Tubridgi Gas Storage Project
Well Construction Activities

ENVIRONMENT PLAN
PUBLIC SUMMARY

E-PLN-019 Well Activities
Rev 2
September 2016
# DOCUMENT CONTROL

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<td><strong>Author</strong></td>
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<tr>
<td>Well Engineering Manager + Senior HSE Advisor</td>
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<td>HSE Manager</td>
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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 four (4) gas storage wells (Well Construction Activities).

The controls within this EP are designed to work in conjunction with the Ashburton West Facilities (ASW) Environment Plan (Rev 11), 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.

DBP Development Group Nominees Pty Ltd is the instrument holder of PL 16, 19, 20, 103 and 112 for the Tubridgi Lateral, Ashburton West Lateral, Griffin Pipeline, Ashburton West Loop, and the Wheatstone Lateral (the ASW Licences).

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

Attn: Land Manager
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;
- 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 any operational activities associated with the DBNGP or ASW pipelines or infrastructure, which is managed separately under the DBNGP Operations Environment Plan (DBNGP EP) or the ASW Environment Plan (ASW EP).

The L9 Production Licence location is roughly bounded by:

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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 2-2 below.

Table 2-1 Associated Environmental Legislation and Other Requirements

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<tr>
<th>Commonwealth Legislation</th>
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<td>National Greenhouse and Energy Reporting Act 2007</td>
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<th>Western Australian Legislation and Associated Regulations</th>
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<td>Aboriginal Heritage Act 1972</td>
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<td>Conservation and Land Management Act 1984</td>
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<td>Contaminated Sites Act 2003</td>
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<td>Dampier to Bunbury Pipeline Act 1997</td>
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<th>Standards</th>
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<td>AS1940:2004 The storage and handling of flammable and combustible liquids</td>
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<td>AS1697 Installation and maintenance of steel pipe systems for gas</td>
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<td>AS1692:2006 Tanks for flammable and combustible liquids</td>
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<td></td>
<td>AS3780:1994 The storage and handling of corrosive substances</td>
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<td></td>
<td>AS2507 :1984 The storage and handling of pesticides</td>
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<th>Australian Pipeline Industry (APIA) Code of Environmental Practice</th>
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<td>Australian Dangerous Goods Code</td>
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<td></td>
<td>ANZECC (1992) Guidelines for Fresh and Marine Water Quality</td>
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<td></td>
<td>DMP Chemical Disclosure Guidelines (2013)</td>
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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.

![Onslow Temperature 1981 to 2010](image)

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 convectional 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 calcereated); 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 Yannarie 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

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)

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

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

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 hypoleucus*)
- 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 dougallii*)
- 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**

<table>
<thead>
<tr>
<th>Species</th>
<th>Protection Status</th>
<th>Preferred Habitat (Ninox 2013)</th>
<th>Potential Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Quoll (<em>Dasyurus hallucatus</em>)</td>
<td>State: Schedule 1 under WC Act Commonwealth: Vulnerable</td>
<td>In the Pilbara, the Northern Quoll has most commonly been recorded in habitats comprising rocky hills, mesas, plateaux, major drainage lines and granite fields.</td>
<td>Unlikely: 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.</td>
</tr>
<tr>
<td>Greater Bilby (<em>Macrotis lagotis</em>)</td>
<td>State: Schedule 1 under WC Act Commonwealth: Vulnerable</td>
<td>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.</td>
<td>Unlikely: 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.</td>
</tr>
<tr>
<td>Pilbara Leaf-nosed Bat –</td>
<td>State: Schedule 1</td>
<td>The Pilbara Leaf-nosed Bat is restricted to relatively deep</td>
<td>Unlikely: This species was listed on the results of the DotE Protected</td>
</tr>
<tr>
<td>Species</td>
<td>Protection Status</td>
<td>Preferred Habitat (Ninox 2013)</td>
<td>Potential Occurrence</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>unnamed Pilbara form</td>
<td>under WC Act</td>
<td>subterranean roosts that are able to provide a warm, humid environment enabling 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.</td>
<td>Matters Report; however, no suitable roosting sites were apparent within the Survey Corridor and there are no records of this species in the general area.</td>
</tr>
<tr>
<td>(Rhinonicteris aurantia)</td>
<td>Commonwealth: Vulnerable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little North-western Mastiff Bat</td>
<td>State:</td>
<td>The Little North-western Mastiff Bat is primarily restricted to mangrove forests and adjacent areas of monsoon forest along larger waterways.</td>
<td>Moderate: This species was not listed in the results of the DPaW NatureMap 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.</td>
</tr>
<tr>
<td>(Mormopterus loriae cobourgiana)</td>
<td>Priority 1 DPaW protected fauna.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Pebble-mound Mouse</td>
<td>State:</td>
<td>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.</td>
<td>Unlikely: 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.</td>
</tr>
<tr>
<td>(Pseudomys chapmani)</td>
<td>Priority 4 DPaW protected fauna</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olive Python</td>
<td>State:</td>
<td>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.</td>
<td>Unlikely: This species was listed in the results of the DPaW NatureMap search; however, there is no suitable habitat within the Survey Corridor.</td>
</tr>
<tr>
<td>(Liias olivaceus barroni Pilbara)</td>
<td>Schedule 1 under WC Act</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commonwealth: Vulnerable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt-water Crocodile</td>
<td>State:</td>
<td>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.</td>
<td>Unlikely: 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.</td>
</tr>
<tr>
<td>(Crocodylus porosus)</td>
<td>Schedule 1 under WC Act</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commonwealth: Listed as Marine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woma</td>
<td>State:</td>
<td>The Woma has been found in a range of habitats including</td>
<td>Low to Moderate: There are no records of this species in the vicinity</td>
</tr>
<tr>
<td>(Aspidites)</td>
<td>Schedule 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Species Protection Status

<table>
<thead>
<tr>
<th>Species</th>
<th>Protection Status</th>
<th>Preferred Habitat (Ninox 2013)</th>
<th>Potential Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>ramseyi)</td>
<td>under WC Act</td>
<td>woodlands, heaths and shrublands. The species is known to shelter during the day in abandoned reptile and/or mammal burrows, hollow logs or thick vegetation.</td>
<td>of the Survey Corridor; however, suitable habitat is present including shrublands and open woodlands.</td>
</tr>
</tbody>
</table>

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 3.18 km from TGS1, 0.96 km from TGS2 and 2.37 km from TGS3.

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.

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 (~250m to 600m) will be required for each of the four wells. Access track extensions will be to a maximum of 10m wide and reduced where possible to ~6m for single vehicle traffic. These tracks, over all 4 sites are approximately 1.5km in length.

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.

The access track extensions, well sites and associated works are covered under Ministerial Approval (MS112).

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 wells site 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;
- 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.

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.

If permanent flowlines are required, they 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.

The flowlines will, where possible, utilise existing infrastructure as well as following flowline routes to the well locations. This targets areas of known previous disturbance and where possible reduces need to undertake further ground disturbance. This is dependent on the capabilities of the current flowlines and testing of these will be part of the project mobilisation (phase one). This is designed to minimise disturbance. If clearing is required the flowline construction footprint would be approximately 20ha.

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:

- 2 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.

4.5.2 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.

4.5.3 Water

Potable water is stored in four (4) 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.

4.5.4 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. This would take the total disturbance footprint of the test phase (phase one) down to approximately 1.2ha. If permanent flowlines are installed then the overall permanent footprint (phase one and phase two) would be 21.2ha.

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 4-1 Contaminants of Potential Concern threshold limits

<table>
<thead>
<tr>
<th>COPC</th>
<th>Cuttings</th>
<th>Onsite Management</th>
<th>Fluids</th>
<th>Onsite Management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit</td>
<td></td>
<td>Unit</td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>mg/kg</td>
<td>100&quot;&quot;</td>
<td>mg/L</td>
<td>0.5&quot;&quot;</td>
</tr>
<tr>
<td>Barium</td>
<td>mg/kg</td>
<td>15,000&quot;&quot;</td>
<td>mg/L</td>
<td>0.01&quot;∞</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/kg</td>
<td>30,000&quot;&quot;</td>
<td>mg/L</td>
<td>30,000</td>
</tr>
<tr>
<td>Chromium VI</td>
<td>mg/kg</td>
<td>100&quot;&quot;</td>
<td>mg/L</td>
<td>0.05&quot;∞</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/kg</td>
<td>1,000&quot;&quot;</td>
<td>mg/L</td>
<td>1&quot;</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/kg</td>
<td>300&quot;&quot;</td>
<td>mg/L</td>
<td>0.1&quot;</td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/kg</td>
<td>600&quot;&quot;</td>
<td>mg/L</td>
<td>1&quot;</td>
</tr>
<tr>
<td>Benzene</td>
<td>mg/kg</td>
<td>1*</td>
<td>mg/L</td>
<td>0.001&quot;∞</td>
</tr>
<tr>
<td>Toluene</td>
<td>mg/kg</td>
<td>3*</td>
<td>mg/L</td>
<td>0.8&quot;∞</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>mg/kg</td>
<td>5*</td>
<td>mg/L</td>
<td>0.3&quot;∞</td>
</tr>
</tbody>
</table>

*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)


∞ Health Values: Australian Drinking Water Guidelines Version 3.2 (NHMRC and NRMMC 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 resspreading, 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 resspreading 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 (e.g. 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
• 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:
  o stop all work within 30 m of potential Heritage site
  o report the location and nature of the site to the Senior Advisor – Environment and Heritage
  o 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.

Refuelling 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 10m x 10m 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 respraying 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 7-3.

The Quarterly Emissions and Discharge Report shall consolidate the results of all monitoring for submission to the DMP as specified in Table 7-5.
### Table 7-1 Overview of monitoring of emissions

<table>
<thead>
<tr>
<th>Equipment/Activity</th>
<th>Emission</th>
<th>Monitoring</th>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venting / flaring</td>
<td>Fugitive gas emission</td>
<td>Monitoring of flow volumes through the compressors and production test kits.</td>
<td>Results are recorded and reported quarterly to DMP.</td>
</tr>
<tr>
<td>Pipeline / flowline maintenance and Testing</td>
<td>Purged Nitrogen</td>
<td>Acknowledging the inert and ubiquitous nature of this gas, monitoring is not proposed.</td>
<td>NA</td>
</tr>
<tr>
<td>Vehicles</td>
<td>Diesel combustion</td>
<td>Diesel purchases shall be monitored using DBPs SAP accounts system.</td>
<td>Direct purchasing values shall be used to calculate emissions of CO₂ equivalents in accordance with the NGER Measurement Determination 2008 and reported quarterly.</td>
</tr>
<tr>
<td>Accommodation septic system</td>
<td>Treated Waste Water</td>
<td>Acknowledging the low operating capacity of this plant no monitoring of effluent is conducted.</td>
<td>The volume of waste water discharge shall be estimated based on equipment specifications and reported quarterly.</td>
</tr>
<tr>
<td>Waste Disposal</td>
<td>Waste – All types</td>
<td>Monitoring and recording of the type and volume of all waste collected for disposal shall be undertaken.</td>
<td>The total volume for each waste stream collected from site shall be reported quarterly.</td>
</tr>
<tr>
<td>Spills</td>
<td>Chemical or hydrocarbon</td>
<td>Any spills will be captured as an event and reported as required.</td>
<td>Event Reports to include volume of spills, type and reported to DMP as required</td>
</tr>
</tbody>
</table>

### 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 Rev 10.

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 7-6 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 7-2 Overview of consultation

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Date of Consultation</th>
<th>Items Discussed/proposed to be discussed</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commonwealth, State and Local Government</td>
<td>May, June 2016</td>
<td>High level overview of TGS provided</td>
<td>Confirmation from OEPA that proposed works can operate under MS112 approval.</td>
</tr>
<tr>
<td>Department of Mines and Petroleum (DMP)</td>
<td>April to June 2016 ongoing</td>
<td>High level overview of activity provided via presentation in person</td>
<td>Recognition of pending Environment Plan for assessment, included in recent site visit for ASW Audit</td>
</tr>
<tr>
<td>Department of Water</td>
<td>2014</td>
<td>Water abstraction Licencing</td>
<td>Water abstraction licenses in place (surface water and groundwater)</td>
</tr>
<tr>
<td>Shire of Ashburton</td>
<td>April 2013, Nov 2015, 2016</td>
<td>High level overview of activity provided</td>
<td>Shire has a full awareness, Approvals relating to road use and construction matters, Ongoing use of roads for project and traffic management planning</td>
</tr>
</tbody>
</table>

Native Title Claimant group
<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Date of Consultation</th>
<th>Items Discussed/proposed to be discussed</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thalanyji</td>
<td>July 2013, 2014, 2015, 2016</td>
<td>Agreement reached on NT and Heritage processes and protocols</td>
<td>Consultation, involvement and engagement continues</td>
</tr>
<tr>
<td>Local Landowners and Other Stakeholders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaseholders for:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minderoo Station – Crown Lease 56/1967</td>
<td>May 2016</td>
<td>Access arrangements</td>
<td>Access agreement reached</td>
</tr>
<tr>
<td>Urala Station – Crown Lease 330/1967</td>
<td>April 2013, 2014, 2015, 2016</td>
<td>Access arrangements</td>
<td>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 excess arrangement was in place with BHPB and included a high level of consultation with the Station Manager</td>
</tr>
<tr>
<td>Urala Station – Crown Lease</td>
<td>Dec 2012 – June 2016</td>
<td>Sale of Urala Station</td>
<td>Sale of Urala Station by BHPB to DDG (2016)</td>
</tr>
</tbody>
</table>
7. References


Beard, J.S. (1975). Pilbara – The Vegetation of the Pilbara Area 1:100 000 Vegetation Series. University of Western Australia Press, Nedlands, WA.


Department of Environment and Conservation (DEC) (2011) Treatment and management of soils and water in acid sulfate soil landscapes


URS (2012a) Griffin Export Facility and Tubridgi Gas Plant Environmental Site Assessment

URS (2012b) Griffin Export Facility and Tubridgi Gas Plant - Remediation Action Plan

URS (2012c) Griffin Export Facility and Tubridgi Gas Plant – GME April 2012

URS (2013a) Griffin Export Facility and Tubridgi Gas Plant – GME Feb 2013


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

DBP HSE Policy: Approved DBP HSE Steering Committee  
Review Date Jan 2018
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.

Sincerely,

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

DBP Statement of Commitment  
Review Date Jan 2018
Appendix B Environmental Aspects and Impacts Risk Register

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

<table>
<thead>
<tr>
<th>Risk</th>
<th>Level</th>
<th>Probability</th>
<th>Impact</th>
<th>Description</th>
<th>Environmental Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk 0289</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>3.2 Disturbance of conservation significant fauna species during camp site operation including Mobile Camp</td>
<td></td>
</tr>
<tr>
<td>Risk 0290</td>
<td>Intermediate</td>
<td>Low</td>
<td>Not rated</td>
<td>3.3 Ignition of a bush fire at camp site</td>
<td></td>
</tr>
<tr>
<td>Risk 0291</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>3.4 Minor spill (&lt; 80 L) of dangerous goods at the camp site</td>
<td></td>
</tr>
<tr>
<td>Risk 0292</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>3.5 Major spill (&gt;80 L) of dangerous goods at the camp site</td>
<td></td>
</tr>
<tr>
<td>Risk 0293</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>3.6 Litter generation at camp site</td>
<td></td>
</tr>
<tr>
<td>Risk 0294</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>3.7 Discharge of a untreated sewage</td>
<td></td>
</tr>
<tr>
<td>Risk 0295</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>3.8 Excessive noise and/or vibrations</td>
<td></td>
</tr>
<tr>
<td>Risk 0305</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.10 Ignition of a bush fire during drilling operations</td>
<td></td>
</tr>
<tr>
<td>Risk 0306</td>
<td>Negligible</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.11 Excessive noise and/or vibrations</td>
<td></td>
</tr>
<tr>
<td>Risk 0307</td>
<td>Negligible</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.12 Light Impacting Fauna</td>
<td></td>
</tr>
<tr>
<td>Risk 0308</td>
<td>Negligible</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.13 Visual Amenity</td>
<td></td>
</tr>
<tr>
<td>Risk 0309</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.14 Disturbance or damage to infrastructure and services</td>
<td></td>
</tr>
<tr>
<td>Risk 0310</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.15 Litter generation during drilling operations</td>
<td></td>
</tr>
<tr>
<td>Risk 0311</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.16 Unplanned discharge of grey water or sewage</td>
<td></td>
</tr>
<tr>
<td>Risk 0312</td>
<td>Negligible</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.17 Third party access</td>
<td></td>
</tr>
<tr>
<td>Risk 0333</td>
<td>Negligible</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.18 Excessive Noise at Urala Homestead</td>
<td></td>
</tr>
<tr>
<td>Risk 0296</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.1 Disturbance of conservation significant flora species, ESA and/or cultural heritage site/s or object/s during drilling operations</td>
<td></td>
</tr>
<tr>
<td>Risk 0297</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.2 Disturbance of fauna including conservation significant fauna species</td>
<td></td>
</tr>
<tr>
<td>Risk 0298</td>
<td>Extreme</td>
<td>Low</td>
<td>Not rated</td>
<td>4.3 Well Control Event</td>
<td></td>
</tr>
<tr>
<td>Risk 0299</td>
<td>Intermediate</td>
<td>Low</td>
<td>Not rated</td>
<td>4.4 Inadequate structural integrity of the well</td>
<td></td>
</tr>
<tr>
<td>Risk 0300</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.5 Unplanned discharge of drilling cuttings</td>
<td></td>
</tr>
<tr>
<td>Risk 0301</td>
<td>Intermediate</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.6 Unplanned discharge of drilling mud or drilling mud constituents</td>
<td></td>
</tr>
<tr>
<td>Risk 0302</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.7 Minor spill (&lt; 80 L) of dangerous</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Level</td>
<td>Category</td>
<td>Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>----------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0302</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.7 Minor spill (&lt; 80 L) of dangerous goods or hazardous substance during drilling phase</td>
<td></td>
</tr>
<tr>
<td>0303</td>
<td>Intermediate</td>
<td>Low</td>
<td>Not rated</td>
<td>4.8 Major spill (&gt;80 L) of dangerous goods or hazardous substance during drilling phase</td>
<td></td>
</tr>
<tr>
<td>0304</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>4.9 Non-routine gas flaring</td>
<td></td>
</tr>
<tr>
<td>0313</td>
<td>Low</td>
<td>Negligible</td>
<td>Not rated</td>
<td>5.1 Inadequate demobilisation</td>
<td></td>
</tr>
<tr>
<td>0314</td>
<td>Intermediate</td>
<td>Negligible</td>
<td>Not rated</td>
<td>5.2 Inadequate rehabilitation</td>
<td></td>
</tr>
</tbody>
</table>
Environmental Plan

### Causes

- Poor planning for the activity and Poor weed and seed controls implemented by the Company

### Preventative Controls

- Level 1 flora survey, including the identification of weed species, to be completed prior to the commencement of Activities.
- On-going review and continuous improvement in Company weed and seed controls through engagement with relevant regulators and stakeholders.
- Adherence to requirements administered by the Department of Agriculture and Food to prevent introduction and spread of disease.
- GIS review of known species within project area.
- Pre-mobilisation requirements for plant and equipment includes weed and seed inspection and sign off requirements.
- E-PRO-014 Clean on Entry Procedure requirements in place as required.

### Recovery Controls

- Environmental Plan
- Daily HSE inspections include identification of any new weeds on site
- Environmental Plan
- Environmental Plan

### Consequences

- Invasive weed species competing with native flora or altering native fauna habitat.
- Flora and fauna impacted by an infectious disease
- Impacting pastoralist bio-security zones.

### 1.1 Introduction/ spread of exotic species

#### Planning and Preparation

**Inherent**

- **LD**: C 3  Intermediate
- **Residual**
  - **LB**: C 3  Low

#### ALARP

Not yet risk rated

---

**[risk_bowtie_01]. Generated with mes.cgrfoundation by Tunde Ajayi on 20 Sep 2016. MESPL. Printed copies are uncontrolled.**
1.2 Disturbance of conservation significant flora species during planning and preparation

**Preventative Controls**
- Level 1 flora survey, including the identification of conservation significant flora species, to be completed prior to the commencement of Activities.
- In accordance with the environmental plan, access track route and well site and camp site locations will be selected to reduce requirement for clearing of conservation significant flora to ALARP including utilising existing cleared roads/tracks or well sites, where available.
- All clearing will be in-line with ten clearing principles.
- E-PRO-002 Native Vegetation Clearance Procedure to be implemented
- ACV process in place for access tracks and well locations
- Survey and pegging of areas prior to any disturbance
- Alignment sheets for access tracks, flowlines and well locations

**Recovery Controls**
- GIS review and alignment sheets developed for clearing areas reviewed post clearing

**Consequences**
- Loss of a local population of a conservation significant flora species.

**Risk Event Description:**
- Inherent
  - LD: Low
  - Environment

- Residual
  - LB: Negligible
  - Environment

- ALARP
  - Not yet risk rated
1.3 Disturbance of conservation significant fauna species during planning and preparation

Preventative Controls

- Regional fauna survey, including the identification of conservation significant fauna species, to be completed prior to the Activities
- Activities designed to minimise disturbance of conservation significant fauna species to ALARP in accordance with this Environment Plan (EP) and the Activity Site Optimisation Procedure.
- Identification of potential fauna habitat in the project area and disturbance footprint designed accordingly
- Fauna licence to be in place prior to any clearing works
- Licensed Fauna Handlers available for any vegetation disturbance activities

For Inherent
- LC
- C2
- Low

For Residual
- LB
- C2
- Negligible

ALARP
- Not yet risk rated

Recovery Controls

- E-PRO-004 Fauna Interaction Procedure implemented for managing interactions with fauna
- Landholder approval in place for release of fauna

Consequences

- Death or injury of conservation significant fauna
1.4 Disturbance of environmentally sensitive areas (ESA) including conservation significant fauna habitat

Planning and Preparation

Consequences

Loss of environmental values associated with ESA.

Loss of conservation significant fauna habitat.

Preventative Controls

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

Consequences

Recovery Controls

Environmental Plan

Environmental Plan

Causes

Poor planning of the location of the Activity area

Preventative Controls

Inherent

Residual

ALARP

Not yet risk rated
Environmental Plan

Risk ID: 0274

1.5 Alteration of surface water during planning.

Preventative Controls

Causes

- Poor planning of the location of the Activity area

In accordance with the EP, the access track route and well site and camp site locations will be situated to minimise potential impact on surface water bodies and surface water flows to ALARP.

- Construction of access tracks and well pads will be designed for local water flows and to prevent water pooling.

- Siting of soil and vegetation stockpiles will be designed to not hinder water flows.

- Potential dewatering site/s shall be planned and included in the design.

