are biologically inert hence no available published test data. Glass is classed as a PLONOR product within OSPAR. The irritation from contact with this product was not identified being from a chemical reaction, however irritation resulting from contact with this product is by mechanical abrasion. Standard PPE is require to handle the product to minimise direct exposure from mechanical contact.	Yes

WellLife 684	Halliburton	Cement Additive	0.5901%	<p>Is a fine rigid fibrous material (carbon fibres). Skin and eye irritations as a result from contact with this product is primarily due to mechanical abrasion. Standard PPE is require to handle the product to minimise direct exposure from mechanical contact.</p> <p>Published toxicology for this product are: Toxicity to Algae: EL50 (72h) > 100 mg/L (Pseudokirchnerella subcapitata) Toxicity to Microorganisms: NOEC (3h) > 1000 mg/L (Activated sludge) Toxicity to Invertebrates EL50 (48h) >100 mg/L (Daphnia magna) Biodegradation: Not applicable (Inorganic) Bioaccumulation: Not applicable</p>	Yes
MICROBOND HT Component	Halliburton	Cement Additive	2.9501%	<p>No data was available in the IUCLID for this component, as "magnesium ions are a major component of all natural waters". Source: IUCLID 2000 Product classified as a PLONOR-Pose Little or No Risk to the Environment in accordance to NL HMCS Category.</p>	Yes
Microbond	Halliburton	Expander	2.9501%	<p>CONSTITUENT 1 (\leq 100%): Freshwater Acute Algae Toxicity 72h EC50: > 100 mg/L (Selenastrum capricornutum) [OECD SIDS]; Freshwater Acute Crustacean Toxicity 48h EC50: > 100 mg/L (Daphnia magna) [OECD SIDS]; Freshwater Acute Fish Toxicity 96h EC50: > 100 mg/L (Oryzias latipes) [OECD SIDS]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 (\leq 30%): Freshwater Acute Algae Toxicity 72h EC50: 3.6 mg/L (Desmodesmus subspicatus) [ECHA]; Freshwater Acute Crustacean Toxicity 48h EC50: 5.4 mg/L (Daphnia magna) [ECHA]; Freshwater Acute Fish Toxicity 96h EC50: > 100 mg/L (Danio rerio) [ECHA]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p>	Yes

			<p>CONSTITUENT 3 ($\leq 10\%$): Effect concentrations in the aquatic environment are attributable to a change in pH value. Freshwater Acute Crustacean Toxicity 48h EC50: 49.1 mg/L (Daphnia magna) [ECHA]; Marine Water Acute Crustacean Toxicity 96h LC50: 158 mg/L (Crangon septemspinosa) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 50.6 mg/L (Oncorhynchus mykiss) [ECHA]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 4 ($\leq 5\%$): Freshwater Acute Algae Toxicity 96h EC50: 650 mg/L (Navicula seminulum) [US EPA ECOTOX]; Freshwater Acute Crustacean Toxicity 48h EC50: 1020 mg/L (Ceriodaphnia dubia) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 7100 mg/L (Lepomis macrochirus) [ECHA]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p>	

C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
Mix Water	NA	22.027%
Portland cement	65997-15-1	53.224%
Water in Product	7732-18-5	8.834%
Magnesium Oxide	1309-48-4	2.661%
Calcium sulfate dihydrate	10101-41-4	2.661%
Crystalline silica, quartz	14808-60-7	2.661%
Functionalized Styrene Butadiene Latex	403824-26-0	2.381%
Silica, amorphous - fumed	7631-86-9	1.871%
Humic acids, sodium salts, polymers with N,N-dimethyl-2-propenamide, sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1) and 2-propenenitrile, sodium bisulfite-terminated	473268-27-8	0.944%
Calcium aluminate	12042-68-1	0.798%
Glass, oxide	65997-17-3	0.532%
Carbon	7440-44-0	0.532%
Calcium hydroxide	1305-62-0	0.266%
Rape Oil	8002-13-9	0.219%
Sulfurous acid, monosodium salt, polymer with formaldehyde and acetone	40104-76-5	0.166%
Sodium bicarbonate	144-55-8	0.133%
Sodium hydroxide	1310-73-2	0.0312%
Monopropylene glycol monooleate	1330-80-9	0.0219%
Sorbitan, monopalmitate	26266-57-9	0.0110%
Aluminium stearate	637-12-7	0.0110%
Styrene	100-42-5	0.00397%
Butadiene	106-99-0	0.00397%
4-Vinylcyclohexene	100-40-3	0.00397%

A. SYSTEM DETAILS:	
OPERATOR:	DDGT
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	Tunes Spacer-III
TOTAL VOLUME OF SYSTEM (m³):	1

B. PRODUCT LIST, Cont'd					
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info	MSDS Attached
Fresh water	Ashbourne River	Mix water	65.7126%	N/A	N/A
NF-6	Halliburton	Reduces air entrainment into cement slurry	0.0165%	Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: > 1000 mg/L (Acartia tonsa) [Halliburton Funded Study]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];	Yes
Barite	Halliburton	Weighting Agent	24.6841%	Acute Fish Toxicity 96hr LC50 76000mg/L @ 96 hr Species Oncorhynchus mykiss EPA Ref# 869 48hr LC50 >30lb/gal (>3594790mg/L) Report no BL8279 Species Pimephales promelas (fish) 48hr LC50 >30lb/bbl (>85556mg/L) Report BL8377 Species Daphnia pulex (Water Flea – crustacean) Bioassay testing where LC50/EC50: >100 mg/L	Yes
SEM-8	Halliburton	Emulsifier	0.5635%	CONSTITUENT 1 (≤100%): Marine Water Acute Algae Toxicity 72h EC50: 32 mg/L (Selenastrum capricornutum) [Madsen et al., 2002] (similar substance); Freshwater Acute Crustacean Toxicity 96h EC50: 1.17 mg/L (Daphnia magna) [Madsen et al., 2002] (similar substance); Freshwater Acute Fish Toxicity 96h LC50: 1-2.5 mg/L (Salmo trutta) [Madsen et al., 2002] (similar substance);	Yes

				<p>Marine Water Biodegradation 28d: 61% [OSPAR]; CONSTITUENT 2 (≤30%): Freshwater Acute Algae Toxicity 72h EC50: > 1000 mg/L (Scenedesmus subspicatus) [IUCLID]; Freshwater Acute Crustacean Toxicity 24h EC50: > 10000 mg/L (Daphnia magna) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 9640 mg/L (Pimephales promelas) [ECHA]; Bioaccumulation Log Pow: 0.15 [IUCLID]; Freshwater Biodegradation 14d: 83% [HSDB]; CONSTITUENT 3 (≤30%): No Hazard CONSTITUENT 4 (≤1%): Freshwater Acute Algae Toxicity 96h EC50: 0.7 mg/L (Selenastrum capricornutum) [CCID] (similar substance); Freshwater Acute Crustacean Toxicity 48h EC50: 0.39 mg/L (Ceriodaphnia dubia) [CCID] (similar substance); Freshwater Acute Fish Toxicity 96h LC50: 1.4 mg/L (Pimephales promelas) [CCID] (similar substance); Bioaccumulation BCF: 12.7-237 [ECHA] (similar substance); Freshwater Biodegradation 28d: 72% [ECHA] (similar substance);</p>	
PEN-5M	Halliburton	Cleaner	0.4820%	<p>CONSTITUENT 1 (≤60%): Whole body BCF values of AEs in fish range from <5 to 233 New Zealand CCID cites algae study (Selenastrum capricornutum) EC50=0.7 mg/L from ECOTOX and daphnia study with EC50=0.39 mg/L from Warne, 1999. CONSTITUENT 2 (≤60%): No Hazard CONSTITUENT 3 (≤30%): Acute Fish Toxicity 96h LC50: 9640 mg/L (Pimephales promelas); Acute Crustacean Toxicity 48h LC50: 1400 mg/L (Crangon crangon); Acute Algae Toxicity 72h EC50: >1000 mg/L (Scenedesmus subspicatus);</p>	Yes
HR-25L	Halliburton	Cement Retarder	0.0000%	<p>CONSTITUENT 1 (≤60%): No Hazard CONSTITUENT 2 (≤60%): Freshwater Acute Algae Toxicity 72h EC50: 51.4 mg/L (Pseudokirchneriella subcapitata) [ECHA]; Freshwater Acute Crustacean Toxicity 48h EC50: 93.3 mg/L (Daphnia</p>	Yes

				<p>magna) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: > 100 mg/L (Danio rerio) [ECHA]; Bioaccumulation Log Pow: 0.24 [Halliburton Funded Study]; Marine Water Biodegradation 28d: 85 % [ECHA];</p>	
TUNED SPACER III	Halliburton	Mud/Cement Spacer	8.5414%	<p>CONSTITUENT 1 (≤30%): Marine Water Acute Algae Toxicity 72h EC50: > 10000 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: > 10000 mg/L (Acartia tonsa) [Halliburton Funded Study]; Marine Water Acute Fish Toxicity 96h LC50: > 5600 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Constituent is a clay mineral of soil and therefore biodegradability is not applicable. Constituent is a clay mineral of soil and therefore bioaccumulation is not applicable. CONSTITUENT 2 (≤10%): Freshwater Acute Algae Toxicity 72h EC50: > 10000 mg/L (Scenedesmus subspicatus) [OECD SIDS] (similar substance); Freshwater Acute Crustacean Toxicity 24h EC50: > 10000 mg/L (Daphnia magna) [OECD SIDS] (similar substance); Freshwater Acute Fish Toxicity 72h LC50: > 10000 mg/L (Cyprinus carpio) [LOLI]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable. CONSTITUENT 3 (≤5%): Component is naturally occurring and not intrinsically hazardous. CONSTITUENT 4 (≤1%): Freshwater Acute Crustacean Toxicity 48h EC50: > 50 mg/L (Daphnia magna) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: > 100 mg/L (Pimephales promelas) [ECHA]; Freshwater Acute Plant Toxicity 72h EC50: 990 mg/L (Lactuca sativa) [ECHA]; Bioaccumulation BCF: 3.2 [ECHA]; Freshwater Biodegradation 28d: 97 % [ECHA]; CONSTITUENT 5 (≤100%):</p>	Yes

			<p>Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 6 ($\leq 1\%$): Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p>	
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C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
Mix Water	NA	65.713%
Barite	13462-86-7	21.762%
Crystalline silica, quartz	14808-60-7	7.530%
Sepiolite	63800-37-3	2.259%
Diatomaceous earth	61790-53-2	0.7530%
Polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt	68037-05-8	0.4968%
Water in Product	7732-18-5	0.4055%
Welan gum	72121-88-1	0.3765%
Isopropanol	67-63-0	0.2765%
Alcohols, C12-16, ethoxylated	68551-12-2	0.2550%
Crystalline silica, cristobalite	14464-46-1	0.07530%
Citric acid	77-92-9	0.07530%
Rape Oil	8002-13-9	0.01452%
Alcohols, C6-10, ethoxylated	70879-83-3	0.004968%
Monopropylene glycol monooleate	1330-80-9	0.001452%
Sorbitan, monopalmitate	26266-57-9	0.0007260%
Aluminium stearate	637-12-7	0.0007260%

A. SYSTEM DETAILS:	
OPERATOR:	DBP
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	Alternate Lead, 12.5 ppg 7" Casing
TOTAL VOLUME OF SYSTEM (m ³):	19.078

B. PRODUCT LIST, Cont'd				
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info
Fresh water		Mix water	35.6506 %	N/A
Cement - Class G	Halliburton	Cement	44.1174 %	<p>CONSTITUENT 1 (≤100%): After hardening with water or moister, cement presents no ecotoxicity risks. (Source: IUCLID 2000) Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 (≤10%): Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p>

Econolite Liquid	Halliburton	Cement Additive Stabiliser	5.4847%	<p>CONSTITUENT 1 ($\leq 60\%$): Freshwater Acute Algae Toxicity 72h EC50: > 345 mg/L (<i>Scenedesmus subspicatus</i>) [ECHA]; Freshwater Acute Crustacean Toxicity 48h EC50: 1700 mg/L (<i>Daphnia magna</i>) [OECD SIDS]; Freshwater Acute Fish Toxicity 96h LC50: 1108 mg/L (<i>Danio rerio</i>) [OECD SIDS]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 ($\leq 60\%$): No Hazard</p>
Gascon 469		Cement Additive Stabiliser	8.6188%	<p>CONSTITUENT 1 ($\leq 1\%$): Effect concentrations in the aquatic environment are attributable to a change in pH value Freshwater Acute Crustacean Toxicity 48h EC50: 40.4 mg/L (<i>Ceriodaphnia</i> sp.) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 125 mg/L (<i>Gambusia affinis</i>) [OECD SIDS]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 ($\leq 60\%$): Freshwater Acute Algae Toxicity 72h EC50: 440 mg/L (<i>Selenastrum capricornutum</i>) [IUCLID; LOLI]; Freshwater Acute Crustacean Toxicity 48h EC50: 7600 mg/L (<i>Ceriodaphnia dubia</i>) [IUCLID; LOLI]; Freshwater Acute Fish Toxicity 96h LC50: 5000 mg/L (<i>Brachydanio rerio</i>) [IUCLID; LOLI]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 3 ($\leq 100\%$): No Hazard</p>
HR-6L	Halliburton	Cement Retarder	1.4221%	<p>CONSTITUENT 1 ($\leq 100\%$): No Hazard</p> <p>CONSTITUENT 2 ($\leq 60\%$): Marine Water Acute Algae Toxicity 72h EC50: 301 mg/L (<i>Skeletonema costatum</i>) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: 1261 mg/L (<i>Acartia tonsa</i>) [Halliburton Funded Study]; Bioaccumulation Log Pow: < 0 [Halliburton Funded Study];</p>

Halad-413L	Halliburton	Fluid Loss Additive	4.3486%	Marine Water Acute Algae Toxicity 72h EC50: 1102 mg/L (<i>Skeletonema costatum</i>) [OSPAR]; Marine Water Acute Crustacean Toxicity 48h LC50: > 2000 mg/L (<i>Acartia tonsa</i>) [OSPAR]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (<i>Scophthalmus maximus</i>) [OSPAR]; Bioaccumulation Log Kow: < 3.5 [Halliburton Funded Study]; Marine Water Biodegradation 28d: 6 % [Halliburton Funded Study];
NF-6	Halliburton	Reduces air entrainment into cement slurry	0.1814%	Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (<i>Skeletonema costatum</i>) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: > 1000 mg/L (<i>Acartia tonsa</i>) [Halliburton Funded Study]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (<i>Scophthalmus maximus</i>) [Halliburton Funded Study]; Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];
D-AIR 3000L	Halliburton	Defoamer	0.1763%	CONSTITUENT 1 (≤60%): Acute Algae Toxicity 96h EC50 : 22 mg/L (<i>Pseudokirchneriella subcapitata</i>) Acute Fish Toxicity Data 96h LC50 : >1000 mg/L (<i>Salmo gairdneri</i>) Acute Crustacean Toxicity 48h EC50: 480 mg/L (<i>Daphnia magna</i>) CONSTITUENT 2 (≤60%): Marine Water Acute Algae Toxicity 72h EC50: 426 mg/L (<i>Skeletonema costatum</i>) [OSPAR]; Marine Water Acute Crustacean Toxicity 48h EC50: 433.2 mg/L (<i>Acartia tonsa</i>) [OSPAR]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (<i>Scophthalmus maximus</i>) [Halliburton Funded Study]; Bioaccumulation Log Pow: 5.06 [Halliburton Funded Study]; CONSTITUENT 3 (≤1%): Component is a synthetic surface modified Amorphous Silica (CAS #: 7631-86-9); Fish and Invertebrate toxicity testing with Amorphous Silica have shown low hazard for this component. Source: OECD SIDS

C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
Mix Water	NA	35.6506%
Portland cement	65997-15-1	36.6434%
Crystalline silica, quartz	14808-60-7	1.8322%
Sodium silicate	1344-09-8	2.7333%
Water in Product	7732-18-5	16.5224%
Sodium hydroxide	1310-73-2	0.0716%
Silica, amorphous - fumed	7631-86-9	4.2952%
Sodium Lignosulfonate	8061-51-6	0.7087%
Humic acids, sodium salts, polymers with N,N-dimethyl-2-propenamido, sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1) and 2-propenenitrile, sodium bisulfite-terminated	473268-27-8	1.0836%
Monopropylene glycol monooleate	1330-80-9	0.0151%
Sorbitan, monopalmitate	26266-57-9	0.0075%
Aluminium stearate	637-12-7	0.0075%
Rape Oil	8002-13-9	0.1507%
Alkenes, C15-C18	93762-80-2	0.1464%
Polypropylene glycol	25322-69-4	0.0879%
Silica, amorphous precipitated	67762-90-7	0.0439%

A. SYSTEM DETAILS:	
OPERATOR:	DBP
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	Alternate Tail, 15.8 ppg 7" Casing
TOTAL VOLUME OF SYSTEM (m ³):	15.897

B. PRODUCT LIST, Cont'd				
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info
Fresh water		Mix water	14.7931%	N/A
Cement - Class G	Halliburton	Cement	55.7152%	<p>CONSTITUENT 1 (≤100%): After hardening with water or moister, cement presents no ecotoxicity risks. (Source: IUCLID 2000) Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 (≤10%): Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p>

Econolite Liquid	Halliburton	Cement Additive Stabiliser	1.3853%	<p>CONSTITUENT 1 ($\leq 60\%$): Freshwater Acute Algae Toxicity 72h EC50: > 345 mg/L (<i>Scenedesmus subspicatus</i>) [ECHA]; Freshwater Acute Crustacean Toxicity 48h EC50: 1700 mg/L (<i>Daphnia magna</i>) [OECD SIDS]; Freshwater Acute Fish Toxicity 96h LC50: 1108 mg/L (<i>Danio rerio</i>) [OECD SIDS]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 ($\leq 60\%$): No Hazard</p>
Gascon 469	Halliburton	Cement Additive Stabiliser	5.4423%	<p>CONSTITUENT 1 ($\leq 1\%$): Effect concentrations in the aquatic environment are attributable to a change in pH value Freshwater Acute Crustacean Toxicity 48h EC50: 40.4 mg/L (<i>Ceriodaphnia</i> sp.) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 125 mg/L (<i>Gambusia affinis</i>) [OECD SIDS]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 ($\leq 60\%$): Freshwater Acute Algae Toxicity 72h EC50: 440 mg/L (<i>Selenastrum capricornutum</i>) [IUCLID; LOLI]; Freshwater Acute Crustacean Toxicity 48h EC50: 7600 mg/L (<i>Ceriodaphnia dubia</i>) [IUCLID; LOLI]; Freshwater Acute Fish Toxicity 96h LC50: 5000 mg/L (<i>Brachydanio rerio</i>) [IUCLID; LOLI]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 3 ($\leq 100\%$): No Hazard</p>
HR-6L	Halliburton	Cement Retarder	1.7960%	<p>CONSTITUENT 1 ($\leq 100\%$): No Hazard</p> <p>CONSTITUENT 2 ($\leq 60\%$): Marine Water Acute Algae Toxicity 72h EC50: 301 mg/L (<i>Skeletonema costatum</i>) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: 1261 mg/L (<i>Acartia tonsa</i>) [Halliburton Funded Study]; Bioaccumulation Log Pow: < 0 [Halliburton Funded Study];</p>

CFR-3L	Halliburton	Friction Reducer	2.8943%	<p>Marine Water Acute Algae Toxicity 72h EC50: > 3300 mg/L (Skeletonema costatum) [Halliburton Funded Study];</p> <p>Marine Water Acute Crustacean Toxicity 48h LC50: 1687 mg/L (Acartia tonsa) [Halliburton Funded Study];</p> <p>Freshwater Acute Fish Toxicity 48h LC50: 7478 mg/L (Aphyosemion bivittatum) [SKW Trostberg];</p> <p>Bioaccumulation Log Pow: < 0 [Halliburton Funded Study];</p> <p>Marine Water Biodegradation 28d: 0% [Halliburton Funded Study];</p>
Halad-413L	Halliburton	Fluid Loss Additive	5.4918%	<p>Marine Water Acute Algae Toxicity 72h EC50: 1102 mg/L (Skeletonema costatum) [OSPAR];</p> <p>Marine Water Acute Crustacean Toxicity 48h LC50: > 2000 mg/L (Acartia tonsa) [OSPAR];</p> <p>Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [OSPAR];</p> <p>Bioaccumulation Log Kow: < 3.5 [Halliburton Funded Study];</p> <p>Marine Water Biodegradation 28d: 6 % [Halliburton Funded Study];</p>
NF-6	Halliburton	Reduces air entrainment into cement slurry	0.2291%	<p>Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (Skeletonema costatum) [Halliburton Funded Study];</p> <p>Marine Water Acute Crustacean Toxicity 48h LC50: > 1000 mg/L (Acartia tonsa) [Halliburton Funded Study];</p> <p>Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study];</p> <p>Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];</p>

D-AIR 3000L	Halliburton	Defoamer	4.4528%	<p>CONSTITUENT 1 (≤60%): Acute Algae Toxicity 96h EC50 : 22 mg/L (Pseudokirchneriella subcapitata) Acute Fish Toxicity Data 96h LC50 : >1000 mg/L (Salmo gairdneri) Acute Crustacean Toxicity 48h EC50: 480 mg/L (Daphnia magna)</p> <p>CONSTITUENT 2 (≤60%): Marine Water Acute Algae Toxicity 72h EC50: 426 mg/L (Skeletonema costatum) [OSPAR]; Marine Water Acute Crustacean Toxicity 48h EC50: 433.2 mg/L (Acartia tonsa) [OSPAR]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Bioaccumulation Log Pow: 5.06 [Halliburton Funded Study];</p> <p>CONSTITUENT 3 (≤1%): Component is a synthetic surface modified Amorphous Silica (CAS #: 7631-86-9); Fish and Invertebrate toxicity testing with Amorphous Silica have shown low hazard for this component. Source: OECD SIDS</p>
WellLife 734	Halliburton	Cement Enhancer	1.1143%	<p>Product is an inert, man-made substance and not intrinsically hazardous. Is a fine rigid fibrous material (glass fibre), which is chemically inert. As such irritation resulting from contact with this product is by mechanical abrasion. Standard PPE is require to handle the product to minimise direct exposure from mechanical contact. The irritation from contact with this product was not identified being from a chemical reaction.</p>
WellLife 684	Halliburton	Cement Additive	1.1143%	<p>LL50(96h): >100 mg/L (Danio rerio) EL50(48h): >100mg/L (Daphnia magna)</p> <p>Is a fine rigid fibrous material (carbon fibres) which is chemically inert. As such irritation resulting from contact with this product is by mechanical abrasion. Standard PPE is require to handle the product to minimise direct exposure from mechanical contact. The irritation from contact with this product was not identified being from a chemical reaction.</p>

Microbond	Halliburton	Expander	2.7858%	<p>CONSTITUENT 1 ($\leq 100\%$): Freshwater Acute Algae Toxicity 72h EC50: > 100 mg/L (<i>Selenastrum capricornutum</i>) [OECD SIDS]; Freshwater Acute Crustacean Toxicity 48h EC50: > 100 mg/L (<i>Daphnia magna</i>) [OECD SIDS]; Freshwater Acute Fish Toxicity 96h EC50: > 100 mg/L (<i>Oryzias latipes</i>) [OECD SIDS]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 2 ($\leq 30\%$): Freshwater Acute Algae Toxicity 72h EC50: 3.6 mg/L (<i>Desmodesmus subspicatus</i>) [ECHA]; Freshwater Acute Crustacean Toxicity 48h EC50: 5.4 mg/L (<i>Daphnia magna</i>) [ECHA]; Freshwater Acute Fish Toxicity 96h EC50: > 100 mg/L (<i>Danio rerio</i>) [ECHA]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 3 ($\leq 10\%$): Effect concentrations in the aquatic environment are attributable to a change in pH value. Freshwater Acute Crustacean Toxicity 48h EC50: 49.1 mg/L (<i>Daphnia magna</i>) [ECHA]; Marine Water Acute Crustacean Toxicity 96h LC50: 158 mg/L (<i>Crangon septemspinosa</i>) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 50.6 mg/L (<i>Oncorhynchus mykiss</i>) [ECHA]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 4 ($\leq 5\%$): Freshwater Acute Algae Toxicity 96h EC50: 650 mg/L (<i>Navicula seminulum</i>) [US EPA ECOTOX]; Freshwater Acute Crustacean Toxicity 48h EC50: 1020 mg/L (<i>Ceriodaphnia dubia</i>) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 7100 mg/L (<i>Lepomis macrochirus</i>) [ECHA]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p>
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Microbond M	Halliburton	Expander	2.7858%	<p>Component 1 ($\leq 100\%$) "No data was available in the IUCLID for this component, as "magnesium ions are a major component of all natural waters". Source: IUCLID 2000"</p> <p>Component 2 ($\leq 1\%$) Toxicity to Algae 72 h EC50: 5131.54 mg/L (Skeletonema Costatum) Toxicity to Fish 96 Hr LC50: ≥ 320 mg/L (Scophthalmus maximus) Toxicity to Crustacean 48 hr LC50: $\geq 10,000$ mg/L (Acartia tonssa) Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable Biodegradation: Substance is inorganic - bioaccumulation is not applicable Source: HESI Internal Data</p> <p>Component 3 ($\leq 1\%$) Freshwater Acute Crustacean Toxicity 48h EC50: > 100 mg/L (Daphnia magna) [ECHA]; Freshwater Acute Fish Toxicity 48h LCO: 1000 mg/L (Leuciscus idus) [ECHA]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable"</p> <p>Component 4 ($\leq 5\%$) Toxicity to Algae 72 h EC50 184.57 mg/L (Pseudokirchnerella subcapitata)(Similar Substance) Toxicity to Fish LC50 33.884 mg/L(Clarias gariepinus) Toxicity to Microorganisms EC50 (3h) 300.4 mg/L (activated sludge) (similar substances) Toxicity to Invertebrates EC50 (48h) 49.1 mg/L (Daphnia magna) (similar substance) Bioaccumulation: Log Kow=-0.571 BCF = 0.5 Biodegradadation: Substance is inorganic - bioaccumulation is not applicable</p> <p>Component 2 ($\leq 5\%$) Invertebrates Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p>
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C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
Mix Water	NA	14.7931%
Portland cement	65997-15-1	48.4461%
Water in Product	7732-18-5	13.8037%
Alkenes, C15-C18	93762-80-2	3.8718%
Silica, amorphous - fumed	7631-86-9	2.8393%
Crystalline silica, quartz	14808-60-7	2.4223%
Calcium sulfate dihydrate	10101-41-4	2.4223%
Polypropylene glycol	25322-69-4	2.3231%
Sulfurous acid, monosodium salt, polymer with formaldehyde and acetone	40104-76-5	1.5100%
Humic acids, sodium salts, polymers with N,N-dimethyl-2-propenamamide, sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1) and 2-propenenitrile, sodium bisulfite-terminated	473268-27-8	1.4326%
Silica, amorphous precipitated	67762-90-7	1.1616%
Glass, oxide	65997-17-3	0.9689%
Carbon	7440-44-0	0.9689%
Sodium Lignosulfonate	8061-51-6	0.9370%
Calcium aluminate	12042-68-1	0.7267%
Sodium silicate	1344-09-8	0.7227%
Calcium hydroxide	1305-62-0	0.2422%
Rape Oil	8002-13-9	0.1992%
Sodium bicarbonate	144-55-8	0.1211%
Sodium hydroxide	1310-73-2	0.0473%
Monopropylene glycol monooleate	1330-80-9	0.0199%
Sorbitan, monopalmitate	26266-57-9	0.0100%
Aluminium stearate	637-12-7	0.0100%

A. SYSTEM DETAILS:	
OPERATOR:	DBP
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	Tuned Spacer E+
TOTAL VOLUME OF SYSTEM (m ³):	25.437968

B. PRODUCT LIST, Cont'd				
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info
Fresh water		Mix water	71.0561%	N/A
NF-6	Halliburton	Reduces air entrainment into cement slurry	0.0909%	Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: > 1000 mg/L (Acartia tonsa) [Halliburton Funded Study]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];
Barite	Halliburton	Weighting Agent	23.4191%	Acute Fish Toxicity 96hr LC50 76000mg/L @ 96 hr Species Oncorhynchus mykiss EPA Ref# 869 48hr LC50 >30lb/gal (>3594790mg/L) Report no BL8279 Species Pimephales promelas (fish) 48hr LC50 >30lb/bbl (>85556mg/L) Report BL8377 Species Daphnia pulex (Water Flea – crustacean) Bioassay testing where LC50/EC50: >100 mg/L

TUNED SPACER E+	Halliburton	Mud/Cement Spacer	4.9794%	<p>CONSTITUENT 1 ($\leq 100\%$): Component is naturally occurring and not intrinsically hazardous.</p> <p>CONSTITUENT 2 ($\leq 10\%$): Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 3 ($\leq 1\%$): Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 4 ($\leq 1\%$): Freshwater Acute Crustacean Toxicity 24h LL50: > 10000 mg/L (Daphnia magna) [Environment Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Environment Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</p> <p>CONSTITUENT 5 ($\leq 30\%$): Freshwater Acute Crustacean Toxicity 48h NOELr: 1000 mg/L (Daphnia magna) [US EPA HPVIS] (similar substance); Freshwater Acute Fish Toxicity 48h LC50: 7300 mg/L (Oncorhynchus mykiss) [US EPA ECOTOX]; Bioaccumulation Log Kow: -3.45 [EPISUITE] (similar substance); Freshwater Biodegradation 10d: 29 % [US EPA HPV Haz. Char. Doc.] (similar substance);</p> <p>CONSTITUENT 6 ($\leq 10\%$): Component is naturally occurring and not intrinsically hazardous.</p>
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SEM-8	Halliburton	Emulsifier	0.1991%	<p>CONSTITUENT 1 ($\leq 100\%$): Marine Water Acute Algae Toxicity 72h EC50: 32 mg/L (<i>Selenastrum capricornutum</i>) [Madsen et al., 2002] (similar substance); Freshwater Acute Crustacean Toxicity 96h EC50: 1.17 mg/L (<i>Daphnia magna</i>) [Madsen et al., 2002] (similar substance); Freshwater Acute Fish Toxicity 96h LC50: 1-2.5 mg/L (<i>Salmo trutta</i>) [Madsen et al., 2002] (similar substance); Marine Water Biodegradation 28d: 61% [OSPAR];</p> <p>CONSTITUENT 2 ($\leq 30\%$): Freshwater Acute Algae Toxicity 72h EC50: > 1000 mg/L (<i>Scenedesmus subspicatus</i>) [IUCLID]; Freshwater Acute Crustacean Toxicity 24h EC50: > 10000 mg/L (<i>Daphnia magna</i>) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 9640 mg/L (<i>Pimephales promelas</i>) [ECHA]; Bioaccumulation Log Pow: 0.15 [IUCLID]; Freshwater Biodegradation 14d: 83% [HSDB];</p> <p>CONSTITUENT 3 ($\leq 30\%$): No Hazard</p> <p>CONSTITUENT 4 ($\leq 1\%$): Freshwater Acute Algae Toxicity 96h EC50: 0.7 mg/L (<i>Selenastrum capricornutum</i>) [CCID] (similar substance); Freshwater Acute Crustacean Toxicity 48h EC50: 0.39 mg/L (<i>Ceriodaphnia dubia</i>) [CCID] (similar substance); Freshwater Acute Fish Toxicity 96h LC50: 1.4 mg/L (<i>Pimephales promelas</i>) [CCID] (similar substance); Bioaccumulation BCF: 12.7-237 [ECHA] (similar substance); Freshwater Biodegradation 28d: 72% [ECHA] (similar substance);</p>
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D-AIR 3000L	Halliburton	Defoamer	0.0850%	<p>CONSTITUENT 1 (≤60%): Acute Algae Toxicity 96h EC50 : 22 mg/L (Pseudokirchneriella subcapitata) Acute Fish Toxicity Data 96h LC50 : >1000 mg/L (Salmo gairdneri) Acute Crustacean Toxicity 48h EC50: 480 mg/L (Daphnia magna)</p> <p>CONSTITUENT 2 (≤60%): Marine Water Acute Algae Toxicity 72h EC50: 426 mg/L (Skeletonema costatum) [OSPAR]; Marine Water Acute Crustacean Toxicity 48h EC50: 433.2 mg/L (Acartia tonsa) [OSPAR]; Marine Water Acute Fish Toxicity 96h LC50: > 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Bioaccumulation Log Pow: 5.06 [Halliburton Funded Study];</p> <p>CONSTITUENT 3 (≤1%): Component is a synthetic surface modified Amorphous Silica (CAS #: 7631-86-9); Fish and Invertebrate toxicity testing with Amorphous Silica have shown low hazard for this component. Source: OECD SIDS</p>
PEN-5M	Halliburton	Cleaner	0.1704%	<p>CONSTITUENT 1 (≤60%): Whole body BCF values of AEs in fish range from <5 to 233 New Zealand CCID cites algae study (Selenastrum capricornutum) EC50=0.7 mg/L from ECOTOX and daphnia study with EC50=0.39 mg/L from Warne, 1999.</p> <p>CONSTITUENT 2 (≤60%): No Hazard</p> <p>CONSTITUENT 3 (≤30%): Acute Fish Toxicity 96h LC50: 9640 mg/L (Pimephales promelas); Acute Crustacean Toxicity 48h LC50: 1400 mg/L (Crangon crangon); Acute Algae Toxicity 72h EC50: >1000 mg/L (Scenedesmus subspicatus);</p>

C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
Mix Water	NA	71.0566%
Crystalline silica, quartz	14808-60-7	0.1384%
Water in Product	7732-18-5	0.0638%
Sodium Lignosulfonate	8061-51-6	1.3840%
Monopropylene glycol monooleate	1330-80-9	0.0084%
Sorbitan, monopalmitate	26266-57-9	0.0042%
Aluminium stearate	637-12-7	0.0042%
Rape Oil	8002-13-9	0.0842%
Alkenes, C15-C18	93762-80-2	0.0788%
Polypropylene glycol	25322-69-4	0.0473%
Silica, amorphous precipitated	67762-90-7	0.0236%
Barite	13462-86-7	21.6978%
Bentonite	1302-78-9	4.6134%
Crystalline silica, cristobalite	14464-46-1	0.0461%
Crystalline silica, tridymite	15468-32-3	0.0461%
Welan gum	72121-88-1	0.4613%
Isopropanol	67-63-0	0.0553%
Polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt	68037-05-8	0.1845%
Alcohols, C6-10, ethoxylated	70879-83-3	0.0018%

A. SYSTEM DETAILS:	
OPERATOR:	DDGT
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	Bentonite Spud Mud
TOTAL VOLUME OF SYSTEM (m³):	1

B. PRODUCT LIST, Cont'd					
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info	MSDS Attached
Fresh water	Ashbourne River	Mix water	95.6100%	N/A	N/A
Bentonite	Halliburton	Viscosifier	4.1700%	Acute Fish Toxicity (Marine) 96h LC50: 8-16 g/l (Salmo gairdneri) Source: IUCLID 2000	Yes
Sodium Bicarbonate	Halliburton	pH control	0.1400%	Acute Fish Toxicity 96h LC50: 7550 mg/l (Gambusia affinis) Acute Crustacean Toxicity 48h EC50: 2350 mg/l (Daphnia magna) Acute Algae Toxicity 5d EC50: 650 mg/l (Nitzschia linearis) Source: IUCLID 2000	Yes
Caustic Soda	Halliburton	pH control	0.0800%	Acute Fish Toxicity TLM96: 730 mg/l (Oncorhynchus mykiss)	Yes

C. CHEMICAL LIST

Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
water	N/A	95.6100%
Bentonite	1302-78-9	3.8781%
Crystalline silica, quartz	14808-60-7	0.2085%
Sodium Bicarbonate	144-55-8	0.1400%
Sodium Hydroxide	1310-72-2	0.0800%
Crystalline silica, tridymite	15468-32-3	0.0417%
Crystalline silica, cristobalite	14464-46-1	0.0417%

A. SYSTEM DETAILS:	
OPERATOR:	DDGT
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	Completion Brine
TOTAL VOLUME OF SYSTEM (m ³):	1

B. PRODUCT LIST, Cont'd					
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info	MSDS Attached
Fresh water	Water supplied by Operator	Mix water	65.2500%	N/A	N/A
Calcium Chloride	Halliburton		27.8300%	<p>Oral Toxicity LD50: >1000 mg/kg (Rat), 2301 mg/kg (Rat). > 2000 mg/kg (Rat), 2240 mg/kg (Rat)</p> <p>Dermal Toxicity LD50: 5000 mg/kg (Rabbit)</p> <p>Toxicity to Algae: ErC50 (72h) 2900 mg/l (pseudokirchnerella subcapitata); ErC50 (72h) 4000 mg/l (pseudokirchnerella subcapitata)</p> <p>Toxicity to Fish: LC50 (96h) 4360 mg/l (Pimephaales promelas); LC50 (48h) 6560 mg/l (Pimephaales promelas); LC50 (24h) 6660 mg/l (Pimephaales promelas)</p> <p>Toxicity to Invertebrates: EC50 (48h) 2400 mg/l (daphnia magna); EC50 (21d) 610 mg/l (reproduction) (daphnia magna)</p>	Yes
BARACOR 100	Halliburton	Corrosion Inhibitor	0.4000%	<p>Toxicity (Ethanol, 2,2'-oxybis-reaction products with ammonia, morpholine derivatives residues):</p> <p>Oral toxicity: LD50; 3816 mg/kg-bw (Rat); Dermal Toxicity: LD50: > 2000 mg/kg (Rat), Inhalation Toxicity: LC50 No toxicity at saturation (rat, 8h, vapour)</p> <p>Toxicity (Methanol):</p> <p>Oral toxicity: LD50; < 790 mg/kg (Rat), 7300 mg/kg (mouse) 14200 mg/kg (rabbit, 300 mg/kg (Human, 6200 mg/kg (Rat); Dermal Toxicity: LD50: 15800 mg/kg (Rat) 393 mg/kg bw primates), 1000 mg/kg (Human), 15800 mg/kg (Rabbit), Inhalation Toxicity: LC50 10 mg/l (human) 4h (vapour), 22500 ppm (rat) 8h, 64000 ppm (Rat) 4h, 83.2 mg/l (rat) 4h, 128.8 mg/l</p>	

(rat) 4h

Toxicity (Nitrilotriacetic acid, trisodium salt monohydrate):

Oral toxicity: LD50; 1740 mg/kg (Rat); Dermal Toxicity: LD50: > 2000 mg/kg (Rat), Inhalation Toxicity: LC50 > 5 mg/l (Rat, Aerosol, 4h)

Ethanol, 2,2'-oxybis-reaction products with ammonia, morpholine derivatives residues

Toxicity to Algae EC50 (72h): 100 mg/l (Skeletonema costatum), EC50 (72h): >120 mg/l (desmodesmus subspicatus), NOEC (72h): >120 mg/l (desmodesmus subspicatus)

Toxicity to Fish LC50 (96h): >100mg/l (Scophthalmus maximus) LC50 (96h) = 681.1 mg/l (Leuciscus idus)

Toxicity to Microorganisms EC50 (3h) > 1000 mg/l (activated sludge)

Toxicity to Invertebrates LC50 (48h): 287.2 mg/l (Acartia tonsa), EC50 (48h) > 120 mg/l (Daphnia Magna)

Methanol

Toxicity to Algae ErC50 (96h): 22000 mg/l (Pseudokirchnerella subcapitata)

Toxicity to Fish LC50: 28200 mg/l (Pimephales promelas) LC50 (96h) =12700-15400 mg/l (Lepomis macrochirus)

Toxicity to Microorganisms IC50 (3h) > 1000 mg/l (activated sludge)

Toxicity to Invertebrates EC50 (96h): 18260 mg/l (Daphnia Magna), NOEC (21 d) 122 mg/l (Daphnia Magna, Reproduction)

Nitrilotriacetic acid, trisodium salt monohydrate

Toxicity to Algae EC50 (72h): >91.5 mg/l (Desmodesmus subspicatus)

Toxicity to Fish TL50 (96):103 mg/l (Pimephales promelas), NOEC (229d) >54 mg/l (Pimephales promelas)

Toxicity to Microorganisms NOEC (909) > 200 mg/l (activated sludge)

Toxicity to Invertebrates TL50 (96h): range 115 mg/l (Gammarus pseudolimnaeus), NOEC (147 d) =9.3mg/l (Gammarus pseudolimnaeus)

Ethanol, 2,2'-oxybis-reaction products with ammonia, morpholine derivatives residues

Persistence and Degradability; no information available

Log Pow <1

Methanol

				<p>Persistence and Degradability (95-97% @ 20d) Log Pow -0.77; BCF = 1.0-4.5 (Cyprinus carpio); BCF <10 (Leuciscus idus melanotus)</p> <p>Nitrilotriacetic acid, trisodium salt monohydrate Persistence and Degradability; Readily biodegradable (100 @ 14d) Log Pow -2.62 (calculated)</p>	
ALDACIDE G	Halliburton	Biocide	0.1200%	<p>Toxicity (Glutaraldehyde) Oral Toxicity: LD 50: 316 mg/kr (Rat) Dermal Toxicity: > 2000mg/kg (Rat), 560 µL/kg (Rabbit) Inhalation Toxicity: LC50: 0.48 mg/l (Rat, 4h) Toxicity (Methanol) Oral Toxicity: LD 50: > 1187-2769 mg/kr (Rat), 3000 mg/kg (Monkey), 300 mg/kg (Human) Dermal Toxicity: 15800mg/kg (Rat), 393 mg/kg (Primate) Inhalation Toxicity: LC50: 87.5 mg/l (Rat, 6h vapour), 128.2 mg/l (Rat, 4h vapour), 83.2 mg/l (rat, 4h), 64000 ppm (rat, 4h), 10 mg/l (Human)</p> <p>Acute Fish Toxicity LC50 96hr: 13 mg/l (Lepomis macrochirus) Acute Crustacean Toxicity TLM48: 0.11 mg/l (Acartia tonsa) Acute Crustacean Toxicity TLM48: 29.73 mg/l (Daphnia Magna) Acute Algae Toxicity EC50: 8.1 mg/l (Skeletonema costatum)</p> <p>Log Pow = <0 OECD 117 Biodegradation = 67% in 28days OECD 306 Skeletonema 72hr EC50 = 0.5mg/L ISO 10253 Acartia 48hr LC50 = 0.1mg/L ISO 14669 Scophthalmus = 96hr LC50 = 60mg/L PARCOM 1995 Abra alba 5day LC50 = 18mg/Kg Fecal pellet production</p>	Yes
OXYGON	Halliburton	Oxygen scavenger	0.1100%	<p>Acute Fish Toxicity 96h NOEC: > 32 mg/l (scophthalmus maximus; Marine) Acute Crustacean Toxicity 48h LC50 738.75 mg/l (acartia tonsa; Marine) Acute Algae Toxicity 72h EC50: 1661.34mg/l (skeletonema costatum; Marine)</p>	Yes

C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
water	N/A	7154.0000%
Calcium Chloride	10043-52-4	2783.0000%
water in product	7732-18-5	18.0000%
Glutaraldehyde	111-30-8	11.8800%
Ethanol, 2,2'-oxybis-reaction products with ammonia, morpholine derivatives residues	68909-77-3	11.6000%
Organic Acid Salt	6381-77-7	11.0000%
Methanol	67-56-1	10.1200%
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	0.4000%

A. SYSTEM DETAILS:	
OPERATOR:	DDGT
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	KCl/Polymer
TOTAL VOLUME OF SYSTEM (m ³):	1

B. PRODUCT LIST, Cont'd					
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info	MSDS Attached
Fresh water	Ashbourne River	Mix water	90.9200%	N/A	N/A
Potassium Chloride	Halliburton	Shale Inhibition	6.1000%	<p>Freshwater Acute Algae Toxicity 72h EC50: > 100 mg/L (Scenedesmus subspicatus) [ECHA];</p> <p>Freshwater Acute Crustacean Toxicity 48h EC50: 660 mg/L (Daphnia magna) [ECHA];</p> <p>Freshwater Acute Fish Toxicity 96h LC50: 880 mg/L (Pimephales promelas) [ECHA];</p> <p>Toxicity: Oral Toxicity: LD50: > 5000 mg/kg (Rat)</p> <p>Ecotoxicity: Acute Crustaceans Toxicity: TLM96: 100-330 ppm (Crangon crangon)</p> <p>Bioaccumulation BCF: 0.47 [OECD SIDS];</p> <p>Biodegradation: Product is inorganic - biodegradation is not applicable.</p>	Yes
BARACARB	Halliburton	Bridging Agent	1.3600%	<p>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa)</p> <p>Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</p>	Yes

BARAZAN D PLUS	Halliburton	Viscosifier	0.4100%	<p>Toxicity – Oral Toxicity: LD 50: >5000 mg/kr (Rat) Inhalation Toxicity: LC50: > 21 mg/lrat</p> <p>Ecotoxicity - Acute Fish Toxicity: TLM96: 320-560ppm (Oncorhynchus mykiss) Ecotoxicity - Acute Crustaceans Toxicity: TLM96: > 75000ppm (Mysidopsis bahia)</p>	Yes
PAC-L	Halliburton	Fluid Loss	0.5400%	Acute Fish Toxicity TLM96: > 500 mg/l (Golden orfe)	Yes
EZ MUD DP	Halliburton	Shale Inhibition	0.4100%	Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)	
ALDACIDE G	Halliburton	Biocide	0.0500%	<p>Toxicity (Glutaraldehyde) Oral Toxicity: LD 50: 316 mg/kr (Rat) Dermal Toxicity: > 2000mg/kg (Rat), 560 µL/kg (Rabbit) Inhalation Toxicity: LC50: 0.48 mg/l (Rat, 4h) Toxicity (Methanol) Oral Toxicity: LD 50: > 1187-2769 mg/kr (Rat), 3000 mg/kg (Monkey), 300 mg/kg (Human) Dermal Toxicity: 15800mg/kg (Rat), 393 mg/kg (Primate) Inhalation Toxicity: LC50: 87.5 mg/l (Rat, 6h vapour), 128.2 mg/l (Rat, 4h vapour), 83.2 mg/l (rat, 4h), 64000 ppm (rat, 4h), 10 mg/l (Human)</p> <p>Acute Fish Toxicity LC50 96hr: 13 mg/l (Lepomis macrochirus) Acute Crustacean Toxicity TLM48: 0.11 mg/l (Acartia tonsa) Acute Crustacean Toxicity TLM48: 29.73 mg/l (Daphnia Magna) Acure Algae Toxicity EC50: 8.1 mg/l (Skeletonema costatum)</p> <p>Log Pow = <0 OECD 117 Biodegradation = 67% in 28days OECD 306 Skeletonema 72hr EC50 = 0.5mg/L ISO 10253 Acartia 48hr LC50 = 0.1mg/L ISO 14669 Scophthalmus = 96hr LC50 = 60mg/L PARCOM 1995 Abra alba 5day LC50 = 18mg/Kg Fecal pellet production</p>	Yes
Sodium Bicarbonate	Halliburton	pH control	0.1400%	Acute Fish Toxicity 96h LC50: 7550 mg/l (Gambusia affinis) Acute Crustacean Toxicity 48h EC50: 2350 mg/l (Daphnia magna) Acure Algae Toxicity 5d EC50: 650 mg/l (Nitzschia linearis) Source: IUCLID 2000	Yes
Caustic Soda	Halliburton	pH control	0.0800%	Acute Fish Toxicity TLM96: 730 mg/l (Oncorhynchus mykiss)	Yes

C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
water	N/A	90.9200%
Potassium Chloride	7447-40-7	6.1000%
Calcium Carbonate	471-34-1	1.2240%
Sodium carboxymethyl cellulose	9004-32-4	0.5346%
Xanthan gum	11138-66-2	0.4100%
Polyacrylamide / polyacrylate copolymer	25085-02-3	0.3690%
Sodium Bicarbonate	144-55-8	0.1400%
Crystalline silica, quartz	14808-60-7	0.1360%
Sodium Hydroxide	1310-72-2	0.0800%
Glutaraldehyde	111-30-8	0.0495%
water in product	7732-18-5	0.0410%
Glyoxal	107-22-2	0.0054%
Methanol	67-56-1	0.0005%

A. SYSTEM DETAILS:	
OPERATOR:	DDGT
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	KCl/Polymer - Contingency
TOTAL VOLUME OF SYSTEM (m³):	1

B. PRODUCT LIST, Cont'd					
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info	MSDS Attached
Fresh water	Ashbourne River	Mix water	90.3100%	N/A	N/A
Potassium Chloride	Halliburton	Shale Inhibition	6.1000%	<p>Freshwater Acute Algae Toxicity 72h EC50: > 100 mg/L (Scenedesmus subspicatus) [ECHA]; Freshwater Acute Crustacean Toxicity 48h EC50: 660 mg/L (Daphnia magna) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 880 mg/L (Pimephales promelas) [ECHA]; Toxicity: Oral Toxicity: LD50: > 5000 mg/kg (Rat)</p> <p>Ecotoxicity: Acute Crustaceans Toxicity: TLM96: 100-330 ppm (Crangon crangon)</p> <p>Bioaccumulation BCF: 0.47 [OECD SIDS]; Biodegradation: Product is inorganic - biodegradation is not applicable.</p>	Yes
BARACARB (All grades)	Halliburton	Bridging Agent	1.3600%	<p>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</p>	Yes

STEELSEAL (all grades)	Halliburton	Lost Circulation	0.6000%	No ecotoxicity data available in sources consulted. However, environmental risks are expected to be low because: . Component is considered non Bioaccumulative or Inherently Toxic, according to Environmet Canada (Canade DSL)	Yes
BARAZAN D PLUS	Halliburton	Viscosifier	0.4100%	Toxicity – Oral Toxicity: LD 50: >5000 mg/kr (Rat) Inhalation Toxicity: LC50: > 21 mg/lrat Ecotoxicity - Acute Fish Toxicity: TLM96: 320-560ppm (Oncorhynchus mykiss) Ecotoxicity - Acute Crustaceans Toxicity: TLM96: > 75000ppm (Mysidopsis bahia)	Yes
PAC-L	Halliburton	Fluid Loss	0.5400%	Acute Fish Toxicity TLM96: > 500 mg/l (Golden orfe)	Yes
EZ MUD DP	Halliburton	Shale Inhibition	0.4100%	Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)	Yes
ALDACIDE G	Halliburton	Biocide	0.0500%	Toxicity (Glutaraldehyde) Oral Toxicity: LD 50: 316 mg/kr (Rat) Dermal Toxicity: > 2000mg/kg (Rat), 560 µL/kg (Rabbit) Inhalation Toxicity: LC50: 0.48 mg/l (Rat, 4h) Toxicity (Methanol) Oral Toxicity: LD 50: > 1187-2769 mg/kr (Rat), 3000 mg/kg (Monkey), 300 mg/kg (Human) Dermal Toxicity: 15800mg/kg (Rat), 393 mg/kg (Primate) Inhalation Toxicity: LC50: 87.5 mg/l (Rat, 6h vapour), 128.2 mg/l (Rat, 4h vapour), 83.2 mg/l (rat, 4h), 64000 ppm (rat, 4h), 10 mg/l (Human) Acute Fish Toxicity LC50 96hr: 13 mg/l (Lepomis macrochirus) Acute Crustacean Toxicity TLM48: 0.11 mg/l (Acartia tonsa) Acute Crustacean Toxicity TLM48: 29.73 mg/l (Daphnia Magna) Acure Algae Toxicity EC50: 8.1 mg/l (Skeletonema costatum) Log Pow = <0 OECD 117 Biodegradation = 67% in 28days OECD 306 Skeletonema 72hr EC50 = 0.5mg/L ISO 10253 Acartia 48hr LC50 = 0.1mg/L ISO 14669 Scophthalmus = 96hr LC50 = 60mg/L PARCOM 1995 Abra alba 5day LC50 = 18mg/Kg Fecal pellet production	Yes

BDF-427	Halliburton	Coagulant	0.2000%	Acute Fish Toxicity LC50: (96 hour) 5-10 mg/l (Brachidanio rerio) Acute Crustacean Toxicity EC50: (48 hour) 20-50 mg/l (Daphnia magna)	Yes
N-SQUEEZE	Halliburton	Lost Circulation	0.2000%	Woodfibre: This component is an prganic substance, exotoxicity information is knnown. However, environmental risks are expected to be low because: Component is derived from a naturally occuring substance Cellulose (CAS#: 9004-34-6) has "no known toxicity". Acute Fish Toxicity LC50 >100mg/l Acute Crustacean Toxicity EC50: >100 mg/l Acute Algae Toxicity EC50: >100mg/l Source IUCLID 2000 Guar Gum Component is naturally occuring substance. No ecotoxicity information was available in the IUCLID. Source: IUCLID 2000 Acute Crustacean Toxicity 48h LC50: 422 mg/l (Daphnia magna) Acute Fish Toxicity 96h LC50: 218 mg/l (Oncorhynchus) Source: ECOTOX	Yes
Sodium Bicarbonate	Halliburton	pH control	0.1400%	Acute Fish Toxicity 96h LC50: 7550 mg/l (Gambusia affinis)) Acute Crustacean Toxicity 48h EC50: 2350 mg/l (Daphnia magna) Acure Algae Toxicity 5d EC50: 650 mg/l (Nitzschia linearis) Source: IUCLID 2000	Yes
Citric Acid	Halliburton	pH control	0.1000%	Acute Fish Toxicity 96h LC50: >440-760 mg/l (Leuciscus idus) Acute Crustacean Toxicity 72h EC50: 120 mg/l (Daphnia magna) Acute Toxicity 7d EC3: 640 mg/l (Scenedesmus quadrucauda) Source: IUCLID 2000	Yes
Soda Ash	Halliburton	Buffer	0.1000%	Ecotoxicity - Freshwater Algae - Acute Toxicity Data Sodium carbonate 120Hr EC50 Nitzschia: 242 mg/l Ecotoxicity - Freshwater Fish - Acute Toxicity Data Sodium carbonate 96 Hr LC50 Lepornis macrochirus: 300 mg/l (static); 96 Hr LC50 Pimephales promelas: 310 - 1200 mg/l (static) Ecotoxicity - Water Flea - Acute Toxicity Data Sodium carbonate 48 Hr EC%) Daphnia magna: 265 mg/l	Yes
Caustic Soda	Halliburton	pH control	0.0800%	Acute Fish Toxicity TLM96: 730 mg/l (Oncorhynchus mykiss)	Yes

C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
water	N/A	89.7100%
Potassium Chloride	7447-40-7	6.1000%
Calcium Carbonate	471-34-1	1.2240%
Calcined petroleum coke	64743-05-1	0.6000%
Sodium carboxymethyl cellulose	9004-32-4	0.5346%
Xanthan gum	11138-66-2	0.4100%
Polyacrylamide / polyacrylate copolymer	25085-02-3	0.3690%
water in product	7732-18-5	0.1400%
Sodium Bicarbonate	144-55-8	0.1400%
Crystalline silica, quartz	14808-60-7	0.1360%
Polyamine	42751-79-1	0.1000%
Citric Acid	77-92-9	0.1000%
Sodium Carbonate	497-19-8	0.1000%
Sodium Hydroxide	1310-72-2	0.0800%
Wood fibre	Mixture (1757)	0.0067%
Cellulose	9005-81-6	0.0067%
Guar Gum	Mixture (1756)	0.0067%
Glutaraldehyde	111-30-8	0.0495%
Glyoxal	107-22-2	0.0054%
Methanol	67-56-1	0.0005%

A. SYSTEM DETAILS:	
OPERATOR:	DDGT
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	KCl/Polymer/Glycol
TOTAL VOLUME OF SYSTEM (m ³):	1

B. PRODUCT LIST, Cont'd					
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info	MSDS Attached
Fresh water	Ashbourne River	Mix water	65.2500%	N/A	N/A
Sodium Chloride	Halliburton	Weighting Agent	16.9200%	<p>Toxicology Data –Selected Inhalation LC50s: Inhalation LC50 Rat >42 g/m³ 1 h (Source: NLM_CIP)</p> <p>Toxicology Data –Selected Inhalation LD50s and LC50s: Oral LD50 Rat 3 g/kg (Source: NLM_CIP); Inhalation LC50 Rat >42 g/m³ 1 h (Source: NLM_CIP)</p> <p>Ecotoxicity – Earthworm – Acute Toxicity Data - 48 Hr LC50 Eisenia foetida: 0.1 - 1 mg/cm² [filter paper]</p> <p>Ecotoxicity – Freshwater Fish– Acute Toxicity Data: 96 Hr LC50 Lepomis macrochirus: 5560 - 6080 mg/L [flow-through]; 96 Hr LC50 Lepomis macrochirus: 12946 mg/L [static]; 96 Hr LC50 Pimephales promelas: 6020 - 7070 mg/L [static]; 96 Hr LC50 Pimephales promelas: 7050 mg/L [semi-static]; 96 Hr LC50 Pimephales promelas: 6420 - 6700 mg/L [static]; 96 Hr LC50 Oncorhynchus mykiss: 4747 - 7824 mg/L [flow-through]</p> <p>Ecotoxicity – Water Flea – Acute Toxicity Data: 48 Hr EC50 Daphnia magna: 1000 mg/L; 48 Hr EC50 Daphnia magna: 340.7 - 469.2 mg/L [Static]</p>	Yes
BARACARB	Halliburton	Bridging Agent	6.5700%	<p>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa)</p> <p>Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</p>	Yes

Potassium Chloride	Halliburton	Shale Inhibition	5.2800%	<p>Freshwater Acute Algae Toxicity 72h EC50: > 100 mg/L (Scenedesmus subspicatus) [ECHA]; Freshwater Acute Crustacean Toxicity 48h EC50: 660 mg/L (Daphnia magna) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 880 mg/L (Pimephales promelas) [ECHA]; Toxicity: Oral Toxicity: LD50: > 5000 mg/kg (Rat)</p> <p>Ecotoxicity: Acute Crustaceans Toxicity: TLM96: 100-330 ppm (Crangon crangon)</p> <p>Bioaccumulation BCF: 0.47 [OECD SIDS]; Biodegradation: Product is inorganic - biodegradation is not applicable.</p>	Yes
GEM CP	Halliburton	Shale Inhibition	1.6400%	<p>Acute Fish Toxicity EC50: 86 mg/l (Abra alba) Acute Crustacean Toxicity TLM48: 356 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 465 mg/l (Skeletonema costatum)</p>	Yes
GEM GP	Halliburton	Shale Inhibition	1.6400%	<p>Toxicity – Oral Toxicity: LD 50: >2000 mg/kr (Rat)</p> <p>Acute Fish Toxicity EC50: 475 ppm (Abra alba) Acute Crustacean Toxicity TLM48: 310 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 391 mg/l (Skeletonema costatum)</p> <p>Log Pow = 0.436 OECD 107 Biodegradation = 68% @ 28 days OECD 306 Skeletonema 72hr EC50 = 391mg/L ISO 10253 Acartia 48hr LC50 = 310mg/L ISO 14669 Scophthalmus 96hr LC50 = >1800mg/L PARCOM 1995 Corophium 10day LC50 = 6597mg/Kg PARCOM1995</p>	Yes
STEELSEAL (all grades)	Halliburton	Lost Circulation	0.6000%	<p>No ecotoxicity data available in sources consulted. However, environmental risks are expected to be low because: . Component is considered non Bioaccumulative or Inherently Toxic, according to Environmet Canada (Canade DSL)</p>	Yes

BARAZAN D PLUS	Halliburton	Viscosifier	0.4700%	<p>Toxicity – Oral Toxicity: LD 50: >5000 mg/kr (Rat) Inhalation Toxicity: LC50: > 21 mg/lrat</p> <p>Ecotoxicity - Acute Fish Toxicity: TLM96: 320-560ppm (Oncorhynchus mykiss) Ecotoxicity - Acute Crustaceans Toxicity: TLM96: > 75000ppm (Mysidopsis bahia)</p>	Yes
PAC-L	Halliburton	Fluid Loss	0.4700%	Acute Fish Toxicity TLM96: > 500 mg/l (Golden orfe)	Yes
EZ MUD DP	Halliburton	Shale Inhibition	0.3500%	<p>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</p>	
BDF-427	Halliburton	Coagulant	0.2000%	<p>Acute Fish Toxicity LC50: (96 hour) 5-10 mg/l (Brachidanio rerio) Acute Crustacean Toxicity EC50: (48 hour) 20-50 mg/l (Daphnia magna)</p>	Yes
N-SQUEEZE	Halliburton	Lost Circulation	0.2000%	<p>Woodfibre: This component is an prganic substance, exotoxicity information is unknown. However, environmental risks are expected to be low because: Component is derived from a naturally occurring substance Cellulose (CAS#: 9004-34-6) has "no known toxicity". Acute Fish Toxicity LC50 >100mg/l Acute Crustacean Toxicity EC50: >100 mg/l Acute Algae Toxicity EC50: >100mg/l Source IUCLID 2000 Guar Gum Component is naturally occurring substance. No ecotoxicity information was available in the IUCLID. Source: IUCLID 2000 Acute Crustacean Toxicity 48h LC50: 422 mg/l (Daphnia magna) Acute Fish Toxicity 96h LC50: 218 mg/l (Oncorhynchus) Source: ECOTOX</p>	Yes
Sodium Bicarbonate	Halliburton	pH control	0.1200%	<p>Acute Fish Toxicity 96h LC50: 7550 mg/l (Gambusia affinis) Acute Crustacean Toxicity 48h EC50: 2350 mg/l (Daphnia magna) Acure Algae Toxicity 5d EC50: 650 mg/l (Nitzschia linearis) Source: IUCLID 2000</p>	Yes

ALDACIDE G	Halliburton	Biocide	0.1200%	<p>Toxicity (Glutaraldehyde) Oral Toxicity: LD 50: 316 mg/kr (Rat) Dermal Toxicity: > 2000mg/kg (Rat), 560 µL/kg (Rabbit) Inhalation Toxicity: LC50: 0.48 mg/l (Rat, 4h) Toxicity (Methanol) Oral Toxicity: LD 50: > 1187-2769 mg/kr (Rat), 3000 mg/kg (Monkey), 300 mg/kg (Human) Dermal Toxicity: 15800mg/kg (Rat), 393 mg/kg (Primate) Inhalation Toxicity: LC50: 87.5 mg/l (Rat, 6h vapour), 128.2 mg/l (Rat, 4h vapour), 83.2 mg/l (rat, 4h), 64000 ppm (rat, 4h), 10 mg/l (Human)</p> <p>Acute Fish Toxicity LC50 96hr: 13 mg/l (Lepomis macrochirus) Acute Crustacean Toxicity TLM48: 0.11 mg/l (Acartia tonsa) Acute Crustacean Toxicity TLM48: 29.73 mg/l (Daphnia Magna) Acure Algae Toxicity EC50: 8.1 mg/l (Skeletonema costatum)</p> <p>Log Pow = <0 OECD 117 Biodegradation = 67% in 28days OECD 306 Skeletonema 72hr EC50 = 0.5mg/L ISO 10253 Acartia 48hr LC50 = 0.1mg/L ISO 14669 Scophthalmus = 96hr LC50 = 60mg/L PARCOM 1995 Abra alba 5day LC50 = 18mg/Kg Fecal pellet production</p>	Yes
Caustic Soda	Halliburton	pH control	0.0700%	Acute Fish Toxicity TLM96: 730 mg/l (Oncorhynchus mykiss)	Yes
Citric Acid	Halliburton	pH control	0.0500%	Acute Fish Toxicity 96h LC50: >440-760 mg/l (Leuciscus idus) Acute Crustacean Toxicity 72h EC50: 120 mg/l (Daphnia magna) Acute Toxicity 7d EC3: 640 mg/l (Scenedesmus quadricauda) Source: IUCLID 2000	Yes
Soda Ash	Halliburton	Buffer	0.0500%	Ecotoxicity - Freshwater Algae - Acute Toxicity Data Sodium carbonate 120Hr EC50 Nitzschia: 242 mg/l Ecotoxicity - Freshwater Fish - Acute Toxicity Data Sodium carbonate 96 Hr LC50 Lepornis macrochirus: 300 mg/l (static); 96 Hr LC50 Pimephales promelas: 310 - 1200 mg/l (static) Ecotoxicity - Water Flea - Acute Toxicity Data Sodium carbonate 48 Hr EC%) Daphnia magna: 265 mg/l	Yes

C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
water	N/A	65.2700%
sodium Chloride	7647-14-5	16.9000%
Calcium Carbonate	471-34-1	5.9130%
Potassium Chloride	7447-40-7	5.2800%
Polyalkylene	9038-95-3	1.6400%
Polyethylene glycol butyl ether	9004-77-7	1.6400%
Crystalline silica, quartz	14808-60-7	0.6570%
Calcined petroleum coke	64743-05-1	0.6000%
Xanthan gum	11138-66-2	0.4700%
Sodium carboxymethyl cellulose	9004-32-4	0.4653%
Polyacrylamide / polyacrylate copolymer	25085-02-3	0.3150%
water in product	7732-18-5	0.1350%
Sodium Bicarbonate	144-55-8	0.1200%
Glutaraldehyde	111-30-8	0.1188%
Polyamine	42751-79-1	0.1000%
Sodium Hydroxide	1310-72-2	0.0700%
Wood fibre	Mixture (1757)	0.0667%
Cellulose	9005-81-6	0.0667%
Guar Gum	Mixture (1756)	0.0667%
Citric Acid	77-92-9	0.0500%
Sodium Carbonate	497-19-8	0.0500%
Glyoxal	107-22-2	0.0047%
Methanol	67-56-1	0.0012%

A. SYSTEM DETAILS:	
OPERATOR:	DDGT
PROJECT / WELL:	Tubridgi Gas Storage Well Campaign
SYSTEM:	KCl/Polymer/Glycol - Contingency
TOTAL VOLUME OF SYSTEM (m ³):	1

B. PRODUCT LIST, Cont'd					
Trade name	Supplier	Purpose	Product in system fluid (mass %)	Toxicity & Ecotoxicity Info	MSDS Attached
Fresh water	Water supplied by Operator	Mix water	63.3100%	N/A	N/A
Sodium Chloride	Halliburton	Weighting Agent	16.8800%	<p>Toxicology Data –Selected Inhalation LC50s: Inhalation LC50 Rat >42 g/m³ 1 h (Source: NLM_CIP)</p> <p>Toxicology Data –Selected Inhalation LD50s and LC50s: Oral LD50 Rat 3 g/kg (Source: NLM_CIP); Inhalation LC50 Rat >42 g/m³ 1 h (Source: NLM_CIP)</p> <p>Ecotoxicity – Earthworm – Acute Toxicity Data - 48 Hr LC50 Eisenia foetida: 0.1 - 1 mg/cm² [filter paper]</p> <p>Ecotoxicity – Freshwater Fish– Acute Toxicity Data: 96 Hr LC50 Lepomis macrochirus: 5560 - 6080 mg/L [flow-through]; 96 Hr LC50 Lepomis macrochirus: 12946 mg/L [static]; 96 Hr LC50 Pimephales promelas: 6020 - 7070 mg/L [static]; 96 Hr LC50 Pimephales promelas: 7050 mg/L [semi-static]; 96 Hr LC50 Pimephales promelas: 6420 - 6700 mg/L [static]; 96 Hr LC50 Oncorhynchus mykiss: 4747 - 7824 mg/L [flow-through]</p> <p>Ecotoxicity – Water Flea – Acute Toxicity Data: 48 Hr EC50 Daphnia magna: 1000 mg/L; 48 Hr EC50 Daphnia magna: 340.7 - 469.2 mg/L [Static]</p>	Yes

BARACARB	Halliburton	Bridging Agent	6.5600%	Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)	Yes
Potassium Chloride	Halliburton	Shale Inhibition	5.2800%	Freshwater Acute Algae Toxicity 72h EC50: > 100 mg/L (Scenedesmus subspicatus) [ECHA]; Freshwater Acute Crustacean Toxicity 48h EC50: 660 mg/L (Daphnia magna) [ECHA]; Freshwater Acute Fish Toxicity 96h LC50: 880 mg/L (Pimephales promelas) [ECHA]; Toxicity: Oral Toxicity: LD50: > 5000 mg/kg (Rat) Ecotoxicity: Acute Crustaceans Toxicity: TLM96: 100-330 ppm (Crangon crangon) Bioaccumulation BCF: 0.47 [OECD SIDS]; Biodegradation: Product is inorganic - biodegradation is not applicable.	Yes
GEM CP	Halliburton	Shale Inhibition	1.6400%	Acute Fish Toxicity EC50: 86 mg/l (Abra alba) Acute Crustacean Toxicity TLM48: 356 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 465 mg/l (Skeletonema costatum)	Yes
GEM GP	Halliburton	Shale Inhibition	1.6400%	Toxicity – Oral Toxicity: LD 50: >2000 mg/kr (Rat) Acute Fish Toxicity EC50: 475 ppm (Abra alba) Acute Crustacean Toxicity TLM48: 310 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 391 mg/l (Skeletonema costatum) Log Pow = 0.436 OECD 107 Biodegradation = 68% @ 28 days OECD 306 Skeletonema 72hr EC50 = 391mg/L ISO 10253 Acartia 48hr LC50 = 310mg/L ISO 14669 Scophthalmus 96hr LC50 = >1800mg/L PARCOM 1995 Corophium 10day LC50 = 6597mg/Kg PARCOM1995	Yes
QUIK-FREE	Halliburton	Spotting Fluid /Stuck Pipe	0.9400%	fatty acid ester: No ecotoxicity data available in sources consulted. However, environmental risks are expected to be low because: <ul style="list-style-type: none"> • Component is defined by Germany's Federal Environmental Agency as "Not Considered Hazardous to Water" (Water Classification Annex 1) Glycerine: Acute Fish Toxicity 48h LC50: > 10000 mg/l (Leuciscus idus)	Yes

melanotus); Acute Crustacean Toxicity 24h EC50: >500 mg/l (Daphnia magna); Source: IUCLID 2000

Modified bentonite: Acute Fish Toxicity 96h LC50: > 500 mg/l (Oncorhynchus mykiss)

Acute Crustacean Toxicity 48h EC50: <500 mg/l (Daphnia magna); Source: OECD SIDS

Mixture of dimer and trimer fatty acids of indefinite composition derived from tall oil

Acute Fish Toxicity 96h LL50: > 1000 mg/l (Pimephales promelas); Acute Crustacean Toxicity 48h EL50: > 1000 mg/l (Daphnia sp)

Acute Algae Toxicity 72h EL50: > 1000mg/l (Selenastrum capricornutum); Source US EPA HPV

fatty acid ester: No ecotoxicity data available in sources consulted.