- Daily HSE Inspections include review of drainage and water pooling

Recovery Controls

Equipment available on site to repair altered flow lines and reinstate as required.

Consequences

- Localised alteration of surface water

Inherent

- LC C2 Low

- Environment

Residual

- LB C2 Negligible

- Environment

ALARP

- Not yet risk rated
1.6 Disturbance of cultural heritage site/s or object/s during planning and preparation

**Preventative Controls**

- 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.

**Recovery Controls**

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

**Consequences**

- Damage to cultural heritage site/s or object/s

**Inherent**

- LB: C3 - Low
- Environment

**Residual**

- LA: C3 - Negligible
- Environment

**ALARP**

- Not yet risk rated

Risk ID: 0275
2.1 Introduction / spread of weed species

Environmental Plan

Recovery Controls

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

Inherent

LC | C3 | Intermediate

Environment

Residual

LB | C3 | Low

Environment

ALARP

Not yet risk rated
2.2 Disturbance of conservation significant flora species during construction of Access Tracks, Well Site and Camp Site and Mobilisation

**Preventative Controls**
- 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.

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

**Consequences**
- Loss of a local population of a conservation significant flora species.
2.3 Disturbance of conservation significant fauna species during construction of Access Tracks, Well Site and Camp Site and Mobilisation

**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 60 km/h
- Traffic Management Plan
- Fauna Licence to be in place for managing any interactions with fauna
- Trained and Competent operator.

**Recovery Controls**

- Licensed Fauna Handler available for managing fauna interactions as required

**Consequences**

- Death or injury of conservation significant fauna

---

**Environmental Plan**

**Inherent**

- LC C 2 Low
- Environment

**Residual**

- LB C 2 Negligible
- Environment

**ALARP**

- Not yet risk rated
### Causes
- Uncontrolled vehicle or personnel access.

### Preventative Controls
- Vehicle and personnel access limited to the access track, well site and camp site to prevent disturbance outside of the Activity area.
- 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.
- HSE Induction for operational personnel including conservation significant flora species, ESA or cultural heritage values within the Activity area.
- Full archaeological and ethnographic survey of proposed areas undertaken prior to any disturbance.
- 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.
- Level 1 flora survey, including the identification of conservation significant flora species, to be completed prior to the commencement of Activities.

### Recovery Controls
- Traffic management plan.
- Inspection and audit process to review clearing areas including Daily Inspections of flowline, access track and wellsite construction against survey and alignment sheets.
- If artefacts are found, work shall cease, the area will be demarcated as per requirements of the Aboriginal Heritage Act 1972.
- Level 1 flora survey, including the identification of conservation significant flora species, to be completed prior to the commencement of Activities.

### Consequences
- Loss of local population of conservation significant flora species.
- Loss of environmental values associated with ESA.
- Damage to cultural heritage site/s or object/s.
Causes

- Fauna fall into open excavations

Preventative Controls

- Boundary of the well site will be fenced and gated at the completion of construction operations to prevent macro fauna (including cattle) entering open excavations.
- An egress path, such as geofabric matting, will be installed on the embankment of open, lined excavations immediately following construction to allow small fauna to climb out.
- Daily visual monitoring of open excavations during routine construction works to check for entrapped fauna.
- Non-operational excavation shall be back filled or covered at the end of each day.
- Fauna Licence to be in place for managing any interactions with fauna.
- Consultation with Station Manager / Leaseholder.
- Minimisation of any time excavations are kept open.
- Minimise amount of trench open at any one time.

2.4 Fauna access to open excavations

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

Inherent

LC  C2  Low
Environment

Residual

LC  C1  Negligible
Environment

ALARP

Not yet risk rated

Recovery Controls

Daily HSE inspections of trenches for fauna

Licensed Fauna Handler available for managing fauna interactions as required

Local Wildlife Carers available to assist as required for injured fauna (Onslow / Karratha)

Consequences

- Fauna injury or death

Risk ID: 0281
2.6 Alteration of surface water flow during Construction of Access Tracks, Well Site and Camp Site and Mobilisation

Preventative Controls

Access track constructed to minimise ponding or flow diversion through the installation of drainage swales, where required.

Well site and camp site constructed to minimise ponding through surface gradients, where required.

Soil and vegetation stockpiles reviewed against water flows (Inspection).

Access track location designed to reduce or minimise any disturbance to surface water flows or impacts on drainage features.

Recovery Controls

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

Environmental Plan

Daily HSE Inspections include review of drainage and water pooling

Consequences

Localised surface water ponding or flow diversion

Inherent

LC  C2  Low

Environment

Residual

LB  C2  Negligible

Environment

ALARP

Not yet risk rated
2.7 Soil disturbance

**Preventative Controls**

- Access track, well site and camp site constructed to avoid concentration of surface water flow.
- Stockpiles constructed with the following dimensions to prevent erosion: Vegetation windrows approximately 1.5 m (W) x 1.5 m (H).
- Separate topsoil and subsoil windrows approximately 3 m (W) x 2 m (H).
- Implement dust suppression measures, such as water spraying as required.
- Soil treatment / stabiliser agent to be used where necessary to minimise potential for soil loss.
- Erosion controls implemented as required to prevent loss of soil offsite.
- Design of access tracks and wellsites specifically allow for stockpile areas and locations.

**Recovery Controls**

- Management and maintenance of erosion controls included as part of Environment Plan.
- Daily HSE inspections include erosion and soil stockpiles.
- Environmental Plan.
- Additional dust suppression implemented for adverse dust conditions.

**Consequences**

- Soil erosion and sedimentation.
- Generation of dust.

**Inherent**

- LC: C1
- Residual

- LB: C1
- Environment

**ALARP**

Not yet risk rated
2.8 Ignition of a bush fire during construction

**Preventative Controls**

- Vehicles and personnel access to be limited to delineated access track, well site and camp site to eliminate the chance of fire ignition sources.
- Sparks from operation and movement of vehicles, machinery and equipment.
- HSE Inductions for operational personnel including bush fire prevention.
- Only correct vehicle type is permitted onsite as per TMP.
- Parking area as per TMP.
- Designated smoking areas.
- Smoking controls included in Project HSE Induction.
- Fire extinguishers.
- Designated butt bins or other specific cigarette disposal options implemented.

**Recovery Controls**

- Fire response / extinguisher in vehicles and infrastructure.
- Land holder consultation and management.
- Emergency Response Plan.

**Consequences**

- Loss of native flora and fauna.

**Risk/Event**

- **Risk/Event Description**: Construction of Access Tracks, Well Site and Camp Site and Mobilisation.

**Environment**

- Inherent
- Residual

- LC C 3 Intermediate
- LB C 3 Low

**ALARP**

- Not yet risk rated.
2.9 Minor spill (< 80 L) of dangerous goods

**Preventative Controls**

- Inappropriate storage or handling of fuel, poor refuelling practices and/or mechanical failure including inadequate maintenance.
- Diesel fuel will be transported in a small tank (approximately 1,200 L) on the back of the service vehicle to refuel machinery and equipment.
- In accordance with the Contractor's Refuelling Procedure all mobile refuelling will be undertaken within the access track, well site or camp site cleared area away from environmentally sensitive areas. A drip tray will be placed under refuelling points during mobile refuelling.
- Well maintained machinery, vehicles and equipment.
- All refuelling of mobile plant must be carried out only at self-contained or bunded location.
- The bund at Ashburton River must have a liner and inspected daily.
- Spill response requirements included in the HSE Induction
- Vehicle pre-start checks.

**Consequences**

- Contamination of soil, surface water or ground water

**Recovery Controls**

- Reporting, investigating and implementing corrective actions for all spills of dangerous goods in accordance with Incident Reporting Procedure.
- Environmental Plan
- Oil Spill Contingency Plan
- Spill kits located with plant and equipment
- Clean up and disposal of contaminated material with a licensed waste contractor

**ALARP**

- Not yet risk rated

**Risk/Event**

- Inherent
  - LD C 1 Low
  - Environment

- Residual
  - LB C 1 Negligible
  - Environment

**Environment**

- Not yet risk rated

**Inherent**

- Environment

**Residual**

- Environment
2.10 Major spill (>80 L) of dangerous goods (diesel fuel only)

**Preventative Controls**
- Vehicle collision or rollover.
- Bunding
  - All refueling of mobile plant must be carried out only at self-contained or bunded location and include drip trays for hoses.
- Vehicle and other plant and equipment pre-start checks.
- The bund at Ashburton river must have a liner and inspected daily.
- BOM checks i.e. weather.
- Sump design ensures capability to contain contaminants.
- Self contained plant and equipment or bunding in place as secondary containment.
- Road Access Coordinator in place to manage vehicle operations and SIMOPS.

**Recovery Controls**
- Containment, clean-up and remediation if required of a spill in accordance with the EP.
- Reporting, investigating and implementing corrective actions for all spills of dangerous goods in accordance with Incident Reporting Procedure.
- Environmental Plan.
- Emergency Response Plan.
- Oil Spill Contingency Plan.
- Landholder Consultation.
- Capability arranged to access equipment in case of spill prior to project commencement.
- Offsite emergency services access available at all times (within control) to assist in case of emergency situation.

**Consequences**
- Contamination of soil, surface water or ground water.

**Inherent**
- Environment
  - LC C3 Intermediate

**Residual**
- Environment
  - LB C3 Low

**ALARP**
- Not yet risk rated
2.11 Disruption of local landholders or other stakeholders

**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.

**Inherent**

- LD: C1 Low Environment

**Residual**

- LC: C1 Negligible Environment

**ALARP**

Not yet risk rated

**Recovery Controls**

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

**Consequences**

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

**Landholder Consultation**

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

Risk ID: 0288

3.1 Disturbance of conservation significant flora species, ESA and/or cultural heritage site/s or object/s at camp site

Preventative Controls

- Uncontrolled vehicle or personnel access.
- Vehicle and personnel access limited to the camp site and access track to prevent disturbance outside of the Activity area.
- Delineation of any heritage sites identified in surveys to minimise any potential disturbance.
- Full archaeological and ethnographic survey of proposed areas undertaken prior to any disturbance.
- Traditional owner Monitors shall be utilized prior to the clearing activity.
- Cultural heritage of local area and requirements included in the HSE induction.
- An HSE Induction for operational personnel including conservation significant species within the Activity area.

Recovery Controls

- Environmental Plan
- Environmental Plan
- Environmental Plan

Consequences

- Loss of a local population of a conservation significant flora species.
- Loss of environmental values associated with ESA.
- Damage to cultural heritage site/s or object/s.

Inherent

- LC
- C2
- Low
- Environment

Residual

- LB
- C2
- Negligible
- Environment

ALARP

- Not yet risk rated
3.2 Disturbance of conservation significant fauna species during camp site operation including Mobile Camp

Preventative Controls

- Vehicles and personnel access limited to camp site to prevent disturbance outside of Activity area.
- Waste Management Procedure E-PRO-015 implemented to manage wastes onsite.
- Fauna Licence to be in place for managing any interactions with fauna.
- Minimal lighting used when it is not a safety requirement for good lighting.
- No ponding of water at accommodation areas.
- All bins lidded/covered to minimise fauna access.

ALARP

Not yet risk rated

Consequences

- Death or injury of conservation significant fauna.

Recovery Controls

- Department of Parks and Wildlife (formerly Department of Environment and Conservation) Wildcare Helpline (9474 9055 - 24 hour telephone service) will be contacted for advice if any fauna becomes injured.
- Licensed Fauna Handler available for managing fauna interactions as required.
- Local Wildlife Carers available to assist as required for injured fauna (Onslow / Karratha).

Risk/Event

<table>
<thead>
<tr>
<th>Risk/Event Description</th>
<th>In Place Control</th>
<th>Critical Control</th>
<th>Critical In Place Control</th>
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<tbody>
<tr>
<td>Risk/Event</td>
<td>Not In Place Control</td>
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3.3 Ignition of a bush fire at camp site

**Preventative Controls**

- Inappropriate disposal of cigarettes
  - Preventative Controls
    - Smoking restricted to designated smoking areas
    - Firefighting equipment located at the camp site and personnel trained in its use.
    - Vehicle and personnel access limited to the camp site and access track
    - Firefighting equipment located at the camp site and personnel trained in its use.
    - Waste Management Procedure E-PRO-015 implemented to manage wastes onsite
    - Designated parking areas at the camp location and buses used where possible to reduce vehicles onsite
    - Traffic Management Plan

- Sparks from cooking and operation and movement of vehicles, machinery and equipment
  - Preventative Controls
    - Ineffective disposal of cigarettes
    - Inappropriate disposal of cigarettes
  - Recovery Controls
    - Local emergency services support
  - Consequences
    - Loss of native flora or fauna

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**Inherent**

- Environment
  - Inherent
    - L C C 3 Intermediate

**Residual**

- Environment
  - Residual
    - L B C 3 Low

**ALARP**

- Not yet risk rated
### Preventative Controls

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

- **Diesel fuel** will be typically transported in a small tank (approximately 1,200 L) on the back of the service vehicle to refuel machinery and equipment.

- In accordance with the Contractor's Refuelling Procedure all mobile refuelling will be undertaken within the access track, well site or camp site cleared area away from environmentally sensitive areas. A drip tray will be placed under refuelling points during mobile refuelling.

- Well maintained machinery, vehicles and equipment.

- **Pre-start Checks.**

- Self contained plant and equipment or bunding in place as secondary containment

- Spill response requirements included in the HSE induction

### Recovery Controls

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

### Consequences

- Contamination of soil, surface water or ground water

### Risk/Event Description

3.4 Minor spill (< 80 L) of dangerous goods at the camp site

### Inherent

- Environmental

### Residual

- Environment

### ALARP

- Not yet risk rated

### Risk/Event

- Spill kits
- Disposal Bins.
- Oil Spill Contingency Plan
- Clean up and disposal of contaminated material with a licensed waste contractor

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### Risk ID: 0292

#### Causes
- Inappropriate handling of hazardous materials including poor refuelling practices

#### 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 80,000 L of diesel will be stored at camp site in self bunded (double skinned) tanks.**

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

- **Vehicle and other plant and equipment pre-start checks.**

- **BOM checks i.e. weather.**

- **Daily inspection of cutting of sump.**

- **Contingency storage.**

- **Free bore of 500mm**

- **Sump design ensures capability to contain contaminants.**

#### Recovery Controls
- **Containment, clean-up and remediation if required of a spill in accordance with the EP**

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

#### Consequences
- **Contamination of soil or water**

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**Risk/Event: 3.5 Major spill (>80 L) of dangerous goods at the camp site**

**Camp Site Operation including Mobile Camp**

**Inherent**
- LB  C3  Low

**Residual**
- LA  C3  Negligible

**ALARP**
- Not yet risk rated

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Risk ID: 0293

3.6 Litter generation at camp site

### Causes

- Improper segregation, storage and/or disposal of wastes
- HSE Induction for operational personnel including waste management
- Putrescible wastes will be stored in lidded skips/bins which will remain closed
- General and industrial wastes will be stored in lidded bins.
- Disposal of putrescible, general and industrial waste at a licensed waste disposal facility
- Management to prevent overflow. (Regular inspections)
- Waste Management Procedure E-PRO-015 implemented to manage wastes onsite
- Segregation of wastes included in the HSE Induction
- Contingency bins available in case of cutoff from waste contractor

### Preventative Controls

- Putrescible wastes will be stored in lidded skips/bins which will remain closed
- General and industrial wastes will be stored in lidded bins.
- Disposal of putrescible, general and industrial waste at a licensed waste disposal facility
- Management to prevent overflow. (Regular inspections)
- Waste Management Procedure E-PRO-015 implemented to manage wastes onsite
- Segregation of wastes included in the HSE Induction
- Contingency bins available in case of cutoff from waste contractor

### Recovery Controls

- Clean-up of litter as required
- HSE inspections daily to include waste management.
- Environmental Plan
- Licensed Fauna Handler available for managing fauna interactions as required

### Consequences

- Contamination of soil, vegetation or surface water by wind borne litter
- Attraction of feral fauna

### Inherent

- L D C 1 Low Environment

### Residual

- L A C 1 Negligible Environment

### ALARP

- Not yet risk rated
3.7 Discharge of an untreated sewage

**Preventative Controls**

- **Inappropriate treatment/disposal of sewage**
  - Septic waste will be managed and monitored in accordance with Waste Monitoring and Management Procedure.
  - Camp grey water will be treated and disposed of onsite through existing infrastructure.
  - Wellsite mini-camp sewage will be either stored and disposal offsite at a licensed waste disposal facility; or treatment through an aerated wastewater treatment system or treatment with Mega-Blue tablets for disposal onsite into a covered leach drain.
  - Biosystems already in place at accommodation.
  - Prestart inspections at well site include sewage management.
  - Routine maintenance checks while operating.

**Recovery Controls**

- Containment, clean-up and remediation if required of a spill in accordance with the EP.
- Capability on site to neutralise any spills as required.

**Consequences**

- Contamination of soil, vegetation or surface water
- Loss or injury of native fauna
- Attraction of feral fauna

**Risk/Event Description**

- **Inherent**
  - Environment
    - Low
  - Residual
    - Environment
      - Negligible

**ALARP**

- Not yet risk rated
3.8 Excessive noise and/or vibrations

**Preventative Controls**

- Operational noise generated from camp operations (e.g. generator) or vehicle movement
- Well maintained and muffled equipment and machinery
- Vehicle and personnel access limited to the camp site and access track
- Minimise night driving at camp accommodation area.
- Short Term Activity
- Nearest sensitive receptor is Urala Homestead which is owned through the DDG pastoral lease
- Designated parking areas at the camp location and buses used where possible to reduce vehicles onsite

**Recovery Controls**

- Environmental Plan
- Noise monitoring conducted as required
- Consultation with Station Manager / Leaseholder.

**Consequences**

- Disturbance of fauna and local landholders

**Risk/Event**

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

**Inherent**

- Environment
- L D: C-1
- Low

**Residual**

- Environment
- L A: C-1
- Negligible

**ALARP**

- Not yet risk rated
4.1 Disturbance of conservation significant flora species, ESA and/or cultural heritage site/s or object/s during drilling operations

**Preventative Controls**

- Machinery and personnel access limited to well site and access track to prevent disturbance outside of the Activity area
- In accordance with the Traffic Management Plan (TMP)
- Designated parking areas at the camp location and buses used where possible to reduce vehicles onsite
- Trained and Competent operator
- HSE Induction for operational personnel including conservation significant flora species, ESA or cultural heritage values within the Activity area
- Road Access Coordinator in place to manage vehicle operations and SIMOPS
- Delineation of any heritage sites identified in surveys to minimise any potential disturbance

**Recovery Controls**

- Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure
- If artefacts are found, work shall cease, the area will be demarcated as per requirements of the Aboriginal Heritage Act 1972

**Consequences**

- Loss of a local population of a conservation significant flora species
- Loss of environmental values associated with ESA
- Damage to cultural heritage site/s or object/s
4.2 Disturbance of fauna including conservation significant fauna species

Machinery and personnel access limited to well site and access track to prevent disturbance outside of the Activity area

An egress path, such as geofabric matting, will be installed on the embankment of open, lined excavations to allow small fauna to climb out

The drill rig will be operating 24hr/7days a week. Visual monitoring of open excavations will be part of the routine tasks of personnel working around these areas. Any entrapped fauna will be reported to the PIC as soon as it is noticed.

Waste Management Procedure implemented as required

Fauna Licence to be in place for managing any interactions with fauna

Drilling Operations

Inherent

Residual

ALARP

Not yet risk rated

Department of Parks and Wildlife (formerly Department of Environment and Conservation) Wildcare Helpline (9474 9055 - 24 hour telephone service) will be contacted for advice if any fauna becomes injured

Licensed Fauna Handler available for managing fauna interactions as required

Local Wildlife Carers available to assist as required for injured fauna (Onslow / Karratha)

Landholder approval in place for release of fauna

Causes

Preventative Controls

Recovery Controls

Consequences

Risk ID: 0297
4.3 Well Control Event

**Preventative Controls**

- Blow out preventer used during drilling operations. Blow out preventers are tested at regular intervals to ensure they are all in good working order.
- Mud program engineered to ensure the integrity of the well being drilled.
- Refer to Well Management Plan.
- Refer to Well Control Manual.
- Safety Drills.
- Supervision from experienced Senior personnel in well control.
- Continuous monitoring of drilling mud and pressure system.
- Trained and Competent operator.
- Regular surface gas detection surveys during operations.

**Recovery Controls**

- Containment, clean-up and remediation if required of a spill in accordance with the EP.
- Identify, assess and manage emergency situations in accordance with the Emergency Response Plan (ERP).

**Consequences**

- Contamination of soil, surface water or groundwater.
- Uncontrolled fire.

**Causes**

- Release of liquid/gaseous hydrocarbons to the environment.

**Inherent**

- LE: C 4
- Environment

**Residual**

- LA: C 4
- Environment

**ALARP**

- Not yet risk rated.

**Risk/Event**

- Risk/Event Description
- Not In Place Control
- In Place Control
- Critical Control
- Critical In Place Control
4.4 Inadequate structural integrity of the well

Drilling Operations

**Preventative Controls**

- Preparation of a Well Management Plan with detailed engineering design and structural integrity assessments, monitoring and reporting procedures.
- Ensuring a stable borehole is drilled with minimal rugosities and tortuosity through proper mud selection and careful management of drilling practices.
- Cementing to support and seal the well casing and prevent movement of liquids up the borehole and protects the casing against corrosion.
- Periodic well integrity testing and inspection during well operations and undertaking appropriate maintenance/rectification procedures.
- Mud logs can be utilised to recognise and implement remedial action for over-pressured zones, lost circulation and gas kicks.
- Cement integrity logs are run to determine the quality of the cement bond to the steel casing.
- Leak Off Test to determine the strength or fracture pressure of the open formation.
- Formation Integrity test for testing strength of formation and shoe to designed pressure.
- Record power tong makeup torque for each connection on casing running tally and data recorder.
- Continuous monitoring of drilling mud and pressure system.

**Recovery Controls**

- Identify, assess and manage emergency situations in accordance with the Emergency Response Plan (ERP).
- Containment, clean-up and remediation if required of a spill in accordance with the EP.
- Blow Out Emergency Response Plan (BOERP).
- Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure.

**Consequences**

Uncontrolled release of hydrocarbons and other formation constituents to aquifer, surface or between subsurface zones.