However, environmental risks are expected to be low because:

- Component is defined by Germany's Federal Environmental Agency as "Not Considered Hazardous to Water" (Water Classification Annex 1)

Soybean oil: No ecotoxicity data available in sources consulted.

However, environmental risks are expected to be low because:

- Component is defined by Germany's Federal Environmental Agency as "Not Considered Hazardous to Water" (Water Classification Annex 1)
- Component is considered not Persistent or Bioaccumulative, according to Environment Canada (Canada DSL):
and
- Component is defined in the EU under REACH Annex IV as a Minimal Risk Compound".

Lecithins: No exotoxicity data available in sources consulted. However, environmental risks are expected to be lower because:

- Component is derived from a naturally occurring substance
- Component is defined by US FDA as a "Generally Recognised As Safe (GRAS) Substance";
- Component is defined by the USDA's National Organic Program as a "Substance Allowed as Ingredients in or on Organic Processed Products";

Isopropanol:

- Component is considered not Persistent or Bioaccumulative, according to Environment Canada (Canada DSL):
and

				<ul style="list-style-type: none"> Component is defined in the EU under REACH Annex IV as a Minimal Risk Compound". Acute Fish Toxicity 96h LC50: > 9640 mg/l (Pimephales Promelas); Acute Crustacean Toxicity 48h LC50: 1400 mg/l (Crangon crangon) Acute Algae Toxicity 72h EL50: > 1000mg/l (Scenedesmus subspicatus); Source: IUCLID 2000 Ethylene glycol monobutyl ether: Acute Fish Toxicity 96h LC50: 14900 mg/l (Lepomis macrochirus) Acute Crustacean Toxicity 48h LC50: 600-1000 mg/l (Crangon crangon);Source: IUCLID 2000 Diethylene glycol monobutyl ether: Acute Fish Toxicity 96h LC50: 1300 mg/l (Lepomis macrochirus) Acute Crustacean Toxicity 248h EC50: 2300 mg/l (Daphnia magna); Source: ECOTOX Crystalline silics, quartz: Biodegradation is "not applicable" for crystalline silics since it is inorganic. Concentration-based toxicity values were not available. Silica is a naturally occurring, insoluble component of soil. Silica plays an essential role in most plants and animals Synthetic amorphous silica: Acute Fish Toxicity 96h LL0: > 10000 mg/l (Branchdanio rerio) Acute Crustacean Toxicity 24h EL50: > 10000mg/l (Daphnia magna) Na-Al silicates Acute Fish Toxicity 96h LL0: > 10000 mg/l (Branchdanio rerio) Acute Algae Toxicity 72h NOEL: 10000mg/l (Scenedesmus subspicatus) Source: IUCLID 2000 Quaternary Ammonium Compounds: Acute Fish Toxicity 96h LC50: > 1000 mg/l (Brachydanio rerio) Acute Crustacean Toxicity 48h EC50: 35.2 mg/l (Daphnia magna) Acute Algae Toxicity 72h EL50: 0.050mg/l (Selenastrum capricornutum); Source: US EPA HPV 	
BAROFIBRE	Halliburton	Lost Circulation	0.7000%	Acute Fish Toxicity LC50: 445 mg/l (Cyprinus carpio) Acute Crustacean Toxicity TLM48: 1875 mg/l (Daphnia magna)	
STEELSEAL (all grades)	Halliburton	Lost Circulation	0.6000%	No ecotoxicity data available in sources consulted. However, environmental risks are expected to be low because: . Component is considered non Bioaccumulative or Inherently Toxic, according to Environmet Canada (Canade DSL)	Yes

BARAZAN D PLUS	Halliburton	Viscosifier	0.4700%	<p>Toxicity – Oral Toxicity: LD 50: >5000 mg/kr (Rat) Inhalation Toxicity: LC50: > 21 mg/lrat</p> <p>Ecotoxicity - Acute Fish Toxicity: TLM96: 320-560ppm (Oncorhynchus mykiss) Ecotoxicity - Acute Crustaceans Toxicity: TLM96: > 75000ppm (Mysidopsis bahia)</p>	Yes
PAC-L	Halliburton	Fluid Loss	0.4700%	Acute Fish Toxicity TLM96: > 500 mg/l (Golden orfe)	Yes
EZ MUD DP	Halliburton	Shale Inhibition	0.3500%	<p>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</p>	Yes
BARALKEAN DUAL	Halliburton	Solvent Cleaning Solution	0.3500%	<p>Ethylene glycol monobutyl ether Toxicity to Algae EC50: 839.56 mg/l (Skeletonema costatum) EC50 (72h): 911 mg/l (biomass); EC50: > 500mg/l (Scenedesmus subspicatus); NOEC (72h): 88 mg/l (biomass) (Pseudokircchne rella subcapitata) Toxicity to Fish LC50: > 1000 mg/l (Scophthalmus maximus juvenile)) LC50 (96h) =1474 mg/l (Oncorhynchus mykiss); NOEC (21d): > 100 mg/l (danio rerio) Toxicity to Microorganisms: TT/EC3(48h): 463 mg/l (Uroneme parduzci): TT/EC3(72h): 73 mg/l (Entosiphom sulcatum): TT/EC3(16h): 700 mg/l (Pseudomonas putida) Toxicity to Invertebrates EC50: >1000 mg/l (Daphnia Magna), EC50 (48h): 1800 mg/l (Daphnia Magna), EC50: 1875 mg/l (Daphnia Magna), NOEC (21 d) 100 mg/l (Daphnia Magna, Reproduction)</p> <p>Mixture of C9-C11 alcohol ethoxylate Toxicity to Algae EC50 (96h): 0.26 mg/l (Selenastrum capricornutum) Toxicity to Fish LC50 (96h): 5.7 mg/l (Onocorhynchus mykiss) NOEC (30d): 0.28 mg/l (Pimephales promelas) (similar substance) Toxicity to Microorganisms : No information available Toxicity to Invertebrates EC50 (48h): 2.5 mg/l (Daphnia Magna), NOEC (21 d) 1.75 mg/l (Daphnia Magna) (similar substance)</p> <p>Citric Acid Acute Fish Toxicity 96h LC50: >440-760 mg/l (Leuciscus idus) Acute Crustacean Toxicity 72h EC50: 120 mg/l (Daphnia magna) Acute Toxicity 7d EC3: 640 mg/l (Scenedesmus quadrucauda) Source: IUCLID 2000</p>	Yes

				<p>Aluminium Sulfate Acute Fish Toxicity 96h LC50: 37 mg/l (Gambusia affinis) Acute Crustacean Toxicity 15min EC50: 136 mg/l (Daphnia magna) Source: IUCLID 2000</p> <p>Ethylene glycol monobutyl ether - Readily bodegradable (75-88% @ 28d) Mixture of C9-C11 alcohol ethoxylate - Readily bodegradable (72-89% @ 28d) (similar substances)</p> <p>Ethylene glycol monobutyl ether Log Pow 0.81</p>	
BDF-427	Halliburton	Coagulant	0.2000%	<p>Acute Fish Toxicity LC50: (96 hour) 5-10 mg/l (Brachidanio rerio) Acute Crustacean Toxicity EC50: (48 hour) 20-50 mg/l (Daphnia magna)</p>	Yes
N-SQUEEZE	Halliburton	Lost Circulation	0.2000%	<p>Woodfibre: This component is an organic substance, exotoxicity information is unknown. However, environmental risks are expected to be low because: Component is derived from a naturally occurring substance Cellulose (CAS#: 9004-34-6) has "no known toxicity". Acute Fish Toxicity LC50 >100mg/l Acute Crustacean Toxicity EC50: >100 mg/l Acute Algae Toxicity EC50: >100mg/l Source IUCLID 2000 Guar Gum Component is naturally occurring substance. No ecotoxicity information was available in the IUCLID. Source: IUCLID 2000 Acute Crustacean Toxicity 48h LC50: 422 mg/l (Daphnia magna) Acute Fish Toxicity 96h LC50: 218 mg/l (Oncorhynchus) Source: ECOTOX</p>	Yes
Sodium Bicarbonate	Halliburton	pH control	0.1200%	<p>Acute Fish Toxicity 96h LC50: 7550 mg/l (Gambusia affinis) Acute Crustacean Toxicity 48h EC50: 2350 mg/l (Daphnia magna) Acure Algae Toxicity 5d EC50: 650 mg/l (Nitzschia linearis) Source: IUCLID 2000</p>	Yes
ALDACIDE G	Halliburton	Biocide	0.1200%	<p>Toxicity (Glutaraldehyde) Oral Toxicity: LD 50: 316 mg/kr (Rat) Dermal Toxicity: > 2000mg/kg (Rat), 560 µL/kg (Rabbit) Inhalation Toxicity: LC50: 0.48 mg/l (Rat, 4h) Toxicity (Methanol) Oral Toxicity: LD 50: > 1187-2769 mg/kr (Rat), 3000</p>	Yes

				<p>mg/kg (Monkey), 300 mg/kg (Human) Dermal Toxicity: 15800mg/kg (Rat), 393 mg/kg (Primate) Inhalation Toxicity: LC50: 87.5 mg/l (Rat, 6h vapour), 128.2 mg/l (Rat, 4h vapour), 83.2 mg/l (rat, 4h), 64000 ppm (rat, 4h), 10 mg/l (Human)</p> <p>Acute Fish Toxicity LC50 96hr: 13 mg/l (Lepomis macrochirus) Acute Crustacean Toxicity TLM48: 0.11 mg/l (Acartia tonsa) Acute Crustacean Toxicity TLM48: 29.73 mg/l (Daphnia Magna) Acure Algae Toxicity EC50: 8.1 mg/l (Skeletonema costatum)</p> <p>Log Pow = <0 OECD 117 Biodegradation = 67% in 28days OECD 306 Skeletonema 72hr EC50 = 0.5mg/L ISO 10253 Acartia 48hr LC50 = 0.1mg/L ISO 14669 Scophthalmus = 96hr LC50 = 60mg/L PARCOM 1995 Abra alba 5day LC50 = 18mg/Kg Fecal pellet production</p>	
Caustic Soda	Halliburton	pH control	0.0700%	Acute Fish Toxicity TLM96: 730 mg/l (Oncorhynchus mykiss)	Yes
Citric Acid	Halliburton	pH control	0.0500%	Acute Fish Toxicity 96h LC50: >440-760 mg/l (Leuciscus idus) Acute Crustacean Toxicity 72h EC50: 120 mg/l (Daphnia magna) Acute Toxicity 7d EC3: 640 mg/l (Scenedesmus quadricauda) Source: IUCLID 2000	Yes
Soda Ash	Halliburton	Buffer	0.0500%	Ecotoxicity - Freshwater Algae - Acute Toxicity Data Sodium carbonate 120Hr EC50 Nitzschia: 242 mg/l Ecotoxicity - Freshwater Fish - Acute Toxicity Data Sodium carbonate 96 Hr LC50 Lepornis macrochirus: 300 mg/l (static); 96 Hr LC50 Pimephales promelas: 310 - 1200 mg/l (static) Ecotoxicity - Water Flea - Acute Toxicity Data Sodium carbonate 48 Hr EC%) Daphnia magna: 265 mg/l	Yes
Fresh water	Water supplied by Operator	Mix water	63.3100%	N/A	N/A
Sodium Chloride	Halliburton	Weighting Agent	16.8800%	Toxicology Data –Selected Inhalation LC50s: Inhalation LC50 Rat >42 g/m3 1 h (Source: NLM_CIP) Toxicology Data –Selected Inhalation LD50s and LC50s: Oral LD50 Rat 3 g/kg (Source: NLM_CIP); Inhalation LC50 Rat >42 g/m3 1 h (Source: NLM_CIP)	Yes

				<p>Ecotoxicity – Earthworm – Acute Toxicity Data - 48 Hr LC50 Eisenia foetida: 0.1 - 1 mg/cm2 [filter paper]</p> <p>Ecotoxicity – Freshwater Fish– Acute Toxicity Data: 96 Hr LC50 Lepomis macrochirus: 5560 - 6080 mg/L [flow-through]; 96 Hr LC50 Lepomis macrochirus: 12946 mg/L [static]; 96 Hr LC50 Pimephales promelas: 6020 - 7070 mg/L [static]; 96 Hr LC50 Pimephales promelas: 7050 mg/L [semi-static]; 96 Hr LC50 Pimephales promelas: 6420 - 6700 mg/L [static]; 96 Hr LC50 Oncorhynchus mykiss: 4747 - 7824 mg/L [flow-through]</p> <p>Ecotoxicity – Water Flea – Acute Toxicity Data: 48 Hr EC50 Daphnia magna: 1000 mg/L; 48 Hr EC50 Daphnia magna: 340.7 - 469.2 mg/L [Static]</p>	
BARACARB	Halliburton	Bridging Agent	6.5600%	<p>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa)</p> <p>Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</p>	Yes

C. CHEMICAL LIST		
Chemicals within products in Part B	CAS number	Maximum Mass fraction in System (%)
water	N/A	6331.0000%
sodium Chloride	7647-14-5	1688.0000%
Calcium Carbonate	471-34-1	590.4000%
Potassium Chloride	7447-40-7	528.0000%
Polyalkylene	9038-95-3	164.0000%
Polyethylene glycol butyl ether	9004-77-7	164.0000%
Plant Material	Organinc material N/A	70.0000%
Crystalline silica, quartz	14808-60-7	65.6000%
Calcined petroleum coke	64743-05-1	60.0000%
Xanthan gum	11138-66-2	47.0000%
Sodium carboxymethyl cellulose	9004-32-4	46.5300%
fatty acid ester	10024-47-2	44.4338%
Glycerine	56-81-5	44.4338%
Polyacrylamide / polyacrylate copolymer	25085-02-3	31.5000%
Ethylene glycol monobutyl ether	111-76-2	21.0000%
water in product	7732-18-5	19.4600%
Sodium Bicarbonate	144-55-8	12.0000%
Glutaraldehyde	111-30-8	11.8800%

Polyamine	42751-79-1	10.0000%
Sodium Hydroxide	1310-72-2	7.0000%
Citric Acid	77-92-9	6.7500%
Wood fibre	Mixture (1757)	6.6667%
Cellulose	9005-81-6	6.6667%
Guar Gum	Mixture (1756)	6.666667%
Mixture of C9-C11 alcohol ethoxylate	68439-46-3	5.9500%
Sodium Carbonate	497-19-8	5.0000%
Modified bentonite	71011-24-0	4.7000%
Glyoxal	107-22-2	0.4700%
Aluminium Sulphate	10043-01-3	0.3500%
Methanol	67-56-1	0.1200%
Mixture of dimer and trimer fatty acids of indefinite composition derived from tall oil	61790-12-3	0.0940%
fatty acid ester	135800-37-2	0.0940%
Soybean oil	8001-22-7	0.0940%
Lecithins	8002-43-5	0.0940%
Isopropanol	67-63-0	0.0094%
Ethylene glycol monobutyl ether	111-76-2	0.0094%
Diethylene glycol monobutyl ether	112-34-5	0.0094%
Crystalline silics, quartz	14808-60-7	0.0094%

Quaternary Ammonium Compounds	61788-63-4	0.0094%

Appendix F Chemical Disclosure MSDS



MATERIAL SAFETY DATA SHEET

Product Trade Name: **CALCIUM CHLORIDE - PELLETS**

Revision Date: 01-Feb-2012

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
 15 Marriott Road
 Jandakot
 WA 6164
 Australia

ACN Number: 009 000 775
 Telephone Number: 61 (08) 9455 8300
 Fax Number: 61 (08) 9455 5300

Product Emergency Telephone
 Australia: 08-64244950
 Papua New Guinea: 05 1 281 575 5000
 New Zealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone
 Australia: 000
 Papua New Guinea: 000
 New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: CALCIUM CHLORIDE - PELLETS
Synonyms: None
Chemical Family: Inorganic Salt
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Accelerator

Prepared By Chemical Compliance
 Telephone: 1-580-251-4335
 e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Calcium chloride	10043-52-4	60 - 100%	Not applicable	Not applicable	Not applicable
Potassium chloride	7447-40-7	2-3	Not applicable	Not applicable	Not applicable

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview	May cause eye, skin, and respiratory irritation. May be harmful if swallowed.
Risk Phrases	R36 Irritating to eyes.
HSNO Classification	6.1D Acutely Toxic Substances 6.1E Acutely Toxic Substances 6.3A Irritating to the skin 6.4A Irritating to the eye 9.3C Harmful to terrestrial vertebrates

4. 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. Remove contaminated clothing and launder before reuse.
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.
Ingestion	Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.
Notes to Physician	Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	All standard fire fighting media
Extinguishing media which must not be used for safety reasons	None known.
Special Exposure Hazards	Not applicable.
Special Protective Equipment for Fire-Fighters	Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures	Use appropriate protective equipment. Avoid creating and breathing dust.
Environmental Precautionary Measures	Prevent from entering sewers, waterways, or low areas.
Procedure for Cleaning / Absorption	Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions	Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust.
Storage Information	Store in a cool, dry location.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	Use in a well ventilated area.
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	Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	White
Odor:	Odorless
pH:	10
Specific Gravity @ 20 C (Water=1):	2.15
Density @ 20 C (kg/l):	Not Determined
Bulk Density @ 20 C (kg/m ³):	Not Determined
Boiling Point/Range (C):	Not Determined Min: > 260
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m ³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m ³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	40
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	110.986
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	None known.
Hazardous Decomposition Products	None known.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Symptoms related to exposure	
Inhalation	May cause respiratory irritation.
Skin Contact	May cause skin irritation. May cause skin burns on prolonged contact.
Eye Contact	May cause severe eye irritation. May cause corneal injury.
Ingestion	Causes burns of the mouth, throat and stomach.
Aggravated Medical Conditions	Skin disorders.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.
Toxicity Tests	
Oral Toxicity:	LD50: 1000 mg/kg (Rat)
Dermal Toxicity:	LD50: > 5000 mg/kg (Rabbit)
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Not determined
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not applicable
Bio-accumulation	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	Bury in a licensed landfill according to federal, state, and local regulations.
Contaminated Packaging	Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR

Not restricted

Air Transportation

ICAO/IATA

Not restricted

Sea Transportation

IMDG

Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory

All components listed on inventory or are exempt.

New Zealand Inventory of Chemicals

This product does not comply with NZIOC

US TSCA Inventory

All components listed on inventory or are exempt.

EINECS Inventory

This product, and all its components, complies with EINECS

Classification

Xi - Irritant.

Risk Phrases

R36 Irritating to eyes.

Safety Phrases

S22 Do not breathe dust.
S24 Avoid contact with skin.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS

Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: **CEMENT - CLASS G**

Revision Date: 29-Apr-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: CEMENT - CLASS G
Synonyms: None
Chemical Family: Cement
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Cement

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Portland cement	65997-15-1	60 - 100%	TWA: 10 mg/m ³	TWA: 10 mg/m ³	TWA: 1 mg/m ³
Crystalline silica, quartz	14808-60-7	<3	TWA: 0.1 mg/m ³	TWA: 0.2 mg/m ³	TWA: 0.025 mg/m ³

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD

May cause eye, skin, and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

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 exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (MSDS) for this product, which has been provided to your employer.

Risk Phrases

R41 Risk of serious damage to eyes.

R43 May cause sensitization by skin contact.

R37/38 Irritating to respiratory system and skin.

HSNO Classification

6.1E (Inhalation) Acutely Toxic Substances 8.2C Corrosive to dermal tissue if exposed for greater than 1 hour 8.3A Corrosive to ocular tissue 6.5B Contact sensitizers 6.7A Known or presumed human carcinogens 6.9A Toxic to human target organs or systems

4. 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, or suspected contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention immediately after flushing.

Ingestion

Under normal conditions, first aid procedures are not required.

Notes to Physician

Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

None - does not burn.

Extinguishing media which must not be used for safety reasons

None known.

Special Exposure Hazards

Not applicable.

Special Protective Equipment for Fire-Fighters

Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

CEMENT - CLASS G

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Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption 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

Handling Precautions Avoid contact with eyes, skin, or clothing. 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.

Storage Information Store in a cool well ventilated area. Keep container closed when not in use. Store locked up. 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. Product has a shelf life of 24 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

Respiratory Protection Wear a NIOSH certified, European Standard EN 149 (FFP2/FFP3), 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 Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Gray
Odor:	Odorless
pH:	12.4
Specific Gravity @ 20 C (Water=1):	3.14
Density @ 20 C (kg/l):	Not Determined
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

9. PHYSICAL AND CHEMICAL PROPERTIES

Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	0
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Not Determined
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	Keep away from any contact with water.
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure **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).

Skin Contact Can dry skin. May cause an allergic skin reaction. May cause alkali burns with confined contact.

Eye Contact May cause severe eye irritation.

Ingestion None known

Aggravated Medical Conditions Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.

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.

Other Information For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity:	Not determined
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Refer to <u>IARC Monograph 68, Silica, Some Silicates and Organic Fibres</u> (June 1997).
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not applicable
Bio-accumulation	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined

Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	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.

14. TRANSPORT INFORMATION

Land Transportation

ADR
Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory	All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
US TSCA Inventory	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS

Classification Xi - Irritant.

Risk Phrases R41 Risk of serious damage to eyes.
R43 May cause sensitization by skin contact.
R37/38 Irritating to respiratory system and skin.

Safety Phrases

S2 Keep out of reach of children.
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S37 Wear suitable gloves.
S24/25 Avoid contact with skin and eyes.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS

Not applicable

Contact**Australian Poisons Information Centre**

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: CFR-3L

Revision Date: 22-Feb-2012

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
 15 Marriott Road
 Jandakot
 WA 6164
 Australia

ACN Number: 009 000 775
 Telephone Number: 61 (08) 9455 8300
 Fax Number: 61 (08) 9455 5300

Product Emergency Telephone
 Australia: 08-64244950
 Papua New Guinea: 05 1 281 575 5000
 NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone
 Australia: 000
 Papua New Guinea: 000
 New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: CFR-3L
Synonyms: None
Chemical Family: Blend
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None
Poisons Schedule: None
Application: Friction Reducer

Prepared By Chemical Compliance
 Telephone: 1-580-251-4335
 e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand OEL	ACGIH TLV-TWA
Sulfonic acid salt		30 - 60%	Not applicable	Not applicable	Not applicable

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview May cause eye and skin irritation.

Risk Phrases None

HSNO Classification Non-hazardous

4. 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 Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media Water fog, carbon dioxide, foam, dry chemical.

Extinguishing media which must not be used for safety reasons None known.

Special Exposure Hazards Decomposition in fire may produce toxic gases.

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 Precautionary Measures Use appropriate protective equipment.

Environmental Precautionary Measures Prevent from entering sewers, waterways, or low areas.

Procedure for Cleaning / Absorption Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Avoid contact with eyes, skin, or clothing.

Storage Information Store away from oxidizers. Store in a cool well ventilated area. Keep container closed when not in use.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use in a well ventilated area.

Respiratory Protection	Dust/mist respirator. (N95, P2/P3)
Hand Protection	Normal work gloves.
Skin Protection	Normal work coveralls.
Eye Protection	Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions	None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Color:	Red
Odor:	Musty
pH:	7
Specific Gravity @ 20 C (Water=1):	1.17
Density @ 20 C (kg/l):	1.17
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined Min: > 98
Flash Point Method:	PMCC
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	67
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	Oxides of sulfur. Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	None known.
Skin Contact	May cause skin irritation.
Eye Contact	May cause mild eye irritation.
Ingestion	None known
Aggravated Medical Conditions	None known.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.
Toxicity Tests	
Oral Toxicity:	LD50: 8670 mg/kg (Rat)
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Not determined
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not determined
Bio-accumulation	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	Disposal should be made in accordance with federal, state, and local regulations.
Contaminated Packaging	Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR
Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory	All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals	This product does not comply with NZIOC
US TSCA Inventory	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS

Classification Not Classified

Risk Phrases None

Safety Phrases None

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS

Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: ECONOLITE LIQUID

Revision Date: 17-Jan-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: ECONOLITE LIQUID
Synonyms: None
Chemical Family: Silicate
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: S5
Application: Light Weight Cement Additive

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Sodium silicate	1344-09-8	35-49	Not applicable	Not applicable	Not applicable

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview	May cause eye and skin burns. May cause respiratory irritation. May be harmful if swallowed.
Risk Phrases	R34 Causes burns.
HSNO Classification	Not Determined

4. 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	In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes. Get medical attention. Remove contaminated clothing and launder before reuse.
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.
Ingestion	Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.
Notes to Physician	Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	Water fog, carbon dioxide, foam, dry chemical.
Extinguishing media which must not be used for safety reasons	None known.
Special Exposure Hazards	Decomposition in fire may produce toxic gases.
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 Precautionary Measures	Use appropriate protective equipment.
Environmental Precautionary Measures	Prevent from entering sewers, waterways, or low areas.
Procedure for Cleaning / Absorption	Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Neutralize to pH of 6-8. Scoop up and remove. Do NOT spread spilled product with water.

7. HANDLING AND STORAGE

Handling Precautions	Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Wash hands after use. Launder contaminated clothing before reuse. Avoid breathing mist.
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Storage Information

Store away from acids. Store in a cool well ventilated area. Keep container closed when not in use.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.
Respiratory Protection	Dust/mist respirator. (N95, P2/P3)
Hand Protection	Impervious rubber gloves.
Skin Protection	Full protective chemical resistant clothing.
Eye Protection	Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions	Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Color:	Clear to hazy
Odor:	Slightly soapy
pH:	11.2
Specific Gravity @ 20 C (Water=1):	1.4
Density @ 20 C (kg/l):	1.4
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	101
Freezing Point/Range (C):	-1
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Strong acids. Amphoteric metals such as aluminum, magnesium, lead, tin, or zinc.

Hazardous Decomposition Products	Toxic fumes.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
<u>Symptoms related to exposure</u>	
Inhalation	Causes severe respiratory irritation.
Skin Contact	May cause skin burns.
Eye Contact	May cause eye burns.
Ingestion	Causes burns of the mouth, throat and stomach.
Aggravated Medical Conditions	Skin disorders.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.
Toxicity Tests	
Oral Toxicity:	LD50: 2000-3000 mg/kg (Rat)
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Not determined
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not determined
Bio-accumulation	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Disposal should be made in accordance with federal, state, and local regulations.
Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR
Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals All components listed on inventory or are exempt.
US TSCA Inventory All components listed on inventory or are exempt.
EINECS Inventory This product, and all its components, complies with EINECS

Classification C - Corrosive.

Risk Phrases R34 Causes burns.

Safety Phrases S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36 Wear suitable protective clothing.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: GASCON 469

Revision Date: 26-Mar-2014

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: GASCON 469
Synonyms: None
Chemical Family: Blend
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Cement Additive

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. HAZARDS IDENTIFICATION

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Hazard Overview May cause mild eye irritation. May cause mild skin irritation.

Classification None

Risk Phrases None

Safety Phrases S24/25 Avoid contact with skin and eyes.

HSNO Classification 6.3B Mildly irritating to the skin

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT (w/w)	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Contains no hazardous substances	Mixture	60 - 100%	Not applicable	Not applicable	Not applicable

Non-Hazardous Substance to Total of 100%

4. 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, or suspected contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention immediately after flushing.

Ingestion Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media
All standard fire fighting media

Extinguishing media which must not be used for safety reasons
None known.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions	Avoid contact with eyes, skin, or clothing. Avoid breathing vapors.
Storage Information	Store in a cool well ventilated area. Keep from excessive heat. Keep from freezing. Keep container closed when not in use. Store in non-rusting containers. Product has a shelf life of 12 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	Use in a well ventilated area.
Respiratory Protection	Dust/mist respirator. (N95, P2/P3)
Hand Protection	Impervious rubber gloves.
Skin Protection	Normal work coveralls.
Eye Protection	Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions	Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Color:	Transparent
Odor:	Odorless
pH:	10
Specific Gravity @ 20 C (Water=1):	1.1
Density @ 20 C (kg/l):	1.098
Bulk Density @ 20 C (kg/M3):	Not Determined
Boiling Point/Range (C):	100
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	80
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	10
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
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Hazardous Polymerization: Will Not Occur

Conditions to Avoid None anticipated

Incompatibility (Materials to Avoid) Strong oxidizers. Strong acids.

Hazardous Decomposition Products None known.

Additional Guidelines Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Acute Toxicity

Inhalation May cause mild respiratory irritation.

Eye Contact May cause mild eye irritation.

Skin Contact May cause mild skin irritation.

Ingestion Irritation of the mouth, throat, and stomach.

Chronic Effects/Carcinogenicity No data available to indicate product or components present at greater than 1% are chronic health hazards.

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Contains no hazardous substances	Mixture	No data available	No data available	No data available

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

Ecotoxicity Product

Acute Fish Toxicity: Not determined

Acute Crustaceans Toxicity: Not determined

Acute Algae Toxicity: Not determined

Ecotoxicity Substance

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Contains no hazardous substances	Mixture	No information available	No information available	No information available	No information available

12.2 Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

Does not bioaccumulate

12.4 Mobility in soil

No information available

12.5 Results of PBT and vPvB assessment

No information available.

12.6 Other adverse effects

13. DISPOSAL CONSIDERATIONS

Disposal Method	Disposal should be made in accordance with federal, state, and local regulations. Incineration recommended in approved incinerator 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.

14. TRANSPORT INFORMATION

Land Transportation

ADR
Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory	All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
US TSCA Inventory	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS
Classification	Not Classified
Risk Phrases	Not classified

Safety Phrases
S24/25 Avoid contact with skin and eyes.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS

Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: HALAD® 413L CEMENT ADDITIVE

Revision Date: 02-May-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substance or Preparation

Product Trade Name: HALAD® 413L CEMENT ADDITIVE
Synonyms: None
Chemical Family: Polymer
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None
Poisons Schedule: None
Application: Fluid Loss Additive

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substance	CAS Number	Percent	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Acrylic polymer	Proprietary	10 - 30%	Not determined	Not determined	Not applicable

Non-hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview No significant hazards expected.

Risk Phrases None

HSNO Classification Non-hazardous

4. 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.

Notes to Physician Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media All standard fire fighting media

Unsuitable Extinguishing Media None known

Special Exposure Hazards Decomposition in fire may produce toxic gases.

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 Precautionary Measures Use Appropriate protective equipment.

Environmental Precautionary Measures None known.

Procedure for Cleaning/Absorption Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Avoid contact with eyes, skin, or clothing.

Storage Information Store away from oxidisers. Product has a shelf life of 24 months

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use in a well ventilated area.

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, 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.
	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:	Liquid
Colour:	Brown-black
Odour:	Sweet
pH:	7.5
Specific Gravity @ 20 C (Water=1):	1.1
Density @ 20 C (kg/l):	1.098
Bulk Density @ 20 C (kg/l):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapour Pressure @ 20 C (mmHg):	Not Determined
Vapour Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate = 1):	Not determined.
Solubility in Water (g/100ml):	Miscible
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerisation:	Will Not Occur
Conditions to Avoid	None anticipated

Incompatibility (Materials to Avoid)	Strong oxidisers.
Hazardous Decomposition Products	Oxides of nitrogen. Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Symptoms related to exposure	
Inhalation	None known.
Skin Contact	None known.
Eye Contact	None known.
Ingestion	None known
Aggravated Medical Conditions	None known.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.
Toxicity Tests	
Oral Toxicity:	LD50: > 5000 mg/kg (Rat)
Dermal Toxicity:	LD50: > 2000 mg/kg (Rabbit)
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Draize Rating (Skin): 0.09/8.0 (Rabbit) Practically Non-irritating
Carcinogenicity:	Not determined
Genotoxicity:	Not determined
Reproductive/Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Slowly biodegradable
Bio-accumulation	Not Determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Disposal should be made in accordance with federal, state and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory	Product contains one or more components not listed on inventory.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
US TSCA Inventory	All components listed.
EINECS Inventory	One or more components not listed on the inventory.

Classification Not Determined

Risk Phrases None

Safety Phrases None

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS:
Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Product Stewardship at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: HR-6L

Revision Date: 02-May-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone
Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone
Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: HR-6L
Synonyms: None
Chemical Family: Lignosulfonate
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Cement Retarder

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Modified lignosulfonate	Proprietary	30 - 60%	Not applicable	Not applicable	Not applicable

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview May cause eye and respiratory irritation.

Risk Phrases None

HSNO Classification Non-hazardous

4. 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.

Notes to Physician Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media Water fog, carbon dioxide, foam, dry chemical.

Extinguishing media which must not be used for safety reasons None known.

Special Exposure Hazards Decomposition in fire may produce toxic gases.

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 Precautionary Measures Use appropriate protective equipment.

Environmental Precautionary Measures Prevent from entering sewers, waterways, or low areas.

Procedure for Cleaning / Absorption Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Avoid contact with eyes, skin, or clothing. Avoid breathing vapors.

Storage Information Store away from oxidizers. Keep container closed when not in use.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use in a well ventilated area.

Respiratory Protection	Not normally necessary.
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:	Liquid
Color:	Dark brown
Odor:	Molasses
pH:	9.5
Specific Gravity @ 20 C (Water=1):	1.21
Density @ 20 C (kg/l):	1.208
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined Min: > 98
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	Oxides of sulfur. Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Symptoms related to exposure	
Inhalation	May cause mild respiratory irritation.
Skin Contact	None known.
Eye Contact	May cause mild eye irritation.
Ingestion	None known
Aggravated Medical Conditions	None known.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.
Toxicity Tests	
Oral Toxicity:	Not determined
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Not determined
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Slowly biodegradable
Bio-accumulation	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	This product is not regarded as hazardous waste. Dispose in accordance with local regulations.
Contaminated Packaging	Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR
Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory	All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
US TSCA Inventory	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS

Classification Not Classified

Risk Phrases None

Safety Phrases None

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Contact

Australian Poisons Information Centre
24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre
0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: **HR-25L**

Revision Date: 14-May-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substance or Preparation

Product Trade Name: HR-25L
Synonyms: None
Chemical Family: Organic acid
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None
Poisons Schedule: None
Application: Cement Retarder

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substance	CAS Number	Percent	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Tartaric acid	87-69-4	30 - 60%	Not determined	Not determined	Not applicable

Non-hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview	May cause eye, skin and respiratory irritation.
Risk Phrases	R41 Risk of serious damage to eyes.
HSNO Classification	8.3A Corrosive to ocular tissue 9.3C Harmful to terrestrial vertebrates

4. 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	In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes. Get medical attention. Remove contaminated clothing and launder before reuse.
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.
Ingestion	Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.
Notes to Physician	Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	All standard fire fighting media
Unsuitable Extinguishing Media	None known
Special Exposure Hazards	Decomposition in fire may produce toxic gases.
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 Precautionary Measures	Use Appropriate protective equipment.
Environmental Precautionary Measures	Prevent from entering sewers, waterways or low areas.
Procedure for Cleaning/Absorption	Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Neutralise to pH of 6-8. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions	Avoid contact with eyes, skin, or clothing. Avoid breathing vapours. Wash hands after use. Launder contaminated clothing before reuse.
Storage Information	Store away from alkalis. Store away from oxidisers. Store in a cool well ventilated area. Keep container closed when not in use. Product has a shelf life of 60 months

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	Use in a well ventilated area.
Respiratory Protection	Dust/mist respirator. (N95,P2/P3)
Hand Protection	Impervious rubber gloves.
Skin Protection	Rubber apron.
Eye Protection	Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions	Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Colour:	Light yellow-green
Odour:	Odourless
pH:	1.7
Specific Gravity @ 20 C (Water=1):	1.2
Density @ 20 C (kg/l):	1.2
Bulk Density @ 20 C (kg/l):	Not Determined
Boiling Point/Range (C):	103
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m ³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m ³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapour Pressure @ 20 C (mmHg):	Not Determined
Vapour Density (Air=1):	Not Determined
Percent Volatiles:	60
Evaporation Rate (Butyl Acetate = 1):	Not determined.
Solubility in Water (g/100ml):	Soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerisation:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Strong oxidisers. Strong alkalis
Hazardous Decomposition Products	Carbon monoxide and carbon dioxide.

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Symptoms related to exposure	
Inhalation	May cause respiratory irritation.
Skin Contact	May cause skin irritation.
Eye Contact	May cause moderate eye irritation.
Ingestion	Irritation of the mouth, throat, and stomach.
Aggravated Medical Conditions	Skin disorders.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.
Toxicity Tests	
Oral Toxicity:	Not determined
Dermal Toxicity:	Not determined.
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity:	Not determined
Genotoxicity:	Not determined
Reproductive/Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not determined
Bio-accumulation	Not Determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	Disposal should be made in accordance with federal, state and local regulations. Incineration recommended in approved incinerator 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.

14. TRANSPORT INFORMATION

Land Transportation

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory	All components listed.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
US TSCA Inventory	All components listed.
EINECS Inventory	All components are listed on the inventory.

Classification Xi - Irritant.

Risk Phrases R41 Risk of serious damage to eyes.

Safety Phrases S36/37/39 Wear suitable protective clothing, gloves and eye/face protection.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS:

Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Product Stewardship at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: LATEX 3000

Revision Date: 31-Jan-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: LATEX 3000
Synonyms: None
Chemical Family: Polymer
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Fluid Loss Additive

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
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2. COMPOSITION/INFORMATION ON INGREDIENTS					
Contains no hazardous substances	Mixture	60 - 100%	Not applicable	Not applicable	Not applicable

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview No significant hazards expected.

Risk Phrases None

HSNO Classification Non-hazardous

4. 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 Get medical attention! If vomiting occurs, keep head lower than hips to prevent aspiration.

Notes to Physician Treatment should be directed at preventing absorption, administering to symptoms as they occur, and providing supportive therapy.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media Water fog, carbon dioxide, foam, dry chemical.

Extinguishing media which must not be used for safety reasons None known.

Special Exposure Hazards Use water spray to cool fire exposed surfaces. Closed containers may explode in fire. Decomposition in fire may produce toxic gases.

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 Precautionary Measures Use appropriate protective equipment.

Environmental Precautionary Measures Prevent from entering sewers, waterways, or low areas.

Procedure for Cleaning / Absorption Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Avoid breathing mist. Material is slippery underfoot.

Storage Information Store in a cool well ventilated area. Keep container closed when not in use.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	Trace amounts of monomers may be released during use of this material. Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.
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, 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. Not normally necessary.
Hand Protection	Impervious rubber gloves.
Skin Protection	Normal work coveralls.
Eye Protection	Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions	None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Color:	Milky white
Odor:	Mild
pH:	4.5
Specific Gravity @ 20 C (Water=1):	1.03
Density @ 20 C (kg/l):	1.05
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	100
Freezing Point/Range (C):	0
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	17
Vapor Density (Air=1):	< 1
Percent Volatiles:	46-48
Evaporation Rate (Butyl Acetate=1):	< 1
Solubility in Water (g/100ml):	Miscible
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	>600
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable

Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	1,3-Butadiene. Styrene.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye and skin contact.
Symptoms related to exposure	
Inhalation	Not a likely route of exposure.
Skin Contact	Prolonged or repeated contact may cause slight skin irritation.
Eye Contact	May cause mild eye irritation.
Ingestion	No adverse health effects are expected from swallowing.
Aggravated Medical Conditions	None known.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.
Toxicity Tests	
Oral Toxicity:	Not determined
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Not determined
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not determined
Bio-accumulation	Not determined

Ecotoxicological Information

Acute Fish Toxicity: LC50: (96 hour) 97811 mg/l (fish) estimated
Acute Crustaceans Toxicity: EC50(48 Hour): 16552 mg/l (Daphnia magna) estimated

Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	Disposal should be made in accordance with federal, state, and local regulations.
Contaminated Packaging	Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR
Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory	Product contains one or more components not listed on inventory.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
US TSCA Inventory	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS

Classification Not Classified

Risk Phrases None

Safety Phrases None

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: MICROBOND HT CEMENT

Revision Date: 01-Feb-2012

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: MICROBOND HT CEMENT

Synonyms: None

Chemical Family: Metal oxide

UN Number: None

Dangerous Goods Class: None

Subsidiary Risk: None

Hazchem Code: None

Poisons Schedule: None

Application: Cement Additive

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand OEL	ACGIH TLV-TWA
Magnesium oxide	1309-48-4	60 - 100%	10 mg/m ³	10 mg/m ³	10 mg/m ³

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview	May cause eye and respiratory irritation.
Risk Phrases	None
HSNO Classification	Non-hazardous

4. 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.
Notes to Physician	Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	All standard fire fighting media
Extinguishing media which must not be used for safety reasons	None known.
Special Exposure Hazards	Not applicable.
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 Precautionary Measures	Use appropriate protective equipment. Avoid creating and breathing dust.
Environmental Precautionary Measures	None known.
Procedure for Cleaning / Absorption	Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions	Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust.
Storage Information	Store in a cool, dry location. Store in a cool well ventilated area. Product has a shelf life of 24 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	Use in a well ventilated area.
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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:	Solid
Color:	White to Light gray
Odor:	Odorless
pH:	10.5
Specific Gravity @ 20 C (Water=1):	3.46
Density @ 20 C (kg/l):	Not Determined
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	0
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	40.32
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	None known.
Hazardous Decomposition Products	None known.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	May cause mild respiratory irritation.
Skin Contact	None known.
Eye Contact	May cause mechanical irritation to eye.
Ingestion	None known
Aggravated Medical Conditions	None known.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.
Toxicity Tests	
Oral Toxicity:	Not determined
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Not determined
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not determined
Bio-accumulation	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	Bury in a licensed landfill according to federal, state, and local regulations.
Contaminated Packaging	Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR

Not restricted

Air Transportation

ICAO/IATA

Not restricted

Sea Transportation

IMDG

Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory

All components listed on inventory or are exempt.

New Zealand Inventory of Chemicals

This product does not comply with NZIOC

US TSCA Inventory

All components listed on inventory or are exempt.

EINECS Inventory

This product, and all its components, complies with EINECS

Classification

Not Classified

Risk Phrases

None

Safety Phrases

None

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS

Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: MICROBOND EXPANDING ADDITIVE

Revision Date: 03-Apr-2014

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: MICROBOND EXPANDING ADDITIVE
Synonyms: None
Chemical Family: Mineral
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Cement Additive

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. HAZARDS IDENTIFICATION

Statement of Hazardous Nature Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Hazard Overview May cause severe eye irritation. May cause skin irritation.

Classification Xi - Irritant.

Risk Phrases R38 Irritating to skin.
R41 Risk of serious damage to eyes.

Safety Phrases S22 Do not breathe dust.
S24/25 Avoid contact with skin and eyes.

HSNO Classification 6.3A Irritating to the skin
6.4A Irritating to the eye

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT (w/w)	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Calcium aluminate	12042-68-1	10 - 30%	Not applicable	Not applicable	10 mg/m ³
Calcium hydroxide	1305-62-0	10 - 30%	TWA: 5 mg/m ³	TWA: 5 mg/m ³	TWA: 5 mg/m ³

Non-Hazardous Substance to Total of 100%

4. 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 Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media
All standard fire fighting media

Extinguishing media which must not be used for safety reasons
None known.

Special Exposure Hazards Decomposition in fire may produce toxic gases.

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 Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures Prevent from entering sewers, waterways, or low areas.

Procedure for Cleaning /
Absorption

Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust.

Storage Information Store in a cool, dry location.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use in a well ventilated area.

Respiratory Protection 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:	Solid
Color:	Light red
Odor:	Odorless
pH:	Not Determined
Specific Gravity @ 20 C (Water=1):	3.2
Density @ 20 C (kg/l):	Not Determined
Bulk Density @ 20 C (kg/M3):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	>600
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	None known.
Hazardous Decomposition Products	Oxides of sulfur. Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Acute Toxicity

Inhalation	May cause respiratory irritation.
Eye Contact	May cause severe eye irritation.
Skin Contact	May cause skin irritation.
Ingestion	Irritation of the mouth, throat, and stomach.

Chronic Effects/Carcinogenicity No data available to indicate product or components present at greater than 1% are chronic health hazards.

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Calcium aluminate	12042-68-1	> 2000 mg/kg (Rat) (similar substance)	> 2000 mg/kg (Rat) (similar substance)	No data available
Calcium hydroxide	1305-62-0	7340 mg/kg (Rat) > 2000 mg/kg (Rat)	>2500 mg/kg (Rabbit)	No data available

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

Ecotoxicity Product

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined

Ecotoxicity Substance

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Calcium aluminate	12042-68-1	EC50(72h): 3.6 mg/L (Desmodesmus subspicatus) NOEC(72h): 2.6 mg/L (Desmodesmus subspicatus)	LC50(96h): >100 mg/L (Danio rerio)	EC50(3h): > 1000 mg/L (Activated sludge of a predominantly domestic sewage)	EC50(48h): 5.4 mg/L (Daphnia magna)

Calcium hydroxide	1305-62-0	EC50(72h): 184.57 mg/L (Pseudokirchnerella subcapitata)	TLM96: 100-500 ppm (Oncorhynchus mykiss) 33.884 mg/L (Clarias gariepinus) LC50(96h): 50.6 mg/L (Oncorhynchus mykiss) LC50(96h): 457 mg/L (Gasterosteus aculeatus)	EC50(3h): 300.4 mg/L (respiration rate) (activated sludge of a predominantly domestic sewage)	TLM96: 478,520 ppm (Mysidopsis bahia) EC50(48h): 49.1 mg/L (Daphnia magna) LC50:(96h): 158 mg/L (Crangon septemspinosa) NOEC(14d): 32 mg/L (Crangon septemspinosa)
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12.2 Persistence and degradability

Substances	Persistence and Degradability
Calcium aluminate	The methods for determining biodegradability are not applicable to inorganic substances.
Calcium hydroxide	The methods for determining biodegradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

No information available

12.4 Mobility in soil

No information available

12.5 Results of PBT and vPvB assessment

No information available.

12.6 Other adverse effects

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR

Not restricted

Air Transportation

ICAO/IATA

Not restricted

Sea Transportation

IMDG

Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory	All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals	This product does not comply with NZIOC
US TSCA Inventory	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS
Classification	Xi - Irritant.
Risk Phrases	R38 Irritating to skin. R41 Risk of serious damage to eyes.
Safety Phrases	S22 Do not breathe dust. S24/25 Avoid contact with skin and eyes.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS

MATERIAL SAFETY DATA SHEET

Product Trade Name: **NF-6**

Revision Date: 10-Apr-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: NF-6
Synonyms: None
Chemical Family: Blend
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Defoamer

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Vegetable oil	Proprietary	60 - 100%	10 mg/m ³	Not applicable	Not applicable
Aluminum stearate	637-12-7	1 - 5%	10 mg/m ³	Not applicable	2 mg/m ³

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview	May cause mild eye, skin, and respiratory irritation. May be harmful if swallowed.
Risk Phrases	None
HSNO Classification	9.1D Slightly harmful in the aquatic environment

4. 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	Get medical attention! If vomiting occurs, keep head lower than hips to prevent aspiration.
Notes to Physician	Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	Carbon dioxide, dry chemical, foam.
Extinguishing media which must not be used for safety reasons	None known.
Special Exposure Hazards	Use water spray to cool fire exposed surfaces. Decomposition in fire may produce toxic gases.
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 Precautionary Measures	Use appropriate protective equipment.
Environmental Precautionary Measures	Prevent from entering sewers, waterways, or low areas.
Procedure for Cleaning / Absorption	Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions	Avoid contact with eyes, skin, or clothing. Avoid breathing vapors.
Storage Information	Store away from oxidizers. Keep container closed when not in use.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	A well ventilated area to control dust levels. Local exhaust ventilation should be used in areas without good cross ventilation.
Respiratory Protection	Not normally needed. But if significant exposures are possible then the following respirator is recommended: Organic vapor respirator with a dust/mist filter. (A2P2/P3)
Hand Protection	Polyvinylchloride gloves.
Skin Protection	Normal work coveralls.
Eye Protection	Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions	Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Color:	Yellow
Odor:	Mild
pH:	Not Determined
Specific Gravity @ 20 C (Water=1):	0.93
Density @ 20 C (kg/l):	0.93
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	182
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	>170
Flash Point Method:	Not Determined
Autoignition Temperature (C):	385
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Disperses
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None known.
Incompatibility (Materials to Avoid)	Strong oxidizers.

Hazardous Decomposition Products Hydrocarbons. Carbon monoxide and carbon dioxide.

Additional Guidelines Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Inhalation None known.

Skin Contact May cause mild skin irritation. May cause an allergic skin reaction.

Eye Contact May cause mild eye irritation.

Ingestion May cause abdominal pain, vomiting, nausea, and diarrhea.

Aggravated Medical Conditions None known.

Chronic Effects/Carcinogenicity No data available to indicate product or components present at greater than 1% are chronic health hazards.

Other Information None known.

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Not determined

Genotoxicity: Not determined

Reproductive / Developmental Toxicity: Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Readily biodegradable

Bio-accumulation Not determined

Ecotoxicological Information

Acute Fish Toxicity: Not determined

Acute Crustaceans Toxicity: Not determined

Acute Algae Toxicity: Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Incineration recommended in approved incinerator 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.

14. TRANSPORT INFORMATION

Land Transportation

ADR
Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals All components listed on inventory or are exempt.
US TSCA Inventory All components listed on inventory or are exempt.
EINECS Inventory This product, and all its components, complies with EINECS

Classification Not Classified

Risk Phrases None

Safety Phrases None

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET**Product Trade Name:** PEN-5M**Revision Date:** 11-Apr-2013**1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING****Statement of Hazardous Nature** Hazardous according to the criteria of NOHSC, Dangerous Goods according to the criteria of ADG.**Manufacturer/Supplier** Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
AustraliaACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300**Product Emergency Telephone**
Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274**Fire, Police & Ambulance - Emergency Telephone**
Australia: 000
Papua New Guinea: 000
New Zealand: 111**Identification of Substances or Preparation****Product Trade Name:** PEN-5M
Synonyms: None
Chemical Family: Blend
UN Number: , UN1993
Dangerous Goods Class: 3
Subsidiary Risk: None
Hazchem Code: 3[Y]
Poisons Schedule: S5
Application: Cleaner**Prepared By** Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com**2. COMPOSITION/INFORMATION ON INGREDIENTS**

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
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2. COMPOSITION/INFORMATION ON INGREDIENTS					
Isopropanol	67-63-0	10 - 30%	TWA: 400 ppm TWA: 983 mg/m ³ STEL: 500 ppm STEL: 1230 mg/m ³	STEL: 500 ppm STEL: 1230 mg/m ³ TWA: 400 ppm TWA: 983 mg/m ³	TWA: 200 ppm STEL: 400 ppm

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview May cause eye, skin, and respiratory irritation. May cause headache, dizziness, and other central nervous system effects. May be harmful if swallowed. Flammable.

Risk Phrases
 R10 Flammable.
 R22 Harmful if swallowed.
 R38 Irritating to skin.
 R41 Risk of serious damage to eyes.

HSNO Classification Not Determined

4. FIRST AID MEASURES

Inhalation If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult give oxygen. Get medical attention.

Skin In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes. Get medical attention. Remove contaminated clothing and launder before reuse.

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.

Ingestion Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media Water fog, carbon dioxide, foam, dry chemical.

Extinguishing media which must not be used for safety reasons None known.

Special Exposure Hazards May be ignited by heat, sparks or flames. Use water spray to cool fire exposed surfaces. Closed containers may explode in fire. Decomposition in fire may produce toxic gases.

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 Precautionary Measures Use appropriate protective equipment. Wear self-contained breathing apparatus in enclosed areas.

Environmental Precautionary Measures Prevent from entering sewers, waterways, or low areas.

Procedure for Cleaning / Absorption

Isolate spill and stop leak where safe. Remove ignition sources and work with non-sparking tools. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions

Avoid contact with eyes, skin, or clothing. Avoid breathing vapors.

Storage Information

Store away from oxidizers. Keep from heat, sparks, and open flames. Keep container closed when not in use. Store between 40.5 F (4.7 C) and 120.5 F (49 C). Product has a shelf life of 24 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.

Respiratory Protection

Organic vapor respirator.

Hand Protection

Impervious rubber gloves.

Skin Protection

Rubber apron.

Eye Protection

Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions

Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Color:	Colorless to Amber
Odor:	Alcohol
pH:	6.5 - 7.5
Specific Gravity @ 20 C (Water=1):	0.96
Density @ 20 C (kg/l):	0.96
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	80
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	25
Flash Point Method:	PMCC
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	33
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	58-60
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Miscible
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	Keep away from heat, sparks and flame.
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure
Inhalation

May cause respiratory irritation. May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.

Skin Contact May cause skin irritation.

Eye Contact May cause eye irritation.

Ingestion Irritation of the mouth, throat, and stomach. May cause abdominal pain, vomiting, nausea, and diarrhea. May cause headache, dizziness, nausea, vomiting, gastrointestinal irritation and central nervous system depression.

Aggravated Medical Conditions Skin disorders. Eye ailments.

Chronic Effects/Carcinogenicity Repeated overexposure may cause liver and kidney effects. May contain ethylene oxide in the headspace of the drum. Ethylene oxide is a cancer and reproductive hazard.

Other Information None known.

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Not determined

Genotoxicity: Not determined

Reproductive / Developmental Toxicity: Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Not determined

Bio-accumulation Not determined

Ecotoxicological Information

Acute Fish Toxicity: Not determined

Acute Crustaceans Toxicity: Not determined

Acute Algae Toxicity: Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Disposal should be made in accordance with federal, state, and local regulations. Incineration recommended in approved incinerator according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR

UN1993, Flammable Liquid, N.O.S. (Contains Isopropanol), 3, III

Air Transportation

ICAO/IATA

UN1993, Flammable Liquid, N.O.S., 3, III
(Contains Isopropanol)

Sea Transportation

IMDG

UN1993, Flammable Liquid, N.O.S. (Contains Isopropanol), 3, III, (25 C)
EmS F-E, S-E

Other Transportation Information

Labels: Flammable Liquid

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory All components listed on inventory or are exempt.

**New Zealand Inventory of
Chemicals
US TSCA Inventory
EINECS Inventory**

All components listed on inventory or are exempt.

All components listed on inventory or are exempt.
This product, and all its components, complies with EINECS

Classification

Xi - Irritant.

Risk Phrases

R10 Flammable.
R22 Harmful if swallowed.
R38 Irritating to skin.
R41 Risk of serious damage to eyes.

Safety Phrases

S2 Keep out of reach of children.
S7 Keep container tightly closed.
S16 Keep away from sources of ignition - No Smoking.
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S24/25 Avoid contact with skin and eyes.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS

Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: SEM-8™ EMULSIFIER

Revision Date: 14-May-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Hazardous according to the criteria of NOHSC, Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: SEM-8™ EMULSIFIER
Synonyms: None
Chemical Family: Ethoxylated alcohols Sulfate
UN Number: , UN1993
Dangerous Goods Class: 3
Subsidiary Risk: None
Hazchem Code: 3[Y]
Poisons Schedule: None Allocated
Application: Emulsifier

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
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2. COMPOSITION/INFORMATION ON INGREDIENTS

Polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt	68037-05-8	60 - 100%	Not applicable	Not applicable	Not applicable
Isopropanol	67-63-0	10 - 30%	TWA: 400 ppm TWA: 983 mg/m ³ STEL: 500 ppm STEL: 1230 mg/m ³	STEL: 500 ppm STEL: 1230 mg/m ³ TWA: 400 ppm TWA: 983 mg/m ³	TWA: 200 ppm STEL: 400 ppm

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview	May cause eye, skin, and respiratory irritation. May cause headache, dizziness, and other central nervous system effects. May be harmful if swallowed. Repeated overexposure may cause liver and kidney effects. Flammable.
Risk Phrases	R10 Flammable. R38 Irritating to skin. R41 Risk of serious damage to eyes. R67 Vapours may cause drowsiness and dizziness.
HSNO Classification	3.1C Flammable Liquids - Medium hazard 6.3A Irritating to the skin 8.3A Corrosive to ocular tissue

4. FIRST AID MEASURES

Inhalation	If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult give oxygen. Get medical attention.
Skin	Wash with soap and water. Get medical attention if irritation persists. Remove contaminated clothing and launder before reuse.
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.
Ingestion	Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.
Notes to Physician	Activated charcoal or gastric lavage may be advisable for significant ingestion.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	Water fog, carbon dioxide, foam, dry chemical.
Extinguishing media which must not be used for safety reasons	None known.
Special Exposure Hazards	Use water spray to cool fire exposed surfaces. Closed containers may explode in fire. Decomposition in fire may produce toxic gases. Vapors are heavier than air and may accumulate in low areas. Vapors may travel along the ground to be ignited at distant locations.
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 Precautionary Measures Use appropriate protective equipment. Wear self-contained breathing apparatus in enclosed areas.

Environmental Precautionary Measures Prevent from entering sewers, waterways, or low areas.

Procedure for Cleaning / Absorption Isolate spill and stop leak where safe. Remove ignition sources and work with non-sparking tools. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Wash hands after use. Launder contaminated clothing before reuse. Ground and bond containers when transferring from one container to another.

Storage Information Store away from oxidizers. Keep from heat, sparks, and open flames. Keep container closed when not in use. Store in a dry location. Store in a cool well ventilated area. Product has a shelf life of 24 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.

Respiratory Protection Not normally needed. But if significant exposures are possible then the following respirator is recommended:
Organic vapor respirator.
In high concentrations, supplied air respirator or a self-contained breathing apparatus.

Hand Protection Impervious rubber gloves. Nitrile gloves. Neoprene gloves. Use Viton or 4H gloves.

Skin Protection Rubber apron.

Eye Protection Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Color:	Clear light yellow
Odor:	Alcohol
pH:	7.0-8.5 @ 5%
Specific Gravity @ 20 C (Water=1):	1.054
Density @ 20 C (kg/l):	1.054
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	-29
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	33.9
Flash Point Method:	SFCC ASTM D-3828
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined

9. PHYSICAL AND CHEMICAL PROPERTIES

Flammability Limits in Air - Upper (g/m ³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	15.7
Vapor Density (Air=1):	> 1
Percent Volatiles:	12
Evaporation Rate (Butyl Acetate=1):	< 1
Solubility in Water (g/100ml):	Soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	71-79 (25C)
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	1.4
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	Keep away from heat, sparks and flame.
Incompatibility (Materials to Avoid)	Strong oxidizers. Strong alkalis.
Hazardous Decomposition Products	Oxides of nitrogen. Oxides of sulfur. Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
<u>Symptoms related to exposure</u> Inhalation	May cause respiratory irritation. May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.
Skin Contact	May cause skin irritation. May cause skin defatting with prolonged exposure.
Eye Contact	May cause severe eye irritation.
Ingestion	Irritation of the mouth, throat, and stomach. May cause abdominal pain, vomiting, nausea, and diarrhea. May cause central nervous system depression including headache, dizziness, drowsiness, muscular weakness, incoordination, slowed reaction time, fatigue blurred vision, slurred speech, giddiness, tremors and convulsions. May affect the heart and cardiovascular system.
Aggravated Medical Conditions	Skin disorders. Eye ailments.
Chronic Effects/Carcinogenicity	Repeated overexposure may cause liver and kidney effects.
Other Information	None known.
Toxicity Tests	
Oral Toxicity:	Not determined

Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Not determined
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	COD: 149 mg O2 per 100 ppm product
Bio-accumulation	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	TLM96: 342 mg/l (Scophthalmus maximus)
Acute Crustaceans Toxicity:	TLM48: 23.3 mg/l (Acartia tonsa)
Acute Algae Toxicity:	EC50: 78 mg/l (Skeletonema costatum)

Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	Disposal should be made in accordance with federal, state, and local regulations. Incineration recommended in approved incinerator 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.

14. TRANSPORT INFORMATION

Land Transportation

ADR

UN1993, Flammable Liquid, N.O.S. (Contains Isopropanol), 3, III

Air Transportation

ICAO/IATA

UN1993, Flammable Liquid, N.O.S., 3, III
(Contains Isopropanol)

Sea Transportation

IMDG

UN1993, Flammable Liquid, N.O.S. (Contains Isopropanol), 3, III, (33.9 C)
EmS F-E, S-E

Other Transportation Information

Labels: Flammable Liquid

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory
New Zealand Inventory of Chemicals
US TSCA Inventory
EINECS Inventory

All components listed on inventory or are exempt.
This product does not comply with NZIOC

All components listed on inventory or are exempt.
This product, and all its components, complies with EINECS

Classification

Xi - Irritant.

Risk Phrases

R10 Flammable.
R38 Irritating to skin.
R41 Risk of serious damage to eyes.
R67 Vapours may cause drowsiness and dizziness.

Safety Phrases

S2 Keep out of reach of children.
S7 Keep container tightly closed.
S16 Keep away from sources of ignition - No Smoking.
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S24/25 Avoid contact with skin and eyes.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS

Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: TUNED SPACER E+

Revision Date: 12-Mar-2015

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature 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.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: TUNED SPACER E+
Synonyms: None
Chemical Family: Mineral
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Cement Spacer

Prepared By Chemical Stewardship
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. HAZARDS IDENTIFICATION

Statement of Hazardous Nature 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.

Hazard Overview

DANGER! - CHRONIC HEALTH HAZARD

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

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 exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, AS/NZS 1715, or equivalent respirator when using this product. Review the Safety Data Sheet (SDS) for this product, which has been provided to your employer.

Classification

T - Toxic.

Risk Phrases

R49 May cause cancer by inhalation.
R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation.

Safety Phrases

S53 Avoid exposure - obtain special instructions before use.
S22 Do not breathe dust.
S38 In case of insufficient ventilation wear suitable respiratory equipment.

HSNO Classification

6.7A Known or presumed human carcinogens
6.9A Toxic to human target organs or systems

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT (w/w)	Australia	NOHSC	New Zealand	ACGIH TLV-TWA
					WES	
Bentonite	1302-78-9	60 - 100%	Not applicable		Not applicable	TWA: 1 mg/m ³
Crystalline silica, quartz	14808-60-7	1 - 5%	TWA: 0.1 mg/m ³		TWA: 0.2 mg/m ³	TWA: 0.025 mg/m ³
Crystalline silica, cristobalite	14464-46-1	0.1 - 1%	TWA: 0.1 mg/m ³		TWA: 0.1 mg/m ³	TWA: 0.025 mg/m ³
Crystalline silica, tridymite	15468-32-3	0.1 - 1%	TWA: 0.1 mg/m ³		TWA: 0.1 mg/m ³	0.05 mg/m ³

Non-Hazardous Substance to Total of 100%

4. 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.

Notes to Physician

Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Water fog, carbon dioxide, foam, dry chemical.

Extinguishing media which must not be used for safety reasons

None known.

Special Exposure Hazards Decomposition in fire may produce toxic gases.

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 Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption 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

Handling Precautions 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.

Storage Information Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

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

Physical State:	Solid
Color:	White to light straw
Odor:	Odorless
pH:	Not Determined
Specific Gravity @ 20 C (Water=1):	1.88 - 2.05
Density @ 20 C (kg/l):	Not Determined
Bulk Density @ 20 C (kg/M3):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	5
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	Oxides of sulfur. Carbon monoxide and carbon dioxide. Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure
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

May cause mechanical skin irritation.

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
Bentonite	1302-78-9	> 5000 mg/kg (Rat) > 2000 mg/kg (Rat)	No data available	> 5.27 mg/L (Rat)
Crystalline silica, quartz	14808-60-7	500 mg/kg (Rat) >15,000 mg/kg (Human)	No data available	No data available
Crystalline silica, cristobalite	14464-46-1	> 5000 mg/kg (Rat)	No data available	No data available
Crystalline silica, tridymite	15468-32-3	> 5000 mg/kg (Rat)	No data available	No data available

12. ECOLOGICAL INFORMATION**Ecotoxicological Information****Ecotoxicity Product**

Acute Fish Toxicity: Not determined
Acute Crustaceans Toxicity: Not determined
Acute Algae Toxicity: Not determined

Ecotoxicity Substance

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates

Bentonite	1302-78-9	EC50(72h): > 100 mg/L (freshwater algae)	TLM96: 10000 ppm (Oncorhynchus mykiss) LC50(96h): 16000 - 19000 mg/L (Oncorhynchus mykiss) LC50(24h): 2800 – 3200 mg/L (black bass, warmouth bass, blue gill and sunfish)	No information available	EC50(96h): 81.6 mg/L (Metacarcinus magister) EC50(96h): 24.8 mg/L (Pandalus danae) EC50(48h) > 100 mg/L (Daphnia magna)
Crystalline silica, quartz	14808-60-7	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, cristobalite	14464-46-1	No information available	LL0 (96h) 10000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, tridymite	15468-32-3	No information available	LL0(96h): 10000 mg/L(Danio rerio) (similar substance)	No information available	LL50(24h): > 10000 mg/L (Daphnia magna) (similar substance)

12.2. Persistence and degradability

Expected to be readily biodegradable

Substances	CAS Number	Persistence and Degradability
Bentonite	1302-78-9	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, cristobalite	14464-46-1	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, tridymite	15468-32-3	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Bentonite	1302-78-9	No information available
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

12.4. Mobility in soil

No information available

12.5. Results of PBT and vPvB assessment

Substances	PBT and vPvB assessment
Bentonite	No data available
Crystalline silica, quartz	Not PBT/vPvB
Crystalline silica, cristobalite	No data available
Crystalline silica, tridymite	No data available

12.6. Other adverse effects

No information available

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Australia Dangerous Goods

UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: 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

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

Chemical Inventories

Australian AICS Inventory All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals All components listed on inventory or are exempt.
US TSCA Inventory All components listed on inventory or are exempt.
EINECS Inventory This product, and all its components, complies with EINECS

Classification T - Toxic.

Risk Phrases R49 May cause cancer by inhalation.
R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation.

Safety Phrases S53 Avoid exposure - obtain special instructions before use.
S22 Do not breathe dust.
S38 In case of insufficient ventilation wear suitable respiratory equipment.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Contact

Australian Poisons Information Centre
24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre
0800 764 766

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.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: **TUNED® SPACER III**

Revision Date: 16-Sep-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: TUNED® SPACER III
Synonyms: None
Chemical Family: Blend
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Cement Spacer

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT (w/w)	Australia NOHSC	New Zealand	ACGIH TLV-TWA
			WES	WES	WES
Crystalline silica, quartz	14808-60-7	60 - 100%	TWA: 0.1 mg/m ³	TWA: 0.2 mg/m ³	TWA: 0.025 mg/m ³

Crystalline silica, cristobalite	14464-46-1	1 - 5%	TWA: 0.1 mg/m ³	TWA: 0.1 mg/m ³	TWA: 0.025 mg/m ³
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Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview

DANGER! - CHRONIC HEALTH HAZARD

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

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 exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (MSDS) for this product, which has been provided to your employer.