**Causes**

- Pressure leak in the well casing

**Consequences**

- Recovery of hydrocarbons and other formation constituents to subsurface or surface zones

**Risk/Event**

- Not yet risk rated

**Risk/Event Description**

**Inherent**

- Low B: C 4: Intermediate

**Residual**

- Low A: C 4: Low

**ALARP**

Not yet risk rated
4.5 Unplanned discharge of drilling cuttings

**Preventative Controls**

- Unplanned release of drilling cuttings
  - The cuttings will be contained, such as within a tank or cuttings storage area lined with an impermeable liner, prior to reuse or disposal. Details of drilling cuttings management will be specified in Environment Plan including measures to ensure potential environmental impacts are managed to ALARP
  - Contingency storage available in mud tank or potable water tank to be used to contain additional cutting or recovered material
  - Cutting sump freeboard to be contingency
  - Sump location on wellsite designed to prevent loss offsite
  - Chemical Disclosure List, MSDS Register available onsite to assist with management of chemical spills

**Recovery Controls**

- Contamination of soil, surface water or groundwater
  - Capability on site to neutralise any spills as required
  - Emergency Response Plan
  - Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure
  - Contingency storage available in mud tank or potable water tank to be used to contain additional cutting or recovered material

**Consequences**

- Not yet risk rated
**Environmental Plan**

**Risk ID: 0301**

### Causes

- Unplanned release of drilling mud outside of active drilling mud system
- Inappropriate storage or handling of hazardous drilling mud constituents

### Preventative Controls

- **Experienced Personnel**
- Continuous monitoring of drilling mud and pressure system.
- Adequate equipment preventative maintenance system.
- All chemicals and other substances to be used down hole during the Activities are required to be fully disclosed in accordance with regulation 15(9) of the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012 (WA) and Chemical Disclosure Guideline.
- Hazardous drilling mud constituents 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.
- Contingency storage available in mud tank or potable water tank to be used to contain additional cutting or recovered material
- Hazardous Substance Management systems - MSDS availability / Storage.

### Recovery Controls

- Environmental Plan
- Spill Response Kits.
- Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure
- Capability on site to neutralise any spills as required

### Consequences

- Contamination of soil, surface water or groundwater

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**Risk Event**: 4.6 Unplanned discharge of drilling mud or drilling mud constituents

**Risk Event Description**: Drilling Operations

**Inherent**

- LC C3: Intermediate Environment

**Residual**

- LA C3: Negligible Environment

**ALARP**

- Not yet risk rated

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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.

### Recovery Controls

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

- 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.

### Risk/Event

- **Risk/Event Description**: 4.7 Minor spill (< 80 L) of dangerous goods or hazardous substance during drilling phase

### Inherent

- **Inherent**: Low

### Residual

- **Residual**: Negligible

### ALARP

- **ALARP**: Not yet risk rated
4.8 Major spill (>80 L) of dangerous goods or hazardous substance during drilling phase

**Drilling Operations**

**Preventative Controls**

- Supervision of the operations by personnel with well control certification as appropriate for the operations being undertaken.
- Preparation of Well Management Plan (WMP) with detailed engineering design and structural integrity assessments, monitoring and reporting procedures.
- 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.
- A self bunded day tank located within a shipping counter will supply diesel to the generators that power the drilling rig. The day tank will be directly connected to the diesel storage tank and fitted with an overflow valve and sensor alarm to prevent overfilling of the day tank.
- 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.
- Housekeeping - Area clean up. All hazardous substances / chemicals to be cleaned and returned to storage area once task completed.

**Recovery Controls**

- Containment, clean-up and remediation if required of a spill.
- Reporting, investigating and implementing corrective actions for all spills of dangerous goods in accordance with Incident Reporting Procedure.
- Environmental Plan
- Oil Spill Contingency Plan
- Emergency Response Plan
- Local emergency services support.
- Contingency storage available in mud tank or potable water tank to be used to contain additional cutting or recovered material.

**Consequences**

- Contamination of soil or water.

**Risk/Event**

- Environmental Plan
- Oil Spill Contingency Plan
- Emergency Response Plan
- Local emergency services support.
- Contingency storage available in mud tank or potable water tank to be used to contain additional cutting or recovered material.

**Inherent**

- LC B C3 Intermediate
- Environment

**Residual**

- LB B C3 Low
- Environment

**ALARP**

- Not yet risk rated
4.9 Non-routine gas flaring

**Causes**
- Flaring due to unexpected drilling influxes.

**Preventative Controls**
- Flaring, if required, will be undertaken using a closed loop flare system which is a fully contained method of flaring any excess gas and any liquids released during well control situations.
- Fully controlled flaring process using Rig based flare

**Recovery Controls**
- Environmental Plan
- Gas measurement for volumes in place.
- Reporting in a timely manner to Regulator.
- Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure.
- Emergency Response Plan.

**Consequences**
- Production of carbon dioxide

**Inherent**
- LC: C 2
  - Environment: Low

**Residual**
- LA: C 2
  - Environment: Negligible

**ALARP**
- Not yet risk rated
4.10 Ignition of a bush fire during drilling operations

**Preventative Controls**

**Causes**
- Blowout during well testing or drilling or due to sparks from the operation and movement of vehicles, machinery and equipment.
- Blow out preventer present on rig. Blow out preventer closed in the event of a blow out during well testing or drilling to shut-in well.
- Flaring, if required, will be undertaken using a closed loop flare system.
- Department of Fire and Emergency Services permit to flare obtained (if required).
- Fire management conducted including but not limited to, maintenance of firebreaks.
- Smoking restricted to designated smoking areas.
- Firefighting equipment located at the well site and personnel trained in its use.
- Vehicle and personnel access limited to the well site and access track.

**Recovery Controls**

**Inherent**
- L B C 3 Low Environment

**Residual**
- L A C 3 Negligible Environment

**ALARP**
- Not yet risk rated

**Consequences**
- Loss of native flora or fauna
- Destruction of fauna habitat

**Equipment**
- Environmental Plan
- Landholder Consultation
- Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure
- Emergency Response Plan
- Local emergency services support
- Environmental Plan
- Landholder Consultation
- Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure
Risk ID: 0306

4.11 Excessive noise and/or vibrations

**Causes**

- Noise generated during routine drilling operations.
- Preventative Controls:
  - Well maintained and muffled equipment and machinery
  - Vehicle and personnel access limited to the well site and access track.
  - Rig is electric and powered by a generator located within a sound proof shipping container.
  - PPE.
  - Consultation with Station Manager / Leaseholder.

**Inherent**

- LB: Negligible

**Residual**

- LA: Negligible

**Consequences**

- Disturbance of fauna and local landholders.

**Recovery Controls**

Drilling Operations

- ALARP
  - Not yet risk rated
Facility lighting required for safety during 24 hour operations.

Preventative Controls

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

Recovery Controls

Disturbance of fauna and local landholders.

Consequences

Drilling Operations

4.12 Light Impacting Fauna

Inherent

<table>
<thead>
<tr>
<th>L B</th>
<th>C 1</th>
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Residual

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</table>

ALARP

Not yet risk rated
Risk ID: 0308

**4.13 Visual Amenity**

**Preventative Controls**
- Vertical elevation of drilling rig.
- Communication with stakeholders and landholders prior to commencement of Activities.

**Recovery Controls**
- Rehabilitation of 75% of area post activity within 3 months of end of well testing.
- Rehabilitation of access tracks to 5m width post construction.

**Consequences**
- Disturbance of fauna and local landholders.

**Inherent**
- L B C 1 Negligible

**Residual**
- L A C 1 Negligible

**ALARP**
- Not yet risk rated
4.14 Disturbance or damage to infrastructure and services

**Preventative Controls**

- 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.

**Recovery Controls**

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

**Consequences**

- Disruption of services to local residents
- Damage to existing infrastructure

**Risk/Event**

- **Risk/Event Description**: Drilling Operations
- **Inherent**
  - LD C-1 Low Environment
- **Residual**
  - LB C-1 Negligible Environment

**ALARP**

Not yet risk rated
4.15 Litter generation during drilling operations

Drilling Operations

**Inherent**
- **Environment**: Low

**Residual**
- **Environment**: Negligible

**ALARP**
- Not yet risk rated

**Causes**

- Improper segregation, storage and/or disposal of wastes.
- HSE Induction for operational personnel including waste management
- Putrescible wastes will be stored in lidded skips/bins which will remain closed
- General and industrial wastes will be stored in bins
- Empty drilling mud chemical drums will be triple rinsed back into the drilling mud processing tanks and stored separately.
- Waste oil, lubricants or other oil contaminated materials (oily rags, spill clean-up pads) will be stored in dedicated, labelled containers within a bunded area.
- Disposal for all putrescible waste, general waste and industrial waste at a licensed waste disposal facility by licensed contractor.
- Records will be kept of waste type and volume.
- HSE inspections daily to include waste management.
- Waste Management Procedure E:PRO-015 implemented to manage wastes onsite

**Preventative Controls**

**Recovery Controls**

- Environmental Plan
- Clean-up of litter as required
- HSE inspections daily to include waste management.
- Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure

**Consequences**

- Contamination of soil, vegetation or surface water by wind borne litter
- Attraction of feral fauna.
4.16 Unplanned discharge of grey water or sewage

**Preventative Controls**

- Causes:
  - Improper segregation, storage and/or disposal of wastes.
  - Septic waste will be managed and monitored.
  - Grey water will be treated and disposed of onsite.
  - Wellsite mini-camp sewage will be either stored and disposal onsite at a licensed waste disposal facility; or treatment through an aerated wastewater treatment system or treatment with Mega-Blue tablets for disposal onsite into a covered leach drain.
  - Prestart/operational checks or Biosystem/treatment.
  - Biosystem included in daily HSE inductions.
  - Contingency in Sump to direct any overflow.

- Recovery Controls:
  - Environmental Plan
  - Capability on site to neutralise any spills as required
  - Emergency Response Plan
  - Landholder Consultation
  - Environmental Plan

- Consequences:
  - Contamination of soil, vegetation or surface water.
  - Attraction of feral fauna.
Risk ID: 0312

### Causes
- Inadequate fencing or signage or due to inadequate stakeholder communication

### Preventative Controls
- Signage kept in place around the boundary of well site
- Communication with stakeholders/landholders prior to commencement of Activities.
- Review of landholder issues with unauthorised access.
- Urala station management of gate and access track.

### Recovery Controls
- Reporting, investigating and implementing corrective actions in accordance with Incident Reporting Procedure

### Consequences
- Damage to drilling facilities

### Inherent
- LC C 1 Negligible
- Environment

### Residual
- LB C 1 Negligible
- Environment

### ALARP
- Not yet risk rated
**5.1 Inadequate demobilisation**

### Causes
- All equipment, personnel and supplies not removed.
- Drilling rig and ancillary equipment removed from the Activity area.
- All waste to be removed for disposal at a licensed waste disposal facility.
- Reuse or disposal of drilling mud and drilling brine.
- Well site and camp site left on a stable condition with erosion or ponding.
- Well head and Christmas tree will be secured.
- Well cellar will be covered or fenced.
- Within three months of suspending the well, progressive rehabilitation and remediation will commence including any gravel pits.
- Rehabilitation using vegetation/topsoil/subsoil stockpiles to reinstate soil profile.
- Ripping and breakup of compacted soil to assist in rehabilitation.
- Removal of liner from sump and requires sampling prior to refilling the sump.

### Recovery Controls
- Reporting, investigating and implementing corrective actions for all spills of dangerous goods in accordance with Incident Reporting Procedure.
- Containment, clean-up and remediation if required of a spill.
- Rehabilitation monitoring.

### Consequences
- Disturbance of fauna.
- Poor condition of soil, vegetation or surface water.

### Inherent Risk/Event
- Environment: LC C2 Low

### Residual Risk/Event
- Environment: LB C2 Negligible

### ALARP
- Not yet risk rated
5.2 Inadequate rehabilitation

Demobilisation and Rehabilitation

Within three months of plugging and abandoning the well, rehabilitation will commence. This includes, but is not limited to, compacted areas will be ripped, recontouring of the Activity area to match the surrounding landscape, and topsoil and vegetation stockpiled respread over the Activity area.

Rehabilitation checklist in place for reinstatement and rehabilitation works

Rehabilitation Criteria set out as required in Environment Plan

Rehabilitation using vegetation/topsoil/subsoil stockpiles to reinstate soil profile.

- **Inherent**
  - LC: C3 Intermediate
  - Residual: LA C3 Negligible

**ALARP**
- Not yet risk rated

**Consequences**
- **Environmental Plan**
  - Demobilisation and Rehabilitation
  - Rehabilitation monitoring.

**Loss of native flora and fauna**

**Erosion or sedimentation.**
Causes

Drilling Activities

Preventative Controls

Well maintained and muffled equipment and machinery

Vehicle and personnel access limited to the camp site and access track

Short Term Activity

Regular communication with local stakeholders.

Rig is electric and powered by a generator located within a sound proof shipping container.

Recovery Controls

Environmental Plan

Consequences

Disturbance of fauna and local landholders.

4.18 Excessive Noise at Urala Homestead

Drilling Operations

Inherent

L B  C 1  Negligible

Environment

Residual

L A  C 1  Negligible

Environment

ALARP

Not yet risk rated
Tubridgi Gas Storage Project
Oil Spill Contingency Plan

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<th>Date</th>
<th>Prepared By</th>
<th>Reviewed By</th>
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</table>
Spill Response – Immediate Response Process

Spill Occurs

Tier 1 – Onsite Management (Incident)

Assess Spill

Tier 2 or 3 – Escalation (Emergency or Crisis)

Safe to respond?

Yes

Three ‘C’ Approach (Control, Contain, Clean Up)

Notification and Reporting

END

No

Minor

Severe

Refer to Emergency Response Plan

END
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

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

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 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**

<table>
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<tr>
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<th>Responsibilities</th>
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| All Personnel | • Identify and respond to oil spills as required  
• Familiarity with escalation and notification procedures as set out in this plan and the emergency response plan |
| DBP General Manager Maintenance | • Act as Incident Controller  
• Ensure resources are made available to assist in response to spills |
| DDG Well PIC | • 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 | • Ensure regulatory notification as required  
• Act as Incident Commander |
| Transportation Services Control Centre (TSCC or Gas Control) | • Coordinate emergency notification process  
• Activate Emergency or Crisis Management Team as required  
• Manage gas systems as required |
## CONTACT DIRECTORY

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<tr>
<th>Notification</th>
<th>Whom</th>
<th>Contact Details</th>
</tr>
</thead>
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<td>Gas Control</td>
<td>TSCC</td>
<td>1800 019 919 in emergency</td>
</tr>
<tr>
<td>DMP</td>
<td>Petroleum Division / Environment</td>
<td><a href="mailto:Petroleum.environment@dmp.wa.gov.au">Petroleum.environment@dmp.wa.gov.au</a>&lt;br&gt;Or online submission</td>
</tr>
<tr>
<td>DER</td>
<td>Pollution Hotline</td>
<td>DER Pollution Hotline&lt;br&gt;1300 784 782</td>
</tr>
<tr>
<td>Local Council</td>
<td>Shire of Ashburton</td>
<td>9184 6001&lt;br&gt;After hours&lt;br&gt;0408 086 789</td>
</tr>
<tr>
<td>DFES</td>
<td>Onslow Volunteer Emergency Service</td>
<td>000 in emergency&lt;br&gt;08 9184 6555</td>
</tr>
<tr>
<td>SES</td>
<td>Emergency number</td>
<td>132 500 in emergency</td>
</tr>
<tr>
<td>Police</td>
<td>Onslow Station</td>
<td>000 in emergency&lt;br&gt;Onslow 08 9159 9100</td>
</tr>
<tr>
<td>Airport</td>
<td>Onslow Airport</td>
<td>9153 2000&lt;br&gt;A/H 0487 654 272</td>
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LEVEL 1 FLORA AND VEGETATION SURVEY

OF THE TUBRI DGI

GAS WELLS SURVEY AREA

Prepared for
DBP

Prepared by
Mattiske Consulting Pty Ltd
May 2016

DBP1606/14/2016
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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 stellateps* 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.
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](image)

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
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

<table>
<thead>
<tr>
<th>Potential Survey Limitation</th>
<th>Impact on Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of information and availability of contextual information (i.e. pre-existing background versus new material).</td>
<td><strong>Not a constraint:</strong> 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.</td>
</tr>
<tr>
<td>Scope (i.e. what life forms, etc., were sampled).</td>
<td><strong>Not a constraint:</strong> Vascular flora was the focus of the survey. These were thoroughly sampled.</td>
</tr>
<tr>
<td>Proportion of flora collected and identified (based on sampling, timing and intensity).</td>
<td><strong>Not a constraint:</strong> 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.</td>
</tr>
<tr>
<td>Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).</td>
<td><strong>Not a constraint:</strong> 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.</td>
</tr>
<tr>
<td>Mapping reliability.</td>
<td><strong>Not a constraint:</strong> 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.</td>
</tr>
<tr>
<td>Timing, weather, season, cycle.</td>
<td><strong>Potential constraint:</strong> 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.</td>
</tr>
<tr>
<td>Disturbances (fire flood, accidental human intervention, etc.).</td>
<td><strong>Not a constraint:</strong> 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.</td>
</tr>
<tr>
<td>Intensity (in retrospect, was the intensity adequate).</td>
<td><strong>Not a constraint:</strong> 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).</td>
</tr>
<tr>
<td>Resources (i.e. were there adequate resources to complete the survey to the required standard).</td>
<td><strong>Not a constraint:</strong> Resources, in terms of time, equipment, support and personnel were adequate to undertake and complete the survey.</td>
</tr>
<tr>
<td>Access problems (i.e. ability to access survey area).</td>
<td><strong>Not a constraint:</strong> Tracks established and maintained by Urala Station provided easy access to the survey area.</td>
</tr>
<tr>
<td>Experience levels (e.g. degree of expertise in plant identification to taxon level).</td>
<td><strong>Not a constraint:</strong> 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.</td>
</tr>
</tbody>
</table>
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 km\(^2\) (Payne et al., 1988). Quaternary 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 (Heddle et al., 1980).

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

<table>
<thead>
<tr>
<th>Land System</th>
<th>Total Extent of Land System (ha)</th>
<th>TGS Injector</th>
<th>Extent of Survey Area (ha)</th>
<th>% Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onslow</td>
<td>86704.8</td>
<td>1</td>
<td>19.271</td>
<td>0.022</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>26.298</td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>42.677</td>
<td>0.492</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>88.246</td>
<td>0.102</td>
</tr>
</tbody>
</table>

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 (201On)**

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 dune fields. *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 Yannarie 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.

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

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 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 clayspans 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 Troglobitic 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

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

<table>
<thead>
<tr>
<th>Species</th>
<th>Legal Status</th>
<th>Control Category</th>
<th>Site</th>
<th>Geographic Location (GDA94; Zone 50K)</th>
<th>Easting (mE)</th>
<th>Northing (mN)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Prosopis pallida</em></td>
<td>s12</td>
<td>C2</td>
<td>TGS3_A</td>
<td></td>
<td>275805</td>
<td>7589325</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Weed Species</th>
<th>Environmental Weed Ranking(^1)</th>
<th>Management Action(^1)</th>
<th>Comments(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Prosopis</em> spp. (Mesquite)</td>
<td>Medium</td>
<td>D, E, F, G</td>
<td>Widespread shrub or small tree found in rangelands, disturbed commons and along rivers from Derby south to Carnarvon. <em>Prosopis</em> spp. are a recognised problem near the coast between Onslow and Karratha.</td>
</tr>
<tr>
<td><em>Cenchrus ciliaris</em> (Buffel grass)</td>
<td>Low</td>
<td>D</td>
<td>Widespread weed of roadsides, creek lines, river edges and most vegetation types in the Pilbara.</td>
</tr>
<tr>
<td><em>Vachellia farnesiana</em> (Mimosa bush)</td>
<td>Low</td>
<td>D, E</td>
<td>A widespread weed of roadsides, creeks, rivers, and disturbed floodplainis from the Kimberley to Carnarvon. This species tends to be restricted to silty flats, but may spread under more favourable moisture conditions.</td>
</tr>
</tbody>
</table>

\(^1\) 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 (\(Pi = 10.03; p = <0.001\)). 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 synchronica* 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 synchronica* 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 synchronica*, *Acacia tetragonophylla*, *Scaevola spinescens* tall sparse shrubland over *Sporobolus mitchellii*, *Eriachne helmsii*, *Eulalia aurea* low open tussock grassland.
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

<table>
<thead>
<tr>
<th>Vegetation Community</th>
<th>Extent of vegetation community mapped by MCPL (2013)</th>
<th>Total extent within current area (ha)</th>
<th>Percentage of current survey area</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>20.03</td>
<td>19.271</td>
<td>21.828</td>
</tr>
<tr>
<td>ID1</td>
<td>83.17</td>
<td>26.298</td>
<td>29.801</td>
</tr>
<tr>
<td>IP8</td>
<td>282.20</td>
<td>12.134</td>
<td>13.750</td>
</tr>
<tr>
<td>IF4</td>
<td>78.16</td>
<td>30.543</td>
<td>34.611</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>88.246</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

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 brachythaenus 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 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

The authors would like to thank Mark Brown and Louise Watson from DBP and for their assistance with this project.

8. LIST OF PERSONNEL

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

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

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*Wildlife Conservation Act 1950*
### APPENDIX A1: DEFINITION OF THREATENED AND PRIORITY FLORA SPECIES (Department of Parks and Wildlife 2016c)

<table>
<thead>
<tr>
<th>Conservation Code</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T</strong></td>
<td>Threatened Flora (Declared Rare Flora – Extant)</td>
</tr>
</tbody>
</table>

"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 Wildlife Conservation Act 1950).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:

- **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."

<table>
<thead>
<tr>
<th><strong>P1</strong></th>
<th>Priority One – Poorly Known Species</th>
</tr>
</thead>
</table>

"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."

<table>
<thead>
<tr>
<th><strong>P2</strong></th>
<th>Priority Two – Poorly Known Species</th>
</tr>
</thead>
</table>

"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."

<table>
<thead>
<tr>
<th><strong>P3</strong></th>
<th>Priority Three – Poorly Known Species</th>
</tr>
</thead>
</table>

"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."

<table>
<thead>
<tr>
<th><strong>P4</strong></th>
<th>Priority Four – Rare Threatened and other species in need of monitoring</th>
</tr>
</thead>
</table>

- **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.
- **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.
- **c.** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy."

<table>
<thead>
<tr>
<th><strong>P5</strong></th>
<th>Priority Five – Conservation Dependent Species</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th>Category Code</th>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex</td>
<td>Extinct</td>
<td>Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.</td>
</tr>
<tr>
<td>ExW</td>
<td>Extinct in the Wild</td>
<td>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.</td>
</tr>
<tr>
<td>CE</td>
<td>Critically Endangered</td>
<td>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.</td>
</tr>
<tr>
<td>E</td>
<td>Endangered</td>
<td>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.</td>
</tr>
<tr>
<td>V</td>
<td>Vulnerable</td>
<td>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.</td>
</tr>
<tr>
<td>CD</td>
<td>Conservation Dependent</td>
<td>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.</td>
</tr>
</tbody>
</table>
### APPENDIX A3: DEFINITION OF THREATENED ECOLOGICAL COMMUNITIES (Department of Parks and Wildlife 2016d)

<table>
<thead>
<tr>
<th>Category Code</th>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
</table>
| PTD           | Presumed Totally Destroyed | 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:  
(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            | Critically Endangered | 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:  
(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 i.e. 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             | Endangered | 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:  
(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 i.e. 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             | Vulnerable | 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:  
(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)


<table>
<thead>
<tr>
<th>Listing Category</th>
<th>Explanation of Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critically endangered</td>
<td>If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.</td>
</tr>
<tr>
<td>Endangered</td>
<td>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.</td>
</tr>
<tr>
<td>Vulnerable</td>
<td>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.</td>
</tr>
</tbody>
</table>
## APPENDIX A5: DEFINITION OF PRIORITY ECOLOGICAL COMMUNITIES (Department of Parks and Wildlife 2016d)

<table>
<thead>
<tr>
<th>Category Code</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Poorly-known ecological communities</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>P2</td>
<td>Poorly-known ecological communities</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>P3</td>
<td>Poorly known ecological communities</td>
</tr>
<tr>
<td></td>
<td>(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:</td>
</tr>
<tr>
<td></td>
<td>(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;</td>
</tr>
<tr>
<td></td>
<td>(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.</td>
</tr>
<tr>
<td>P4</td>
<td>Conservation Dependent ecological communities</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>P5</td>
<td>Conservation Dependent ecological communities</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
</tbody>
</table>
### Control Category

<table>
<thead>
<tr>
<th>Control Category</th>
<th>Control Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C1 (Exclusion)</strong></td>
<td>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.</td>
</tr>
<tr>
<td>'(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’</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
<tr>
<td><strong>C2 (Eradication)</strong></td>
<td>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.</td>
</tr>
<tr>
<td>'(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’</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
<tr>
<td><strong>C3 (Management)</strong></td>
<td>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 to —</td>
</tr>
<tr>
<td>'(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 —</td>
<td></td>
</tr>
<tr>
<td>(i) alleviate the harmful impact of the declared pest in the area; or</td>
<td></td>
</tr>
<tr>
<td>(ii) reduce the number or distribution of the declared pest in the area; or</td>
<td></td>
</tr>
<tr>
<td>(iii) prevent or contain the spread of the declared pest in the area.’</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>
# APPENDIX A8: DEFINITION OF VEGETATION CONDITION SCALE (Keighery 1994)

<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Pristine (1)</td>
<td>Pristine or nearly so, no obvious sign of disturbance.</td>
</tr>
<tr>
<td>Excellent (2)</td>
<td>Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.</td>
</tr>
<tr>
<td>Very Good (3)</td>
<td>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.</td>
</tr>
<tr>
<td>Good (4)</td>
<td>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.</td>
</tr>
<tr>
<td>Degraded (5)</td>
<td>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.</td>
</tr>
<tr>
<td>Completely Degraded (6)</td>
<td>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.</td>
</tr>
</tbody>
</table>
### APPENDIX B: GPS LOCATION OF SITES FOR THE TUBRIDGI GAS WELLS SURVEY AREA, 2016

<table>
<thead>
<tr>
<th>SURVEY SITE</th>
<th>DATUM</th>
<th>GDA94</th>
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<td>EASTING</td>
<td>NORTHING</td>
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<td>7590760</td>
</tr>
<tr>
<td>TGS1 B</td>
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<td>7590807</td>
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<td>TGS2 A</td>
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<td>TGS2 B</td>
<td>275433</td>
<td>7591255</td>
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<td>TGS3 A</td>
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<td>7589325</td>
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<tr>
<td>TGS3 B</td>
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<td>7589234</td>
</tr>
<tr>
<td>TGS3 C</td>
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## APPENDIX C: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE TUBRIDGI GAS WELLS SURVEY AREA, 2016

Note: * denotes introduced species;

<table>
<thead>
<tr>
<th>FAMILY</th>
<th>SPECIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marsileaceae</td>
<td>*Marsilea hirsuta</td>
</tr>
<tr>
<td>Poaceae</td>
<td>*Cenchrus ciliaris</td>
</tr>
<tr>
<td></td>
<td>Chrysopogon fallax</td>
</tr>
<tr>
<td></td>
<td>Eragrostis ?erioporta</td>
</tr>
<tr>
<td></td>
<td>Eragrostis xerophila</td>
</tr>
<tr>
<td></td>
<td>Eriachne helmsii</td>
</tr>
<tr>
<td></td>
<td>Sporobolus sp.</td>
</tr>
<tr>
<td></td>
<td>Triodia epactia</td>
</tr>
<tr>
<td></td>
<td>?Urochloa occidentalis</td>
</tr>
<tr>
<td>Proteaceae</td>
<td>Grevillea stenobotrya</td>
</tr>
<tr>
<td>Chenopodiaceae</td>
<td>Enchylaena tomentosa</td>
</tr>
<tr>
<td></td>
<td>Rhagodia eremaea</td>
</tr>
<tr>
<td></td>
<td>Tecticornia indica subsp. leiestachya</td>
</tr>
<tr>
<td>Amaranthaceae</td>
<td>Ptilotus sp.</td>
</tr>
<tr>
<td>Gyrostemonaceae</td>
<td>Gyrostemon ramulosus</td>
</tr>
<tr>
<td>Lauraceae</td>
<td>Cassytha ?capillaris</td>
</tr>
<tr>
<td>Fabaceae</td>
<td>Acacia sclerosperma subsp. sclerosperma</td>
</tr>
<tr>
<td></td>
<td>Acacia sericophylla</td>
</tr>
<tr>
<td></td>
<td>Acacia stellaticeps</td>
</tr>
<tr>
<td></td>
<td>Acacia synchronica</td>
</tr>
<tr>
<td></td>
<td>Acacia tetragonophylla</td>
</tr>
<tr>
<td></td>
<td>Crotalaria cunninghamii subsp. cunninghamii</td>
</tr>
<tr>
<td></td>
<td>*Prosopis pallida</td>
</tr>
<tr>
<td></td>
<td>Senna artemisioides subsp. helmsii</td>
</tr>
<tr>
<td></td>
<td>Senna glutinosa subsp. chatelainiana</td>
</tr>
<tr>
<td></td>
<td>Sesbania cannabina</td>
</tr>
<tr>
<td></td>
<td>Tephrosia rosea var. clementii</td>
</tr>
<tr>
<td></td>
<td>*Vachellia farnesiana</td>
</tr>
<tr>
<td>Euphorbiaceae</td>
<td>Adriana tomentosa var. tomentosa</td>
</tr>
<tr>
<td>Malvaceae</td>
<td>Hibiscus brachychlaenus</td>
</tr>
<tr>
<td></td>
<td>Sida rohlena subsp. rohlena</td>
</tr>
<tr>
<td>Elatinaceae</td>
<td>Bergia perennis subsp. exigua</td>
</tr>
<tr>
<td>Frankeniacae</td>
<td>Frankenia ambita</td>
</tr>
<tr>
<td>Myrtaceae</td>
<td>Eucalyptus victrix</td>
</tr>
<tr>
<td></td>
<td>Verticordia forrestii</td>
</tr>
</tbody>
</table>
## APPENDIX C: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE TUBRIDGI GAS WELLS SURVEY AREA, 2016

Note: * denotes introduced species;

<table>
<thead>
<tr>
<th>FAMILY</th>
<th>SPECIES</th>
</tr>
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<tbody>
<tr>
<td>Convolvulaceae</td>
<td><em>Cressa australis</em></td>
</tr>
<tr>
<td></td>
<td><em>Evolvulus alsinoides</em></td>
</tr>
<tr>
<td>Boraginaceae</td>
<td><em>Heliotropium</em> sp.</td>
</tr>
<tr>
<td>Lamiaceae</td>
<td><em>Quoya loxocarpa</em></td>
</tr>
<tr>
<td>Solanaceae</td>
<td><em>Solanum lasiophyllum</em></td>
</tr>
<tr>
<td>Plantaginaceae</td>
<td><em>Stemodia</em> sp. Onslow (A.A. Mitchell 76/148)</td>
</tr>
<tr>
<td>Cucurbitaceae</td>
<td><em>Cucumis</em> ?variabilis</td>
</tr>
<tr>
<td>Goodeniaceae</td>
<td><em>Scaevola sericophylla</em></td>
</tr>
<tr>
<td></td>
<td><em>Scaevola spinescens</em></td>
</tr>
<tr>
<td></td>
<td>?Goodeniaceae sp.</td>
</tr>
<tr>
<td>Asteraceae</td>
<td><em>Centipeda minima</em> subsp. macrocephala</td>
</tr>
<tr>
<td></td>
<td>?<em>Gnephosis</em> sp.</td>
</tr>
<tr>
<td></td>
<td><em>Pterocaulon sphacelatum</em></td>
</tr>
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</table>
### APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE TUBRIDGI GAS WELLS SURVEY AREA, 2016

Note: * denotes introduced species

<table>
<thead>
<tr>
<th>Species</th>
<th>TGS1_A</th>
<th>TGS1_B</th>
<th>TGS2_A</th>
<th>TGS2_B</th>
<th>TGS3_A</th>
<th>TGS3_B</th>
<th>TGS3_C</th>
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</tr>
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<td>x</td>
<td>x</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td>x</td>
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<tr>
<td>Acacia synchronicia</td>
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<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Acacia tetragonophylla</td>
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</tr>
<tr>
<td>Adriana tomentosa var. tomentosa</td>
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<td></td>
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</tr>
<tr>
<td>Bergia perennis subsp. exigua</td>
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</tr>
<tr>
<td>Cassytha ?capillaris</td>
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<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
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</tr>
<tr>
<td>* Cenchrus ciliaris</td>
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<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td></td>
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<tr>
<td>Cressa australis</td>
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<td>x</td>
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<td>Enchylaena tomentosa</td>
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<td></td>
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<td>Eragrostis ?erio pada</td>
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<td>x</td>
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<td>Eragrostis xerophila</td>
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<td></td>
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</tr>
<tr>
<td>Eriachne helmsii</td>
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<td>Eucalyptus victrix</td>
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<td>Evolulus alsinoides</td>
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</tr>
<tr>
<td>? Gnephosis sp.</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>? Goodeniaceae sp.</td>
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</tr>
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<td>Grevillea stenobotrya</td>
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<td>Hibiscus brachychlaenus</td>
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<tr>
<td>* Prosopis pallida</td>
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<td></td>
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<td>Pterocaulon sphaelatum</td>
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<tr>
<td>Ptilotus sp.</td>
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<tr>
<td>Rhagodia eremaea</td>
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<td>x</td>
<td>x</td>
<td>x</td>
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<td></td>
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</tr>
<tr>
<td>Scaevola sericophylla</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
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<tr>
<td>Scaevola spinescens</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Senna artemisioides subsp. helmsii</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Senna glutinosa subsp. chatelainiana</td>
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<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sesbania cannabina</td>
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<td></td>
<td></td>
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<td>Sida rohdenae subsp. rohdenae</td>
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<td></td>
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</tr>
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<td>Solanum lasiophyllum</td>
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<td></td>
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</tr>
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<td>Sporobolus sp.</td>
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</tr>
<tr>
<td>Stemodia sp. Onslow (A.A. Mitchell 76/148)</td>
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<td>Tecticornia indica subsp. lelostachya</td>
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</table>

Species within the Tubridgi Gas Wells survey area, 2016.
### APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE TUBRIDGI GAS WELLS SURVEY AREA, 2016

Note: * denotes introduced species

<table>
<thead>
<tr>
<th>Species</th>
<th>TGS1_A</th>
<th>TGS1_B</th>
<th>TGS2_A</th>
<th>TGS2_B</th>
<th>TGS3_A</th>
<th>TGS3_B</th>
<th>TGS3_C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tephrosia rosea var. clementii</td>
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<td></td>
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<td></td>
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<td>x</td>
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<td>Triodia epactia</td>
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<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>?Urochloa occidentalis</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Vachellia farnesiana</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Verticordia forrestii</td>
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APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES BY VEGETATION COMMUNITY FOR THE TUBRIDI GSI GAS WELLS SURVEY AREA, 2016

Note: * denotes introduced species

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<th>SPECIES</th>
<th>Vegetation Community</th>
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<tr>
<td>Acacia sclerosperma subsp. sclerosperma</td>
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<tr>
<td>Acacia sericophylla</td>
<td>x</td>
</tr>
<tr>
<td>Acacia stellaticeps</td>
<td></td>
</tr>
<tr>
<td>Acacia synchroniccia</td>
<td></td>
</tr>
<tr>
<td>Acacia tetragonophylla</td>
<td></td>
</tr>
<tr>
<td>Adriana tomentosa var. tomentosa</td>
<td></td>
</tr>
<tr>
<td>Bergia perennis subsp. exigua</td>
<td></td>
</tr>
<tr>
<td>Cassytha ?capillaris</td>
<td></td>
</tr>
<tr>
<td>*Cenchrus ciliaris</td>
<td>x</td>
</tr>
<tr>
<td>Centipeda minima subsp. macrocephala</td>
<td></td>
</tr>
<tr>
<td>Chrysopogon fallax</td>
<td>x</td>
</tr>
<tr>
<td>Cressa australis</td>
<td></td>
</tr>
<tr>
<td>Crotalaria cunninghamii subsp. cunninghamii</td>
<td></td>
</tr>
<tr>
<td>Cucumis ?variabilis</td>
<td></td>
</tr>
<tr>
<td>Enchylaena tomentosa</td>
<td>x</td>
</tr>
<tr>
<td>Eragrostis ?eriopoda</td>
<td></td>
</tr>
<tr>
<td>Eragrostis xerophila</td>
<td>x</td>
</tr>
<tr>
<td>Eriachne helmsii</td>
<td>x</td>
</tr>
<tr>
<td>Eucalyptus victrix</td>
<td></td>
</tr>
<tr>
<td>Evolulus alsinoide</td>
<td>x</td>
</tr>
<tr>
<td>Frankenia ambita</td>
<td>x</td>
</tr>
<tr>
<td>?Gnephosis sp.</td>
<td></td>
</tr>
<tr>
<td>?Goodeniaceae sp.</td>
<td></td>
</tr>
<tr>
<td>Grevillea stenobotrya</td>
<td></td>
</tr>
<tr>
<td>Gyrotemon ramulosus</td>
<td></td>
</tr>
<tr>
<td>Heliotropium sp.</td>
<td></td>
</tr>
<tr>
<td>Hibiscus brachychlaenus</td>
<td></td>
</tr>
<tr>
<td>Marsilea hirsuta</td>
<td>x</td>
</tr>
<tr>
<td>*Prosopis pallida</td>
<td>x</td>
</tr>
<tr>
<td>Pteroaulon sphaelatum</td>
<td></td>
</tr>
<tr>
<td>Pilotus sp.</td>
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</tr>
<tr>
<td>Quoya loxocarpa</td>
<td>x</td>
</tr>
<tr>
<td>Rhagodia eremaea</td>
<td>x</td>
</tr>
<tr>
<td>Scaevola sericophylla</td>
<td>x</td>
</tr>
<tr>
<td>Scaevola spinescens</td>
<td></td>
</tr>
<tr>
<td>Senna artemisioides subsp. helmsii</td>
<td>x</td>
</tr>
<tr>
<td>Senna glutinosa subsp. chatelainana</td>
<td>x</td>
</tr>
<tr>
<td>Sesbania cannabina</td>
<td></td>
</tr>
<tr>
<td>Sida rohlanse subsp. rohlanse</td>
<td>x</td>
</tr>
<tr>
<td>Solanum lasiophyllum</td>
<td>x</td>
</tr>
<tr>
<td>Sporobolus sp.</td>
<td></td>
</tr>
<tr>
<td>Stemodia sp. Onslow (A.A. Mitchell 76/148)</td>
<td></td>
</tr>
<tr>
<td>Tecticornia indica subsp. leioastachya</td>
<td></td>
</tr>
<tr>
<td>Tephrosia rosea var. clementii</td>
<td></td>
</tr>
<tr>
<td>Triodia epactia</td>
<td>x</td>
</tr>
<tr>
<td>?Urochloa occidentalis</td>
<td>x</td>
</tr>
<tr>
<td>*Vachellia farnesiana</td>
<td>x</td>
</tr>
<tr>
<td>Verticordia forrestii</td>
<td>x</td>
</tr>
</tbody>
</table>
APPENDIX F: SUMMARY DETAILS OF SURVEY SITES ESTABLISHED WITHIN THE TUBRI DGI 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

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.

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

* 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

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.

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

* 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.

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

* 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.

<table>
<thead>
<tr>
<th>Species</th>
<th>Ht (cm)</th>
<th>% A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia sericophylla</td>
<td>200</td>
<td>1.8</td>
</tr>
<tr>
<td>Acacia stellaticeps</td>
<td>55</td>
<td>20</td>
</tr>
<tr>
<td>Cassytha ? capillaris</td>
<td>CL</td>
<td>0.02</td>
</tr>
<tr>
<td>* Cenchrus ciliaris</td>
<td>40</td>
<td>0.5</td>
</tr>
<tr>
<td>Crotalaria cunninghamii subsp. cunninghamii</td>
<td>80</td>
<td>0.02</td>
</tr>
<tr>
<td>Cucumis ? variabilis</td>
<td>20</td>
<td>0.01</td>
</tr>
<tr>
<td>Ergrogris ? eriopoda</td>
<td>35</td>
<td>0.01</td>
</tr>
<tr>
<td>Evolvolus alsinoides</td>
<td>15</td>
<td>0.01</td>
</tr>
<tr>
<td>?Goodeniaceae sp.</td>
<td>50</td>
<td>0.02</td>
</tr>
<tr>
<td>Pterocaulen sphacelatum</td>
<td>25</td>
<td>0.01</td>
</tr>
<tr>
<td>Scaevola sericophylla</td>
<td>30</td>
<td>0.05</td>
</tr>
<tr>
<td>Senna glutinosa subsp. chatelainiana</td>
<td>100</td>
<td>0.01</td>
</tr>
<tr>
<td>Sida rohlenae subsp. rohlenae</td>
<td>90</td>
<td>0.01</td>
</tr>
<tr>
<td>Solanum lasiophyllum</td>
<td>35</td>
<td>0.01</td>
</tr>
<tr>
<td>Triodia epactia</td>
<td>40</td>
<td>60</td>
</tr>
</tbody>
</table>

* Denotes introduced (exotic) species
Site: TGS3_A  
Date: 16/05/16  
Personnel: JC/BE  
Community: MCPL_IF4

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

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

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 victoria* low open woodland over *Acacia* spp. mid sparse shrubland over low open tussock grassland.

<table>
<thead>
<tr>
<th>Species</th>
<th>Ht (cm)</th>
<th>% A</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia sericophylla</em></td>
<td>210</td>
<td>2</td>
</tr>
<tr>
<td><em>Acacia synchronica</em></td>
<td>150</td>
<td>0.5</td>
</tr>
<tr>
<td><em>Acacia tetragonophylla</em></td>
<td>200</td>
<td>1.8</td>
</tr>
<tr>
<td><em>Cenchrus ciliaris</em></td>
<td>40</td>
<td>0.05</td>
</tr>
<tr>
<td><em>Chrysopogon fallax</em></td>
<td>50</td>
<td>0.08</td>
</tr>
<tr>
<td><em>Enchylaena tomentosa</em></td>
<td>110</td>
<td>0.1</td>
</tr>
<tr>
<td><em>Eriachne helmsii</em></td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td><em>Eucalyptus victoria</em></td>
<td>450</td>
<td>15</td>
</tr>
<tr>
<td><em>Prosopis pallida</em></td>
<td>50</td>
<td>0.05</td>
</tr>
<tr>
<td><em>Ptilotus sp.</em></td>
<td>20</td>
<td>0.01</td>
</tr>
<tr>
<td><em>Rhagodia eremaea</em></td>
<td>150</td>
<td>0.2</td>
</tr>
<tr>
<td><em>Senna artemisiodes subsp. helmsii</em></td>
<td>30</td>
<td>0.02</td>
</tr>
<tr>
<td><em>Solanum lasiophyllum</em></td>
<td>15</td>
<td>0.01</td>
</tr>
</tbody>
</table>

* Denotes introduced (exotic) species
APPENDIX F: SUMMARY DETAILS OF SURVEY SITES ESTABLISHED WITHIN THE TUBRIGI 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_1F4

### Soil
- **Soil:** Clay loam  
- **Soil Notes:** Brown to orange clayey loam and some areas shallow cracking clay

### Outcropping
- **Outcropping:** None

### Aspect
- **Aspect:** N/A

### Age since fire
- **Age since fire:** 10 +

### Condition
- **Condition:** Excellent

### Litter cover %
- **Litter cover %:** 10

### Litter type
- **Litter type:** Twigs and leaves

### Bare ground %
- **Bare ground %:** 20

### Field description
- **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 Table

<table>
<thead>
<tr>
<th>Species</th>
<th>Ht (cm)</th>
<th>% A</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia sericophylla</em></td>
<td>200</td>
<td>0.8</td>
</tr>
<tr>
<td><em>Acacia synchronica</em></td>
<td>150</td>
<td>0.5</td>
</tr>
<tr>
<td><em>Acacia tetragonophylla</em></td>
<td>220</td>
<td>2.5</td>
</tr>
<tr>
<td><em>Cenchrus ciliaris</em></td>
<td>40</td>
<td>0.2</td>
</tr>
<tr>
<td><em>Chrysopogon fallax</em></td>
<td>60</td>
<td>0.05</td>
</tr>
<tr>
<td><em>Eragrostis xerophila</em></td>
<td>40</td>
<td>0.2</td>
</tr>
<tr>
<td><em>Eriachne helmsii</em></td>
<td>50</td>
<td>8</td>
</tr>
<tr>
<td><em>Ptilotus sp.</em></td>
<td>40</td>
<td>0.01</td>
</tr>
<tr>
<td><em>Rhagodia eremae</em></td>
<td>80</td>
<td>0.02</td>
</tr>
<tr>
<td><em>Scaevola spinescens</em></td>
<td>160</td>
<td>0.4</td>
</tr>
<tr>
<td><em>Sesbania cannabina</em></td>
<td>160</td>
<td>0.2</td>
</tr>
<tr>
<td><em>Vachellia farnesiana</em></td>
<td>180</td>
<td>0.6</td>
</tr>
</tbody>
</table>

* Denotes introduced (exotic) species
APPENDIX F: SUMMARY DETAILS OF SURVEY SITES ESTABLISHED WITHIN THE TUBRIDI DGI 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

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.