Risk Phrases

R49 May cause cancer by inhalation.

R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation.

HSNO Classification

6.7A Known or presumed human carcinogens

6.9A Toxic to human target organs or systems

4. 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.

Notes to Physician

Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Special Exposure Hazards

Not applicable.

Special Protective Equipment for Fire-Fighters

Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures	Use appropriate protective equipment. Avoid creating and breathing dust.
Environmental Precautionary Measures	None known.
Procedure for Cleaning / Absorption	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

Handling Precautions	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.
Storage Information	Do not reuse empty container. Store in a well ventilated area. Keep container closed when not in use. Store locked up.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.
Respiratory Protection	Wear a NIOSH certified, European Standard EN 149 (FFP2/FFP3), 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

Physical State:	Powder
Color:	Dark gray
Odor:	Odorless
pH:	Not Determined
Specific Gravity @ 20 C (Water=1):	2.51
Density @ 20 C (kg/l):	Not Determined
Bulk Density @ 20 C (kg/M3):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined

Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m ³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

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 mild eye irritation.

Skin Contact

May cause mechanical skin irritation.

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	500 mg/kg (Rat)	No data available	No data available
Crystalline silica, cristobalite	14464-46-1	No data available	No data available	No data available

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

Ecotoxicity Product

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined

Ecotoxicity Substance

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
Crystalline silica, quartz	14808-60-7	No information available	No information available	No information available	No information available
Crystalline silica, cristobalite	14464-46-1	No information available	No information available	No information available	No information available

12.2 Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

Does not bioaccumulate

12.4 Mobility in soil

No information available

12.5 Results of PBT and vPvB assessment

No information available.

12.6 Other adverse effects

13. DISPOSAL CONSIDERATIONS

Disposal Method	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.

14. TRANSPORT INFORMATION

Land Transportation

ADR
Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory	All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
US TSCA Inventory	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS

Classification T - Toxic.

Crystalline silica is not classified as a carcinogen in EU Council Directives 67/548/EEC and 88/379/EEC.

Risk Phrases R49 May cause cancer by inhalation.
R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation.

Safety Phrases S53 Avoid exposure - obtain special instructions before use.
S22 Do not breathe dust.
S38 In case of insufficient ventilation wear suitable respiratory equipment.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS

Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS

MATERIAL SAFETY DATA SHEET

Product Trade Name: WellLife™ 684

Revision Date: 10-Apr-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone
Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
NewZealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone
Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: WellLife™ 684
Synonyms: None
Chemical Family: Not applicable
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Cement Additive

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Carbon	7440-44-0	60 - 100%	Not applicable	Not applicable	10 mg/m ³

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview	May cause eye and respiratory irritation. May cause delayed injury to lungs. Airborne dust may be explosive.
Risk Phrases	None
HSNO Classification	Non-hazardous

4. 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	Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.
Notes to Physician	Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media	Water fog, carbon dioxide, foam, dry chemical.
Extinguishing media which must not be used for safety reasons	None known.
Special Exposure Hazards	Flammable dust when in finely divided and highly suspended state.
Special Protective Equipment for Fire-Fighters	Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures	Use appropriate protective equipment. Avoid creating and breathing dust.
Environmental Precautionary Measures	None known.
Procedure for Cleaning / Absorption	Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions	Avoid creating or inhaling dust. Avoid dust accumulations.
Storage Information	Store away from oxidizers. Store in a dry location. Product has a shelf life of 60 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	A well ventilated area to control dust levels.
Respiratory Protection	<p>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, 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.</p> <p>Not normally needed. But if significant exposures are possible then the following respirator is recommended: Dust/mist respirator. (N95, P2/P3)</p>
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:	fibers
Color:	Black
Odor:	Odorless
pH:	Not Determined
Specific Gravity @ 20 C (Water=1):	1.9
Density @ 20 C (kg/l):	Not Determined
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	> 450
Flash Point Method:	PMCC
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	6
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur

Conditions to Avoid	None known.
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Inhalation

May cause mild respiratory irritation.

Skin Contact

May cause mild skin irritation.

Eye Contact

May cause mild eye irritation.

Ingestion

May cause mild gastric distress.

Aggravated Medical Conditions

Skin disorders.

Chronic Effects/Carcinogenicity

Prolonged, excessive exposure to dust may cause pneumoconiosis, a lung disease caused by inhaling dust particles less than 0.5 micrometers into the lungs.

Other Information

None known.

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Not determined

Genotoxicity: Not determined

Reproductive / Developmental Toxicity: Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Not determined

Bio-accumulation Not determined

Ecotoxicological Information

Acute Fish Toxicity: Not determined

Acute Crustaceans Toxicity: Not determined

Acute Algae Toxicity: Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR
Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory	All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
US TSCA Inventory	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS

Classification Not Classified

Risk Phrases None

Safety Phrases S22 Do not breathe dust.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: WellLife™ 734

Revision Date: 12-Apr-2013

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone
Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
New Zealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone
Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: WellLife™ 734
Synonyms: None
Chemical Family: Inorganic
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Cement Enhancer

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Contains no hazardous substances	Mixture	60 - 100%	Not applicable	Not applicable	Not applicable

Non-Hazardous Substance to Total of 100%

3. HAZARDS IDENTIFICATION

Hazard Overview No significant hazards expected.

Risk Phrases None

HSNO Classification Non-hazardous

4. FIRST AID MEASURES

Inhalation Under normal conditions, first aid procedures are not required.

Skin Under normal conditions, first aid procedures are not required.

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.

Notes to Physician Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media All standard fire fighting media

Extinguishing media which must not be used for safety reasons None known.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Material is slippery underfoot. Keep floors clean of spills.

Storage Information Store in a dry location. Product has a shelf life of 60 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls None known.

Respiratory Protection Not normally necessary.

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:	Solid
Color:	White to Variable
Odor:	Odorless
pH:	Not Determined
Specific Gravity @ 20 C (Water=1):	2.6
Density @ 20 C (kg/l):	2.48
Bulk Density @ 20 C (kg/m³):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	1200
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None known.
Incompatibility (Materials to Avoid)	None known.
Hazardous Decomposition Products	None known.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
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Symptoms related to exposure

Inhalation	None known.
Skin Contact	None known.
Eye Contact	May cause mechanical irritation to eye.
Ingestion	None known
Aggravated Medical Conditions	None known.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.

Toxicity Tests

Oral Toxicity:	Not determined
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Draize Rating (Eye): 1.3/110 (Rabbit) Practically Non-irritating Draize Rating (Skin): 0.5/8.0 (Rabbit) Non-Irritating
Carcinogenicity	Not determined
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not biodegradable
Bio-accumulation	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	TLM96: > 1,000,000 ppm (Mysidopsis bahia) SPP @ 10 ppb
Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	Bury in a licensed landfill according to federal, state, and local regulations. Substance should NOT be deposited into a sewage facility.
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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**Land Transportation****ADR**

Not restricted

Air Transportation**ICAO/IATA**

Not restricted

Sea Transportation**IMDG**

Not restricted

Other Transportation Information

Labels: None

15. REGULATORY INFORMATION**Chemical Inventories****Australian AICS Inventory**

All components listed on inventory or are exempt.

New Zealand Inventory of Chemicals

All components listed on inventory or are exempt.

US TSCA Inventory

All components listed on inventory or are exempt.

EINECS Inventory

This product, and all its components, complies with EINECS

Classification

Not Classified

Risk Phrases

None

Safety Phrases

None

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS

Not applicable

Contact**Australian Poisons Information Centre**

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

SAFETY DATA SHEET

D-AIR 3000L

Revision Date: 17-Feb-2015

Revision Number: 16

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

1.1. Product Identifier

Product Name D-AIR 3000L

Other means of Identification

Synonyms: None
Product Code: HM003191

Recommended use of the chemical and restrictions on use

Recommended Use Defoamer
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

E-Mail address: fdunexchem@halliburton.com

Emergency phone number

61 (08) 9455 8300

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word

Not Hazardous

Hazard Statements

Not Classified

Precautionary Statements**Prevention** None**Response** None**Storage** None**Disposal** None**Contains****Substances**

Alkenes

CAS Number

Proprietary

Other hazards which do not result in classification

None known

Australia Classification*For the full text of the R/H-phrases mentioned in this Section, see Section 16***Classification**

Not Classified

Risk Phrases

None

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Alkenes	Proprietary	60 - 100%	

4. First aid measures**Description of necessary 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

Get medical attention! If vomiting occurs, keep head lower than hips to prevent aspiration.

Symptoms caused by exposure

May cause lung damage if swallowed.

Medical Attention and Special Treatment**Notes to Physician**

Treat symptomatically

5. Fire Fighting Measures**Suitable extinguishing equipment**

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**Special Exposure Hazards**

Decomposition in fire may produce toxic gases.

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

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment.

6.2. Environmental precautions

None known.

6.3. 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

7.1. Precautions for Safe Handling**Handling Precautions**

Avoid contact with eyes, skin, or clothing. Avoid breathing vapors.

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 oxidizers. Keep container closed when not in use. Product has a shelf life of 24 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring**Exposure Limits**

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Alkenes	Proprietary	Not applicable	Not applicable

Appropriate engineering controls**Engineering Controls**

Use in a well ventilated area.

Personal protective equipment (PPE)**Respiratory Protection**

Not normally necessary.

Hand Protection

None known.

Skin Protection

Normal work coveralls.

Eye Protection

Wear safety glasses or goggles to protect against exposure.

Other Precautions

None known.

Environmental Exposure Controls

No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Liquid **Color:** Opaque
Odor: Hydrocarbon **Odor Threshold:** No information available

<u>Property</u>	<u>Values</u>
Remarks/ - Method	
pH:	5.5-7.9
Freezing Point/Range	No data available
Melting Point/Range	No data available
Boiling Point/Range	No data available
Flash Point	> 121 °C PMCC
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	0.92
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 applicable

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 oxidizers.

10.6. Hazardous Decomposition Products

Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Most Important Symptoms/Effects

May cause lung damage if swallowed.

Numerical measures of toxicity

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Alkenes	Proprietary	> 5000 mg/kg (Rat) (similar substance)	> 2000 mg/kg (Rat) (similar substance)	> 2.1 mg/L (Rat)

Immediate, delayed and chronic health effects from exposure**Inhalation**

May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.

Eye Contact

May cause mild eye irritation.

Skin Contact

May cause mild skin irritation.

Ingestion

May cause abdominal pain, vomiting, nausea, and diarrhea. Aspiration into the lungs may cause chemical pneumonitis including coughing, difficulty breathing, wheezing, coughing up blood and pneumonia, which can be fatal.

Chronic Effects/Carcinogenicity No data available to indicate product or components present at greater than 1% are chronic health hazards.

Exposure Levels

No data available

Interactive effects

None known.

Data limitations

No data available

12. Ecological Information

Ecotoxicity**Product Ecotoxicity Data**

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Alkenes	Proprietary	EC50(72h): > 1000 mg/L (Selenastrum capicomutum) (similar substance)	LL50(96h): > 1000 mg/L (Oncorhynchus mykiss) (similar substance) LL50(96h): > 10000 mg/L (Scophthalmus maximus) (similar substance)	No information available	EC50(48h): > 1000 mg/L (Daphnia magna) (similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Alkenes	Proprietary	Readily biodegradable (77 - 81% @ 28d)

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Alkenes	Proprietary	> 7

12.4. Mobility in soil

No information available

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations**Safe handling and disposal methods**

Disposal should be made in accordance with federal, state, and local regulations. Incineration recommended in approved incinerator according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information**Safety, health and environmental regulations specific for the product****International Inventories**

Australian AICS Inventory	All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS
US TSCA Inventory	All components listed on inventory or are exempt.
Canadian DSL Inventory	All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information**Date of preparation or review**

Revision Date: 17-Feb-2015

Revision Note

Update to Format SECTION: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

Not applicable

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

SAFETY DATA SHEET

BARACARB

Revision Date: 27-Jun-2016

Revision Number: 34

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name BARACARB

Other means of Identification

Synonyms None
Hazardous Material Number: HM004943

Recommended use of the chemical and restrictions on use

Recommended Use Bridging Agent
Uses advised against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: + 61 1 800 686 951
Papua New Guinea: + 61 1 800 686 951
NewZealand: +64 800 451719

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

E-mail Address fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Carcinogenicity

Category 2 - H351

Label elements, including precautionary statements**Hazard pictograms****Signal Word**

Warning

Hazard Statements:

H351 - Suspected of causing cancer if inhaled

Precautionary Statements**Prevention**

P201 - Obtain special instructions before use
 P202 - Do not handle until all safety precautions have been read and understood
 P281 - Use personal protective equipment as required

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

Contains**Substances**

Crystalline silica, quartz

CAS Number

14808-60-7

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).

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

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Crystalline silica, quartz	14808-60-7	0.1 - 1%	Carc. 2 (H351) STOT RE 1 (H372)

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also

been associated with scleroderma and kidney disease.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical

Special exposure hazards in a fire

Not applicable

Special protective equipment and precautions for fire fighters

Special protective equipment for firefighters

Not applicable

6. Accidental release measures

6.1. 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. Evacuate all persons from the area.

6.2. Environmental precautions

None known.

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. 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. 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.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Crystalline silica, quartz	14808-60-7	TWA: 0.1 mg/m ³	TWA: 0.025 mg/m ³

Appropriate engineering controls**Engineering Controls**

Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

Personal protective equipment (PPE)**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

No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Solid Powder

Odor: Odorless

Color: White

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

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

Information on routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Most Important Symptoms/Effects

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

Numerical measures of toxicity

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 information available	No data available

Immediate, delayed and chronic health effects from exposure

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.

Exposure Levels

No data available

Interactive effects

Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.

Data limitations

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	Mechanical irritation of the eyes is possible. No information available

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. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.

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

Ecotoxicity**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)	LL0 (96 h) =10000 mg/L (Danio rerio)	No information available	LL50 (24 h) >10000 mg/L (Daphnia magna)

12.2. Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

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

Does not bioaccumulate.

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

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations**Safe handling and disposal methods**

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any 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.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information**Safety, health and environmental regulations specific for the product****International Inventories**

Australian AICS Inventory	All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.
New Zealand Inventory of Chemicals	All components are listed on the NZIoC or are subject to a relevant exemption, permit, or assessment certificate.
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.

Poisons Schedule number

None Allocated

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

16. Other information**Date of preparation or review**

Revision Date: 27-Jun-2016

Revision Note

SDS sections updated: 2

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

H351 - Suspected of causing cancer if inhaled

H372 - Causes damage to organs through prolonged or repeated exposure if inhaled

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 abbreviations or acronyms used

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NOEC – No Observed Effect Concentration

OEL – Occupational Exposure Limit

PBT – Persistent Bioaccumulative and Toxic

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

vPvB – very Persistent and very Bioaccumulative

h - hour

mg/m³ - 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

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End of Safety Data Sheet

SAFETY DATA SHEET

BDF™-427

Revision Date: 01-Oct-2015

Revision Number: 5

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name BDF™-427

Other means of Identification

Synonyms: None
Product Code: HM005969

Recommended use of the chemical and restrictions on use

Recommended Use Additive
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300

E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word Not Hazardous

Hazard Statements Not Classified

Precautionary Statements

Prevention None

Response None

Storage None

Disposal None

Contains

Substances

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

NA

Other hazards which do not result in classification

None known

Australia Classification

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

Classification Not Classified

Risk Phrases None

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures

Description of necessary 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 Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Symptoms caused by exposure

No significant hazards expected.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical**Special Exposure Hazards**

Decomposition in fire may produce harmful gases.

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

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment.

6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas.

6.3. 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. Do NOT spread spilled product with water.

7. Handling and storage

7.1. Precautions for Safe Handling**Handling Precautions**

Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Material is slippery underfoot.

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 oxidizers. Store in a cool well ventilated area. Keep container closed when not in use. Store at temperatures between 40 and 90 F (5 and 35 C).

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring**Exposure Limits**

Substances	CAS Number	Australia NOHSC	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**Engineering Controls**

Use in a well ventilated area.

Personal protective equipment (PPE)**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

Impervious rubber gloves.

Skin Protection

Rubber apron.

Eye Protection

Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions

None known.

Environmental Exposure Controls

No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Liquid
Odor: Slight
Color: Clear Yellow
Odor Threshold: No information available

<u>Property</u>	<u>Values</u>
<u>Remarks/ - Method</u>	
pH:	5-9
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	No data available
Water Solubility	Miscible with 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 oxidizers.

10.6. Hazardous Decomposition Products

Oxides of nitrogen. Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on 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	NA	No data available	No data available	No data available

cut-off values according to the competent authority				
-----------------------------------------------------	--	--	--	--

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 None known.

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

None known.

Data limitations

No data available

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

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

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations**Safe handling and disposal methods**

Disposal should be made in accordance with federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information**Safety, health and environmental regulations specific for the product****International Inventories****Australian AICS Inventory**

All components listed on inventory or are exempt.

New Zealand Inventory of Chemicals

All components listed on inventory or are exempt.

EINECS Inventory

This product, and all its components, complies with EINECS

US TSCA Inventory

All components listed on inventory or are exempt.

Canadian DSL Inventory

All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information**Date of preparation or review**

Revision Date: 01-Oct-2015

Revision Note

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NOEC – No Observed Effect Concentration

OEL – Occupational Exposure Limit

PBT – Persistent Bioaccumulative and Toxic

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

vPvB – very Persistent and very Bioaccumulative

h - hour

mg/m³ - milligram/cubic meter

mm - millimeter

mmHg - millimeter mercury

w/w - weight/weight

d - day

Key literature references and sources for data

www.ChemADVISOR.com/

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End of Safety Data Sheet

SAFETY DATA SHEET

CITRIC ACID ANHYDROUS

Revision Date: 29-Apr-2016

Revision Number: 2

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name CITRIC ACID ANHYDROUS

Other means of Identification

Synonyms None

Hazardous Material Number: MC600116

Recommended use of the chemical and restrictions on use

Recommended Use Solvent

Uses advised against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Multi-Chem Mintech
1 Ward Road
East Rockingham
WA 6168
Australia

Telephone Number: 61 (08) 9419 5300

Fax Number: 61 (08) 9439 1055 Emergency Telephone Number: + 61 1 800 686 951

E-mail Address fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Serious Eye Damage/Irritation

Category 2 - H319

Label elements, including precautionary statements

Hazard pictograms



Signal Word	Warning
Hazard Statements:	H319 - Causes serious eye irritation
Precautionary Statements	
Prevention	P264 - Wash face, hands and any exposed skin thoroughly after handling P280 - Wear 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
Storage	None
Disposal	None
Contains Substances	CAS Number
Citric acid	77-92-9

Other hazards which do not result in classification

None known

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

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Citric acid	77-92-9	60 - 100%	Eye Irrit. 2A (H319)

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

Causes eye irritation

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment**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**Special exposure hazards in a fire**

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 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.

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.

7. Handling and storage

7.1. Precautions for safe handling**Handling Precautions**

Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities**Storage Information**

Store in a cool, dry location.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring**Exposure Limits**

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Citric acid	77-92-9	Not applicable	Not applicable

Appropriate engineering controls**Engineering Controls**

Use in a well ventilated area.

Personal protective equipment (PPE)**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

Impervious rubber gloves.

Skin Protection

Normal work coveralls.

Eye Protection

Dust proof goggles.

Other Precautions

None known.

Environmental Exposure Controls No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Solid **Color:** White
Odor: Odorless **Odor Threshold:** No information available

<u>Property</u> <u>Remarks/ - Method</u>	<u>Values</u>
pH:	1.8
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	1.66
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	1000 °C / 1832 °F
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 192.12
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 oxidizers. Strong alkalis.

10.6. Hazardous decomposition products

Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Most Important Symptoms/Effects

Causes eye irritation

Numerical measures of toxicity

LD50 Oral: 11700 mg/kg; (Rat)

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Citric acid	77-92-9	5400 mg/kg (Rat) 5790 mg/kg (Mouse) 11,700 mg/kg (Rat)	> 2000 mg/kg	No data available

Test species: Rat

Immediate, delayed and chronic health effects from exposure

Inhalation	May cause mild respiratory irritation.
Eye Contact	Causes moderate eye irritation
Skin Contact	Not irritating to skin in rabbits.
Ingestion	Irritation of the mouth, throat, and stomach. 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.

Exposure Levels

No data available

Interactive effects

None known.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Citric acid	77-92-9	Not irritating to skin in rabbits.

Substances	CAS Number	Serious eye damage/irritation
Citric acid	77-92-9	Causes moderate eye irritation

Substances	CAS Number	Skin Sensitization
Citric acid	77-92-9	Patch test on human volunteers did not demonstrate sensitization properties

Substances	CAS Number	Respiratory Sensitization
Citric acid	77-92-9	No information available

Substances	CAS Number	Mutagenic Effects
Citric acid	77-92-9	Did not show mutagenic effects in animal experiments

Substances	CAS Number	Carcinogenic Effects
Citric acid	77-92-9	Did not show carcinogenic effects in animal experiments

Substances	CAS Number	Reproductive toxicity
Citric acid	77-92-9	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Citric acid	77-92-9	No data of sufficient quality are available.

Substances	CAS Number	STOT - repeated exposure
Citric acid	77-92-9	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	Aspiration hazard
Citric acid	77-92-9	No adverse health effects are expected from swallowing.

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Citric acid	77-92-9	NOEC (8d) 425 mg/L (cell density) (Scenedesmus quadricauda) LOEC (8d) >80 mg/L (Microcystis aeruginosa)	LC50 (96h) 1516 mg/L (Lepomis macrochirus) LC50 (48h) 440 mg/L (Leuciscus idus melanotus) LC50 (96h) >100 mg/L (Pimephales promelas)	TT (72h) 485 mg/L (Entosiphon sulcatum)	TLM96 100-330 ppm (Crangon crangon) EC50 (24h) 1535 mg/L (Daphnia magna) LC50 (48h) 160 mg/L (Daphnia magna) EC50 (48h) >50 mg/L (Daphnia magna)

12.2. Persistence and degradability

Biodegradable.

Substances	CAS Number	Persistence and Degradability
Citric acid	77-92-9	Readily biodegradable (97% @ 28d)

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Citric acid	77-92-9	-1.61 to -1.80

12.4. Mobility in soil

Substances	CAS Number	Mobility
Citric acid	77-92-9	No information available

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product**International Inventories****Australian AICS Inventory**

All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.

New Zealand Inventory of Chemicals

All components are listed on the NZIoC or are subject to a relevant exemption, permit, or assessment certificate.

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.

Poisons Schedule number

None Allocated

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

16. Other information**Date of preparation or review**

Revision Date: 29-Apr-2016

Revision Note

SDS sections updated: 2

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

H319 - Causes serious eye irritation

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 abbreviations or acronyms used

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NOEC – No Observed Effect Concentration

OEL – Occupational Exposure Limit

PBT – Persistent Bioaccumulative and Toxic

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

vPvB – very Persistent and very Bioaccumulative

h - hour

mg/m³ - milligram/cubic meter

mm - millimeter

mmHg - millimeter mercury

w/w - weight/weight

d - day

Key literature references and sources for data

www.ChemADVISOR.com/

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

EZ-MUD® DP

Revision Date: 03-Mar-2016

Revision Number: 20

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name EZ-MUD® DP

Other means of Identification

Synonyms None
Product Code: HM003644

Recommended use of the chemical and restrictions on use

Recommended Use Shale Inhibitor
Uses advised against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: + 61 1 800 686 951
Papua New Guinea: + 61 1 800 686 951
NewZealand: +64 800 451719

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

E-mail Address fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements**Hazard pictograms****Signal Word** Not Hazardous**Hazard Statements** Not Classified**Precautionary Statements****Prevention** None**Response** None**Storage** None**Disposal** None**Contains****Substances**

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

NA

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).

Australia Classification*For the full text of the H-phrases mentioned in this Section, see Section 16***Classification** Not Classified
Risk Phrases None**3. Composition/information on Ingredients**

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures**Description of necessary 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** Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.**Symptoms caused by exposure**

No significant hazards expected.

Medical Attention and Special Treatment**Notes to Physician** Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

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

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

6.1. 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. Slippery when wet.

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.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions

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. 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 oxidizers. Store in a cool, dry location. Product has a shelf life of 24 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	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

Engineering Controls

Use in a well ventilated area.

Personal protective equipment (PPE)

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

Respiratory Protection	product. 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.
Environmental Exposure Controls	No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Solid	Color	White
Odor:	Mild	Odor Threshold:	No information available

<u>Property</u>	<u>Values</u>
Remarks/ - Method	
pH:	6-8
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	0.8
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

VOC Content (%)	No data available
Bulk Density	40 lbs/ft ³

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 oxidizers.

10.6. Hazardous decomposition products

Ammonia. Oxides of nitrogen. Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on 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	None known.
Eye Contact	May cause mild eye irritation.
Skin Contact	May cause mild skin irritation.
Ingestion	None known.

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

None known.

Data limitations

No data available

12. Ecological Information

Ecotoxicity**Product Ecotoxicity Data**

No data available

Substance Ecotoxicity Data

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

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product**International Inventories**

Australian AICS Inventory	All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.
New Zealand Inventory of Chemicals	All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.
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 All components listed on inventory or are exempt.
(DSL)

Poisons Schedule number

None Allocated

International Agreements**Montreal Protocol - Ozone Depleting Substances:**

Does not apply

Stokholm Convention - Persistent Organic Pollutants:

Does not apply

Rotterdam Convention - Prior Informed Consent:

Does not apply

Basel Convention - Hazardous Waste:

Does not apply

16. Other information

Date of preparation or review**Revision Date:** 03-Mar-2016**Revision Note**

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NOEC – No Observed Effect Concentration

OEL – Occupational Exposure Limit

PBT – Persistent Bioaccumulative and Toxic

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

vPvB – very Persistent and very Bioaccumulative

h - hour

mg/m³ - milligram/cubic meter

mm - millimeter

mmHg - millimeter mercury

w/w - weight/weight

d - day

Key literature references and sources for datawww.ChemADVISOR.com/**Disclaimer Statement**

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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

MATERIAL SAFETY DATA SHEET

Product Trade Name: GEM™ CP

Revision Date: 12-Mar-2014

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
New Zealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substance or Preparation

Product Trade Name: GEM™ CP
Synonyms: None
Chemical Family: Polyalkylene glycol
UN Number: None
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None
Poisons Schedule: None
Application: Shale stabilizer

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

3. HAZARDS IDENTIFICATION

Statement of Hazardous Nature Non-Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Hazard Overview May cause mild eye, skin, and respiratory irritation. May be harmful if inhaled.

Classification Xn - Harmful.

Risk Phrases R20 Harmful by inhalation.

Safety Phrases S2 Keep out of reach of children.

HSNO Classification 6.1D (Inhalation) Acutely Toxic Substances
6.9B Harmful to human target organs or systems

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substance	CAS Number	Percent	Australia NOHSC	New Zealand WES	ACGIH TLV-TWA
Methyloxirane polymer with oxirane, monbutyl ether	9038-95-3	60 - 100%	Not determined	Not determined	Not applicable

Non-hazardous Substance to Total of 100%

4. 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, or suspected contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention immediately after flushing.

Ingestion Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Water fog, carbon dioxide, foam, dry chemical.

Unsuitable Extinguishing Media

None known

Special Exposure Hazards Decomposition in fire may produce toxic gases.

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 Precautionary Measures Use Appropriate protective equipment.

Environmental Precautionary Measures Prevent from entering sewers, waterways or low areas.

**Procedure for
Cleaning/Absorption**

Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions

Avoid contact with eyes, skin, or clothing. Avoid breathing mist. Avoid breathing vapours.

Storage Information

Store away from oxidisers. Store away from acids. Store away from alkalis. Keep container closed when not in use. Product has a shelf life of 60 months

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.

Respiratory Protection

Not normally needed. But if significant exposures are possible then the following respirator is recommended. Organic vapour respirator with a dust/mist filter.

Hand Protection

Impervious rubber gloves. Polyvinylchloride gloves. Neoprene gloves.

Skin Protection

Rubber apron.

Eye Protection

Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions

Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Colour:	Clear light yellow
Odour:	Mild
pH:	5-7.5 (10%)
Specific Gravity @ 20 C (Water=1):	1.02
Density @ 20 C (kg/l):	0.97
Bulk Density @ 20 C (kg/l):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (C):	Not Determined
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	> 93
Flash Point Method:	PMCC
Autoignition Temperature (C):	Not Determined Minimum: 370
Flammability Limits in Air - Lower (g/m³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapour Pressure @ 20 C (mmHg):	< 0.01
Vapour Density (Air=1):	> 1
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate = 1):	< 0.1
Solubility in Water (g/100ml):	Soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	19
Partition Coefficient/n-Octanol/Water:	0.353

Molecular Weight (g/mole): 405
 Decomposition Temperature (C): Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable

Hazardous Polymerisation: Will Not Occur

Conditions to Avoid None known.

Incompatibility (Materials to Avoid) Strong oxidisers. Strong acids. Strong alkalis

Hazardous Decomposition Products Carbon monoxide and carbon dioxide.

Additional Guidelines Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure None known

Symptoms related to exposure

Acute Toxicity

Inhalation May cause mild respiratory irritation.

Eye Contact May cause mild eye irritation.

Skin Contact Prolonged or repeated contact may cause slight skin irritation.

Ingestion Irritation of the mouth, throat, and stomach.

Chronic Effects/Carcinogenicity Prolonged or repeated exposure may cause lung damage.

Toxicology data for the components

Substance	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Methyloxirane polymer with oxirane, monbutyl ether	9038-95-3	12300 µL/kg (Rat) > 4728 mg/kg (Rat)	20 mL/kg (Rabbit) > 21140 mg/kg (Rat)	0.26 mg/L 4H

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

Ecotoxicity Product

Acute Fish Toxicity: EC50: 86 ppm (Abra alba)

Acute Crustaceans Toxicity: TLM48: 356 mg/l (Acartia tonsa)

Acute Algae Toxicity: EC50: 465 mg/l (Skeletonema costatum)

Ecotoxicity Substance

Substance	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Methyloxirane polymer with oxirane, monbutyl ether	9038-95-3	EC50: 465 mg/l (Skeletonema costatum)	LC50(96h): 3170 - 11900 mg/L (Pimephales promelas)	No information available	TLM48: 356 mg/l (Acartia tonsa) EC50(48h): 17000 - 19000 mg/L (Daphnia magna)

12.2 Persistence and degradability

Not readily biodegradable

12.3 Bioaccumulative potential

Substance	Log Pow
Methyloxirane polymer with oxirane, monbutyl ether	0.353

12.4 Mobility in soil

No information available

12.5 Results of PBT and vPvB assessment

No information available.

12.6 Other adverse effects

13. DISPOSAL CONSIDERATIONS

Disposal Method Disposal should be made in accordance with federal, state and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

Chemical Inventories

Australian AICS Inventory All components listed.
New Zealand Inventory of Chemicals This product does not comply with NZIOC
US TSCA Inventory All components listed.
EINECS Inventory All components are listed on the inventory.

Classification Xn - Harmful.

Risk Phrases R20 Harmful by inhalation.

Safety Phrases S2 Keep out of reach of children.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS:

Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Product Stewardship at 1-580-251-4335.

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 MSDS

SAFETY DATA SHEET

according to Regulation (EC) No. 453/2010

GEM™ GP

Revision Date: 18-Sep-2015

Revision Number: 42

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

1.1. Product Identifier

Product Name GEM™ GP
Internal ID Code HM003660

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

Recommended Use	Shale stabilizer
Sector of uses	Refer to the Annex for a listing of uses.
Product category(ies)	Not applicable
Process categories	PROC2 - Use in closed, continuous process with occasional controlled exposure (e.g. sampling) PROC5 - Mixing or blending in batch processes for formulation of mixtures and articles (multistage and/or significant contact) PROC9 - Transfer of substance or mixture into small containers (dedicated filling line, including weighing) PROC19 - Hand-mixing with intimate contact and only PPE available PROC20 - Heat and pressure transfer fluids in dispersive use but closed systems PROC8a - Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities
Article categories	Not applicable
Environmental release category(ies)	ERC4 - Industrial use of processing aids in processes and products, not becoming part of articles ERC8d - Wide dispersive outdoor use of processing aids in open systems
Sector of uses	SU2a - Mining, (without offshore industries) SU2b - Offshore industries SU3 - Industrial uses SU 22 - Professional uses

1.3. Details of the supplier of the safety data sheet

Halliburton Manufacturing Services, Ltd.
 Halliburton House, Howemoss Crescent
 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

Emergency telephone - §45 - (EC)1272/2008	
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	+210 7793777
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

Serious Eye Damage/Irritation	Category 1 - (H318)
-------------------------------	---------------------

2.2. Label Elements

Hazard pictograms

Signal Word

Danger

Hazard Statements:

H318 - Causes serious eye damage

Precautionary Statements:

P280 - Wear eye protection/face protection

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

P310 - Immediately call a POISON CENTER or doctor/physician

Contains

Substances

Polyethylene glycol butyl ether

CAS Number

9004-77-7

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
Polyethylene glycol butyl ether	500-012-0	9004-77-7	60 - 100%	Eye Corr. 1 (H318)	01-2119484615-30

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, 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

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

Causes severe eye irritation which may damage tissue.

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**

Water fog, carbon dioxide, foam, dry chemical.

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**

Decomposition in fire may produce harmful gases.

Special exposure hazards arising from the substance or preparation itself, combustion products, resulting gases

Cool drums with water spray

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 contact with skin, eyes and clothing. Avoid breathing vapors. Ensure adequate ventilation.

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

Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. 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 breathing vapors. Wash hands after use. Launder contaminated clothing before reuse. Ensure adequate ventilation. 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 away from oxidizers. Store away from acids. Keep container closed when not in use.

7.3. Specific end use(s)**Exposure scenario**

Please refer to the attached Annex for a listing of exposure scenarios.