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

* Denotes introduced (exotic) species
APPENDIX G: HIERARCHICAL CLUSTER DENDROGRAM OF SITES SURVEYED WITHIN THE TUBRI DGI GAS WELLS SURVEY AREA, 2016
Appendix E Chemical Disclosure List
## A. SYSTEM DETAILS:

<table>
<thead>
<tr>
<th>OPERATOR:</th>
<th>DDGT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT / WELL:</td>
<td>Tubridi Gas Storage Well Campaign</td>
</tr>
<tr>
<td>SYSTEM:</td>
<td>Slurry 1: 12.5ppg Lead</td>
</tr>
<tr>
<td>TOTAL VOLUME OF SYSTEM (m³):</td>
<td>1</td>
</tr>
</tbody>
</table>

## B. PRODUCT LIST, Cont'd

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
</tr>
</thead>
</table>
| Fresh water | Ashbourne River| Mix water| 48.6380%                        | 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. |
| Cement - Class G | Halliburton | Cement | 46.4715%                        | 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. | Yes |

MSDS Attached: N/A

---

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.

Yes
<table>
<thead>
<tr>
<th>Constituent</th>
<th>Halliburton</th>
<th>Function</th>
<th>Percentage</th>
<th>Toxicity Data</th>
<th>Bioaccumulation</th>
<th>Biodegradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Econolite Liquid</td>
<td>Halliburton</td>
<td>Cement Additive Stabiliser</td>
<td>4.6200%</td>
<td>Freshwater Acute Algae Toxicity 72h EC50: &gt; 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.</td>
<td>No Hazard</td>
<td>Yes</td>
</tr>
<tr>
<td>NF-6</td>
<td>Halliburton</td>
<td>Reduces air entrainment into cement slurry</td>
<td>0.0382%</td>
<td>Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: &gt; 1000 mg/L (Acartia tonsa) [Halliburton Funded Study]; Marine Water Acute Fish Toxicity 96h LC50: &gt; 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];</td>
<td>No Hazard</td>
<td>Yes</td>
</tr>
<tr>
<td>Calcium Chloride</td>
<td>Halliburton</td>
<td>Excellerator</td>
<td>0.2323%</td>
<td>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.</td>
<td>No Hazard</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------</td>
<td>------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Biodegradation:</strong> Substance is inorganic - biodegradation is not applicable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemicals within products in Part B</td>
<td>CAS number</td>
<td>Maximum Mass fraction in System (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------</td>
<td>------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mix Water</td>
<td>NA</td>
<td>48.64%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portland cement</td>
<td>65997-15-1</td>
<td>42.26%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water in Product</td>
<td>7732-18-5</td>
<td>4.205%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium silicate</td>
<td>1344-09-8</td>
<td>2.521%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>2.113%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium Chloride, dihydrate</td>
<td>10035-04-8</td>
<td>0.2112%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rape Oil</td>
<td>8002-13-9</td>
<td>0.03474%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium Chloride</td>
<td>7647-14-5</td>
<td>0.01056%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monopropylene glycol monooleate</td>
<td>1330-80-9</td>
<td>0.003474%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminium stearate</td>
<td>637-12-7</td>
<td>0.001737%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorbitan, monopalmitate</td>
<td>26266-57-9</td>
<td>0.001737%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### A. SYSTEM DETAILS:

<table>
<thead>
<tr>
<th>OPERATOR:</th>
<th>DDGT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT / WELL:</td>
<td>Tubridgi Gas Storage Well Campaign</td>
</tr>
<tr>
<td>SYSTEM:</td>
<td>Slurry 2, 15.8ppg Tail 9 5/8” CSG</td>
</tr>
<tr>
<td>TOTAL VOLUME OF SYSTEM (m³):</td>
<td>1</td>
</tr>
</tbody>
</table>

### B. PRODUCT LIST, Cont'd

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
<th>MSDS Attached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>Ashbourne River</td>
<td>Mix water</td>
<td>20.0717%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

#### Cement - Class G

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
<th>MSDS Attached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halliburton</td>
<td>Cement</td>
<td>66.1432%</td>
<td>CONSTITUENT 1 (≤100%): After hardening with water or moister, cement presents no ecotoxicity risks. (Source: IUCLID 2000) Freshwater Acute Crustacean Toxicity 24h LL50: &gt; 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. CONSTITUENT 2 (≤10%): Freshwater Acute Crustacean Toxicity 24h LL50: &gt; 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.</td>
<td>Yes</td>
</tr>
<tr>
<td>Product</td>
<td>Manufacturer</td>
<td>Constituent</td>
<td>Concentration</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------</td>
<td>-------------</td>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Gascon 469</td>
<td></td>
<td>Cement Additive Stabiliser</td>
<td>3.8754%</td>
<td>CONSTITUENT 1 (≤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. CONSTITUENT 2 (≤60%): Freshwater Acute Algae Toxicity 72h EC50: 440 mg/L (Selenastrum capricornutum) [IUCLID; LOILI]; Freshwater Acute Crustacean Toxicity 48h EC50: 7600 mg/L (Ceriodaphnia dubia) [IUCLID; LOILI]; Freshwater Acute Fish Toxicity 96h LC50: 5000 mg/L (Brachydanio rerio) [IUCLID; LOILI]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable. CONSTITUENT 3 (≤100%): No Hazard.</td>
</tr>
<tr>
<td>HR-6L</td>
<td>Halliburton</td>
<td>Cement Retarder</td>
<td>3.5527%</td>
<td>No Hazard</td>
</tr>
<tr>
<td>CFR-3L</td>
<td>Halliburton</td>
<td>Friction Reducer</td>
<td>2.0611%</td>
<td>Marine Water Acute Algae Toxicity 72h EC50: &gt; 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].</td>
</tr>
<tr>
<td>Constituent</td>
<td>Brand</td>
<td>Type</td>
<td>%</td>
<td>Marine Water Acute Algae Toxicity 72h EC50</td>
</tr>
<tr>
<td>-------------</td>
<td>-------</td>
<td>------</td>
<td>----</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Halad-413L</td>
<td>Halliburton</td>
<td>Fluid Loss Additive</td>
<td>3.9108%</td>
<td>Marine Water Acute Algae Toxicity 72h EC50: 1102 mg/L (Skeletonema costatum) [OSPAR]; Marine Water Acute Crustacean Toxicity 48h LC50: &gt; 2000 mg/L (Acartia tonsa) [OSPAR]; Marine Water Acute Fish Toxicity 96h LC50: &gt; 1000 mg/L (Scophthalmus maximus) [OSPAR]; Bioaccumulation Log Kow: &lt; 3.5 [Halliburton Funded Study]; Marine Water Biodegradation 28d: 6% [Halliburton Funded Study];</td>
</tr>
<tr>
<td>NF-6</td>
<td>Halliburton</td>
<td>Reduces air entrainment into cement slurry</td>
<td>0.0544%</td>
<td>Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: &gt; 1000 mg/L (Acartia tonsa) [Halliburton Funded Study]; Marine Water Acute Fish Toxicity 96h LC50: &gt; 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];</td>
</tr>
<tr>
<td>Calcium Chloride</td>
<td>Halliburton</td>
<td>Accelerator</td>
<td>0.3307%</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>Chemicals within products in Part B</td>
<td>CAS number</td>
<td>Maximum Mass fraction in System (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>----------------</td>
<td>-------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mix Water</td>
<td>NA</td>
<td>20.072%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portland cement</td>
<td>65997-15-1</td>
<td>59.169%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water in Product</td>
<td>7732-18-5</td>
<td>11.254%</td>
<td></td>
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</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>2.958%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silica, amorphous - fumed</td>
<td>7631-86-9</td>
<td>2.080%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium Lignosulfonate</td>
<td>8061-51-6</td>
<td>1.907%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfurous acid, monosodium salt, polymer with formaldehyde and acetone</td>
<td>40104-76-5</td>
<td>1.106%</td>
<td></td>
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</tr>
<tr>
<td>Humic acids, sodium salts, polymers with N,N-dimethyl-2-propenamide,</td>
<td>473268-27-8</td>
<td>1.050%</td>
<td></td>
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</tr>
<tr>
<td>sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and 2-propenenitrile, sodium bisulfite-terminated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium Chloride, dihydrate</td>
<td>10035-04-8</td>
<td>0.296%</td>
<td></td>
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</tr>
<tr>
<td>Rape Oil</td>
<td>8002-13-9</td>
<td>0.0487%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>0.0347%</td>
<td></td>
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<tr>
<td>Sodium Chloride</td>
<td>7647-14-5</td>
<td>0.0148%</td>
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<tr>
<td>Monopropylene glycol monooleate</td>
<td>1330-80-9</td>
<td>0.00487%</td>
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</tr>
<tr>
<td>Sorbitan, monopalmitate</td>
<td>26266-57-9</td>
<td>0.00243%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminium stearate</td>
<td>637-12-7</td>
<td>0.00243%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## A. SYSTEM DETAILS:

<table>
<thead>
<tr>
<th>OPERATOR:</th>
<th>DDGT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT / WELL:</td>
<td>Tubridgi Gas Storage Well Campaign</td>
</tr>
<tr>
<td>SYSTEM:</td>
<td>Slurry 3, 15.4ppg, 7-in CSG</td>
</tr>
<tr>
<td>TOTAL VOLUME OF SYSTEM (m³):</td>
<td>1</td>
</tr>
</tbody>
</table>

## B. PRODUCT LIST, Cont’d

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>Ashbourne River</td>
<td>Mix water</td>
<td>22.0274%</td>
<td>N/A</td>
</tr>
<tr>
<td>Cement - Class G</td>
<td>Halliburton</td>
<td>Cement</td>
<td>58.9983%</td>
<td>CONSTITUENT 1 (≤100%): After hardening with water or moisten, cement presents no ecotoxicity risks. (Source: IUCLID 2000) Freshwater Acute Crustacean Toxicity 24h LL50: &gt; 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. CONSTITUENT 2 (≤10%): Freshwater Acute Crustacean Toxicity 24h LL50: &gt; 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.</td>
</tr>
</tbody>
</table>

MSDS Attached: Yes
<table>
<thead>
<tr>
<th>Material</th>
<th>Function</th>
<th>Constituent</th>
<th>Toxicity Details</th>
<th>Biodegradation</th>
<th>Bioaccumulation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gascon 469</td>
<td>Cement Additive Stabiliser</td>
<td>3.4568%</td>
<td>CONSTITUENT 1 (≤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.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONSTITUENT 2 (≤60%): Freshwater Acute Algae Toxicity 72h EC50: 440 mg/L (Selenastrum capricornutum) [IUCLID; LOILI]; Freshwater Acute Crustacean Toxicity 48h EC50: 7600 mg/L (Ceriodaphnia dubia) [IUCLID; LOILI]; Freshwater Acute Fish Toxicity 96h LC50: 5000 mg/L (Brachydanio rerio) [IUCLID; LOILI]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONSTITUENT 3 (≤100%): No Hazard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFR-3L</td>
<td>Friction Reder</td>
<td>0.3062%</td>
<td>Marine Water Acute Algae Toxicity 72h EC50: &gt; 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: &lt; 0 [Halliburton Funded Study]; Marine Water Biodegradation 28d: 0% [Halliburton Funded Study];</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Halad-413L</td>
<td>Fluid Loss Additive</td>
<td>3.4882%</td>
<td>Marine Water Acute Algae Toxicity 72h EC50: 1102 mg/L (Skeletonema costatum) [OSPAR]; Marine Water Acute Crustacean Toxicity 48h LC50: &gt; 2000 mg/L (Acartia tonsa) [OSPAR]; Marine Water Acute Fish Toxicity 96h LC50: &gt; 1000 mg/L (Scophthalmus maximus) [OSPAR];</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTITUENT 1 (≤ 60%):</td>
<td>Acute Fish Toxicity LC50 96h: &gt;1000 mg/L (Cyprinodon variegatus)</td>
<td>No Hazard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTITUENT 2 (≤ 60%):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTITUENT 3 (≤ 0.1%):</td>
<td>Acute Fish Toxicity 48h LC50: &gt;1,000 mg/L [Catalyst Partners SDS]; 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</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTITUENT 4 (≤ 0.1%):</td>
<td>Acute Fish Toxicity 96h LC50: &gt; 1000 mg/L (Scophthalmus maximus)</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTITUENT 5 (≤ 0.1%):</td>
<td>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</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NF-6**

**Halliburton**

Reduces air entrainment into cement slurry

| Bioaccumulation Log Kow: < 3.5 [Halliburton Funded Study]; Marine Water Biodegradation 28d: 6 % [Halliburton Funded Study]; |

**Latex 3000**

**Halliburton**

Cement Expanding Additive

| 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]; |

**WellLife 734**

**Halliburton**

Cement Enhancer

| 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. |

<p>| Source: OECD SIDS; Bioaccumulation BCF: 13 | Yes |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Category</th>
<th>Description</th>
<th>Toxicity</th>
<th>Pesticide Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>WellLife 684</td>
<td>Halliburton</td>
<td>Cement Additive</td>
<td>0.5901%</td>
<td>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. Published toxicology for this product are: Toxicity to Algae: EL50 (72h) &gt; 100 mg/L (Pseudokirchnerella subcapitata) Toxicity to Microorganisms: NOEC (3h) &gt; 1000 mg/L (Activated sludge) Toxicity to Invertebrates EL50 (48h) &gt;100 mg/L (Daphnia magna) Bioaccumulation: Not applicable (Inorganic) Biodegradation: Not applicable.</td>
</tr>
<tr>
<td>MICROBOND HT Component</td>
<td>Halliburton</td>
<td>Cement Additive</td>
<td>2.9501%</td>
<td>No data was available in the IUCLID for this component, as &quot;magnesium ions are a major component of all natural waters&quot;. Source: IUCLID 2000 Product classified as a PLONOR-Pose Little or No Risk to the Environment in accordance to NL HMCS Category.</td>
</tr>
<tr>
<td>Microbond</td>
<td>Halliburton</td>
<td>Expander</td>
<td>2.9501%</td>
<td>CONSTITUENT 1 (≤ 100%): Freshwater Acute Algae Toxicity 72h EC50: &gt; 100 mg/L (Selenastrum capricornutum) [OECD SIDS]; Freshwater Acute Crustacean Toxicity 48h EC50: &gt; 100 mg/L (Daphnia magna) [OECD SIDS]; Freshwater Acute Fish Toxicity 96h EC50: &gt; 100 mg/L (Oryzias latipes) [OECD SIDS]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable. CONSTITUENT 2 (≤ 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: &gt; 100 mg/L (Danio rerio) [ECHA]; Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.</td>
</tr>
<tr>
<td>Constituent</td>
<td>Acute Toxicity</td>
<td>Chronic Toxicity</td>
<td>Bioaccumulation</td>
<td>Biodegradation</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------</td>
<td>------------------</td>
<td>-----------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>Constituent 3 (≤ 10%)</strong></td>
<td>Effect concentrations in the aquatic environment are attributable to a change in pH value.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Freshwater Acute Crustacean Toxicity 48h EC50: 49.1 mg/L (Daphnia magna) [ECHA];</td>
<td>Marine Water Acute Crustacean Toxicity 96h LC50: 158 mg/L (Crangon septemspinosa) [ECHA];</td>
<td>Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable.</td>
<td>Biodegradation: Substance is inorganic - biodegradation is not applicable.</td>
</tr>
<tr>
<td></td>
<td>Freshwater Acute Fish Toxicity 96h LC50: 50.6 mg/L (Oncorhynchus mykiss) [ECHA];</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Constituent 4 (≤ 5%)</strong></td>
<td>Freshwater Acute Algae Toxicity 96h EC50: 650 mg/L (Navicula seminulum) [US EPA ECOTOX];</td>
<td>Freshwater Acute Crustacean Toxicity 48h EC50: 1020 mg/L (Ceriodaphnia dubia) [ECHA];</td>
<td>Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable.</td>
<td>Biodegradation: Substance is inorganic - biodegradation is not applicable.</td>
</tr>
<tr>
<td></td>
<td>Freshwater Acute Fish Toxicity 96h LC50: 7100 mg/L (Lepomis macrochirus) [ECHA];</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>


### C. CHEMICAL LIST

**Chemicals within products in Part B**

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS number</th>
<th>Maximum Mass fraction in System (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Water</td>
<td>NA</td>
<td>22.027%</td>
</tr>
<tr>
<td>Portland cement</td>
<td>65997-15-1</td>
<td>53.224%</td>
</tr>
<tr>
<td>Water in Product</td>
<td>7732-18-5</td>
<td>8.834%</td>
</tr>
<tr>
<td>Magnesium Oxide</td>
<td>1309-48-4</td>
<td>2.661%</td>
</tr>
<tr>
<td>Calcium sulfate dihydrate</td>
<td>10101-41-4</td>
<td>2.661%</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>2.661%</td>
</tr>
<tr>
<td>Functionalized Styrene Butadiene Latex</td>
<td>403824-26-0</td>
<td>2.381%</td>
</tr>
<tr>
<td>Silica, amorphous - fumed</td>
<td>7631-86-9</td>
<td>1.871%</td>
</tr>
<tr>
<td>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</td>
<td>473268-27-8</td>
<td>0.944%</td>
</tr>
<tr>
<td>Calcium aluminate</td>
<td>12042-68-1</td>
<td>0.798%</td>
</tr>
<tr>
<td>Glass, oxide</td>
<td>65997-17-3</td>
<td>0.532%</td>
</tr>
<tr>
<td>Carbon</td>
<td>7440-44-0</td>
<td>0.532%</td>
</tr>
<tr>
<td>Calcium hydroxide</td>
<td>1305-62-0</td>
<td>0.266%</td>
</tr>
<tr>
<td>Rape Oil</td>
<td>8002-13-9</td>
<td>0.219%</td>
</tr>
<tr>
<td>Sulfurous acid, monosodium salt, polymer with formaldehyde and acetone</td>
<td>40104-76-5</td>
<td>0.166%</td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>144-55-8</td>
<td>0.133%</td>
</tr>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>0.0312%</td>
</tr>
<tr>
<td>Monopropylene glycol monooleate</td>
<td>1330-80-9</td>
<td>0.0219%</td>
</tr>
<tr>
<td>Sorbitan, monopalmitate</td>
<td>26266-57-9</td>
<td>0.0110%</td>
</tr>
<tr>
<td>Aluminium stearate</td>
<td>637-12-7</td>
<td>0.0110%</td>
</tr>
<tr>
<td>Styrene</td>
<td>100-42-5</td>
<td>0.00397%</td>
</tr>
<tr>
<td>Butadiene</td>
<td>106-99-0</td>
<td>0.00397%</td>
</tr>
<tr>
<td>4-Vinylcyclohexene</td>
<td>100-40-3</td>
<td>0.00397%</td>
</tr>
</tbody>
</table>
### A. SYSTEM DETAILS:

<table>
<thead>
<tr>
<th>OPERATOR:</th>
<th>DDGT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT / WELL:</td>
<td>Tubridgi Gas Storage Well Campaign</td>
</tr>
<tr>
<td>SYSTEM:</td>
<td>Tunes Spacer-III</td>
</tr>
<tr>
<td>TOTAL VOLUME OF SYSTEM (m³):</td>
<td>1</td>
</tr>
</tbody>
</table>

### B. PRODUCT LIST, Cont'd

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
<th>MSDS Attached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>Ashbourne River</td>
<td>Mix water</td>
<td>65.7126%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>NF-6</td>
<td>Halliburton</td>
<td>Reduces air entrainment into cement slurry</td>
<td>0.0165%</td>
<td>Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (Skeletonema costatum) [Halliburton Funded Study]; Marine Water Acute Crustacean Toxicity 48h LC50: &gt; 1000 mg/L (Acartia tonsa) [Halliburton Funded Study]; Marine Water Acute Fish Toxicity 96h LC50: &gt; 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study]; Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];</td>
<td>Yes</td>
</tr>
<tr>
<td>Barite</td>
<td>Halliburton</td>
<td>Weighting Agent</td>
<td>24.6841%</td>
<td>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);</td>
<td>Yes</td>
</tr>
<tr>
<td>SEM-8</td>
<td>Halliburton</td>
<td>Emulsifier</td>
<td>0.5635%</td>
<td>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);</td>
<td>Yes</td>
</tr>
<tr>
<td>CONSTITUENT 1 (≤60%)</td>
<td>No Hazard</td>
<td>0.4820%</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------</td>
<td>---------</td>
<td>------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTITUENT 2 (≤30%)</td>
<td>No Hazard</td>
<td>0.0000%</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTITUENT 3 (≤30%)</td>
<td>No Hazard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTITUENT 4 (≤30%)</td>
<td>No Hazard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PEN-5M** Halliburton Cleaner

- 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);

**HR-25L** Halliburton Cement Retarder

- Marine Water Biodegradation 28d: 61% [OSPAR];
- 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);
  - Acute Algae Toxicity 72h EC50: 51.4 mg/L (Pseudokirchneriella subcapitata) [ECHA];
  - Freshwater Acute Crustacean Toxicity 48h EC50: 93.3 mg/L (Daphnia magna);
- CONSTITUENT 4 (≤30%):
  - No Hazard
| TUNED SPACER III | Halliburton Mud/Cement | 8.5414% | 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%):  | Yes |
<p>| CONSTITUENT 6 (≤1%) | Freshwater Acute Crustacean Toxicity 24h LL50: &gt; 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>
<table>
<thead>
<tr>
<th>Chemicals within products in Part B</th>
<th>CAS number</th>
<th>Maximum Mass fraction in System (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Water</td>
<td>NA</td>
<td>65.713%</td>
</tr>
<tr>
<td>Barite</td>
<td>13462-86-7</td>
<td>21.762%</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>7.530%</td>
</tr>
<tr>
<td>Sepiolite</td>
<td>63800-37-3</td>
<td>2.259%</td>
</tr>
<tr>
<td>Diatomaceous earth</td>
<td>61790-53-2</td>
<td>0.7530%</td>
</tr>
<tr>
<td>Polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt</td>
<td>68037-05-8</td>
<td>0.4968%</td>
</tr>
<tr>
<td>Water in Product</td>
<td>7732-18-5</td>
<td>0.4055%</td>
</tr>
<tr>
<td>Welan gum</td>
<td>72121-88-1</td>
<td>0.3765%</td>
</tr>
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<td>Isopropanol</td>
<td>67-63-0</td>
<td>0.2765%</td>
</tr>
<tr>
<td>Alcohols, C12-16, ethoxylated</td>
<td>68551-12-2</td>
<td>0.2550%</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>0.07530%</td>
</tr>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>0.07530%</td>
</tr>
<tr>
<td>Rape Oil</td>
<td>8002-13-9</td>
<td>0.01452%</td>
</tr>
<tr>
<td>Alcohols, C6-10, ethoxylated</td>
<td>70879-83-3</td>
<td>0.004968%</td>
</tr>
<tr>
<td>Monopropylene glycol monooleate</td>
<td>1330-80-9</td>
<td>0.001452%</td>
</tr>
<tr>
<td>Sorbitan, monopalmitate</td>
<td>26266-57-9</td>
<td>0.0007260%</td>
</tr>
<tr>
<td>Aluminium stearate</td>
<td>637-12-7</td>
<td>0.0007260%</td>
</tr>
</tbody>
</table>
### A. SYSTEM DETAILS:

<table>
<thead>
<tr>
<th>OPERATOR:</th>
<th>DDGT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT / WELL:</td>
<td>Tubridgi Gas Storage Well Campaign</td>
</tr>
<tr>
<td>SYSTEM:</td>
<td>Tunes Spacer E+</td>
</tr>
<tr>
<td>TOTAL VOLUME OF SYSTEM (m³):</td>
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</tr>
</tbody>
</table>

### B. PRODUCT LIST, Cont’d

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
<th>MSDS Attached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>Ashbourne River</td>
<td>Mix water</td>
<td>66.1692%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>NF-6</td>
<td>Halliburton</td>
<td>Reduces air entrainment into cement slurry</td>
<td>0.0166%</td>
<td>Marine Water Acute Algae Toxicity 72h EC50: 1100 mg/L (Skeletonema costatum) [Halliburton Funded Study];</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Marine Water Acute Crustacean Toxicity 48h LC50: &gt; 1000 mg/L (Acartia tonsa) [Halliburton Funded Study];</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>Marine Water Acute Fish Toxicity 96h LC50: &gt; 1000 mg/L (Scophthalmus maximus) [Halliburton Funded Study];</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Marine Water Biodegradation 28d: 70% [Halliburton Funded Study];</td>
<td></td>
</tr>
<tr>
<td>Barite</td>
<td>Halliburton</td>
<td>Weighting Agent</td>
<td>28.4581%</td>
<td>Acute Fish Toxicity 96hr LC50 76000mg/L @ 96 hr Species Oncorhynchus mykiss EPA Ref# 869 48hr LC50 &gt;30lb/gal (&gt;3594790mg/L) Report no BL8279 Species Pimephales promelas (fish) 48hr LC50 &gt;30lb/bbl (&gt;85556mg/L) Report BL8377 Species Daphnia pulex (Water Flea – crustacean) Bioassay testing where LC50/EC50: &gt;100 mg/L</td>
<td>Yes</td>
</tr>
<tr>
<td>TUNED SPACER E+</td>
<td>Halliburton</td>
<td>Mud/Cement Spacer</td>
<td>4.3034%</td>
<td>CONSTITUENT 1 (≤100%): Component is naturally occurring and not intrinsically hazardous. CONSTITUENT 2 (≤10%): Freshwater Acute Crustacean Toxicity 24h LL50: &gt; 10000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Acute Fish Toxicity 96h LL0: 10000 mg/L (Danio rerio) [Health Canada] (similar substance);</td>
<td>Yes</td>
</tr>
<tr>
<td>SEM-8</td>
<td>Halliburton</td>
<td>Emulsifier</td>
<td>Concentration (%)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>0.5674</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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);

**CONSTITUENT 2 (≤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.

**CONSTITUENT 3 (≤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.

**CONSTITUENT 4 (≤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.

**CONSTITUENT 5 (≤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);

**CONSTITUENT 6 (≤10%)**:
Component is naturally occurring and not intrinsically hazardous.

| Yes |
| PEN-5M | Halliburton Cleaner | 0.4853% | 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); | Yes |
## C. CHEMICAL LIST

<table>
<thead>
<tr>
<th>Chemicals within products in Part B</th>
<th>CAS number</th>
<th>Maximum Mass fraction in System (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Water</td>
<td>NA</td>
<td>66.169%</td>
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<tr>
<td>Barite</td>
<td>13462-86-7</td>
<td>26.478%</td>
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<tr>
<td>Bentonite</td>
<td>1302-78-9</td>
<td>4.004%</td>
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<tr>
<td>Sodium Lignosulfonate</td>
<td>8061-51-6</td>
<td>1.201%</td>
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<tr>
<td>Polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt</td>
<td>68037-05-8</td>
<td>0.5279%</td>
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<tr>
<td>Water in Product</td>
<td>7732-18-5</td>
<td>0.4308%</td>
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<tr>
<td>Welan gum</td>
<td>72121-88-1</td>
<td>0.4004%</td>
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<tr>
<td>Isopropanol</td>
<td>67-63-0</td>
<td>0.2938%</td>
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<tr>
<td>Alcohols, C12-16, ethoxylated</td>
<td>68551-12-2</td>
<td>0.2709%</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>0.1201%</td>
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<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>0.04004%</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>0.04004%</td>
</tr>
<tr>
<td>Rape Oil</td>
<td>8002-13-9</td>
<td>0.01543%</td>
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<tr>
<td>Alcohols, C6-10, ethoxylated</td>
<td>70879-83-3</td>
<td>0.005279%</td>
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<tr>
<td>Monopropylene glycol monooleate</td>
<td>1330-80-9</td>
<td>0.001543%</td>
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<tr>
<td>Sorbitan, monopalmitate</td>
<td>26266-57-9</td>
<td>0.0007713%</td>
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<tr>
<td>Aluminium stearate</td>
<td>637-12-7</td>
<td>0.0007713%</td>
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### A. SYSTEM DETAILS:

<table>
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<tr>
<th>OPERATOR</th>
<th>DDGT</th>
</tr>
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<tbody>
<tr>
<td>PROJECT / WELL</td>
<td>Tubridgi Gas Storage Well Campaign</td>
</tr>
<tr>
<td>SYSTEM</td>
<td>Bentonite Spud Mud</td>
</tr>
<tr>
<td>TOTAL VOLUME OF SYSTEM (m$^3$):</td>
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</table>

### B. PRODUCT LIST, Cont'd

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
<th>MSDS Attached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>Ashbourne River</td>
<td>Mix water</td>
<td>95.6100%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Bentonite</td>
<td>Halliburton</td>
<td>Viscosifier</td>
<td>4.1700%</td>
<td>Acute Fish Toxicity (Marine) 96h LC50: 8-16 g/l (Salmo gairdneri) Source: IUCLID 2000</td>
<td>Yes</td>
</tr>
<tr>
<td>Sodium Bicarbonate</td>
<td>Halliburton</td>
<td>pH control</td>
<td>0.1400%</td>
<td>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</td>
<td>Yes</td>
</tr>
<tr>
<td>Caustic Soda</td>
<td>Halliburton</td>
<td>pH control</td>
<td>0.0800%</td>
<td>Acute Fish Toxicity TLM96: 730 mg/l (Oncorhynchus mykiss)</td>
<td>Yes</td>
</tr>
<tr>
<td>Chemicals within products in Part B</td>
<td>CAS number</td>
<td>Maximum Mass fraction in System (%)</td>
<td></td>
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<td>------------</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>water</td>
<td>N/A</td>
<td>95.6100%</td>
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<tr>
<td>Bentonite</td>
<td>1302-78-9</td>
<td>3.8781%</td>
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</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>0.2085%</td>
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<tr>
<td>Sodium Bicarbonate</td>
<td>144-55-8</td>
<td>0.1400%</td>
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<tr>
<td>Sodium Hydroxide</td>
<td>1310-72-2</td>
<td>0.0800%</td>
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<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>0.0417%</td>
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</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>0.0417%</td>
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<td></td>
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</tbody>
</table>
**A. SYSTEM DETAILS:**

<table>
<thead>
<tr>
<th>OPERATOR:</th>
<th>DDGT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT / WELL:</td>
<td>Tubridgi Gas Storage Well Campaign</td>
</tr>
<tr>
<td>SYSTEM:</td>
<td>Completion Brine</td>
</tr>
<tr>
<td>TOTAL VOLUME OF SYSTEM (m³):</td>
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</tbody>
</table>

**B. PRODUCT LIST, Cont'd**

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
<th>MSDS Attached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>Water supplied by Operator</td>
<td>Mix water</td>
<td>65.2500%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Calcium Chloride</td>
<td>Halliburton</td>
<td>Corrosion Inhibitor</td>
<td>27.8300%</td>
<td>Oral Toxicity LD50: &gt;1000 mg/kg (Rat), 2301 mg/kg (Rat), &gt; 2000 mg/kg (Rat), 2240 mg/kg (Rat), Dermal Toxicity LD50: 5000 mg/kg (Rabbit), Toxicity to Algae: ErC50 (72h) 2900 mg/l (pseudokirchnerella subcapitata); ErC50 (72h) 4000 mg/l (pseudokirchnerella subcapitata), Toxicity to Fish: LC50 (96h) 4360 mg/l (Pimephaales promelas); LC50 (48h) 6560 mg/l (Pimephaales promelas); LC50 (24h) 6660 mg/l (Pimephaales promelas), Toxicity to Invertebrates: EC50 (48h) 2400 mg/l (daphnia magna); EC50 (21d) 610 mg/l (reproduction) (daphnia magna)</td>
<td>Yes</td>
</tr>
<tr>
<td>BARACOR 100</td>
<td>Halliburton</td>
<td>Corrosion Inhibitor</td>
<td>0.4000%</td>
<td>Toxicity (Ethanol, 2,2'-oxybis-reaction products with ammonia, morpholine derivatives residues): Oral toxicity: LD50, 3816 mg/kg-bw (Rat); Dermal Toxicity: LD50: &gt; 2000 mg/kg (Rat), Inhalation Toxicity: LC50 No toxicity at saturation (rat, 8h, vapour); Toxicity (Methanol): Oral toxicity: LD50: &lt; 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</td>
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<tr>
<td>Substance</td>
<td>Toxicity (Nitrilotriacetic acid, trisodium salt monohydrate):</td>
<td>Oral toxicity: LD50: 1740 mg/kg (Rat); Dermal Toxicity: LD50: &gt; 2000 mg/kg (Rat); Inhalation Toxicity: LC50 &gt; 5 mg/l (Rat, Aerosol, 4h)</td>
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<tr>
<td>Ethanol, 2,2'-oxybis-reaction products with ammonia, morpholine derivatives residues</td>
<td>Toxicity to Algae EC50 (72h): 100 mg/l (Skeletonema costatum), EC50 (72h): &gt;120 mg/l (desmodesmus subspicatus), NOEC (72h): &gt;120 mg/l (desmodesmus subspicatus)</td>
<td>Toxicity to Invertebrates LC50 (48h): 287.2 mg/l (Acartia tonsa), EC50 (48h) &gt; 120 mg/l (Daphnia Magna)</td>
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<tr>
<td>Toxizität (Nitrilotriacetic acid, trisodium salt monohydrate):</td>
<td>Ethanol, 2,2'-oxybis-reaction products with ammonia, morpholine derivatives residues</td>
<td>Methanol</td>
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<tr>
<td>Toxicity to Algae EC50 (72h): &gt;91.5 mg/l (Desmodesmus subspicatus)</td>
<td>Toxicity to Fish TL50 (96):103 mg/l (Pimephales promelas), NOEC (229d) &gt;54 mg/l (Pimephales promelas)</td>
<td>Methanol</td>
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<tr>
<td>Toxicity to Microorganisms NOEC (909) &gt; 200 mg/l (activated sludge)</td>
<td>Toxicity to Invertebrates TL50 (96): range 115 mg/l (Gammarus pseudolimnaeus), NOEC (147 d) =9.3mg/l (Gammarus pseudolimnaeus)</td>
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<td>Methanol</td>
<td>Persistence and Degradability: no information available</td>
<td>Log Pow &lt;1</td>
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<td>Methanol</td>
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<tr>
<td>Chemical Name</td>
<td>Company</td>
<td>Type</td>
<td>Persistence and Degradability (95-97% @ 20d)</td>
<td>Toxicity (Glutaraldehyde) Oral Toxicity: LD 50: 316 mg/kg (Rat) Dermal Toxicity: &gt; 2000 mg/kg (Rat), 560 µL/kg (Rabbit) Inhalation Toxicity: LC50: 0.48 mg/l (Rat, 4h) Toxicity (Methanol) Oral Toxicity: LD 50: &gt; 1187-2769 mg/kg (Rat), 3000 mg/kg (Monkey), 300 mg/kg (Human) Dermal Toxicity: 15800 mg/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)</td>
<td>Toxicity (Glutaraldehyde) Oral Toxicity: LD 50: 316 mg/kg (Rat) Dermal Toxicity: &gt; 2000 mg/kg (Rat), 560 µL/kg (Rabbit) Inhalation Toxicity: LC50: 0.48 mg/l (Rat, 4h) Toxicity (Methanol) Oral Toxicity: LD 50: &gt; 1187-2769 mg/kg (Rat), 3000 mg/kg (Monkey), 300 mg/kg (Human) Dermal Toxicity: 15800 mg/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)</td>
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<tr>
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</tr>
<tr>
<td>ALDACIDE G</td>
<td>Halliburton</td>
<td>Biocide</td>
<td>Log Pow -0.77; BCF = 1.0-4.5 (Cyprinus carpio); BCF &lt;10 (Leuciscus idus melanotus)</td>
<td>Log P ow = &lt;0 OECD 117 Biodegradation = 67% in 28days OECD 306 Skeletonema 72hr EC50 = 0.5 mg/L ISO 10253 Acartia 48hr LC50 = 0.1 mg/L ISO 14669 Scophthalmus = 96hr LC50 = 60 mg/L PARCOM 1995 Abra alba 5day LC50 = 18 mg/Kg Fecal pellet production</td>
<td>Log Pow = &lt;0 OECD 117 Biodegradation = 67% in 28days OECD 306 Skeletonema 72hr EC50 = 0.5 mg/L ISO 10253 Acartia 48hr LC50 = 0.1 mg/L ISO 14669 Scophthalmus = 96hr LC50 = 60 mg/L PARCOM 1995 Abra alba 5day LC50 = 18 mg/Kg Fecal pellet production</td>
</tr>
<tr>
<td>OXYGON</td>
<td>Halliburton</td>
<td>Oxygen scavenger</td>
<td>Log Pow = &lt;0 OECD 117 Biodegradation = 67% in 28days OECD 306 Skeletonema 72hr EC50 = 0.5 mg/L ISO 10253 Acartia 48hr LC50 = 0.1 mg/L ISO 14669 Scophthalmus = 96hr LC50 = 60 mg/L PARCOM 1995 Abra alba 5day LC50 = 18 mg/Kg Fecal pellet production</td>
<td>Acute Fish Toxicity 96h NOEC: &gt; 32 mg/l (scophthalmus maximus; Marine) Acute Crustacean Toxicity 48h LC50 738.75 mg/l (acartia tonsa; Marine) Acute Algae Toxicity 72h EC50: 1661.34 mg/l (Skeletonema costatum; Marine)</td>
<td>Acute Fish Toxicity 96h NOEC: &gt; 32 mg/l (scophthalmus maximus; Marine) Acute Crustacean Toxicity 48h LC50 738.75 mg/l (acartia tonsa; Marine) Acute Algae Toxicity 72h EC50: 1661.34 mg/l (Skeletonema costatum; Marine)</td>
</tr>
<tr>
<td>Chemicals within products in Part B</td>
<td>CAS number</td>
<td>Maximum Mass fraction in System (%)</td>
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<tr>
<td>water</td>
<td>N/A</td>
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<tr>
<td>Calcium Chloride</td>
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<td>water in product</td>
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<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
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<td>Ethanol, 2,2'-oxybis-reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>11.6000%</td>
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<td>Organic Acid Salt</td>
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<td>Methanol</td>
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<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>0.4000%</td>
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## A. SYSTEM DETAILS:

<table>
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<tr>
<th>OPERATOR:</th>
<th>DDGT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT / WELL:</td>
<td>Tubridgi Gas Storage Well Campaign</td>
</tr>
<tr>
<td>SYSTEM:</td>
<td>KCl/Polymer</td>
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<tr>
<td>TOTAL VOLUME OF SYSTEM (m³):</td>
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</table>

## B. PRODUCT LIST, Cont’d

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
<th>MSDS Attached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>Ashbourne River</td>
<td>Mix water</td>
<td>90.9200%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Potassium Chloride</td>
<td>Halliburton</td>
<td>Shale Inhibition</td>
<td>6.1000%</td>
<td>Freshwater Acute Algae Toxicity 72h EC50: &gt; 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: &gt; 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.</td>
<td>Yes</td>
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<tr>
<td>BARACARB</td>
<td>Halliburton</td>
<td>Bridging Agent</td>
<td>1.3600%</td>
<td>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa) Acute Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</td>
<td>Yes</td>
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<tr>
<td>Chemical Name</td>
<td>Catalog Name</td>
<td>Function</td>
<td>Concentration (g/l)</td>
<td>Toxicity</td>
<td>Ecotoxicity</td>
</tr>
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<tr>
<td>BARAZAN D PLUS</td>
<td>Halliburton</td>
<td>Viscosifier</td>
<td>0.4100%</td>
<td>Toxicity – Oral Toxicity: LD 50: &gt;5000 mg/kr (Rat)</td>
<td>Ecotoxicity - Acute Fish Toxicity: TLM96: 320-560ppm (Oncorhynchus mykiss)</td>
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<td>Inhalation Toxicity: LC50: &gt; 21 mg/lrat</td>
<td>Ecotoxicity - Acute Crustaceans Toxicity: TLM96: &gt; 75000ppm (Mysidopsis bahia)</td>
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<tr>
<td>PAC-L</td>
<td>Halliburton</td>
<td>Fluid Loss</td>
<td>0.5400%</td>
<td>Acute Fish Toxicity TLM96: &gt; 500 mg/l (Golden orfe)</td>
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<tr>
<td>EZ MUD DP</td>
<td>Halliburton</td>
<td>Shale Inhibition</td>
<td>0.4100%</td>
<td>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa)</td>
<td>Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</td>
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<tr>
<td>ALDACIDE G</td>
<td>Halliburton</td>
<td>Biocide</td>
<td>0.0500%</td>
<td>Toxicity (Glutaraldehyde) Oral Toxicity: LD 50: 316 mg/kr (Rat)</td>
<td>Acute Fish Toxicity LC50 96hr: 13 mg/l (Lepomis macrochirus)</td>
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<td>Dermal Toxicity: &gt; 2000mg/kg (Rat), 560 µL/kg (Rabbit)</td>
<td>Acute Crustacean Toxicity TLM48: 0.11 mg/l (Acartia tonsa)</td>
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<td>Inhalation Toxicity: LC50: 0.48 mg/l (Rat, 4h)</td>
<td>Acute Crustacean Toxicity TLM48: 29.73 mg/l (Daphnia Magna)</td>
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<td>Toxicity (Methanol) Oral Toxicity: LD 50: &gt; 1187-2769 mg/kr (Rat), 3000 mg/kg (Monkey), 300 mg/kg (Human)</td>
<td>Acute Algae Toxicity EC50: 8.1 mg/l (Skeletonema costatum)</td>
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<tr>
<td></td>
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<td>Dermal Toxicity: 15800mg/kg (Rat), 393 mg/kg (Primate)</td>
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<td>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)</td>
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<tr>
<td>Sodium Bicarbonate</td>
<td>Halliburton</td>
<td>pH control</td>
<td>0.1400%</td>
<td>Acute Fish Toxicity 96h LC50: 7550 mg/l (Gambusia affinis))</td>
<td>Acute Fish Toxicity 96h LC50: 7550 mg/l (Gambusia affinis)</td>
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<td>Acute Crustacean Toxicity 48h EC50: 2350 mg/l (Daphnia magna)</td>
<td>Acute Crustacean Toxicity 48h EC50: 2350 mg/l (Daphnia magna)</td>
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<td>Acure Algae Toxicity 5d EC50: 650 mg/l (Nitzschia linearis)</td>
<td>Acure Algae Toxicity 5d EC50: 650 mg/l (Nitzschia linearis)</td>
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<td>Caustic Soda</td>
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<td>pH control</td>
<td>0.0800%</td>
<td>Acute Fish Toxicity TLM96: 730 mg/l (Oncorhynchus mykiss)</td>
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<td>Chemicals within products in Part B</td>
<td>CAS number</td>
<td>Maximum Mass fraction in System (%)</td>
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<td>water</td>
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<td>90.9200%</td>
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<td>Potassium Chloride</td>
<td>7447-40-7</td>
<td>6.1000%</td>
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<td>Calcium Carbonate</td>
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<td>Polyacrylamide / polyacrylate copolymer</td>
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<td>Sodium Bicarbonate</td>
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<td>Crystalline silica, quartz</td>
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<td>0.1360%</td>
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<td>Sodium Hydroxide</td>
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<td>Glutaraldehyde</td>
<td>111-30-8</td>
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<td>Methanol</td>
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### A. SYSTEM DETAILS:

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<tr>
<th>OPERATOR:</th>
<th>DDGT</th>
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<tbody>
<tr>
<td>PROJECT / WELL:</td>
<td>Tubridgi Gas Storage Well Campaign</td>
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<tr>
<td>SYSTEM:</td>
<td>KCl/Polymer - Contingency</td>
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<td>TOTAL VOLUME OF SYSTEM (m³):</td>
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### B. PRODUCT LIST, Cont’d