Other Guidelines

No information available

SECTION 8: Exposure controls/personal protection**8.1. Control parameters****Exposure Limits**

Substances	CAS Number	EU	UK	Netherlands	France
Polyethylene glycol butyl ether	9004-77-7	Not applicable	Not applicable	Not applicable	Not applicable

Substances	CAS Number	Germany	Spain	Portugal	Finland
Polyethylene glycol butyl ether	9004-77-7	Not applicable	Not applicable	Not applicable	Not applicable

Substances	CAS Number	Austria	Ireland	Switzerland	Norway
Polyethylene glycol butyl ether	9004-77-7	Not applicable	Not applicable	Not applicable	Not applicable

Substances	CAS Number	Italy	Poland	Hungary	Czech Republic
Polyethylene glycol butyl ether	9004-77-7	Not applicable	Not applicable	Not applicable	Not applicable

Substances	CAS Number	Denmark	Romania	Croatia	Cyprus
Polyethylene glycol butyl ether	9004-77-7	Not applicable	Not applicable	Not applicable	Not applicable

Derived No Effect Level (DNEL)

Worker

Substances	Long-term exposure - systemic effects, Inhalation	Acute / short term exposure - systemic effects, Inhalation	Long-term exposure - local effects, Inhalation	Acute / short term exposure - local effects, Inhalation	Long-term exposure - systemic effects, Dermal	Acute / short term exposure - systemic effects, Dermal	Long-term exposure - local effects, Dermal	Acute / short term exposure - local effects, Dermal	Hazards for the eyes - local effects
Polyethylene glycol butyl ether	195 mg/m ³	Not available	Not available	Not available	50 mg/kg bw/day	Not available	Not available	Not available	Not available

General Population

Substances	Long-term exposure - systemic effects, Inhalation	Acute / short term exposure - systemic effects, Inhalation	Long-term exposure - local effects, Inhalation	Acute / short term exposure - local effects, Inhalation	Long-term exposure - systemic effects, Dermal	Acute / short term exposure - systemic effects, Dermal	Long-term exposure - local effects, Dermal	Acute / short term exposure - local effects, Dermal	Long-term exposure - systemic effects, Oral	Acute / short term exposure - local effects, Oral	Hazards for the eyes - local effects
Polyethylene glycol butyl ether	117 mg/m ³	Not available	Not available	Not available	25 mg/kg bw/day	Not available	Not available	Not available	2.5mg/kg bw/day	Not available	Not available

Predicted No Effect Concentration (PNEC)

Substances	Freshwater	Marine water	Intermittent release	Sewage treatment plant	Sediment (freshwater)	Sediment (marine water)	Air	Soil	Secondary poisoning
Polyethylene glycol butyl ether	4.5 mL	0.31 mg/L	24.9 mg/L	500 mg/L	6.6 mg/kg dw	0.66 mg/kg dw	Not available	1.32 mg/kg dw	333 mg/kg food

8.2. Exposure controls

Engineering Controls

Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.

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

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. (>= 0.35 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

Rubber apron.

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 No information available

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical State: Liquid
Odor: Mild
Color: Yellow to brown
Odor Threshold: No information available

<u>Property</u> <u>Remarks/ - Method</u>	<u>Values</u>
pH:	6.5 - 9
Freezing Point / Range	-45 °C
Melting Point / Range	No data available
Boiling Point / Range	126 °C / 260 °F
Flash Point	166 °C / 330 °F PMCC
Flammability (solid, gas)	No data available
Upper flammability limit	3.8 %
Lower flammability limit	0.8 %
Evaporation rate	No data available
Vapor Pressure	0.002 mmHg
Vapor Density	No data available
Specific Gravity	1.012
Water Solubility	Miscible with water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	203 °C / 397.4 °F
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

Keep away from heat, sparks and flame.

10.5. Incompatible materials

Strong oxidizers. Mineral acids.

10.6. Hazardous decomposition products

Carbon monoxide and carbon dioxide.

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

Inhalation	May cause mild respiratory irritation.
Eye Contact	Causes severe eye irritation which may damage tissue.
Skin Contact	May cause mild skin irritation.
Ingestion	Irritation of the mouth, throat, and stomach. 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
Polyethylene glycol butyl ether	9004-77-7	> 5000 mg/kg (Rat) > 2000 mg/kg (Rat)	6540 mg/kg (Rat) 3540 mg/kg (Rabbit) (similar substance) > 2000 mg/kg (Rat) (similar substance)	> 2.6 mg/L (Rat) 4h (similar substance) > 2000 mg/L (Rat) 1h (similar substance)

Substances	CAS Number	Skin corrosion/irritation
Polyethylene glycol butyl	9004-77-7	Non-irritating to the skin (Rabbit)

ether		
Substances	CAS Number	Serious eye damage/irritation
Polyethylene glycol butyl ether	9004-77-7	Eye, rabbit: Causes severe eye irritation which may damage tissue.
Substances	CAS Number	Skin Sensitization
Polyethylene glycol butyl ether	9004-77-7	Did not cause sensitization on laboratory animals (guinea pig) (similar substances)
Substances	CAS Number	Respiratory Sensitization
Polyethylene glycol butyl ether	9004-77-7	
Substances	CAS Number	Mutagenic Effects
Polyethylene glycol butyl ether	9004-77-7	In vivo tests did not show mutagenic effects. In vitro tests did not show mutagenic effects. (similar substances)
Substances	CAS Number	Carcinogenic Effects
Polyethylene glycol butyl ether	9004-77-7	No information available
Substances	CAS Number	Reproductive toxicity
Polyethylene glycol butyl ether	9004-77-7	Not regarded as a reproductive and developmental toxicant. Did not show teratogenic effects in animal experiments. (similar substances)
Substances	CAS Number	STOT - single exposure
Polyethylene glycol butyl ether	9004-77-7	No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)
Substances	CAS Number	STOT - repeated exposure
Polyethylene glycol butyl ether	9004-77-7	No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)
Substances	CAS Number	Aspiration hazard
Polyethylene glycol butyl ether	9004-77-7	Not applicable

SECTION 12: Ecological information

12.1. Toxicity

Ecotoxicity effects

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Polyethylene glycol butyl ether	9004-77-7	EC50(72h): 391 mg/L (growth rate) (Skeletonema costatum)	EC50: 475 ppm (Abra alba) LC50(96h): >1800 mg/L (Scophthalmus maximus)	IC50(16h): > 5000 mg/L (Growth inhibition, Activated sludge) (similar substance – 2-(2-(2-butoxyethoxy)ethoxy)ethanol) EC10(30m): > 1995 mg/L (respiration rate, activated sludge) (similar substance – 2-(2-(2-butoxyethoxy)ethoxy)ethanol)	TLM48: 310 mg/l (Acartia tonsa) EC50(48h): > 3200 mg/L (Daphnia magna) (similar substance – ethanol, 2-butoxy-, manufacture of, by-products from)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
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Polyethylene glycol butyl ether	9004-77-7	Readily biodegradable (68% @ 28d)
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12.3. Bioaccumulative potential

Does not bioaccumulate.

Substances	CAS Number	Log Pow
Polyethylene glycol butyl ether	9004-77-7	0.436

12.4. Mobility in soil

Substances	CAS Number	Mobility
Polyethylene glycol butyl ether	9004-77-7	Log Kow < 4.5

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).

Substances	PBT and vPvB assessment
Polyethylene glycol butyl ether	Not PBT/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**

Disposal should be made in accordance with 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

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/NDL - Canadian Domestic Substances List/Non-Domestic Substances List

Germany, Water Endangering Classes (WGK) WGK 1: Low hazard to waters.

15.2. Chemical safety assessment

Yes

SECTION 16: Other information

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

H318 - Causes serious eye damage

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: 18-Sep-2015

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

Annex to SDS					
Substances	CAS Number	Process categories	Environmental release category	Product category(ies)	Sector of uses
Polyethylene glycol butyl ether	9004-77-7	PROC2; PROC5; PROC8a; PROC9; PROC19; PROC20	ERC4; ERC8d	-	SU2a; SU2b; SU3; SU22

Exposure Scenario

Application of bulk onshore/offshore oilfield liquid or solid/powder.

1. Title Section

Use Use in batch process where opportunities for exposure arise.
Transfer from support vessel to installation.
Transfer from bulk/ IBC/ drum to on-site storage, transfer to process.
Transfer from pot/tin/tube to process. On-site sampling and testing e.g. QC

Sector of uses SU2a - Mining, (without offshore industries)
SU2b - Offshore industries
SU3 - Industrial uses
SU 22 - Professional uses

Worker

Process categories PROC2 - Use in closed, continuous process with occasional controlled exposure (e.g. sampling)
PROC5 - Mixing or blending in batch processes for formulation of mixtures and articles (multistage and/or significant contact)
PROC9 - Transfer of substance or mixture into small containers (dedicated filling line, including weighing)
PROC19 - Hand-mixing with intimate contact and only PPE available
PROC20 - Heat and pressure transfer fluids in dispersive use but closed systems
PROC8a - Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities

Product category(ies) Not applicable
Article categories Not applicable

Environmental

Environmental release category(ies) ERC4 - Industrial use of processing aids in processes and products, not becoming part of articles
ERC8d - Wide dispersive outdoor use of processing aids in open systems

2. Conditions of use affecting exposure

Control of environmental exposure

Substances	Control of environmental exposure
Polyethylene glycol butyl ether	Substance is complex UVCB. Miscible in water. Practically non-toxic to aquatic species. Readily biodegradable. Low potential for bioaccumulation.

Amount used, frequency and duration of use (or from service life)

Substances	Daily Amount Per Site	Annual site tonnage	Frequency	Duration of use
Polyethylene glycol butyl ether	-	200	Continuous release.	30 d/y

Technical and organisational conditions and measures

Substances	Technical and organisational conditions and measures
Polyethylene glycol butyl ether	Treatment of air emissions is not required for the purposes of REACH compliance but may be needed to comply with other environmental legislation. Prevent environmental discharge consistent with regulatory requirements.

Conditions and measures related to sewage treatment plant

Substances	Conditions and measures related to sewage treatment plant
Polyethylene glycol butyl ether	The substance is completely released to the environment or destroyed during use and no significant waste is generated.

Substances	Assumed municipal sewage treatment plant flow m3/d	Wastewater Emission Removal Efficiency	Estimated product removal from wastewater via municipal sewage treatment
Polyethylene glycol butyl ether	0	-	-

Conditions and measures related to treatment of waste (including article waste)

Substances	Conditions and measures related to treatment of waste (including article waste)
Polyethylene glycol butyl ether	No wastewater treatment required. Dispose of contents/container in accordance with local/regional/national/international regulations.

Other conditions affecting environmental exposure

Substances	Receiving surface water flow m3/d	Degradation
Polyethylene glycol butyl ether	-	68% @ 28d

Control of Worker Exposure

Product (article) characteristics

Physical State:	Liquid
Vapor Pressure	0.002 mmHg
Dustiness	Not applicable

Substances	Limit the substance content in the product to
Polyethylene glycol butyl ether	100%

Amount used (or contained in articles), frequency and duration of use/exposure

Substances	Amounts used (daily)	Covers daily exposures up to (hours/day)	Frequency (days/year)
Polyethylene glycol butyl ether	-	8	-

Technical and organisational conditions and measures

Substances	Technical and organisational conditions and measures
Polyethylene glycol butyl ether	Transfer via enclosed lines. Clear spills immediately. Use drum pumps or carefully pour from container. Clear transfer lines prior to de-coupling. Avoid spillage when withdrawing pump. Handle substance within a closed system. Provide extract ventilation to points where emissions occur. Ensure the ventilation system is regularly maintained and tested. Drill floor operations - Limit the substance content in the product to 25 %. Drain or remove substance from equipment prior to break-in or maintenance. Store substance within a closed system. Avoid dip sampling. Fill containers/cans at dedicated fill points supplied with local extract ventilation.

Conditions and measures related to personal protection, hygiene and health evaluation

Substances	Conditions and measures related to personal protection, hygiene and health evaluation
Polyethylene glycol butyl ether	Use suitable eye protection. Wear suitable gloves tested to EN374. Refer to section 8 of the SDS.

Other conditions affecting workers exposure

Substances	Other conditions affecting workers exposure
Polyethylene glycol butyl ether	Assumes a good basic standard of occupational hygiene is implemented. Assumes use at not more than 20°C above ambient temperature (unless stated differently).

Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply

Substances	Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
Polyethylene glycol butyl ether	Wash hands after use. Launder contaminated clothing before reuse.

3. Exposure estimation and reference to its source

Environmental release and exposure

Substances	Release to Water	Release to Air	Release to Soil	Release estimation method	Local freshwater dilution factor	Local marine water dilution factor
Polyethylene glycol butyl ether						

Substances
Polyethylene glycol butyl ether

CAS Number
9004-77-7

Revision Number: 42

Revision Date: 18-Sep-2015

Polyethylene glycol butyl ether	0.07	0.005	0	No information available	-	100
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Substances	Protection Target	Exposure estimate (based on: EUSES 2.1.2)	Unit	RCR
Polyethylene glycol butyl ether	Marine water Sediment (marine water)	0.00749 <0.0001	mg/L mg/kg dw	0.0242 <0.0001

Worker exposure

Substances	Route of exposure and type of effects	Exposure estimate	Assessment Method	RCR
Polyethylene glycol butyl ether	Short-term exposure - local effects, Inhalation ppm Short-term exposure - local effects, Dermal mg/kg bw/day	<=7 <=13.71	No information available	<=0.304 <=0.274

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Scaling method

Scaling parameters

For scaling see: <http://www.ecetoc.org/tra>, ECETOC TRA worker v2.3, modified version.

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his implemented risk management measures are adequate.

SAFETY DATA SHEET

N-SQUEEZE™

Revision Date: 21-Sep-2015

Revision Number: 20

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name N-SQUEEZE™

Other means of Identification

Synonyms: None
Product Code: HM003709

Recommended use of the chemical and restrictions on use

Recommended Use Loss Circulation Material
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word Not Hazardous

Hazard Statements Not Classified

Precautionary Statements

Prevention None

Response None

Storage None

Disposal None

Contains

Substances

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

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).

Australia Classification

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

Classification Not Classified

Risk Phrases None

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

No significant hazards expected.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

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

Special Exposure Hazards

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 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

6.1. 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.

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.

7. Handling and storage

7.1. Precautions for Safe Handling

Handling Precautions

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

Storage Information

Store in a cool, dry location. Product has a shelf life of 36 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	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

Engineering Controls

Use in a well ventilated area.

Personal protective equipment (PPE)

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.

Environmental Exposure Controls

No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Solid
Color: Light brown
Odor: Woody
Odor Threshold: No information available

<u>Property</u>	<u>Values</u>
<u>Remarks/ - Method</u>	
pH:	9-10
Freezing Point/Range	No data available
Melting Point/Range	No data available
Boiling Point/Range	No data available
Flash Point	> 93 °C
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	2.6
Water Solubility	Partly soluble
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
Bulk Density 22 lbs/ft³

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 oxidizers.

10.6. Hazardous Decomposition Products

Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on 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	NA	No data available	No data available	No data available

concentrations above cut-off values according to the competent authority				
--------------------------------------------------------------------------	--	--	--	--

Immediate, delayed and chronic health effects from exposure

Inhalation May cause mild respiratory irritation.
Eye Contact May cause mechanical irritation to eye.
Skin Contact Can dry skin.
Ingestion None known.

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

None known.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Eye damage/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Skin Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Respiratory Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Mutagenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Carcinogenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Reproductive toxicity
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - single exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - repeated exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Aspiration hazard
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

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

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations**Safe handling and disposal methods**

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information**Safety, health and environmental regulations specific for the product****International Inventories****Australian AICS Inventory**

All components listed on inventory or are exempt.

New Zealand Inventory of Chemicals

All components listed on inventory or are exempt.

EINECS Inventory

This product, and all its components, complies with EINECS

US TSCA Inventory

All components listed on inventory or are exempt.

Canadian DSL Inventory

All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information**Date of preparation or review**

Revision Date: 21-Sep-2015

Revision Note

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight CAS – Chemical Abstracts Service EC50 – Effective Concentration 50% LC50 – Lethal Concentration 50% LD50 – Lethal Dose 50% LL50 – Lethal Loading 50% mg/kg – milligram/kilogram mg/L – milligram/liter NOEC – No Observed Effect Concentration OEL – Occupational Exposure Limit PBT – Persistent Bioaccumulative and Toxic ppm – parts per million STEL – Short Term Exposure Limit TWA – Time-Weighted Average vPvB – very Persistent and very Bioaccumulative h - hour mg/m³ - milligram/cubic meter mm - millimeter mmHg - millimeter mercury w/w - weight/weight d - day

Key literature references and sources for data

www.ChemADVISOR.com/

Disclaimer Statement

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End of Safety Data Sheet

SAFETY DATA SHEET

SODA ASH

Revision Date: 21-Jun-2016

Revision Number: 40

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name SODA ASH

Other means of Identification

Synonyms None
Hazardous Material Number: HM001822

Recommended use of the chemical and restrictions on use

Recommended Use Buffer
Uses advised against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-mail Address fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Serious Eye Damage/Irritation	Category 2 - H319
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Label elements, including precautionary statements

Hazard pictograms



Signal Word	Warning
Hazard Statements:	H319 - Causes serious eye irritation
Precautionary Statements	
Prevention	P264 - Wash face, hands and any exposed skin thoroughly after handling P280 - Wear 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
Storage	None
Disposal	None
Contains Substances	CAS Number
Sodium carbonate	497-19-8

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).

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

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Sodium carbonate	497-19-8	60 - 100%	Eye Irrit. 2 (H319)

4. First aid measures

Description of necessary 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	Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Symptoms caused by exposure

Causes eye irritation

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment**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**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

6.1. 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.

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.

7. Handling and storage

7.1. Precautions for safe handling**Handling Precautions**

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**Storage Information**

Store away from acids. Store in a cool, dry location. Product has a shelf life of 36 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring**Exposure Limits**

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Sodium carbonate	497-19-8	Not applicable	Not applicable

Appropriate engineering controls**Engineering Controls**

Use in a well ventilated area. Localized ventilation should be used to control dust levels.

Personal protective equipment (PPE)**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.

Hand Protection	Normal work gloves.
Skin Protection	Normal work coveralls.
Eye Protection	Dust proof goggles.
Other Precautions	None known.
Environmental Exposure Controls	Do not allow material to contaminate ground water system

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Powder	Color	White
Odor:	Odorless	Odor Threshold:	No information available

<u>Property</u> <u>Remarks/ - Method</u>	<u>Values</u>
pH:	11.5
Freezing Point / Range	No data available
Melting Point / Range	851 °C
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	2.5
Water Solubility	Partly soluble
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	105.99 g/mole
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.

11. Toxicological Information

Information on routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Most Important Symptoms/Effects

Causes eye irritation

Numerical measures of toxicity

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium carbonate	497-19-8	4090 mg/kg (Rat) 2800 mg/kg (Rat)	2210 mg/kg (Mouse) > 2000 mg/kg (Rabbit)	2.3 mg/L (Rat) 2h

Immediate, delayed and chronic health effects from exposure

Inhalation	May cause respiratory irritation.
Eye Contact	Causes eye irritation.
Skin Contact	Prolonged or repeated contact may cause skin irritation.
Ingestion	Irritation 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

None known.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Sodium carbonate	497-19-8	Non-irritating to the skin

Substances	CAS Number	Serious eye damage/irritation
Sodium carbonate	497-19-8	Irritating to eyes

Substances	CAS Number	Skin Sensitization
Sodium carbonate	497-19-8	Not classified

Substances	CAS Number	Respiratory Sensitization
Sodium carbonate	497-19-8	No information available

Substances	CAS Number	Mutagenic Effects
Sodium carbonate	497-19-8	In vivo tests did not show mutagenic effects.

Substances	CAS Number	Carcinogenic Effects
Sodium carbonate	497-19-8	No information available

Substances	CAS Number	Reproductive toxicity
Sodium carbonate	497-19-8	Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Sodium carbonate	497-19-8	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Sodium carbonate	497-19-8	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	Aspiration hazard
Sodium carbonate	497-19-8	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Sodium carbonate	497-19-8	EC50 242 mg/L (Nitzschia)	TLM24 385 mg/L (Lepomis macrochirus) LC50 310-1220 mg/L (Pimephales promelas) LC50 (96h) 300 mg/L (Lepomis macrochirus)	No information available	EC50 265 mg/L (Daphnia magna) EC50 (48h) 200 – 227 mg/L (Ceriodaphnia sp.)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Sodium carbonate	497-19-8	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Sodium carbonate	497-19-8	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Sodium carbonate	497-19-8	No information available

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations**Safe handling and disposal methods**

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product**International Inventories****Australian AICS Inventory**

All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.

New Zealand Inventory of Chemicals

All components are listed on the NZIoC or are subject to a relevant exemption, permit, or assessment certificate.

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.

Poisons Schedule number

None Allocated

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

16. Other information**Date of preparation or review**

Revision Date: 21-Jun-2016

Revision Note

SDS sections updated: 2

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

H319 - Causes serious eye irritation

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 abbreviations or acronyms used

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NOEC – No Observed Effect Concentration

OEL – Occupational Exposure Limit

PBT – Persistent Bioaccumulative and Toxic

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

vPvB – very Persistent and very Bioaccumulative

h - hour

mg/m³ - milligram/cubic meter

mm - millimeter

mmHg - millimeter mercury

w/w - weight/weight

d - day

Key literature references and sources for data

www.ChemADVISOR.com/

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End of Safety Data Sheet

SAFETY DATA SHEET

POTASSIUM CHLORIDE

Revision Date: 04-Sep-2015

Revision Number: 22

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name POTASSIUM CHLORIDE

Other means of Identification

Synonyms: None
Product Code: HM001200

Recommended use of the chemical and restrictions on use

Recommended Use Brine
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word Not Hazardous

Hazard Statements Not Classified

Precautionary Statements

Prevention None

Response None

Storage None

Disposal None

Contains

Substances

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

NA

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).

Australia Classification

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

Classification Not Classified

Risk Phrases None

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

No significant hazards expected.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical

Special Exposure Hazards

Not applicable.

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

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.

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.

7. Handling and storage

7.1. Precautions for Safe Handling

Handling Precautions

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

Storage Information

Store in a cool, dry location. Product has a shelf life of 60 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	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

Engineering Controls

Use in a well ventilated area.

Personal protective equipment (PPE)

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

9. Physical and Chemical Properties

to the competent authority				
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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. Irritation 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
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Eye damage/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Skin Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Respiratory Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Mutagenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Carcinogenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Reproductive toxicity

Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable
--------------------------------------------------------------------------------------------------------------	----	----------------

Substances	CAS Number	STOT - single exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - repeated exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Aspiration hazard
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

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

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations**Safe handling and disposal methods**

Bury in a licensed landfill according to federal, state, and local regulations. Substance should NOT be deposited into a sewage facility.

Disposal of any 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.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information**Safety, health and environmental regulations specific for the product****International Inventories**

Australian AICS Inventory	All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS
US TSCA Inventory	All components listed on inventory or are exempt.
Canadian DSL Inventory	All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information**Date of preparation or review**

Revision Date: 04-Sep-2015

Revision Note

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight CAS – Chemical Abstracts Service EC50 – Effective Concentration 50% LC50 – Lethal Concentration 50% LD50 – Lethal Dose 50% LL50 – Lethal Loading 50% mg/kg – milligram/kilogram mg/L – milligram/liter NOEC – No Observed Effect Concentration OEL – Occupational Exposure Limit PBT – Persistent Bioaccumulative and Toxic ppm – parts per million STEL – Short Term Exposure Limit TWA – Time-Weighted Average vPvB – very Persistent and very Bioaccumulative h - hour mg/m³ - 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

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End of Safety Data Sheet

SAFETY DATA SHEET

CAUSTIC SODA

Revision Date: 22-Jan-2016

Revision Number: 32

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Dangerous Goods according to the criteria of ADG.

1.1. Product Identifier

Product Name CAUSTIC SODA

Other means of Identification

Synonyms: None
Product Code: HM003599

Recommended use of the chemical and restrictions on use

Recommended Use pH Control
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: + 61 1 800 686 951
Papua New Guinea: + 61 1 800 686 951
NewZealand: +64 800 451719

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Dangerous Goods according to the criteria of ADG.

Classification of the hazardous chemical

Skin Corrosion / irritation	Category 1 - H314
Serious Eye Damage / Eye Irritation	Category 1 - H318
Specific Target Organ Toxicity - (Single Exposure)	Category 3 - H335
Substances/mixtures corrosive to metal.	Category 1 - H290

Label elements, including precautionary statements**Hazard Pictograms****Signal Word**

Danger

Hazard Statements

H290 - May be corrosive to metals
 H314 - Causes severe skin burns and eye damage
 H318 - Causes serious eye damage
 H335 - May cause respiratory irritation

Precautionary Statements**Prevention**

P234 - Keep only in original container
 P260 - Do not breathe dust/fume/gas/mist/vapors/spray
 P264 - Wash face, hands and any exposed skin thoroughly after handling
 P271 - Use only outdoors or in a well-ventilated area
 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
 P390 - Absorb spillage to prevent material damage

Storage

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

Disposal

P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

Contains**Substances**

Sodium hydroxide

CAS Number

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).

Australia Classification

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

Classification

C - Corrosive.

Risk Phrases R35 Causes severe burns.
R37 Irritating to respiratory system.

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Sodium hydroxide	1310-73-2	60 - 100%	Skin Corr. 1A (H314) Eye Corr. 1 (H318) STOT SE 3 (H335) Met. Corr. 1 (H290)

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

Causes severe skin irritation with tissue destruction. Causes severe eye irritation which may damage tissue. May cause respiratory irritation.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific 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

6.1. 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.

6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas. Consult local authorities.

6.3. Methods and material for containment and cleaning up

Neutralize to pH of 6-8. Scoop up and remove.

7. Handling and storage

7.1. Precautions for Safe Handling**Handling Precautions**

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.

7.2. Conditions for safe storage, including any incompatibilities**Storage Information**

Store away from acids. Store in a cool, dry location. Store locked up.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring**Exposure Limits**

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Sodium hydroxide	1310-73-2	2 mg/m ³	2 mg/M3

Appropriate engineering controls**Engineering Controls**

Use in a well ventilated area. Localized ventilation should be used to control dust levels.

Personal protective equipment (PPE)**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

9.1. Information on basic physical and chemical properties

Physical State: Solid

Color: White to off white

Odor: Odorless

Odor Threshold: No information available

Property

Values

Remarks/ - Method

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
9.2. Other information	
Molecular Weight	40
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

Contact with acids. Peroxides. Halogenated compounds. Prolonged contact with aluminum, lead, or zinc may liberate flammable hydrogen.

10.6. Hazardous Decomposition Products

None known.

11. Toxicological Information

Information on routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Most Important Symptoms/Effects

Causes severe skin irritation with tissue destruction. Causes severe eye irritation which may damage tissue. May cause respiratory irritation.

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	Causes severe respiratory irritation.
Eye Contact	Causes severe eye irritation which may damage tissue.
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**Product Ecotoxicity Data**

No data available

Substance Ecotoxicity Data

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 reticulata)	No information available	EC50 (48h) 40.4 mg/L (Ceriodaphnia sp.)

12.2. 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.
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12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Sodium hydroxide	1310-73-2	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Sodium hydroxide	1310-73-2	No information available

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Disposal should be made in accordance with federal, state, and local regulations.

Disposal of any 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.

Environmental regulations

Not applicable

14. Transport 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

Special precautions during transport

None

HazChem Code

2R

15. Regulatory Information

Safety, health and environmental regulations specific for the product**International Inventories****Australian AICS Inventory**

All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.

New Zealand Inventory of Chemicals

All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.

EINECS Inventory

This product, and all its components, complies with EINECS

US TSCA Inventory

All components listed on inventory or are exempt.

Canadian DSL Inventory

All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

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

16. Other information**Date of preparation or review**

Revision Date: 22-Jan-2016

Revision Note

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

R35 Causes severe burns.

R37 Irritating to respiratory system.

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

H290 - May be corrosive to metals

H314 - Causes severe skin burns and eye damage

H318 - Causes serious eye damage

H335 - May cause respiratory irritation

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 abbreviations or acronyms used

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NOEC – No Observed Effect Concentration

OEL – Occupational Exposure Limit

PBT – Persistent Bioaccumulative and Toxic

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

vPvB – very Persistent and very Bioaccumulative

h - hour

mg/m³ - 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

SAFETY DATA SHEET

BENTONITE

Revision Date: 15-Mar-2016

Revision Number: 38

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name BENTONITE

Other means of Identification

Synonyms None
Product Code: HM000126

Recommended use of the chemical and restrictions on use

Recommended Use Weight Additive
Uses advised against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-mail Address fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Carcinogenicity	Category 2 - H351
Specific Target Organ Toxicity - (Repeated Exposure)	Category 2 - H373

Label elements, including precautionary statements

Hazard pictograms



Signal Word	Warning
Hazard Statements	H351 - Suspected of causing cancer H373 - May cause damage to organs through prolonged or repeated exposure
Precautionary Statements	
Prevention	P201 - Obtain special instructions before use P202 - Do not handle until all safety precautions have been read and understood P260 - Do not breathe dust/fume/gas/mist/vapors/spray P281 - Use personal protective equipment as required
Response	P308 + P313 - IF exposed or concerned: Get medical advice/attention P314 - Get medical attention/advice if you feel unwell
Storage	P405 - Store locked up
Disposal	P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

Contains**Substances**

	CAS Number
Crystalline silica, quartz	14808-60-7
Crystalline silica, cristobalite	14464-46-1
Crystalline silica, tridymite	15468-32-3

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).

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

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Crystalline silica, quartz	14808-60-7	1 - 5%	Carc. 2 (H351) STOT RE 1 (H372)
Crystalline silica, cristobalite	14464-46-1	0.1 - 1%	Carc. 2 (H351) STOT RE 1 (H372)
Crystalline silica, tridymite	15468-32-3	0.1 - 1%	Carc. 2 (H351) STOT RE 1 (H372)

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease. Potential carcinogen. Prolonged or repeated exposure may cause damage to organs.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment**Suitable Extinguishing Media**

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical**Special exposure hazards in a fire**

None anticipated

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.

6.2. Environmental precautions

None known.

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**

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**

Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring**Exposure Limits**

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Crystalline silica, quartz	14808-60-7	TWA: 0.1 mg/m ³	TWA: 0.025 mg/m ³
Crystalline silica, cristobalite	14464-46-1	TWA: 0.1 mg/m ³	TWA: 0.025 mg/m ³
Crystalline silica, tridymite	15468-32-3	TWA: 0.1 mg/m ³	TWA: 0.05 mg/m ³

Appropriate engineering controls**Engineering Controls**

Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

Personal protective equipment (PPE)**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

No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Solid

Color: Various

Odor: Odorless

Odor Threshold: No information available

PropertyValues

Remarks/ - Method

pH:

9.9

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

2.65

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

Hydrofluoric acid.

10.6. Hazardous decomposition products

Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

11. Toxicological Information**Information on routes of exposure****Principle Route of Exposure** Eye or skin contact, inhalation.**Symptoms related to exposure****Most Important Symptoms/Effects**

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease. Potential carcinogen. Prolonged or repeated exposure may cause damage to organs.

Numerical measures of toxicity**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 information available	No data available
Crystalline silica, cristobalite	14464-46-1	>15,000 mg/kg (Human)	No data available	No data available
Crystalline silica, tridymite	15468-32-3	>15,000 mg/kg (Human)	No data available	No data available

Immediate, delayed and chronic health effects from exposure**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.

Exposure Levels

No data available

Interactive effects

Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin
Crystalline silica, cristobalite	14464-46-1	Non-irritating to the skin
Crystalline silica, tridymite	15468-32-3	Non-irritating to the skin

Substances	CAS Number	Serious eye damage/irritation
Crystalline silica, quartz	14808-60-7	Mechanical irritation of the eyes is possible. No information available
Crystalline silica, cristobalite	14464-46-1	Mechanical irritation of the eyes is possible.
Crystalline silica, tridymite	15468-32-3	Mechanical irritation of the eyes is possible.

Substances	CAS Number	Skin Sensitization
Crystalline silica, quartz	14808-60-7	No information available.
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	Respiratory Sensitization
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	Mutagenic Effects
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.
Crystalline silica, cristobalite	14464-46-1	Not regarded as mutagenic.
Crystalline silica, tridymite	15468-32-3	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. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, cristobalite	14464-46-1	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. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, tridymite	15468-32-3	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. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.

Substances	CAS Number	Reproductive toxicity
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available

Crystalline silica, tridymite	15468-32-3	No information available
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Substances	CAS Number	STOT - single exposure
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, cristobalite	14464-46-1	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, tridymite	15468-32-3	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)
Crystalline silica, cristobalite	14464-46-1	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, tridymite	15468-32-3	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
Crystalline silica, cristobalite	14464-46-1	Not applicable
Crystalline silica, tridymite	15468-32-3	Not applicable

12. Ecological Information

Ecotoxicity

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)	LL0 (96 h) =10000 mg/L (Danio rerio)	No information available	LL50 (24 h) >10000 mg/L (Daphnia magna)
Crystalline silica, cristobalite	14464-46-1	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, tridymite	15468-32-3	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 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.
Crystalline silica, cristobalite	14464-46-1	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, tridymite	15468-32-3	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
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Bury in a licensed landfill according to federal, state, and local regulations. Substance should NOT be deposited into a sewage facility.

Disposal of any 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.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product

International Inventories

Australian AICS Inventory All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.

New Zealand Inventory of Chemicals All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.

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.

Poisons Schedule number

None Allocated

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

16. Other information

Date of preparation or review

Revision Date: 15-Mar-2016

Revision Note

SDS sections updated: 2

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

H351 - Suspected of causing cancer if inhaled

H372 - Causes damage to organs through prolonged or repeated exposure if inhaled

H373 - May cause damage to organs through prolonged or repeated exposure if inhaled

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 abbreviations or acronyms used

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NOEC – No Observed Effect Concentration

OEL – Occupational Exposure Limit

PBT – Persistent Bioaccumulative and Toxic

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

vPvB – very Persistent and very Bioaccumulative

h - hour

mg/m³ - 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

SAFETY DATA SHEET

PAC™-L

Revision Date: 21-Sep-2015

Revision Number: 27

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name PAC™-L

Other means of Identification

Synonyms: None
Product Code: HM003724

Recommended use of the chemical and restrictions on use

Recommended Use Fluid Loss Additive

Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: + 61 1 800 686 951
Papua New Guinea: + 61 1 800 686 951
NewZealand: +64 800 451719

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word Not Hazardous

Hazard Statements Not Classified

Precautionary Statements

Prevention None

Response None

Storage None

Disposal None

Contains

Substances

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

NA

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).