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
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<tr>
<td>Fresh water</td>
<td>Ashbourne River</td>
<td>Mix water</td>
<td>90.3100%</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Potassium Chloride</td>
<td>Halliburton</td>
<td>Shale Inhibition</td>
<td>6.1000%</td>
<td>Freshwater Acute Algae Toxicity 72h EC50: &gt; 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: &gt; 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.</td>
<td>Yes</td>
</tr>
<tr>
<td>BARACARB (All grades)</td>
<td>Halliburton</td>
<td>Bridging Agent</td>
<td>1.3600%</td>
<td>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa) Acute Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</td>
<td>Yes</td>
</tr>
<tr>
<td>Product</td>
<td>Manufacturer</td>
<td>Category</td>
<td>Toxicity</td>
<td>Details</td>
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<tr>
<td>STEELSEAL (all grades)</td>
<td>Halliburton</td>
<td>Lost Circulation</td>
<td>0.6000%</td>
<td>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 Environment Canada (Canadian DSL)</td>
<td>Yes</td>
</tr>
<tr>
<td>BARAZAN D PLUS</td>
<td>Halliburton</td>
<td>Viscosifier</td>
<td>0.4100%</td>
<td>Toxicity – Oral Toxicity: LD 50: &gt;5000 mg/kr (Rat)</td>
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<td>Yes</td>
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<td>Ecotoxicity - Acute Crustaceans Toxicity: TLM96: &gt; 75000ppm (Mysidopsis bahia)</td>
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<td>PAC-L</td>
<td>Halliburton</td>
<td>Fluid Loss</td>
<td>0.5400%</td>
<td>Acute Fish Toxicity TLM96: &gt; 500 mg/l (Golden orfe)</td>
<td>Yes</td>
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<tr>
<td>EZ MUD DP</td>
<td>Halliburton</td>
<td>Shale Inhibition</td>
<td>0.4100%</td>
<td>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa)</td>
<td>Yes</td>
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<tr>
<td>ALDACIDE G</td>
<td>Halliburton</td>
<td>Biocide</td>
<td>0.0500%</td>
<td>Toxicity (Glutaraldehyde) Oral Toxicity: LD 50: 316 mg/kr (Rat)</td>
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<td>Inhalation Toxicity: LC50: 0.48 mg/l (Rat, 4h)</td>
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<td>Toxicity (Methanol) Oral Toxicity: LD 50: &gt; 1187-2769 mg/kr (Rat),</td>
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<td>3000 mg/kg (Monkey), 300 mg/kg (Human)</td>
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<td>Dermal Toxicity: 15800mg/kg (Rat), 393 mg/kg (Primate)</td>
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<td>Inhalation Toxicity: LC50: 87.5 mg/l (Rat, 6h vapour), 128.2 mg/l</td>
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<td>(Rat, 4h vapour), 83.2 mg/l (rat, 4h), 64000 ppm (rat, 4h), 10 mg/l</td>
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<td>Acute Fish Toxicity LC50 96hr: 13 mg/l (Lepomis macrochirus)</td>
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<td>Acute Crustacean Toxicity TLM48: 0.11 mg/l (Acartia tonsa)</td>
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<td></td>
<td>Acute Crustacean Toxicity TLM48: 29.73 mg/l (Daphnia Magna)</td>
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<td></td>
<td></td>
<td>Acute Algae Toxicity EC50: 8.1 mg/l (Skeletonema costatum)</td>
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<td>Log Pow = &lt;0 OECD 117</td>
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<td>Biodegradation = 67% in 28days OECD 306</td>
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<td>Skeletonema 72hr EC50 = 0.5mg/L ISO 10253</td>
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<td>Acartia 48hr LC50 = 0.1mg/L ISO 14669</td>
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<td>Scophthalmus = 96hr LC50 = 60mg/L PARCOM 1995</td>
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<td>Abra alba 5day LC50 = 18mg/Kg Fecal pellet production</td>
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<td>Component</td>
<td>Halliburton</td>
<td>Type</td>
<td>Concentration</td>
<td>Acute Fish Toxicity LC50: (96 hour) 5-10 mg/l (Brachidiano rerio)</td>
<td>Acute Crustacean Toxicity EC50: (48 hour) 20-50 mg/l (Daphnia magna)</td>
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<td>BDF-427</td>
<td>Halliburton</td>
<td>Coagulant</td>
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</table>
| N-SQUEEZE       | Halliburton          | Lost Circulation | 0.2000%      | **Woodfibre**: This component is an organic substance, exotoxicity information is known. 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". |                                                                   | Yes |
<p>| 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)      |     |
| Citric Acid     | Halliburton          | pH control     | 0.1000%       | Acute Fish Toxicity 96h LC50: &gt;440-760 mg/l (Leuciscus idus)      | Acute Crustacean Toxicity 72h EC50: 120 mg/l (Daphnia magna)       |     |
| 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) | Yes |
| Caustic Soda    | Halliburton          | pH control     | 0.0800%       | Acute Fish Toxicity TLM96: 730 mg/l (Oncorhynchus mykiss)         |                                                                    |     |</p>
<table>
<thead>
<tr>
<th>Chemicals within products in Part B</th>
<th>CAS number</th>
<th>Maximum Mass fraction in System (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>N/A</td>
<td>89.7100%</td>
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<tr>
<td>Potassium Chloride</td>
<td>7447-40-7</td>
<td>6.1000%</td>
</tr>
<tr>
<td>Calcium Carbonate</td>
<td>471-34-1</td>
<td>1.2240%</td>
</tr>
<tr>
<td>Calcined petroleum coke</td>
<td>64743-05-1</td>
<td>0.6000%</td>
</tr>
<tr>
<td>Sodium carboxymethyl cellulose</td>
<td>9004-32-4</td>
<td>0.5346%</td>
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<tr>
<td>Xanthan gum</td>
<td>11138-66-2</td>
<td>0.4100%</td>
</tr>
<tr>
<td>Polyacrylamide / polyacrylate copolymer</td>
<td>25085-02-3</td>
<td>0.3690%</td>
</tr>
<tr>
<td>water in product</td>
<td>7732-18-5</td>
<td>0.1400%</td>
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<tr>
<td>Sodium Bicarbonate</td>
<td>144-55-8</td>
<td>0.1400%</td>
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<td>Crystalline silica, quartz</td>
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<td>0.1360%</td>
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<tr>
<td>Polyamine</td>
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<td>0.0495%</td>
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<tr>
<td>Glyoxal</td>
<td>107-22-2</td>
<td>0.0054%</td>
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<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>0.0005%</td>
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A. SYSTEM DETAILS:

| OPERATOR: | DDGT |
| PROJECT / WELL: | Tubridgi Gas Storage Well Campaign |
| SYSTEM: | KCl/Polymer/Glycol |
| TOTAL VOLUME OF SYSTEM (m³): | 1 |

B. PRODUCT LIST, Cont’d

<table>
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<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
<th>MSDS Attached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>Ashbourne River</td>
<td>Mix water</td>
<td>65.2500%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Sodium Chloride</td>
<td>Halliburton</td>
<td>Weighting Agent</td>
<td>16.9200%</td>
<td>Toxicology Data – Selected Inhalation LC50s: Inhalation LC50 Rat &gt;42 g/m³ 1 h (Source: NLM_CIP) \nToxicology Data – Selected Inhalation LD50s and LC50s: Oral LD50 Rat 3 g/kg (Source: NLM_CIP); Inhalation LC50 Rat &gt;42 g/m³ 1 h (Source: NLM_CIP) \nEcotoxicity – Earthworm – Acute Toxicity Data - 48 Hr LC50 Eisenia fetida: 0.1 - 1 mg/cm² [filter paper] \nEcotoxicity – Freshwater Fish – Acute Toxicity Data: 96 Hr LC50 Lepomis macrochirus: 5560 - 6000 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] \nEcotoxicity – 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]</td>
<td>Yes</td>
</tr>
<tr>
<td>BARACARB</td>
<td>Halliburton</td>
<td>Bridging Agent</td>
<td>6.5700%</td>
<td>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa)\nAcute Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</td>
<td>Yes</td>
</tr>
<tr>
<td>Product</td>
<td>Vendor</td>
<td>Application</td>
<td>Concentration</td>
<td>Key Toxicity Data</td>
<td>Environmental Risk</td>
</tr>
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<td>-----------------------------------------------------------------------------------</td>
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<tr>
<td>Potassium Chloride</td>
<td>Halliburton</td>
<td>Shale Inhibition</td>
<td>5.2800%</td>
<td>Freshwater Acute Algae Toxicity 72h EC50: &gt; 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: &gt; 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.</td>
<td>Yes</td>
</tr>
<tr>
<td>GEM CP</td>
<td>Halliburton</td>
<td>Shale Inhibition</td>
<td>1.6400%</td>
<td>Acute Fish Toxicity EC50: 86 mg/l (Abra alba) Acute Crustacean Toxicity TLM48: 356 mg/l (Acartia tonsa) Acute Algae Toxicity EC50: 465 mg/l (Skeletonema costatum)</td>
<td>Yes</td>
</tr>
<tr>
<td>GEM GP</td>
<td>Halliburton</td>
<td>Shale Inhibition</td>
<td>1.6400%</td>
<td>Toxicity – Oral Toxicity: LD 50: &gt;2000 mg/kg (Rat) Acute Fish Toxicity EC50: 475 ppm (Abra alba) Acute Crustacean Toxicity TLM48: 310 mg/l (Acartia tonsa) Acute 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 Acartha 48hr LC50 = 310mg/L ISO 14669 Scophthalmus 96hr LC50 = &gt;1800mg/L PARCOM 1995 Corophium 10day LC50 = 6597mg/Kg PARCOM1995</td>
<td>Yes</td>
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<tr>
<td>STEELSEAL</td>
<td>Halliburton</td>
<td>Lost Circulation</td>
<td>0.6000%</td>
<td>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 Environment Canada (Canade DSL)</td>
<td>Yes</td>
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<tr>
<td>Product Name</td>
<td>Company</td>
<td>Type</td>
<td>Concentration</td>
<td>Toxicity Information</td>
<td>Yes/No</td>
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<tr>
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<td>-----------</td>
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<td>---------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
</tbody>
</table>
| BARAZAN D PLUS          | Halliburton | Viscosifier        | 0.4700%       | Toxicity – Oral Toxicity: LD 50: >5000 mg/kg (Rat) Inhalation Toxicity: LC50: >21 mg/lrat  
Ecotoxicity - Acute Fish Toxicity: TLM96: 320-560ppm (Onchorhyncus mykiss)  
Ecotoxicity - Acute Crustaceans Toxicity: TLM96: >75000ppm (Mysidopsis bahia)                                                                                                                                                                                                 | 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%       | Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa)  
Acute Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)                                                                                                                                                                                                                                                                                             |        |
| 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 organic substance, ecotoxicity 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 (Onchorhynchus)  
Source: ECOTOX                                                                                                                                                                                                                                                                              | Yes    |
| Sodium Bicarbonate      | Halliburton | pH control         | 0.1200%       | 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    |
| Chemical          | Application | Type    | Concentration | Toxicity (Glutaraldehyde) Oral Toxicity: LD 50: 316 mg/kg (Rat)  
Dermal Toxicity: > 2000 mg/kg (Rat), 560 µL/kg (Rabbit)  
Inhalation Toxicity: LC50: 0.48 mg/l (Rat, 4h)  
Toxicity (Methanol) Oral Toxicity: LD 50: > 1187-2769 mg/kg (Rat), 3000 mg/kg (Monkey), 300 mg/kg (Human)  
Dermal Toxicity: 15800 mg/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)  
Acute Algae Toxicity EC50: 8.1 mg/l (Skeletonema costatum)  
Log Pow = <0 OECD 117  
Biodegradation = 67% in 28 days 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 |
| 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 quadrucauda)  
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 Lepomis 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 |
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<th>Chemicals within products in Part B</th>
<th>CAS number</th>
<th>Maximum Mass fraction in System (%)</th>
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<tr>
<td>water</td>
<td>N/A</td>
<td>65.2700%</td>
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<tr>
<td>sodium Chloride</td>
<td>7647-14-5</td>
<td>16.9000%</td>
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<tr>
<td>Calcium Carbonate</td>
<td>471-34-1</td>
<td>5.9130%</td>
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<tr>
<td>Potassium Chloride</td>
<td>7447-40-7</td>
<td>5.2800%</td>
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<tr>
<td>Polyalkylene</td>
<td>9038-95-3</td>
<td>1.6400%</td>
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<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>1.6400%</td>
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<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>0.6570%</td>
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<td>Calcined petroleum coke</td>
<td>64743-05-1</td>
<td>0.6000%</td>
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<td>Xanthan gum</td>
<td>11138-66-2</td>
<td>0.4700%</td>
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<td>Sodium carboxymethyl cellulose</td>
<td>9004-32-4</td>
<td>0.4653%</td>
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<tr>
<td>Polyacrylamide / polyacrylate copolymer</td>
<td>25085-02-3</td>
<td>0.3150%</td>
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<tr>
<td>water in product</td>
<td>7732-18-5</td>
<td>0.1350%</td>
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<td>Sodium Bicarbonate</td>
<td>144-55-8</td>
<td>0.1200%</td>
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<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>0.1188%</td>
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<tr>
<td>Polyamine</td>
<td>42751-79-1</td>
<td>0.1000%</td>
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<td>Sodium Hydroxide</td>
<td>1310-72-2</td>
<td>0.0700%</td>
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<tr>
<td>Wood fibre</td>
<td>Mixture (1757)</td>
<td>0.0667%</td>
</tr>
<tr>
<td>Cellulose</td>
<td>9005-81-6</td>
<td>0.0667%</td>
</tr>
<tr>
<td>Guar Gum</td>
<td>Mixture (1756)</td>
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<tr>
<td>Citric Acid</td>
<td>77-92-9</td>
<td>0.0500%</td>
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<tr>
<td>Sodium Carbonate</td>
<td>497-19-8</td>
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<td>Glyoxal</td>
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<tr>
<td>Methanol</td>
<td>67-56-1</td>
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### A. SYSTEM DETAILS:

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<th>OPERATOR:</th>
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<tr>
<td>PROJECT / WELL:</td>
<td>Tubridgi Gas Storage Well Campaign</td>
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<tr>
<td>SYSTEM:</td>
<td>KCl/Polymer/Glycol - Contingency</td>
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<td>TOTAL VOLUME OF SYSTEM (m³):</td>
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### B. PRODUCT LIST, Cont'd

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<thead>
<tr>
<th>Trade name</th>
<th>Supplier</th>
<th>Purpose</th>
<th>Product in system fluid (mass %)</th>
<th>Toxicity &amp; Ecotoxicity Info</th>
<th>MSDS Attached</th>
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</thead>
<tbody>
<tr>
<td>Fresh water</td>
<td>Water supplied by Operator</td>
<td>Mix water</td>
<td>63.3100%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
| 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)  
Ecotoxicity – Earthworm – Acute Toxicity Data - 48 Hr LC50 Eisenia fetida: 0.1 - 1 mg/cm² [filter paper]  
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]  
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] | Yes           |
<table>
<thead>
<tr>
<th>Product</th>
<th>Company</th>
<th>Category</th>
<th>Concentration</th>
<th>Acute Fish Toxicity EC50</th>
<th>Acute Crustacean Toxicity TLM48</th>
<th>Acute Algae Toxicity EC50</th>
<th>Toxicity Notes</th>
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<tbody>
<tr>
<td>BARACARB</td>
<td>Halliburton</td>
<td>Bridging Agent</td>
<td>6.5600%</td>
<td></td>
<td>Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa)</td>
<td>Acute Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</td>
<td>Yes</td>
</tr>
<tr>
<td>Potassium Chloride</td>
<td>Halliburton</td>
<td>Shale Inhibition</td>
<td>5.2800%</td>
<td></td>
<td>Freshwater Acute Algae Toxicity 72h EC50: &gt; 100 mg/L (Scenedesmus subspicatus)</td>
<td>Freshwater Acute Crustacean Toxicity 48h EC50: 660 mg/L (Daphnia magna)</td>
<td>Yes</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Freshwater Acute Fish Toxicity 96h LC50: 880 mg/L (Pimephales promelas)</td>
<td>Toxicity: Oral Toxicity: LD50: &gt; 5000 mg/kg (Rat)</td>
<td>Ecotoxicity: Acute Crustaceans Toxicity: TLM96: 100-330 ppm (Crangon crangon)</td>
</tr>
<tr>
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</tr>
<tr>
<td>GEM CP</td>
<td>Halliburton</td>
<td>Shale Inhibition</td>
<td>1.6400%</td>
<td></td>
<td>Acute Fish Toxicity EC50: 86 mg/l (Abra alba)</td>
<td>Acute Crustacean Toxicity TLM48: 356 mg/l (Acartia tonsa)</td>
<td>Acute Algae Toxicity EC50: 465 mg/l (Skeletonema costatum)</td>
</tr>
<tr>
<td>GEM GP</td>
<td>Halliburton</td>
<td>Shale Inhibition</td>
<td>1.6400%</td>
<td></td>
<td>Toxicity – Oral Toxicity: LD 50: &gt;2000 mg/kr (Rat)</td>
<td>Acute Fish Toxicity EC50: 475 ppm (Abra alba)</td>
<td>Acute Crustacean Toxicity TLM48: 310 mg/l (Acartia tonsa)</td>
</tr>
<tr>
<td>QUIK-FREE</td>
<td>Halliburton</td>
<td>Spotting Fluid /Stuck Pipe</td>
<td>0.9400%</td>
<td>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 &quot;Not Considered Hazardous to Water&quot; (Water Classification Annex 1)</td>
<td>Glycerine: Acute Fish Toxicity 48h LC50: &gt; 10000 mg/l (Leuciscus idus</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>
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
- 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

**Crystaline 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 (Brachydandio reio)
- 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

<table>
<thead>
<tr>
<th>Component</th>
<th>Toxicity Tests &amp; Values</th>
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<tr>
<td>BAROFLBRE Halliburton Lost Circulation</td>
<td>Acute Fish Toxicity LC50: 445 mg/l (Cyprinus carpio)</td>
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<tr>
<td>STEELSEAL (all grades) Halliburton Lost Circulation</td>
<td>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 Environment Canada (Canade DSL)</td>
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<tr>
<td>Chemical Name</td>
<td>Company</td>
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<tr>
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<td>BARAZAN D PLUS</td>
<td>Halliburton</td>
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<td>PAC-L</td>
<td>Halliburton</td>
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<td>EZ MUD DP</td>
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<td>BARALKEAN DUAL</td>
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<tr>
<td>Aluminium Sulfate</td>
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<td>Ethylene glycol monobutyl ether</td>
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<th>Acute Crustacean Toxicity EC50</th>
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<tbody>
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<td>BDF-427</td>
<td>Halliburton</td>
<td>Coagulant</td>
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<td>(96 hour) 5-10 mg/l (Brachidiono rerio)</td>
<td>(48 hour) 20-50 mg/l (Daphnia magna)</td>
<td>Yes</td>
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<tr>
<td>Woodfibre</td>
<td></td>
<td></td>
<td></td>
<td>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 &quot;no known toxicity&quot;.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-SQUEEZE</td>
<td>Halliburton</td>
<td>Lost Circulation</td>
<td>0.2000%</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Guar Gum</td>
<td></td>
<td></td>
<td></td>
<td>Component is naturally occurring substance. No ecotoxicity information was available in the IUCLID.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium Bicarbonate</td>
<td>Halliburton</td>
<td>pH control</td>
<td>0.1200%</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>ALDACIDE G</td>
<td>Halliburton</td>
<td>Biocide</td>
<td>0.1200%</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Ingredient</td>
<td>Source</td>
<td>pH Control</td>
<td>pH</td>
<td>EC50</td>
<td>Source</td>
<td>Toxicology Data</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------------------------</td>
<td>------------</td>
<td>----</td>
<td>------</td>
<td>-----------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Caustic Soda</td>
<td>Halliburton</td>
<td>pH control</td>
<td>0.0700%</td>
<td></td>
<td></td>
<td>Acute Fish Toxicity TLM96: 730 mg/l (Oncorhynchus mykiss)</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>Halliburton</td>
<td>pH control</td>
<td>0.0500%</td>
<td></td>
<td></td>
<td>Acute Fish Toxicity 96h LC50: &gt;440-760 mg/l (Leuciscus idus)</td>
</tr>
<tr>
<td>Soda Ash</td>
<td>Halliburton</td>
<td>Buffer</td>
<td>0.0500%</td>
<td></td>
<td></td>
<td>Ecotoxicity - Freshwater Algae - Acute Toxicity Data Sodium carbonate 120hr EC50</td>
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<tr>
<td>Fresh water</td>
<td>Operator</td>
<td>Mix water</td>
<td>63.3100%</td>
<td>N/A</td>
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<td>N/A</td>
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<tr>
<td>Sodium Chloride</td>
<td>Halliburton</td>
<td>Weighting Agent</td>
<td>16.8800%</td>
<td></td>
<td></td>
<td>Toxicology Data –Selected Inhalation LC50s: Inhalation LC50 Rat &gt;42 g/m3 1 h (Source: NLM_CIP)</td>
</tr>
</tbody>
</table>

- mg/kg (Monkey), 300 mg/kg (Human)
- Dermal Toxicity: 15800 mg/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)
- Acute 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

- 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 quadrucauda) 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: 285 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>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>BARACARB</strong></td>
<td>Halliburton</td>
<td>Bridging Agent</td>
<td><strong>6.5600%</strong> Acute Crustacean Toxicity TLM48: 2202 mg/l (Acartia tonsa) Acure Algae Toxicity EC50: 4310 mg/l (Skeletonema costatum)</td>
</tr>
<tr>
<td></td>
<td></td>
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<td><strong>Ecotoxicity – Earthworm – Acute Toxicity Data - 48 Hr LC50 Eisenia foetida: 0.1 - 1 mg/cm² [filter paper]</strong></td>
</tr>
<tr>
<td></td>
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<td></td>
<td><strong>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]</strong></td>
</tr>
<tr>
<td></td>
<td></td>
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<td><strong>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]</strong></td>
</tr>
<tr>
<td>Chemicals within products in Part B</td>
<td>CAS number</td>
<td>Maximum Mass fraction in System (%)</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------------</td>
<td>-------------------------------------</td>
<td></td>
</tr>
<tr>
<td>water</td>
<td>N/A</td>
<td>6331.0000%</td>
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</tr>
<tr>
<td>sodium Chloride</td>
<td>7647-14-5</td>
<td>1688.0000%</td>
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</tr>
<tr>
<td>Calcium Carbonate</td>
<td>471-34-1</td>
<td>590.4000%</td>
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<tr>
<td>Potassium Chloride</td>
<td>7447-40-7</td>
<td>528.0000%</td>
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<tr>
<td>Polyalkylene</td>
<td>9038-95-3</td>
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<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
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<td>Plant Material</td>
<td>Organinc material N/A</td>
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<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
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<tr>
<td>Calcined petroleum coke</td>
<td>64743-05-1</td>
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<tr>
<td>Xanthan gum</td>
<td>11138-66-2</td>
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<td>Sodium carboxymethyl cellulose</td>
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<td>fatty acid ester</td>
<td>10024-47-2</td>
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<tr>
<td>Glycerine</td>
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<tr>
<td>Polyacrylamide / polyacrylate copolymer</td>
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<tr>
<td>Ethylene glycol monobutyl ether</td>
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<tr>
<td>water in product</td>
<td>7732-18-5</td>
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<td>Glutaraldehyde</td>
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<td>Ingredient</td>
<td>CAS Number</td>
<td>Percentage</td>
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<td>Polyamine</td>
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<td>Sodium Hydroxide</td>
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<td>Citric Acid</td>
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<td>Wood fibre</td>
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<td>Cellulose</td>
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<td></td>
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<tr>
<td>Guar Gum</td>
<td>Mixture (1756)</td>
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<tr>
<td>Mixture of C9-C11 alcohol ethoxylate</td>
<td>68439-46-3</td>
<td>5.9500%</td>
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<tr>
<td>Sodium Carbonate</td>
<td>497-19-8</td>
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<tr>
<td>Modified bentonite</td>
<td>71011-24-0</td>
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<tr>
<td>Glyoxal</td>
<td>107-22-2</td>
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<tr>
<td>Aluminium Sulphate</td>
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<tr>
<td>Methanol</td>
<td>67-56-1</td>
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<td>Mixture of dimer and trimer fatty acids of indefinite composition derived from tall oil</td>
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</tr>
<tr>
<td>Fatty acid ester</td>
<td>135800-37-2</td>
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<tr>
<td>Soybean oil</td>
<td>8001-22-7</td>
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<td>Lecithins</td>
<td>8002-43-5</td>
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<td>Isopropanol</td>
<td>67-63-0</td>
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<tr>
<td>Ethylene glycol monobutyl ether</td>
<td>111-76-2</td>
<td>0.0094%</td>
<td></td>
</tr>
<tr>
<td>Diethylene glycol monobutyl ether</td>
<td>112-34-5</td>
<td>0.0094%</td>
<td></td>
</tr>
<tr>
<td>Crystalline silics, quartz</td>
<td>14808-60-7</td>
<td>0.0094%</td>
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<tr>
<td>Quaternary Ammonium Compounds</td>
<td>61788-63-4</td>
<td>0.0094%</td>
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</table>
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>60 - 100%</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Potassium chloride</td>
<td>7447-40-7</td>
<td>2-3</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