Australia Classification

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

Classification Not Classified

Risk Phrases None

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

No significant hazards expected.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

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

Special Exposure Hazards

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 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

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.

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.

7. Handling and storage

7.1. Precautions for Safe Handling

Handling Precautions

Avoid creating or inhaling dust. Avoid dust accumulations. Ensure adequate ventilation. Slippery when wet. 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.

7.2. Conditions for safe storage, including any incompatibilities

Storage Information

Store away from oxidizers. Store in a dry location. Product has a shelf life of 36 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	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

Engineering Controls

A well ventilated area to control dust levels. Local exhaust ventilation should be used in

areas without good cross ventilation.

Personal protective equipment (PPE)

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.
Environmental Exposure Controls	Do not allow material to contaminate ground water system

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Powder	Color: White to off white
Odor: Odorless	Odor Threshold: No information available

<u>Property</u> <u>Remarks/ - Method</u>	<u>Values</u>
pH:	6.5-9 (1%)
Freezing Point/Range	No data available
Melting Point/Range	No data available
Boiling Point/Range	No data available
Flash Point	221 °C / 430 °F
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	1.6
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	400 °C / 752 °F
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
Bulk Density	40-55 lbs/ft3

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 oxidizers.

10.6. Hazardous Decomposition Products

Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on 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 None known.

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

None known.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Eye damage/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Skin Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Respiratory Sensitization
Contains no hazardous substances in	NA	Not applicable

concentrations above cut-off values according to the competent authority		
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Substances	CAS Number	Mutagenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Carcinogenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Reproductive toxicity
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - single exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - repeated exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Aspiration hazard
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

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
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Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available
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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

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product**International Inventories**

Australian AICS Inventory

All components listed on inventory or are exempt.

New Zealand Inventory of Chemicals

All components listed on inventory or are exempt.

EINECS Inventory

This product, and all its components, complies with EINECS

US TSCA Inventory

All components listed on inventory or are exempt.

Canadian DSL Inventory

All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information

Date of preparation or review**Revision Date:** 21-Sep-2015**Revision Note**

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight CAS – Chemical Abstracts Service EC50 – Effective Concentration 50% LC50 – Lethal Concentration 50% LD50 – Lethal Dose 50% LL50 – Lethal Loading 50% mg/kg – milligram/kilogram mg/L – milligram/liter NOEC – No Observed Effect Concentration OEL – Occupational Exposure Limit PBT – Persistent Bioaccumulative and Toxic ppm – parts per million STEL – Short Term Exposure Limit TWA – Time-Weighted Average vPvB – very Persistent and very Bioaccumulative h - hour mg/m³ - 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

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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

BARAZAN® D PLUS

Revision Date: 15-Sep-2015

Revision Number: 21

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name BARAZAN® D PLUS

Other means of Identification

Synonyms: None
Product Code: HM003535

Recommended use of the chemical and restrictions on use

Recommended Use Viscosifier
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word Not Hazardous

Hazard Statements Not Classified

Precautionary Statements

Prevention None

Response None

Storage None

Disposal None

Contains

Substances

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

NA

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).

Australia Classification

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

Classification Not Classified

Risk Phrases None

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

No significant hazards expected.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

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

Special Exposure Hazards

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 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

6.1. 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.

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.

7. Handling and storage

7.1. Precautions for Safe Handling

Handling Precautions

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.

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 oxidizers. Store in a cool, dry location. Product has a shelf life of 24 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	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

Engineering Controls

Use in a well ventilated area.

Personal protective equipment (PPE)

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.
Environmental Exposure Controls Do not allow material to contaminate ground water system

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Powder **Color:** White to off white
Odor: Slight **Odor Threshold:** No information available

<u>Property</u>	<u>Values</u>
Remarks/ - Method	
pH:	7 (1%)
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	1.6
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	204 °C / 400 °F
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 1000000
VOC Content (%) No data available
Bulk Density 52.4 lbs/ft3

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 oxidizers.

10.6. Hazardous Decomposition Products

Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on 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 impede respiration.
Eye Contact	May cause mild eye irritation.
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.

Exposure Levels

No data available

Interactive effects

None known.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Eye damage/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Skin Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Respiratory Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Mutagenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Carcinogenic Effects
Contains no hazardous substances in	NA	Not applicable

concentrations above cut-off values according to the competent authority		
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Substances	CAS Number	Reproductive toxicity
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - single exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - repeated exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Aspiration hazard
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

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

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product**International Inventories**

Australian AICS Inventory All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals All components listed on inventory or are exempt.
EINECS Inventory This product, and all its components, complies with EINECS
US TSCA Inventory All components listed on inventory or are exempt.
Canadian DSL Inventory All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information

Date of preparation or review

Revision Date: 15-Sep-2015

Revision Note

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight CAS – Chemical Abstracts Service EC50 – Effective Concentration 50% LC50 – Lethal Concentration 50% LD50 – Lethal Dose 50% LL50 – Lethal Loading 50% mg/kg – milligram/kilogram mg/L – milligram/liter NOEC – No Observed Effect Concentration OEL – Occupational Exposure Limit PBT – Persistent Bioaccumulative and Toxic ppm – parts per million STEL – Short Term Exposure Limit TWA – Time-Weighted Average vPvB – very Persistent and very Bioaccumulative h - hour mg/m³ - 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

WHO/FAO

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

ALDACIDE® G ANTIMICROBIAL

Revision Date: 09-May-2016

Revision Number: 35

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Dangerous Goods according to the criteria of ADG.

1.1. Product Identifier

Product Name ALDACIDE® G ANTIMICROBIAL

Other means of Identification

Synonyms None
Hazardous Material Number: HM003462

Recommended use of the chemical and restrictions on use

Recommended Use Biocide
Uses advised against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-mail Address fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Dangerous Goods according to the criteria of ADG.

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
Reproductive Toxicity	Category 1B - H360
Specific Target Organ Toxicity - (Single Exposure)	Category 3 - H335

Acute Aquatic Toxicity	Category 1 - H400
Chronic Aquatic Toxicity	Category 3 - H412

Label elements, including precautionary statements**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
 H335 - May cause respiratory irritation
 H360 - May damage fertility or the unborn child
 H400 - Very toxic to aquatic life
 H412 - Harmful to aquatic life with long lasting effects

Precautionary Statements**Prevention**

P201 - Obtain special instructions before use
 P202 - Do not handle until all safety precautions have been read and understood
 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/protective clothing/eye protection/face protection
 P281 - Use personal protective equipment as required
 P285 - In case of inadequate ventilation wear respiratory protection

Response

P301+ P312 - IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
 P330 - Rinse mouth
 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 victim to fresh air and keep at rest in a position comfortable for breathing
 P310 - Immediately call a POISON CENTER or doctor/physician
 P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
 P391 - Collect spillage

Storage

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

Disposal

P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

Contains

Substances
 Glutaraldehyde
 Methanol

CAS Number
 111-30-8
 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).

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

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Glutaraldehyde	111-30-8	10 - 30%	Acute Tox. 3 (H301) Acute Tox. 2 (H330) Skin Corr. 1B (H314) Eye Corr. 1 (H318) Resp. Sens. 1 (H334) Skin Sens. 1 (H317) STOT SE 3 (H335) Aquatic Acute 1 (H400) Aquatic Chronic 2 (H411)
Methanol	67-56-1	0.1 - 1%	Acute Tox. 3 (H301) Acute Tox. 3 (H311) Acute Tox. 3 (H331) Repr. 1B (H360) STOT SE 1 (H370) Flam. Liq. 2 (H225)

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

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.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment**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**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

6.1. 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.

6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas.

6.3. 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

7.1. Precautions for safe handling**Handling Precautions**

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.

7.2. Conditions for safe storage, including any incompatibilities**Storage Information**

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.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring**Exposure Limits**

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Glutaraldehyde	111-30-8	0.1 ppm	0.05 ppm
Methanol	67-56-1	TWA: 200 ppm TWA: 262 mg/m ³ STEL: 250 ppm STEL: 328 mg/m ³	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.

Personal protective equipment (PPE)**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.

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

9.1. Information on basic physical and chemical properties

Physical State:	Liquid	Color	Clear light yellow
Odor:	Sharp	Odor Threshold:	No information available

<u>Property</u>	<u>Values</u>
<u>Remarks/ - Method</u>	
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

9.2. Other information

VOC Content (%)	No data available
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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

Keep away from heat, sparks and flame.

10.5. Incompatible materials

Strong acids. Strong alkalis.

10.6. Hazardous decomposition products

Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on 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, vapor, 4h)

Immediate, delayed and chronic health effects from exposure

Inhalation	Toxic if inhaled. May cause allergic respiratory reaction. Causes severe respiratory irritation. Inhalation of vapors may result in skin sensitization.
Eye Contact	Causes serious eye damage.
Skin Contact	Causes severe burns. May cause an allergic skin reaction.
Ingestion	Causes burns of the mouth, throat and stomach. Harmful if swallowed.

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
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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

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

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)	LC50 (96h) 10 mg/L (Lepomis macrochirus) NOEC (97d) 1.6 mg/L (Oncorhynchus mykiss) LC50 (96h) 3.5 mg/L (Oncorhynchus mykiss)	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)
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 (Daphnia magna) NOEC (21 d) =208 mg/L (Daphnia magna)

12.2. Persistence and degradability

Readily biodegradable

Substances	CAS Number	Persistence and Degradability
Glutaraldehyde	111-30-8	Readily biodegradable (75% @ 28d)
Methanol	67-56-1	(95-97% @ 20d)

12.3. Bioaccumulative potential

Does not bioaccumulate.

Substances	CAS Number	Log Pow
Glutaraldehyde	111-30-8	-0.36
Methanol	67-56-1	-0.77 BCF = 1.0 – 4.5 (Cyprinus carpio) BCF < 10 (Leuciscus idus melanotus)

12.4. 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's constant (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

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Disposal should be made in accordance with federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

14. Transport 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: III
Environmental Hazards: Marine Pollutant

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product**International Inventories**

Australian AICS Inventory All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.
New Zealand Inventory of Chemicals All components are listed on the NZIoC or are subject to a relevant exemption, permit, or assessment certificate.
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.

Poisons Schedule number

S6

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

16. Other information

Date of preparation or review

Revision Date: 09-May-2016

Revision Note**Full text of H-Statements referred to under sections 2 and 3**

H301 - Toxic if swallowed
 H302 - Harmful if swallowed
 H314 - Causes severe skin burns and eye damage
 H317 - May cause an allergic skin reaction
 H318 - Causes serious eye damage
 H330 - Fatal if inhaled
 H331 - Toxic if inhaled

H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled

H335 - May cause respiratory irritation

H400 - Very toxic to aquatic life

H411 - Toxic to aquatic life with long lasting effects

H412 - Harmful to aquatic life with long lasting effects

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 abbreviations or acronyms used

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NOEC – No Observed Effect Concentration

OEL – Occupational Exposure Limit

PBT – Persistent Bioaccumulative and Toxic

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

vPvB – very Persistent and very Bioaccumulative

h - hour

mg/m³ - 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

SAFETY DATA SHEET

OXYGON™

Revision Date: 21-Sep-2015

Revision Number: 21

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name OXYGON™

Other means of Identification

Synonyms: None
Product Code: HM003723

Recommended use of the chemical and restrictions on use

Recommended Use Oxygen Scavenger
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word Not Hazardous

Hazard Statements Not Classified

Precautionary Statements

Prevention None

Response None

Storage None

Disposal None

Contains

Substances

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

NA

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).

Australia Classification

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

Classification Not Classified

Risk Phrases

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

No significant hazards expected.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical

Special Exposure Hazards

Not applicable.

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

6.1. 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.

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.

7. Handling and storage

7.1. Precautions for Safe Handling

Handling Precautions

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.

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 oxidizers. Store in a cool, dry location. Product has a shelf life of 36 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	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

Engineering Controls

Use in a well ventilated area.

Personal protective equipment (PPE)

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.

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.

Environmental Exposure Controls Do not allow material to contaminate ground water system

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

<u>Property</u> <u>Remarks/ - Method</u>	<u>Values</u>
pH:	5.5-8 (5%)
Freezing Point/Range	No data available
Melting Point/Range	No data available
Boiling Point/Range	No data available
Flash Point	No data available
upper flammability limit	0.5 oz/ft3
lower flammability limit	0.28 oz/ft3
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	1.2
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	640 °C / 1184 °F
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
Bulk Density 45-65 lbs/ft3

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 oxidizers.

10.6. Hazardous Decomposition Products

Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on 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	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.

Exposure Levels

No data available

Interactive effects

None known.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Eye damage/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Skin Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Respiratory Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Mutagenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Carcinogenic Effects
Contains no hazardous substances in	NA	Not applicable

concentrations above cut-off values according to the competent authority		
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Substances	CAS Number	Reproductive toxicity
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - single exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - repeated exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Aspiration hazard
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

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

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product**International Inventories**

Australian AICS Inventory All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals All components listed on inventory or are exempt.
EINECS Inventory This product, and all its components, complies with EINECS
US TSCA Inventory All components listed on inventory or are exempt.
Canadian DSL Inventory All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information

Date of preparation or review

Revision Date: 21-Sep-2015

Revision Note

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight CAS – Chemical Abstracts Service EC50 – Effective Concentration 50% LC50 – Lethal Concentration 50% LD50 – Lethal Dose 50% LL50 – Lethal Loading 50% mg/kg – milligram/kilogram mg/L – milligram/liter NOEC – No Observed Effect Concentration OEL – Occupational Exposure Limit PBT – Persistent Bioaccumulative and Toxic ppm – parts per million STEL – Short Term Exposure Limit TWA – Time-Weighted Average vPvB – very Persistent and very Bioaccumulative h - hour mg/m³ - 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

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End of Safety Data Sheet

SAFETY DATA SHEET

BARITE

Revision Date: 09-Oct-2015

Revision Number: 44

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name BARITE

Other means of Identification

Synonyms: None
Product Code: HM000105

Recommended use of the chemical and restrictions on use

Recommended Use Weight Additive
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Carcinogenicity	Category 2 - H351
Specific Target Organ Toxicity - (Repeated Exposure)	Category 2 - H373

Label elements, including precautionary statements

Hazard Pictograms



Signal Word	Warning
Hazard Statements	H351 - Suspected of causing cancer if inhaled H373 - May cause damage to organs through prolonged or repeated exposure if inhaled
Precautionary Statements	
Prevention	P201 - Obtain special instructions before use P202 - Do not handle until all safety precautions have been read and understood P260 - Do not breathe dust/fume/gas/mist/vapors/spray P281 - Use personal protective equipment as required
Response	P308 + P313 - IF exposed or concerned: Get medical advice/attention P314 - Get medical attention/advice if you feel unwell
Storage	P405 - Store locked up
Disposal	P501 - Dispose of contents/container in accordance with local/regional/national/international regulations
Contains Substances	CAS Number
Barium sulfate	7727-43-7
Crystalline silica, quartz	14808-60-7

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).

Australia Classification

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

Classification T - Toxic.

Risk Phrases R49 May cause cancer by inhalation.
R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation.

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Barium sulfate	7727-43-7	60 - 100%	
Crystalline silica, quartz	14808-60-7	1 - 5%	Carc. 2 (H351) STOT RE 1 (H372)

4. First aid measures

Description of necessary first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory

Eyes	irritation develops or if breathing becomes difficult. 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	Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Symptoms caused by exposure

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment**Suitable Extinguishing Media**

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical**Special Exposure Hazards**

None anticipated

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

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment. Avoid creating and breathing dust.

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**

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 in a well ventilated area. Keep container closed when not in use. Store locked up. 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.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Barium sulfate	7727-43-7	TWA: 10 mg/m ³	TWA: 10 mg/m ³
Crystalline silica, quartz	14808-60-7	TWA: 0.1 mg/m ³	TWA: 0.025 mg/m ³

Appropriate engineering controls

Engineering Controls

Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

Personal protective equipment (PPE)

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

No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Solid
Odor: Odorless

Color: Pink to tan to gray
Odor Threshold: No information available

Property

Values

Remarks/ - Method

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

4.23

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

Molecular Weight

233.4

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

None known.

10.6. Hazardous Decomposition Products

Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

11. Toxicological Information

Information on routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Most Important Symptoms/Effects

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

Numerical measures of toxicity

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Barium sulfate	7727-43-7	> 5000 mg/kg (Rat) > 3000mg/kg (Mouse)	No data available	>1.1 mg/L (rat, aerosol, 4hr) (similar substance)
Crystalline silica, quartz	14808-60-7	>15,000 mg/kg (Human)	No data available	No data available

Immediate, delayed and chronic health effects from exposure

Product Information

Inhalation

Under certain conditions of use, some of the product ingredients may cause the following:
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

May produce nervous system effects such as feeling of weakness, unsteady walk, and dilation of blood vessels. May affect the heart and cardiovascular system.

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.

Prolonged inhalation of fine barium sulfate dusts form harmless nodular granules in lung, an affliction called baritosis. Baritosis produces no symptoms of bronchitis or emphysema, and lung functioning is not affected although dyspnea, upon exertion, may occur. The nodulation disappears if exposure is stopped.

Exposure Levels

No data available

Interactive effects

Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Barium sulfate	7727-43-7	Non-irritating to the skin (in vitro) (similar substances)
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin

Substances	CAS Number	Eye damage/irritation
Barium sulfate	7727-43-7	Non-irritating to the eye (similar substances)
Crystalline silica, quartz	14808-60-7	Mechanical irritation of the eyes is possible.

Substances	CAS Number	Skin Sensitization
Barium sulfate	7727-43-7	Did not cause sensitization on laboratory animals (mouse) (similar substances)
Crystalline silica, quartz	14808-60-7	No information available.

Substances	CAS Number	Respiratory Sensitization
Barium sulfate	7727-43-7	No information available
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	Mutagenic Effects
Barium sulfate	7727-43-7	In vitro tests did not show mutagenic effects (similar substances)
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
Barium sulfate	7727-43-7	Did not show carcinogenic effects in animal experiments (similar substances)
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. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.

Substances	CAS Number	Reproductive toxicity
Barium sulfate	7727-43-7	No information available
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	STOT - single exposure
Barium sulfate	7727-43-7	No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Barium sulfate	7727-43-7	No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)
Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Barium sulfate	7727-43-7	Not applicable
Crystalline silica, quartz	14808-60-7	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Barium sulfate	7727-43-7	No information available	LC50 (96h) 3.5 mg/L (Danio rerio) BCF 1.2-74.4 L/kg (Lepomis macrochirus)	No information available	NOEC (7d) 100 mg/L (Cancer anthonyi)
Crystalline silica, quartz	14808-60-7	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)

12.2. Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

Substances	CAS Number	Persistence and Degradability
Barium sulfate	7727-43-7	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Does not bioaccumulate

Substances	CAS Number	Log Pow
Barium sulfate	7727-43-7	No information available
Crystalline silica, quartz	14808-60-7	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Barium sulfate	7727-43-7	No information available
Crystalline silica, quartz	14808-60-7	No information available

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Bury in a licensed landfill according to federal, state, and local regulations. Substance should NOT be deposited into a sewage facility.

Disposal of any 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.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information**Safety, health and environmental regulations specific for the product****International Inventories**

Australian AICS Inventory All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals All components listed on inventory or are exempt.
EINECS Inventory This product, and all its components, complies with EINECS
US TSCA Inventory All components listed on inventory or are exempt.
Canadian DSL Inventory All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information**Date of preparation or review****Revision Date:** 09-Oct-2015**Revision Note**

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R49 May cause cancer by inhalation.

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

H351 - Suspected of causing cancer if inhaled
H372 - Causes damage to organs through prolonged or repeated exposure
H373 - May cause damage to organs through prolonged or repeated exposure if inhaled

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 abbreviations or acronyms used

bw – body weight
CAS – Chemical Abstracts Service
EC50 – Effective Concentration 50%
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
NOEC – No Observed Effect Concentration
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
vPvB – very Persistent and very Bioaccumulative
h - hour
mg/m³ - 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

SAFETY DATA SHEET

CALCIUM CHLORIDE, ANHYDROUS POWDER

Revision Date: 27-Apr-2016

Revision Number: 31

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name CALCIUM CHLORIDE, ANHYDROUS POWDER

Other means of Identification

Synonyms None
Hazardous Material Number: HM003590

Recommended use of the chemical and restrictions on use

Recommended Use Brine
Uses advised against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: + 61 1 800 686 951
Papua New Guinea: + 61 1 800 686 951
NewZealand: +64 800 451719

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

E-mail Address fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Serious Eye Damage/Irritation	Category 2 - H319
-------------------------------	-------------------

Label elements, including precautionary statements

Hazard pictograms



Signal Word Warning
Hazard Statements: H319 - Causes serious eye irritation

Precautionary Statements

Prevention P264 - Wash face, hands and any exposed skin thoroughly after handling
 P280 - Wear 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
Storage None
Disposal None

Contains Substances Calcium chloride **CAS Number** 10043-52-4

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).

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

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Calcium chloride	10043-52-4	60 - 100%	Eye Irrit. 2A (H319)

4. First aid measures

Description of necessary 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. Remove contaminated clothing and launder before reuse.
Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Symptoms caused by exposure

Causes eye irritation

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical

Special exposure hazards in a fire

None anticipated

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. Avoid contact with skin, eyes and clothing. Ensure adequate ventilation.

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.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions

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

Storage Information

Store in a cool, dry location.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Calcium chloride	10043-52-4	Not applicable	Not applicable

Appropriate engineering controls

Engineering Controls Use in a well ventilated area.

Personal protective equipment (PPE)

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. Dust/mist respirator. (N95, P2/P3)
Hand Protection	Normal work gloves.
Skin Protection	Normal work coveralls.
Eye Protection	Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions	None known.
Environmental Exposure Controls	No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Solid	Color: White
Odor: Odorless	Odor Threshold: No information available

<u>Property</u>	<u>Values</u>
Remarks/ - Method	
pH:	10
Freezing Point / Range	No data available
Melting Point / Range	782 °C / 1439.6 °F
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	2.15
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	110.986
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

None known.

10.6. Hazardous decomposition products

None known.

11. Toxicological Information

Information on routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Most Important Symptoms/Effects

Causes eye irritation

Numerical measures of toxicity

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Calcium chloride	10043-52-4	> 1000 mg/kg (Rat) 2301 mg/kg (Rat) > 2000 mg/kg (Rat) 2240 mg/kg (Rat)	5000 mg/kg (Rabbit)	No data available

Immediate, delayed and chronic health effects from exposure

Inhalation May cause mild respiratory irritation.

Eye Contact Causes eye irritation.

Skin Contact May cause mild skin irritation.

Ingestion Irritation 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
Calcium chloride	10043-52-4	Causes mild skin irritation (Rabbit)

Substances	CAS Number	Serious eye damage/irritation
Calcium chloride	10043-52-4	Causes moderate eye irritation (Rabbit)

Substances	CAS Number	Skin Sensitization
Calcium chloride	10043-52-4	No information available

Substances	CAS Number	Respiratory Sensitization
Calcium chloride	10043-52-4	No information available

Substances	CAS Number	Mutagenic Effects
Calcium chloride	10043-52-4	Did not show mutagenic effects in animal experiments

Substances	CAS Number	Carcinogenic Effects
Calcium chloride	10043-52-4	No information available

Substances	CAS Number	Reproductive toxicity
Calcium chloride	10043-52-4	Animal testing did not show any effects on fertility.

Substances	CAS Number	STOT - single exposure
Calcium chloride	10043-52-4	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Calcium chloride	10043-52-4	No information available.

Substances	CAS Number	Aspiration hazard
Calcium chloride	10043-52-4	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Calcium chloride	10043-52-4	ErC50 (72h) 2900 mg/L (Pseudokirchnerella subcapitata) ErC50 (72h) 4000 mg/L (Pseudokirchnerella subcapitata)	LC50 (96h) 4630 mg/L (Pimephales promelas) LC50 (48h) >6560 mg/L (Pimephales promelas) LC50 (24h) >6660 mg/L (Pimephales promelas)	No information available	EC50 (48h) 2400 mg/L (Daphnia magna) EC50 (21d) 610 mg/L (reproduction) (Daphnia magna)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Calcium chloride	10043-52-4	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Calcium chloride	10043-52-4	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Calcium chloride	10043-52-4	No information available

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport
 None

HazChem Code
 None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product

International Inventories

Australian AICS Inventory	All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.
New Zealand Inventory of Chemicals	All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.
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.

Poisons Schedule number
 None Allocated

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

16. Other information

Date of preparation or review

Revision Date: 27-Apr-2016

Revision Note
 SDS sections updated: 2

Full text of H-Statements referred to under sections 2 and 3
 H319 - Causes serious eye irritation

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 abbreviations or acronyms used

bw – body weight
 CAS – Chemical Abstracts Service
 EC50 – Effective Concentration 50%
 LC50 – Lethal Concentration 50%
 LD50 – Lethal Dose 50%
 LL50 – Lethal Loading 50%
 mg/kg – milligram/kilogram
 mg/L – milligram/liter

NOEC – No Observed Effect Concentration
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
vPvB – very Persistent and very Bioaccumulative
h - hour
mg/m³ - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
w/w - weight/weight
d - day

Key literature references and sources for data

www.ChemADVISOR.com/
OSHA
ECHA C&L

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End of Safety Data Sheet

SAFETY DATA SHEET

SODIUM BICARBONATE

Revision Date: 22-Sep-2015

Revision Number: 26

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name SODIUM BICARBONATE

Other means of Identification

Synonyms: None
Product Code: HM001824

Recommended use of the chemical and restrictions on use

Recommended Use Buffer
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word Not Hazardous

Hazard Statements Not Classified

Precautionary Statements

Prevention None

Response None

Storage None

Disposal None

Contains

Substances

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

NA

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).

Australia Classification

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

Classification Not Classified

Risk Phrases None

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

No significant hazards expected.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical**Special Exposure Hazards**

Not applicable.

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**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.

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.

7. Handling and storage**7.1. Precautions for Safe Handling****Handling Precautions**

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.

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 dry location.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection**Control parameters - exposure standards, biological monitoring****Exposure Limits**

Substances	CAS Number	Australia NOHSC	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**Engineering Controls**

A well ventilated area to control dust levels. Local exhaust ventilation should be used in areas without good cross ventilation.

Personal protective equipment (PPE)**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.

Environmental Exposure Controls

Do not allow material to contaminate ground water system

cut-off values according to the competent authority				
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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	None known.

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

None known.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Eye damage/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Skin Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Respiratory Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Mutagenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Carcinogenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Reproductive toxicity

Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable
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Substances	CAS Number	STOT - single exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - repeated exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Aspiration hazard
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

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

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations**Safe handling and disposal methods**

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information**Safety, health and environmental regulations specific for the product****International Inventories**

Australian AICS Inventory	All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS
US TSCA Inventory	All components listed on inventory or are exempt.
Canadian DSL Inventory	All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information**Date of preparation or review**

Revision Date: 22-Sep-2015

Revision Note

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight CAS – Chemical Abstracts Service EC50 – Effective Concentration 50% LC50 – Lethal Concentration 50% LD50 – Lethal Dose 50% LL50 – Lethal Loading 50% mg/kg – milligram/kilogram mg/L – milligram/liter NOEC – No Observed Effect Concentration OEL – Occupational Exposure Limit PBT – Persistent Bioaccumulative and Toxic ppm – parts per million STEL – Short Term Exposure Limit TWA – Time-Weighted Average vPvB – very Persistent and very Bioaccumulative h - hour mg/m³ - 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

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End of Safety Data Sheet

SAFETY DATA SHEET

STEELSEAL®

Revision Date: 22-Sep-2015

Revision Number: 22

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name STEELSEAL®

Other means of Identification

Synonyms: None
Product Code: HM003768

Recommended use of the chemical and restrictions on use

Recommended Use Loss Circulation Material
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: + 61 1 800 686 951
Papua New Guinea: + 61 1 800 686 951
NewZealand: +64 800 451719

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements**Hazard Pictograms****Signal Word** Not Hazardous**Hazard Statements** Not Classified**Precautionary Statements****Prevention** None**Response** None**Storage** None**Disposal** None**Contains****Substances**

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

NA

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).

Australia Classification*For the full text of the H-phrases mentioned in this Section, see Section 16***Classification** Not Classified**Risk Phrases** None**3. Composition/information on Ingredients**

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures**Description of necessary 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** Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.**Symptoms caused by exposure**

No significant hazards expected.

Medical Attention and Special Treatment

Notes to Physician

Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment**Suitable Extinguishing Media**

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical**Special Exposure Hazards**

Combustible dust when in finely divided and highly suspended state.

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

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.

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.

7. Handling and storage

7.1. Precautions for Safe Handling**Handling Precautions**

Avoid creating or inhaling dust. Avoid dust accumulations. Wet activated carbon removes oxygen from air causing a severe hazard to workers inside carbon vessels and enclosed or confined spaces. Before entering such an area, sampling and dark procedures for low oxygen levels should be taken to ensure ample oxygen availability. 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.

7.2. Conditions for safe storage, including any incompatibilities**Storage Information**

Store away from oxidizers. Store in a dry location. Keep from heat, sparks, and open flames. Product has a shelf life of 60 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring**Exposure Limits**

Substances	CAS Number	Australia NOHSC	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**Engineering Controls**

A well ventilated area to control dust levels.

Personal protective equipment (PPE)

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.
Environmental Exposure Controls	Do not allow material to contaminate ground water system

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Solid	Color:	Dark gray
Odor:	Odorless	Odor Threshold:	No information available

<u>Property</u>	<u>Values</u>
Remarks/ - Method	
pH:	No data available
Freezing Point/Range	No data available
Melting Point/Range	No data available
Boiling Point/Range	4200 °C / 7592 °F
Flash Point	> 356 °C / > 673 °F
lower flammability limit	0.07-0.12 oz/ft3
Evaporation rate	No data available
Vapor Pressure	1
Vapor Density	0.4
Specific Gravity	1.75
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
Bulk Density	38-45 lbs/ft3

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. Strong alkalis.

10.6. Hazardous Decomposition Products

Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on 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 mechanical irritation to eye.

Skin Contact

May cause mild skin irritation.

Ingestion

May cause mild gastric distress.

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
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Eye damage/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Skin Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Respiratory Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Mutagenic Effects
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Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable
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Substances	CAS Number	Carcinogenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Reproductive toxicity
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - single exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - repeated exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Aspiration hazard
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

12. Ecological Information

Ecotoxicity
Product Ecotoxicity Data
 No data available

Substance Ecotoxicity Data

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

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product**International Inventories**

Australian AICS Inventory All components listed on inventory or are exempt.

New Zealand Inventory of Chemicals All components listed on inventory or are exempt.

EINECS Inventory This product, and all its components, complies with EINECS

US TSCA Inventory All components listed on inventory or are exempt.

Canadian DSL Inventory All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information

Date of preparation or review**Revision Date:** 22-Sep-2015**Revision Note**

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight CAS – Chemical Abstracts Service EC50 – Effective Concentration 50% LC50 – Lethal Concentration 50% LD50 – Lethal Dose 50% LL50 – Lethal Loading 50% mg/kg – milligram/kilogram mg/L – milligram/liter NOEC – No Observed Effect Concentration OEL – Occupational Exposure Limit PBT – Persistent Bioaccumulative and Toxic ppm – parts per million STEL – Short Term Exposure Limit TWA – Time-Weighted Average vPvB – very Persistent and very Bioaccumulative h - hour mg/m³ - 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

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End of Safety Data Sheet

MATERIAL SAFETY DATA SHEET

Product Trade Name: BARAKLEAN® DUAL

Revision Date: 09-Jul-2014

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Statement of Hazardous Nature Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: 08-64244950
Papua New Guinea: 05 1 281 575 5000
New Zealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

Identification of Substances or Preparation

Product Trade Name: BARAKLEAN® DUAL
Synonyms: None
Chemical Family: Blend
Dangerous Goods Class: None
Subsidiary Risk: None
Hazchem Code: None Allocated
Poisons Schedule: None Allocated
Application: Solvent Cleaning Solution

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. HAZARDS IDENTIFICATION

Statement of Hazardous Nature Hazardous according to the criteria of NOHSC, Non-Dangerous Goods according to the criteria of ADG.

Hazard Overview May cause severe eye irritation. May cause skin irritation. May cause headache, dizziness, and other central nervous system effects. May be harmful if swallowed. May be absorbed through the skin. Combustible

Classification Xn - Harmful.

Risk Phrases R38 Irritating to skin.
R41 Risk of serious damage to eyes.
R20/21/22 Harmful by inhalation, by contact with skin and if swallowed.

Safety Phrases S46 If swallowed, seek medical advice immediately and show this container or label.
S36/37 Wear suitable protective clothing and gloves.

HSNO Classification 6.1D (Oral) Acutely Toxic Substances
6.1D (Dermal) Acutely Toxic Substances
6.1D (Inhalation) Acutely Toxic Substances
6.4A Irritating to the eye
8.3A Corrosive to ocular tissue
9.1A Very ecotoxic in the aquatic environment

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT (w/w)	Australia	NOHSC	New Zealand	ACGIH TLV-TWA
			WES			
Ethylene glycol monobutyl ether	111-76-2	30 - 60%	TWA: 20 ppm 96.9 mg/m ³ STEL: 50 ppm STEL: 242 mg/m ³	TWA: 25 ppm	TWA: 121 mg/m ³	TWA: 20 ppm
Alcohols, C9-11, ethoxylated	68439-46-3	10 - 30%	Not applicable	Not applicable	Not applicable	Not applicable

Non-Hazardous Substance to Total of 100%

4. FIRST AID MEASURES

Inhalation If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult give oxygen. Get medical attention.

Skin In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes. Get medical attention. Remove contaminated clothing and launder before reuse.

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.

Ingestion If swallowed, induce vomiting immediately by giving two glasses of water and sticking fingers down throat; never give anything to an unconscious person. Get medical attention.

Notes to Physician Not Applicable

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Water fog, carbon dioxide, foam, dry chemical.

Extinguishing media which must not be used for safety reasons

None known.

Special Exposure Hazards Use water spray to cool fire exposed surfaces. Closed containers may explode in fire. Decomposition in fire may produce toxic gases. Fight fire from a safe distance and from a protected location.

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 Precautionary Measures Use appropriate protective equipment. Wear self-contained breathing apparatus in enclosed areas.

Environmental Precautionary Measures Prevent from entering sewers, waterways, or low areas.

Procedure for Cleaning / Absorption Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Wash hands after use. Launder contaminated clothing before reuse.

Storage Information Store away from oxidizers. Keep from heat, sparks, and open flames. Keep container closed when not in use. Product has a shelf life of 24 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.

Respiratory Protection Organic vapor respirator.
In high concentrations, supplied air respirator or a self-contained breathing apparatus.

Hand Protection Butyl rubber gloves.

Skin Protection Rubber apron.

Eye Protection Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions Eyewash fountains and safety showers must be easily accessible. Rubber boots

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Color:	Clear
Odor:	Characteristic
pH:	4 (10%)
Specific Gravity @ 20 C (Water=1):	0.97
Density @ 20 C (kg/l):	0.944
Bulk Density @ 20 C (kg/M3):	Not Determined
Boiling Point/Range (C):	168-173
Freezing Point/Range (C):	-70
Pour Point/Range (C):	Not Determined
Flash Point/Range (C):	68

Flash Point Method:	CC
Autoignition Temperature (C):	240
Flammability Limits in Air - Lower (g/m ³):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (g/m ³):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined
Vapor Pressure @ 20 C (mmHg):	.968 @ 25C
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Miscible
Solubility in Solvents (g/100ml):	Not Determined
VOCs (g/l):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined
Decomposition Temperature (C):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	Keep away from heat, sparks and flame.
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Acute Toxicity

Inhalation

May cause respiratory irritation. May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.

Eye Contact

May cause severe eye irritation.

Skin Contact

May cause skin irritation. May be absorbed through the skin and produce effects similar to those caused by inhalation and/or ingestion.

Ingestion

May cause abdominal pain, vomiting, nausea, and diarrhea.

Chronic Effects/Carcinogenicity

Prolonged or repeated exposure may cause embryo and fetus toxicity. May cause testicular toxicity. Repeated overexposure may cause liver and kidney effects.

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
------------	------------	-----------	-------------	-----------------

Ethylene glycol monobutyl ether	111-76-2	470 mg/kg (Rat) 1414 mg/kg (Guinea pig) 1746 mg/kg (Rat) 320 mg/kg (Rabbit) 530 mg/kg (Rat) 560 mg/kg (Rat) 3000 mg/kg (Rat) 2400 (Rat)	220 mg/kg (Rabbit) 2270 mg/kg (Rat) 200 mg/kg (Guinea pig) >2000 mg/kg (Rabbit) 841 mg/kg (Rabbit) 435 mg/kg (Rabbit) >2000 mg/kg (Guinea pig) >2000 mg/kg (Rat) 100 mg/kg (Rabbit) 207 mg/kg (Guinea pig) 400-500 mg/kg (Rabbit)	450 ppm (Rat) 4h 2.174 mg/L (Rat) 4h 2.21 mg/L (Rat) 4h 450-486 ppm (Rat) 4h 925 ppm (Rat) 4h >633 ppm (Guinea pig) 1h
Alcohols, C9-11, ethoxylated	68439-46-3	1400 mg/kg (Rat) 1378 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	No toxicity at saturation (similar substances)

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

Ecotoxicity Product

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined

Ecotoxicity Substance

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Ethylene glycol monobutyl ether	111-76-2	EC50: 839.56 mg/l (Skeletonema costatum) EC50(72h): 911 mg/L (biomass) EC50: > 500 mg/l (Scenedesmus subspicatus) NOEC(72h): 88 mg/L (biomass)(Pseudokirchnerella subcapitata)	LC50: > 1000 mg/l (Scophthalmus maximus juvenile) LC50(96h): 1474 mg/L (Oncorhynchus mykiss) NOEC(21d): > 100mg/L (Danio rerio)	TT/EC3(48h): 463 mg/L (Uronema parduzci) TT/EC3(72h): 73 mg/L (Entosiphon sulcatum) TT/EC3(16h): 700 mg/L (Pseudomonas putida)	EC50: >1000 mg/L (Daphnia magna) EC50 (48h): 1800 mg/L (Daphnia magna) EC50: 1875 mg/l (Daphnia magna) NOEC(21d)(reproduction) : 100 mg/L (Daphnia magna)
Alcohols, C9-11, ethoxylated	68439-46-3	EC50(96h): 0.26 mg/L (Selenastrum capricornutum)	LC50(96h): 5.7 mg/L (Oncorhynchus mykiss) NOEC(30d): 0.28 mg/L (Pimephales promelas) (similar substance)	No information available	EC50(48h): 2.5 mg/L (Daphnia magna) NOEC(21d): 1.75 mg/L (Daphnia magna) (similar substance)

12.2. Persistence and degradability

No information available

Substances	Persistence and Degradability
Ethylene glycol monobutyl ether	Readily biodegradable (75-88% @ 28d)
Alcohols, C9-11, ethoxylated	Readily biodegradable (72 - 89% @ 28d) (similar substances)

12.3. Bioaccumulative potential

Does not bioaccumulate

Substances	Log Pow
Ethylene glycol monobutyl ether	0.81

12.4. Mobility in soil

No information available

12.5. Results of PBT and vPvB assessment

This mixture contains no substance considered to be very persistent nor very bioaccumulating (vPvB).

12.6. Other adverse effects

13. DISPOSAL CONSIDERATIONS

Disposal Method Disposal should be made in accordance with federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Australia Dangerous Goods

UN Number: Not restricted.
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: 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

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

Chemical Inventories

Australian AICS Inventory All components listed on inventory or are exempt.

New Zealand Inventory of Chemicals All components listed on inventory or are exempt.

US TSCA Inventory All components listed on inventory or are exempt.

EINECS Inventory This product, and all its components, complies with EINECS

Classification Xn - Harmful.

Risk Phrases R38 Irritating to skin.
R41 Risk of serious damage to eyes.
R20/21/22 Harmful by inhalation, by contact with skin and if swallowed.

Safety Phrases S46 If swallowed, seek medical advice immediately and show this container or label.
S36/37 Wear suitable protective clothing and gloves.

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS

Not applicable

Contact

Australian Poisons Information Centre

24 Hour Service: - 13 11 26

Police or Fire Brigade: - 000 (exchange): - 1100

New Zealand National Poisons Centre

0800 764 766

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 Compliance at 1-580-251-4335.

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 MSDS*****

SAFETY DATA SHEET

QUIK-FREE®

Revision Date: 30-Sep-2015

Revision Number: 17

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name QUIK-FREE®

Other means of Identification

Synonyms: None
Product Code: HM004906

Recommended use of the chemical and restrictions on use

Recommended Use Spotting fluid
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word Not Hazardous

Hazard Statements Not Classified

Precautionary Statements

Prevention None

Response None

Storage None

Disposal None

Contains

Substances

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

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).

Australia Classification

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

Classification Not Classified

Risk Phrases None

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures

Description of necessary first aid measures

Inhalation If inhaled, move victim to fresh air and seek medical attention.
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 Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Symptoms caused by exposure

No significant hazards expected.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

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

Special Exposure Hazards

Decomposition in fire may produce harmful gases.

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

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment.

6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas.

6.3. 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

7.1. Precautions for Safe Handling

Handling Precautions

Avoid contact with eyes, skin, or clothing. Wash hands after use.

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 oxidizers. Product has a shelf life of 36 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	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

Engineering Controls Use in a well ventilated area.

Personal protective equipment (PPE)

Respiratory Protection Not normally necessary.

Hand Protection Impervious rubber gloves.

Skin Protection Normal work coveralls.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

Environmental Exposure Controls No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Liquid
Odor: Fatty acid
Color: Clear light yellow
Odor Threshold: No information available

<u>Property</u> <u>Remarks/ - Method</u>	<u>Values</u>
pH:	No data available
Freezing Point/Range	No data available
Melting Point/Range	No data available
Boiling Point/Range	No data available
Flash Point	> 180 °C / > 356 °F PMCC
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	0.98
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 oxidizers.

10.6. Hazardous Decomposition Products

Oxides of sulfur. Acrolein. Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on 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.

Exposure Levels

No data available

Interactive effects

None known.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Eye damage/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Skin Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Respiratory Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Mutagenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Carcinogenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Reproductive toxicity
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - single exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - repeated exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Aspiration hazard
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

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

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Disposal should be made in accordance with federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product

International Inventories

Australian AICS Inventory	Product contains one or more components not listed on inventory.
New Zealand Inventory of Chemicals	All components listed on inventory or are exempt.
EINECS Inventory	This product, and all its components, complies with EINECS
US TSCA Inventory	All components listed on inventory or are exempt.
Canadian DSL Inventory	Product contains one or more components not listed on the inventory.

Poisons Schedule number

None Allocated

16. Other information

Date of preparation or review

Revision Date: 30-Sep-2015

Revision Note

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight CAS – Chemical Abstracts Service EC50 – Effective Concentration 50% LC50 – Lethal Concentration 50% LD50 – Lethal Dose 50% LL50 – Lethal Loading 50% mg/kg – milligram/kilogram mg/L – milligram/liter NOEC – No Observed Effect Concentration OEL – Occupational Exposure Limit PBT – Persistent Bioaccumulative and Toxic ppm – parts per million STEL – Short Term Exposure Limit TWA – Time-Weighted Average vPvB – very Persistent and very Bioaccumulative h - hour mg/m³ - milligram/cubic meter mm - millimeter mmHg - millimeter mercury w/w - weight/weight d - day

Key literature references and sources for data

www.ChemADVISOR.com/

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

SODIUM CHLORIDE

Revision Date: 08-Sep-2015

Revision Number: 23

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name SODIUM CHLORIDE

Other means of Identification

Synonyms: None
Product Code: HM001682

Recommended use of the chemical and restrictions on use

Recommended Use Additive
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300
E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word Not Hazardous

Hazard Statements Not Classified

Precautionary Statements

Prevention None

Response None

Storage None

Disposal None

Contains

Substances

Sodium chloride

CAS Number

7647-14-5

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).

Australia Classification

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

Classification Not Classified

Risk Phrases None

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Sodium chloride	7647-14-5	60 - 100%	

4. First aid measures

Description of necessary 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.

Symptoms caused by exposure

Causes mild eye irritation.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical

Special Exposure Hazards

None anticipated

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**6.1. Personal precautions, protective equipment and emergency procedures**

Use appropriate protective equipment. Avoid creating and breathing dust.

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.

7. Handling and storage**7.1. Precautions for Safe Handling****Handling Precautions**

Avoid creating or inhaling dust.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities**Storage Information**

Store in a cool, dry location.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection**Control parameters - exposure standards, biological monitoring****Exposure Limits**

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Sodium chloride	7647-14-5	Not applicable	Not applicable

Appropriate engineering controls**Engineering Controls**

Use in a well ventilated area.

Personal protective equipment (PPE)**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.

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.

Environmental Exposure Controls

No information available

9. Physical and Chemical Properties**9.1. Information on basic physical and chemical properties**

Physical State: Solid
Odor: Odorless

Color: White
Odor Threshold: No information available

PropertyValuesRemarks/ - Method**pH:**

No data available

Freezing Point/Range

No data available

Melting Point/Range

801 °C / 1473.8 °F

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

2.16

Water Solubility

Very soluble

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

None known.

10.6. Hazardous Decomposition Products

None known.

11. Toxicological Information

Information on routes of exposure**Principle Route of Exposure** Eye or skin contact, inhalation.**Symptoms related to exposure****Most Important Symptoms/Effects**

Causes mild eye irritation.

Numerical measures of toxicity**Toxicology data for the components**

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium chloride	7647-14-5	3000 mg/kg (Rat) 3550 mg/kg (Rat)	>10000 mg/kg (Rabbit)	42 mg/L (Rat) 1h

Immediate, delayed and chronic health effects from exposure**Inhalation** May cause mild respiratory irritation.**Eye Contact** Causes mild eye irritation.**Skin Contact** May cause mild skin irritation.

Ingestion None known.

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

None known.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Sodium chloride	7647-14-5	Non-irritating to the skin (Rabbit)

Substances	CAS Number	Eye damage/irritation
Sodium chloride	7647-14-5	May cause mild eye irritation. (Rabbit)

Substances	CAS Number	Skin Sensitization
Sodium chloride	7647-14-5	No information available

Substances	CAS Number	Respiratory Sensitization
Sodium chloride	7647-14-5	No information available

Substances	CAS Number	Mutagenic Effects
Sodium chloride	7647-14-5	No information available

Substances	CAS Number	Carcinogenic Effects
Sodium chloride	7647-14-5	Did not show carcinogenic effects in animal experiments

Substances	CAS Number	Reproductive toxicity
Sodium chloride	7647-14-5	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Sodium chloride	7647-14-5	No information available

Substances	CAS Number	STOT - repeated exposure
Sodium chloride	7647-14-5	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	Aspiration hazard
Sodium chloride	7647-14-5	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Sodium chloride	7647-14-5	EC50 (120h) 2430 mg/L (Nitzschia sp.)	TLM96 > 1000 mg/L (Oncorhynchus mykiss) LC50 (96h) 5840 mg/L (Lepomis macrochirus) NOEC (33d) 252 mg/L (Pimephales promelas)	NOEC 5000 – 8000 mg/L (activated sludge) NOEC 292-584 mg/L (Escherichia coli)	TLM96 > 1,000,000 ppm (Mysidopsis bahia) LC50 (48h) 874-4136 mg/L (Daphnia magna) NOEC (21d) 314 mg/L (Daphnia pulex)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Sodium chloride	7647-14-5	No information available

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Sodium chloride	7647-14-5	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Sodium chloride	7647-14-5	No information available

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations**Safe handling and disposal methods**

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any 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.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information**Safety, health and environmental regulations specific for the product****International Inventories**

Australian AICS Inventory All components listed on inventory or are exempt.

New Zealand Inventory of Chemicals All components listed on inventory or are exempt.

EINECS Inventory This product, and all its components, complies with EINECS

US TSCA Inventory All components listed on inventory or are exempt.

Canadian DSL Inventory All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information

Date of preparation or review**Revision Date:** 08-Sep-2015**Revision Note**

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight CAS – Chemical Abstracts Service EC50 – Effective Concentration 50% LC50 – Lethal Concentration 50% LD50 – Lethal Dose 50% LL50 – Lethal Loading 50% mg/kg – milligram/kilogram mg/L – milligram/liter NOEC – No Observed Effect Concentration OEL – Occupational Exposure Limit PBT – Persistent Bioaccumulative and Toxic ppm – parts per million STEL – Short Term Exposure Limit TWA – Time-Weighted Average vPvB – very Persistent and very Bioaccumulative h - hour mg/m³ - 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

SAFETY DATA SHEET

BAROFIBRE®

Revision Date: 15-Sep-2015

Revision Number: 26

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature 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.

1.1. Product Identifier

Product Name BAROFIBRE®

Other means of Identification

Synonyms: None
Product Code: HM003539

Recommended use of the chemical and restrictions on use

Recommended Use Loss Circulation Material
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: + 61 1 800 686 951
Papua New Guinea: + 61 1 800 686 951
NewZealand: +64 800 451719

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature 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.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements**Hazard Pictograms****Signal Word** Not Hazardous**Hazard Statements** Not Classified**Precautionary Statements****Prevention** None**Response** None**Storage** None**Disposal** None**Contains****Substances**

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

CAS Number

NA

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).

Australia Classification*For the full text of the H-phrases mentioned in this Section, see Section 16***Classification** Not Classified**Risk Phrases** None**3. Composition/information on Ingredients**

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not Applicable

4. First aid measures**Description of necessary first aid measures****Inhalation** Under normal conditions, first aid procedures are not required. Move person to fresh air.**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** Under normal conditions, first aid procedures are not required.**Ingestion** Under normal conditions, first aid procedures are not required.**Symptoms caused by exposure**

No significant hazards expected.

Medical Attention and Special Treatment**Notes to Physician** Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

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

Special Exposure Hazards

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 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

6.1. 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.

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.

7. Handling and storage

7.1. Precautions for Safe Handling

Handling Precautions

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.

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 oxidizers. Store in a dry location. Product has a shelf life of 36 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	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

Engineering Controls Use in a well ventilated area.

Personal protective equipment (PPE)

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. Dust/mist respirator. (N95, P2/P3)
Hand Protection	Normal work gloves.
Skin Protection	Normal work coveralls.
Eye Protection	Safety glasses.
Other Precautions	None known.
Environmental Exposure Controls	Do not allow material to contaminate ground water system

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Solid Powder	Color:	Tan
Odor:	Odorless	Odor Threshold:	No information available

<u>Property</u>	<u>Values</u>
<u>Remarks/ - Method</u>	
pH:	4.9 (1%)
Freezing Point/Range	190 °C
Melting Point/Range	No data available
Boiling Point/Range	No data available
Flash Point	193 °C / 380 °F PMCC
lower flammability limit	0.29
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	1.3
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

9.2. Other information

VOC Content (%)	No data available
Bulk Density	24-31 lbs/ft3

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 oxidizers.

10.6. Hazardous Decomposition Products

None known.

11. Toxicological Information

Information on 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 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.

Exposure Levels

No data available

Interactive effects

None known.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Eye damage/irritation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable.

Substances	CAS Number	Skin Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Respiratory Sensitization
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Mutagenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Carcinogenic Effects
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Reproductive toxicity
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - single exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	STOT - repeated exposure
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

Substances	CAS Number	Aspiration hazard
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

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

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations**Safe handling and disposal methods**

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

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

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information**Safety, health and environmental regulations specific for the product****International Inventories**

Australian AICS Inventory All components listed on inventory or are exempt.
New Zealand Inventory of Chemicals All components listed on inventory or are exempt.

EINECS Inventory This product, and all its components, complies with EINECS
US TSCA Inventory All components listed on inventory or are exempt.
Canadian DSL Inventory All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

16. Other information

Date of preparation or review

Revision Date: 15-Sep-2015

Revision Note

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

None

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

None

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 abbreviations or acronyms used

bw – body weight CAS – Chemical Abstracts Service EC50 – Effective Concentration 50% LC50 – Lethal Concentration 50% LD50 – Lethal Dose 50% LL50 – Lethal Loading 50% mg/kg – milligram/kilogram mg/L – milligram/liter NOEC – No Observed Effect Concentration OEL – Occupational Exposure Limit PBT – Persistent Bioaccumulative and Toxic ppm – parts per million STEL – Short Term Exposure Limit TWA – Time-Weighted Average vPvB – very Persistent and very Bioaccumulative h - hour mg/m³ - 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

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End of Safety Data Sheet

SAFETY DATA SHEET

BARACOR® 100

Revision Date: 22-Jan-2016

Revision Number: 52

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Dangerous Goods according to the criteria of ADG.

1.1. Product Identifier

Product Name BARACOR® 100

Other means of Identification

Synonyms: None
Product Code: HM003391

Recommended use of the chemical and restrictions on use

Recommended Use Corrosion Inhibitor
Uses Advised Against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton/Baroid Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: 61 (08) 9455 8300
Fax Number: 61 (08) 9455 5300

Product Emergency Telephone

Australia: + 61 1 800 686 951
Papua New Guinea: + 61 1 800 686 951
NewZealand: +64 800 451719

Fire, Police & Ambulance - Emergency Telephone

Australia: 000
Papua New Guinea: 000
New Zealand: 111

E-Mail address: fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Dangerous Goods according to the criteria of ADG.

Classification of the hazardous chemical

Acute Oral Toxicity	Category 4 - H302
Skin Corrosion / irritation	Category 2 - H315
Serious Eye Damage / Eye Irritation	Category 1 - H318
Skin Sensitization	Category 1 - H317
Carcinogenicity	Category 2 - H351
Reproductive Toxicity	Category 1B - H360
Specific Target Organ Toxicity - (Single Exposure)	Category 1 - H370
Flammable liquids.	Category 3 - H226

Label elements, including precautionary statements**Hazard Pictograms****Signal Word**

Danger

Hazard Statements

H226 - Flammable liquid and vapor
 H302 - Harmful if swallowed
 H315 - Causes skin irritation
 H317 - May cause an allergic skin reaction
 H318 - Causes serious eye damage
 H351 - Suspected of causing cancer
 H360 - May damage fertility or the unborn child
 H370 - Causes damage to organs

Precautionary Statements**Prevention**

P201 - Obtain special instructions before use
 P202 - Do not handle until all safety precautions have been read and understood
 P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking
 P233 - Keep container tightly closed
 P240 - Ground/Bond container and receiving equipment
 P241 - Use explosion-proof electrical/ventilating/lighting/equipment
 P242 - Use only non-sparking tools
 P243 - Take precautionary measures against static discharge
 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
 P272 - Contaminated work clothing should not be allowed out of the workplace
 P280 - Wear protective gloves/eye protection/face protection
 P281 - Use personal protective equipment as required

Response

P301+ P312 - IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
 P330 - Rinse mouth
 P302 + P352 - IF ON SKIN: Wash with plenty of soap and water
 P333 + P313 - If skin irritation or rash occurs: Get medical advice/attention
 P363 - Wash contaminated clothing before reuse

P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
 P310 - Immediately call a POISON CENTER or doctor/physician
 P307 + P311 - IF exposed: Call a POISON CENTER or doctor/physician
 P370 + P378 - In case of fire: Use water spray for extinction

Storage P403 + P235 - Store in a well-ventilated place. Keep cool
 P405 - Store locked up

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

Contains**Substances**

Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues

Methanol

Nitritotriacetic acid, trisodium salt monohydrate

CAS Number

68909-77-3

67-56-1

5064-31-3

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).

Australia Classification

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

Classification T - Toxic.

Risk Phrases

R10 Flammable.

R22 Harmful if swallowed.

R38 Irritating to skin.

R40 Limited evidence of a carcinogenic effect.

R41 Risk of serious damage to eyes.

R43 May cause sensitization by skin contact.

R61 May cause harm to the unborn child.

R39/23/24/25 Toxic: danger of very serious irreversible effects through inhalation, in contact with skin, and if swallowed.

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	10 - 30%	Skin Irrit. 2 (H315) Eye Corr. 1 (H318) Skin Sens. 1 (H317)
Methanol	67-56-1	10 - 30%	Acute Tox. 3 (H301) Acute Tox. 3 (H311) Acute Tox. 3 (H331) Repr. 1B (H360) STOT SE 1 (H370) Flam. Liq. 2 (H225)
Nitritotriacetic acid, trisodium salt monohydrate	5064-31-3	1 - 5%	Acute Tox. 4 (H302) Eye Irrit. 2A (H319) Carc. 2 (H351)

4. First aid measures

Description of necessary 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 15 minutes. Get medical attention. Remove contaminated clothing and launder before reuse.
Ingestion	Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Symptoms caused by exposure

Causes severe eye irritation which may damage tissue. Causes skin irritation. May cause allergic skin reaction. Harmful if swallowed. Potential carcinogen. Potential reproductive hazard. May cause birth defects. May cause damage to internal organs.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment**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**Special Exposure Hazards**

May be ignited by heat, sparks or flames. Use water spray to cool fire exposed surfaces. Closed containers may explode in fire. Decomposition in fire may produce harmful gases. Runoff to sewer may cause fire or explosion hazard.

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

6.1. Personal precautions, protective equipment and emergency procedures

Remove sources of ignition. Use appropriate protective equipment. Wear self-contained breathing apparatus in enclosed areas. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing. Avoid breathing vapors. Evacuate all persons from the area.

6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas. Consult local authorities.

6.3. Methods and material for containment and cleaning up

Isolate spill and stop leak where safe. Remove ignition sources and work with non-sparking tools. Contain spill with sand or other inert materials. Scoop up and remove.

7. Handling and storage

7.1. Precautions for Safe Handling**Handling Precautions**

Remove sources of ignition. Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Ensure adequate ventilation. Wash hands after use. Launder contaminated clothing before reuse. Ground and bond containers when transferring from one container to another. 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**Storage Information**

Store away from oxidizers. Keep from heat, sparks, and open flames. Keep container closed when not in use. Product has a shelf life of 24 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring**Exposure Limits**

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	Not applicable	Not applicable
Methanol	67-56-1	TWA: 200 ppm TWA: 262 mg/m ³ STEL: 250 ppm STEL: 328 mg/m ³	TWA: 200 ppm STEL: 250 ppm
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	Not applicable	Not applicable

Appropriate engineering controls**Engineering Controls**

Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.

Personal protective equipment (PPE)**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. Positive pressure self-contained breathing apparatus if methanol is released.

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): Neoprene gloves. Nitrile gloves. Butyl rubber gloves. (>= .? 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

Rubber apron.

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

9.1. Information on basic physical and chemical properties

Physical State: Liquid

Color: Brown

Odor: Alcohol

Odor Threshold: No information available

Property

Values

Remarks/ - Method

pH:

9-11

Freezing Point/Range

-23 °C

Melting Point/Range

No data available

Boiling Point/Range

100 °C / 212 °F

Flash Point	33 °C / 92 °F PMCC
upper flammability limit	36%
lower flammability limit	6%
Evaporation rate	1.6
Vapor Pressure	No data available
Vapor Density	> 1
Specific Gravity	1.01
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	-0.84
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

Keep away from heat, sparks and flame.

10.5. Incompatible Materials

Strong oxidizers.

10.6. Hazardous Decomposition Products

Ammonia. Oxides of nitrogen. Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure**Most Important Symptoms/Effects**

Causes severe eye irritation which may damage tissue. Causes skin irritation. May cause allergic skin reaction. Harmful if swallowed. Potential carcinogen. Potential reproductive hazard. May cause birth defects. May cause damage to internal organs.

Numerical measures of toxicity**Toxicology data for the components**

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	3816 mg/kg-bw (rat)	> 2000 mg/kg (Rat)	No toxicity at saturation (rat, 8 h, vapour)
Methanol	67-56-1	< 790 mg/kg (rat) 7300 mg/kg (mouse) 14200 mg/kg (rabbit) 300 mg/kg (Human) 6200 mg/kg (Rat)	15800 mg/kg (Rabbit) 393 mg/kg bw (primates) 1000 mg/kg (Human) 15800 mg/kg (Rabbit)	10 mg/L (Human) 4h (vapor) 22,500 ppm (Rat) 8h 64,000 ppm (Rat) 4h 83.2 mg/L (rat) 4h 128.8 mg/L (rat) 4h
Nitritotriacetic acid, trisodium salt monohydrate	5064-31-3	1740 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 5 mg/L (Rat, Aerosol, 4h)

Immediate, delayed and chronic health effects from exposure

Inhalation May cause respiratory irritation. May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.

Eye Contact Causes severe eye irritation which may damage tissue.
Skin Contact Causes skin irritation. May cause an allergic skin reaction. May be absorbed through the skin.

Ingestion Harmful if swallowed.

Chronic Effects/Carcinogenicity Prolonged or repeated exposure may cause eye, blood, lung, liver, kidney, heart, central nervous system and spleen damage. Contains nitrilotriacetic acid or its salts, which is NTP Classification 2 (Reasonably Anticipated to be a Human Carcinogen) and IARC Classification 2B (a Possible Human Carcinogen) Prolonged or repeated exposure may cause embryo and fetus toxicity.

Exposure Levels

No data available

Interactive effects

Skin disorders. Eye ailments.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	Causes moderate skin irritation. (Rabbit) Skin, rabbit:
Methanol	67-56-1	Non-irritating to the skin (Rabbit)
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	Non-irritating to the skin (Rabbit) Not irritating to skin in rabbits. Skin, rabbit:

Substances	CAS Number	Eye damage/irritation
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	Causes eye burns. Causes severe eye irritation. Will damage tissue.
Methanol	67-56-1	Non-irritating to the eye (Rabbit)
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	Irritating to eyes. (Rabbit) Eye, rabbit: Causes moderate eye irritation.

Substances	CAS Number	Skin Sensitization
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	May cause sensitization by skin contact (mouse)
Methanol	67-56-1	Did not cause sensitization on laboratory animals (guinea pig)
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	Did not cause sensitization on laboratory animals (guinea pig)

Substances	CAS Number	Respiratory Sensitization
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	No information available
Methanol	67-56-1	No information available
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	No information available

Substances	CAS Number	Mutagenic Effects
Ethanol, 2,2'-oxybis-,	68909-77-3	In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects.

reaction products with ammonia, morpholine derivatives residues		
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.
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	Not regarded as mutagenic. In vivo tests did not show mutagenic effects. In vitro tests did not show mutagenic effects

Substances	CAS Number	Carcinogenic Effects
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	No information available.
Methanol	67-56-1	No data of sufficient quality are available.
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	Contains nitrilotriacetic acid or its salts, which is listed as a suspect carcinogen of the urinary tract and kidneys by NTP, based on feeding studies with laboratory animals. According to the ACGIH guidelines, NTA would "not be considered an occupational carcinogen of any significance." IARC cancer review classification: 2B (Possibly Carcinogenic to Humans) Available data indicate that this substance is a suspected carcinogen.

Substances	CAS Number	Reproductive toxicity
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.
Methanol	67-56-1	Experiments have shown reproductive toxicity effects on laboratory animals
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	No significant toxicity observed in animal studies at concentration requiring classification.
Methanol	67-56-1	May cause disorder and damage to the Central Nervous System (CNS)
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	No significant toxicity observed in animal studies at concentration requiring classification.
Methanol	67-56-1	No data of sufficient quality are available.
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	Aspiration hazard
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	Not applicable
Methanol	67-56-1	Not applicable
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Ethanol, 2,2'-oxybis-,	68909-77-3	EC50 (72 h) =100 mg/L	LC50 (96 h) >100 mg/L	EC50 (3h) > 1000 mg/L	LC50 (48 h) =287.2 mg/L

reaction products with ammonia, morpholine derivatives residues		(Skeletonema costatum) EC50 (72 h) >120 mg/L (Desmodesmus subspicatus) NOEC (72 h) >120 mg/L (Desmodesmus subspicatus)	(Scophthalmus maximus) LC50 (96 h) =681.1 mg/L (Leuciscus idus)	(activated sludge)	(Acartia tonsa) EC50 (48 h) >120 mg/L (Daphnia Magna)
Methanol	67-56-1	ErC50 (96h) 22000 mg/L (Pseudokirchnerella subcapitata)	LC50 28200 mg/L (Pimephales promelas) LC50 (96h) 12700 – 15400 mg/L (Lepomis macrochirus)	IC50 (3h) > 1000 mg/L (activated sludge)	EC50 (96h) 18260 mg/L (Daphnia magna) NOEC (21d) 122 mg/L (Daphnia magna, Reproduction)
Nitritotriacetic acid, trisodium salt monohydrate	5064-31-3	EC50 (72 h) >91.5 mg/L (Desmodesmus subspicatus)	TL50 (96 h) =103 mg/L (Pimephales promelas) NOEC (229 d) >54 mg/L (Pimephales promelas)	NOEC (90d) >200 mg/L (activated sludge)	TL50 (96 h) range 115 mg/L (Gammarus pseudolimnaeus) NOEC (147 d) =9.3 mg/L (Gammarus pseudolimnaeus)

12.2. Persistence and degradability

Not readily biodegradable

Substances	CAS Number	Persistence and Degradability
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	No information available
Methanol	67-56-1	(95-97% @ 20d)
Nitritotriacetic acid, trisodium salt monohydrate	5064-31-3	Readily biodegradable (100 @ 14d)

12.3. Bioaccumulative potential

Does not bioaccumulate.

Substances	CAS Number	Log Pow
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	Log Pow <1
Methanol	67-56-1	-0.77 BCF = 1.0 – 4.5 (Cyprinus carpio) BCF < 10 (Leuciscus idus melanotus)
Nitritotriacetic acid, trisodium salt monohydrate	5064-31-3	-2.62 (calculated)

12.4. Mobility in soil

Substances	CAS Number	Mobility
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3	No information available
Methanol	67-56-1	No information available
Nitritotriacetic acid, trisodium salt monohydrate	5064-31-3	No information available

12.6. Other adverse effects**Endocrine Disruptor Information**

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations**Safe handling and disposal methods**

Disposal should be made in accordance with federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

14. Transport Information**Transportation Information**

UN Number: UN1993
UN Proper Shipping Name: Flammable Liquid, N.O.S. (Contains Methanol)
Transport Hazard Class(es): 3
Packing Group: III
Environmental Hazards: Not applicable

Special precautions during transport

None

HazChem Code

3WE

15. Regulatory Information

Safety, health and environmental regulations specific for the product

International Inventories

Australian AICS Inventory	All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.
New Zealand Inventory of Chemicals	All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.
EINECS Inventory	This product does not comply with EINECS
US TSCA Inventory	All components listed on inventory or are exempt.
Canadian DSL Inventory	All components listed on inventory or are exempt.

Poisons Schedule number

S6

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

16. Other information

Date of preparation or review

Revision Date: 22-Jan-2016

Revision Note

SDS sections updated: 2

Full text of R-phrases referred to under Sections 2 and 3

R10 Flammable.
 R22 Harmful if swallowed.
 R38 Irritating to skin.
 R39/23/24/25 Toxic: danger of very serious irreversible effects through inhalation, in contact with skin, and if swallowed.
 R40 Limited evidence of a carcinogenic effect.
 R41 Risk of serious damage to eyes.
 R43 May cause sensitization by skin contact.
 R61 May cause harm to the unborn child.

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

H225 - Highly flammable liquid and vapor
 H226 - Flammable liquid and vapor
 H301 - Toxic if swallowed
 H302 - Harmful if swallowed
 H311 - Toxic in contact with skin
 H315 - Causes skin irritation

H317 - May cause an allergic skin reaction
H318 - Causes serious eye damage
H319 - Causes serious eye irritation
H331 - Toxic if inhaled
H351 - Suspected of causing cancer
H360 - May damage fertility or the unborn child
H370 - Causes damage to organs

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 abbreviations or acronyms used

bw – body weight
CAS – Chemical Abstracts Service
EC50 – Effective Concentration 50%
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
NOEC – No Observed Effect Concentration
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
vPvB – very Persistent and very Bioaccumulative
h - hour
mg/m³ - 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

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End of Safety Data Sheet