CALCIUM CHLORIDE - PELLETS
Page 1 of 6
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/m³): 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/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): 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

CALCIUM CHLORIDE - PELLETS
Page 5 of 6
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
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: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
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</thead>
<tbody>
<tr>
<td>Portland cement</td>
<td>65997-15-1</td>
<td>60 - 100%</td>
<td>TWA: 10 mg/m³</td>
<td>TWA: 10 mg/m³</td>
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<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>&lt;3</td>
<td>TWA: 0.1 mg/m³</td>
<td>TWA: 0.2 mg/m³</td>
<td>TWA: 0.025 mg/m³</td>
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</table>

CEMENT - CLASS G
Page 1 of 7
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 sensitisers 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.
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

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

10. STABILITY AND REACTIVITY

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability Data</td>
<td>Stable</td>
</tr>
<tr>
<td>Hazardous Polymerization</td>
<td>Will Not Occur</td>
</tr>
<tr>
<td>Conditions to Avoid</td>
<td>Keep away from any contact with water.</td>
</tr>
<tr>
<td>Incompatibility (Materials to Avoid)</td>
<td>Hydrofluoric acid.</td>
</tr>
<tr>
<td>Hazardous Decomposition Products</td>
<td>Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).</td>
</tr>
<tr>
<td>Additional Guidelines</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

11. TOXICOLOGICAL INFORMATION

<table>
<thead>
<tr>
<th>Exposure Route</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principle Route of Exposure</td>
<td>Eye or skin contact, inhalation.</td>
</tr>
<tr>
<td>Symptoms related to exposure</td>
<td>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 &quot;Chronic Effects/Carcinogenicity“ subsection below).</td>
</tr>
<tr>
<td>Skin Contact</td>
<td>Can dry skin. May cause an allergic skin reaction. May cause alkali burns with confined contact.</td>
</tr>
<tr>
<td>Eye Contact</td>
<td>May cause severe eye irritation.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>None known</td>
</tr>
<tr>
<td>Aggravated Medical Conditions</td>
<td>Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.</td>
</tr>
</tbody>
</table>
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 IARC Monograph 68, Silica, Some Silicates and Organic Fibres (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
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: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand OEL</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfonic acid salt</td>
<td></td>
<td>30 - 60%</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

CFR-3L
Page 1 of 6
# 3. HAZARDS IDENTIFICATION

<table>
<thead>
<tr>
<th>Hazard Overview</th>
<th>May cause eye and skin irritation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Phrases</td>
<td>None</td>
</tr>
<tr>
<td>HSNO Classification</td>
<td>Non-hazardous</td>
</tr>
</tbody>
</table>

# 4. FIRST AID MEASURES

<table>
<thead>
<tr>
<th>Inhalation</th>
<th>If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Wash with soap and water. Get medical attention if irritation persists.</td>
</tr>
<tr>
<td>Eyes</td>
<td>In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>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.</td>
</tr>
<tr>
<td>Notes to Physician</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

# 5. FIRE FIGHTING MEASURES

<table>
<thead>
<tr>
<th>Suitable Extinguishing Media</th>
<th>Water fog, carbon dioxide, foam, dry chemical.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extinguishing media which must not be used for safety reasons</td>
<td>None known.</td>
</tr>
<tr>
<td>Special Exposure Hazards</td>
<td>Decomposition in fire may produce toxic gases.</td>
</tr>
<tr>
<td>Special Protective Equipment for Fire-Fighters</td>
<td>Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.</td>
</tr>
</tbody>
</table>

# 6. ACCIDENTAL RELEASE MEASURES

<table>
<thead>
<tr>
<th>Personal Precautionary Measures</th>
<th>Use appropriate protective equipment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Precautionary Measures</td>
<td>Prevent from entering sewers, waterways, or low areas.</td>
</tr>
<tr>
<td>Procedure for Cleaning / Absorption</td>
<td>Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.</td>
</tr>
</tbody>
</table>

# 7. HANDLING AND STORAGE

<table>
<thead>
<tr>
<th>Handling Precautions</th>
<th>Avoid contact with eyes, skin, or clothing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Information</td>
<td>Store away from oxidizers. Store in a cool well ventilated area. Keep container closed when not in use.</td>
</tr>
</tbody>
</table>

# 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

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

## 10. STABILITY AND REACTIVITY

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability Data:</td>
<td>Stable</td>
</tr>
<tr>
<td>Hazardous Polymerization:</td>
<td>Will Not Occur</td>
</tr>
<tr>
<td>Conditions to Avoid</td>
<td>None anticipated</td>
</tr>
<tr>
<td>Incompatibility (Materials to Avoid):</td>
<td>Strong oxidizers.</td>
</tr>
<tr>
<td>Additional Guidelines</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>
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***
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
New Zealand: 06-7559274

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

Identification of Substances or Preparation

<table>
<thead>
<tr>
<th>Product Trade Name:</th>
<th>ECONOLITE LIQUID</th>
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</thead>
<tbody>
<tr>
<td>Synonyms:</td>
<td>None</td>
</tr>
<tr>
<td>Chemical Family:</td>
<td>Silicate</td>
</tr>
<tr>
<td>UN Number:</td>
<td>None</td>
</tr>
<tr>
<td>Dangerous Goods Class:</td>
<td>None</td>
</tr>
<tr>
<td>Subsidiary Risk:</td>
<td>None</td>
</tr>
<tr>
<td>Hazchem Code:</td>
<td>None Allocated</td>
</tr>
<tr>
<td>Poisons Schedule:</td>
<td>S5</td>
</tr>
<tr>
<td>Application:</td>
<td>Light Weight Cement Additive</td>
</tr>
</tbody>
</table>

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

2. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
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</thead>
<tbody>
<tr>
<td>Sodium silicate</td>
<td>1344-09-8</td>
<td>35-49</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

ECONOLITE LIQUID
Page 1 of 6
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.
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/m^3):  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/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
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.

Symptoms related to exposure

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***
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
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: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances</td>
<td>Mixture</td>
<td>60 - 100%</td>
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<td>Not applicable</td>
</tr>
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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

<table>
<thead>
<tr>
<th>Property</th>
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<tbody>
<tr>
<td>Physical State</td>
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</tr>
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<td>Specific Gravity @ 20 C (Water=1)</td>
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<tr>
<td>Density @ 20 C (kg/l)</td>
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<td>Bulk Density @ 20 C (kg/M3)</td>
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<td>Flash Point/Range (C):</td>
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<td>Flash Point Method:</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Autoignition Temperature (C):</td>
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</tr>
<tr>
<td>Flammability Limits in Air - Lower (g/m³):</td>
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</tr>
<tr>
<td>Flammability Limits in Air - Lower (%)</td>
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</tr>
<tr>
<td>Flammability Limits in Air - Upper (g/m³):</td>
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<tr>
<td>Flammability Limits in Air - Upper (%)</td>
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</tr>
<tr>
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<td>Solubility in Solvents (g/100ml):</td>
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<td>VOCs (g/l):</td>
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<td>Viscosity, Dynamic @ 20 C (centipoise):</td>
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<td>Viscosity, Kinematic @ 20 C (centistokes):</td>
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<td>Partition Coefficient/n-Octanol/Water:</td>
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<tr>
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</tr>
<tr>
<td>Decomposition Temperature (C):</td>
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</table>

10. STABILITY AND REACTIVITY

Stability Data: Stable
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

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<tr>
<td>substances</td>
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<td></td>
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</tr>
</tbody>
</table>

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

Ecotoxicity Product

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

Ecotoxicity Substance

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
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</thead>
<tbody>
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<td>Contains no hazardous</td>
<td>Mixture</td>
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<td>No information available</td>
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</tr>
<tr>
<td>substances</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.
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
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: 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

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS Number</th>
<th>Percent</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acrylic polymer</td>
<td>Proprietary</td>
<td>10 - 30%</td>
<td>Not determined</td>
<td>Not determined</td>
<td>Not applicable</td>
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</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Physical State:</th>
<th>Liquid</th>
</tr>
</thead>
<tbody>
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<td>Colour:</td>
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<td>Specific Gravity @ 20 C (Water=1):</td>
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<td>Density @ 20 C (kg/l):</td>
<td>1.098</td>
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<tr>
<td>Bulk Density @ 20 C (kg/l):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Boiling Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Freezing Point/Range (C):</td>
<td>Not Determined</td>
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<tr>
<td>Pour Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flash Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flash Point Method:</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Autoignition Temperature (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Lower (g/m³):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Lower (%):</td>
<td>Not Determined</td>
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<tr>
<td>Flammability Limits in Air - Upper (g/m³):</td>
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<tr>
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<td>Not Determined</td>
</tr>
<tr>
<td>Vapour Pressure @ 20 C (mmHg):</td>
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<td>Vapour Density (Air=1):</td>
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<td>Percent Volatiles:</td>
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<td>Solubility in Solvents (g/100ml):</td>
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<td>VOCs (g/l):</td>
<td>Not Determined</td>
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<tr>
<td>Viscosity, Dynamic @ 20 C (centipoise):</td>
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<td>Partition Coefficient/n-Octanol/Water:</td>
<td>Not Determined</td>
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<td>Molecular Weight (g/mole):</td>
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<tr>
<td>Decomposition Temperature (C):</td>
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</table>

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
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***
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
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: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
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</thead>
<tbody>
<tr>
<td>Modified lignosulfonate</td>
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<td>30 - 60%</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
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</table>
### 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

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Physical State</td>
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<td>Freezing Point/Range (°C)</td>
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<td>Evaporation Rate (Butyl Acetate=1)</td>
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<td>Viscosity, Kinematic @ 20 C (centistokes)</td>
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</tr>
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<td>Decomposition Temperature (°C)</td>
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10. STABILITY AND REACTIVITY

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<td>Conditions to Avoid</td>
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<td>Incompatibility (Materials to Avoid)</td>
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<td>Oxides of sulfur. Carbon monoxide and carbon dioxide.</td>
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<tr>
<td>Additional Guidelines</td>
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</table>
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

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***END OF MSDS***
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
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: 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

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS Number</th>
<th>Percent</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
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</thead>
<tbody>
<tr>
<td>Tartaric acid</td>
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<td>Not determined</td>
<td>Not applicable</td>
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</table>
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

HR-25L
Page 2 of 6
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

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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<td>Solubility in Solvents (g/100ml)</td>
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<td>VOCs (g/l)</td>
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<td>Partition Coefficient/n-Octanol/Water</td>
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<tr>
<td>Decomposition Temperature (C)</td>
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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***
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
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: 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

<table>
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<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
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LATEX 3000
Page 1 of 6
2. COMPOSITION/INFORMATION ON INGREDIENTS

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<th>Contains no hazardous substances</th>
<th>Mixture</th>
<th>60 - 100%</th>
<th>Not applicable</th>
<th>Not applicable</th>
<th>Not applicable</th>
</tr>
</thead>
</table>

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.

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
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: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand OEL</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium oxide</td>
<td>1309-48-4</td>
<td>60 - 100%</td>
<td>10 mg/m³</td>
<td>10 mg/m³</td>
<td>10 mg/m³</td>
</tr>
</tbody>
</table>
3. HAZARDS IDENTIFICATION

<table>
<thead>
<tr>
<th>Hazard Overview</th>
<th>May cause eye and respiratory irritation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Phrases</td>
<td>None</td>
</tr>
<tr>
<td>HSNO Classification</td>
<td>Non-hazardous</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

<table>
<thead>
<tr>
<th>Inhalation</th>
<th>If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Wash with soap and water. Get medical attention if irritation persists.</td>
</tr>
<tr>
<td>Eyes</td>
<td>In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>Under normal conditions, first aid procedures are not required.</td>
</tr>
<tr>
<td>Notes to Physician</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

5. FIRE FIGHTING MEASURES

<table>
<thead>
<tr>
<th>Suitable Extinguishing Media</th>
<th>All standard fire fighting media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extinguishing media which must not be used for safety reasons</td>
<td>None known.</td>
</tr>
<tr>
<td>Special Exposure Hazards</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Special Protective Equipment for Fire-Fighters</td>
<td>Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.</td>
</tr>
</tbody>
</table>

6. ACCIDENTAL RELEASE MEASURES

<table>
<thead>
<tr>
<th>Personal Precautionary Measures</th>
<th>Use appropriate protective equipment. Avoid creating and breathing dust.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Precautionary Measures</td>
<td>None known.</td>
</tr>
<tr>
<td>Procedure for Cleaning / Absorption</td>
<td>Scoop up and remove.</td>
</tr>
</tbody>
</table>

7. HANDLING AND STORAGE

<table>
<thead>
<tr>
<th>Handling Precautions</th>
<th>Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Information</td>
<td>Store in a cool, dry location. Store in a cool well ventilated area. Product has a shelf life of 24 months.</td>
</tr>
</tbody>
</table>

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

| Engineering Controls | Use in a well ventilated area.  |
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

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***END OF MSDS***
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
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: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium aluminate</td>
<td>12042-68-1</td>
<td>10 - 30%</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>10 mg/m³</td>
</tr>
<tr>
<td>Calcium hydroxide</td>
<td>1305-62-0</td>
<td>10 - 30%</td>
<td>TWA: 5 mg/m³</td>
<td>TWA: 5 mg/m³</td>
<td>TWA: 5 mg/m³</td>
</tr>
</tbody>
</table>

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.

MICROBOND EXPANDING ADDITIVE
Page 2 of 6
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/PERSOHAL 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

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State:</td>
<td>Solid</td>
</tr>
<tr>
<td>Color:</td>
<td>Light red</td>
</tr>
<tr>
<td>Odor:</td>
<td>Odorless</td>
</tr>
<tr>
<td>pH:</td>
<td>Not Determined</td>
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<tr>
<td>Specific Gravity @ 20 C (Water=1):</td>
<td>3.2</td>
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<tr>
<td>Density @ 20 C (kg/l):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Bulk Density @ 20 C (kg/M3):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Boiling Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Freezing Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Pour Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flash Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flash Point Method:</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Autoignition Temperature (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Lower (g/m³):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Lower (%):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Upper (g/m³):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Upper (%):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Vapor Pressure @ 20 C (mmHg):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Vapor Density (Air=1):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Percent Volatiles:</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Evaporation Rate (Butyl Acetate=1):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Solubility in Water (g/100ml):</td>
<td>Insoluble</td>
</tr>
<tr>
<td>Solubility in Solvents (g/100ml):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>VOCs (g/l):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Viscosity, Dynamic @ 20 C (centipoise):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Viscosity, Kinematic @ 20 C (centistokes):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Partition Coefficient/n-Octanol/Water:</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Molecular Weight (g/mole):</td>
<td>&gt;600</td>
</tr>
<tr>
<td>Decomposition Temperature (C):</td>
<td>Not Determined</td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY

MICROBOND EXPANDING ADDITIVE
Page 3 of 6
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium aluminate</td>
<td>12042-68-1</td>
<td>&gt; 2000 mg/kg (Rat) (similar substance)</td>
<td>&gt; 2000 mg/kg (Rat) (similar substance)</td>
<td>No data available</td>
</tr>
<tr>
<td>Calcium hydroxide</td>
<td>1305-62-0</td>
<td>7340 mg/kg (Rat) &gt; 2000 mg/kg (Rat)</td>
<td>&gt;2500 mg/kg (Rabbit)</td>
<td>No data available</td>
</tr>
</tbody>
</table>

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

Ecotoxicity Product

Acute Fish Toxicity: Not determined

Acute Crustaceans Toxicity: Not determined

Acute Algae Toxicity: Not determined

Ecotoxicity Substance

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium aluminate</td>
<td>12042-68-1</td>
<td>EC50(72h): 3.6 mg/L (Desmodesmus subspicatus) NOEC(72h): 2.6 mg/L (Desmodesmus subspicatus) LC50(96h): &gt;100 mg/L (Danio rerio)</td>
<td>EC50(3h): &gt; 1000 mg/L (Activated sludge of a predominantly domestic sewage)</td>
<td>EC50(48h): 5.4 mg/L (Daphnia magna)</td>
<td></td>
</tr>
</tbody>
</table>
Calcium hydroxide | EC50(72h): 184.57 mg/L (Pseudokirchnerella subcapitata) | TLM96: 100-500 ppm (Oncorhynchus mykiss) 33.884 mg/L (Clarias gariepinus) 50.6 mg/L (Oncorhynchus mykiss) 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)

### 12.2 Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium aluminate</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
<tr>
<td>Calcium hydroxide</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
</tbody>
</table>

### 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
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: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetable oil</td>
<td>Proprietary</td>
<td>60 - 100%</td>
<td>10 mg/m³</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Aluminum stearate</td>
<td>637-12-7</td>
<td>1 - 5%</td>
<td>10 mg/m³</td>
<td>Not applicable</td>
<td>2 mg/m³</td>
</tr>
</tbody>
</table>

NF-6
Page 1 of 6
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
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: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEN-5M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Page 1 of 6
2. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CAS Number</th>
<th>Concentration</th>
<th>TWA</th>
<th>STEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopropanol</td>
<td>67-63-0</td>
<td>10 - 30%</td>
<td>400 ppm</td>
<td>500 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>983 mg/m³</td>
<td>1230 mg/m³</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State:</td>
<td>Liquid</td>
</tr>
<tr>
<td>Color:</td>
<td>Colorless to Amber</td>
</tr>
<tr>
<td>Odor:</td>
<td>Alcohol</td>
</tr>
<tr>
<td>pH:</td>
<td>6.5 - 7.5</td>
</tr>
<tr>
<td>Specific Gravity @ 20 C (Water=1):</td>
<td>0.96</td>
</tr>
<tr>
<td>Density @ 20 C (kg/l):</td>
<td>0.96</td>
</tr>
<tr>
<td>Bulk Density @ 20 C (kg/m³):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Boiling Point/Range (C):</td>
<td>80</td>
</tr>
<tr>
<td>Freezing Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Pour Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flash Point/Range (C):</td>
<td>25</td>
</tr>
<tr>
<td>Flash Point Method:</td>
<td>PMCC</td>
</tr>
<tr>
<td>Autoignition Temperature (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Lower (g/m³):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Lower (%):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Upper (g/m³):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Upper (%):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Vapor Pressure @ 20 C (mmHg):</td>
<td>33</td>
</tr>
<tr>
<td>Vapor Density (Air=1):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Percent Volatiles:</td>
<td>58-60</td>
</tr>
<tr>
<td>Evaporation Rate (Butyl Acetate=1):</td>
<td>Not Determined</td>
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<tr>
<td>Solubility in Water (g/100ml):</td>
<td>Miscible</td>
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<tr>
<td>Solubility in Solvents (g/100ml):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>VOCs (g/l):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Viscosity, Dynamic @ 20 C (centipoise):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Viscosity, Kinematic @ 20 C (centistokes):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Partition Coefficient/n-Octanol/Water:</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Molecular Weight (g/mole):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Decomposition Temperature (C):</td>
<td>Not Determined</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Mobility (Water/Soil/Air)</th>
<th>Not determined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistence/Degradability</td>
<td>Not determined</td>
</tr>
<tr>
<td>Bio-accumulation</td>
<td>Not determined</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Disposal Method</th>
<th>Disposal should be made in accordance with federal, state, and local regulations. Incineration recommended in approved incinerator according to federal, state, and local regulations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminated Packaging</td>
<td>Follow all applicable national or local regulations.</td>
</tr>
</tbody>
</table>

14. TRANSPORT INFORMATION

**Land Transportation**

<table>
<thead>
<tr>
<th>ADR</th>
<th>UN1993, Flammable Liquid, N.O.S.(Contains Isopropanol), 3, III</th>
</tr>
</thead>
</table>

**Air Transportation**

<table>
<thead>
<tr>
<th>ICAO/IATA</th>
<th>UN1993, Flammable Liquid, N.O.S., 3, III (Contains Isopropanol)</th>
</tr>
</thead>
</table>

**Sea Transportation**

<table>
<thead>
<tr>
<th>IMDG</th>
<th>UN1993, Flammable Liquid, N.O.S.(Contains Isopropanol), 3, III, (25 C) EmS F-E, S-E</th>
</tr>
</thead>
</table>

**Other Transportation Information**

<table>
<thead>
<tr>
<th>Labels:</th>
<th>Flammable Liquid</th>
</tr>
</thead>
</table>

15. REGULATORY INFORMATION

**Chemical Inventories**

<table>
<thead>
<tr>
<th>Australian AICS Inventory</th>
<th>All components listed on inventory or are exempt.</th>
</tr>
</thead>
</table>

PEN-5M
Page 5 of 6
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
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
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: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
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</thead>
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<tr>
<td>SEM-8™ EMULSIFIER</td>
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</table>
2. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CAS No.</th>
<th>Percentage</th>
<th>TWA (ppm)</th>
<th>STEL (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt</td>
<td>88037-05-8</td>
<td>60 - 100%</td>
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<td>Not applicable</td>
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<tr>
<td>Isopropanol</td>
<td>67-63-0</td>
<td>10 - 30%</td>
<td>TWA: 400 ppm</td>
<td>STEL: 500 ppm</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>TWA: 983 mg/m³</td>
<td>STEL: 1230 mg/m³</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>TWA: 400 ppm</td>
<td>STEL: 983 mg/m³</td>
</tr>
</tbody>
</table>

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.


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

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<tr>
<th>Property</th>
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<tr>
<td>Flammability Limits in Air - Upper (%)</td>
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<td>Vapor Pressure @ 20 C (mmHg)</td>
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<tr>
<td>Percent Volatiles</td>
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<td>Evaporation Rate (Butyl Acetate=1)</td>
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<tr>
<td>Solubility in Water (g/100ml)</td>
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<tr>
<td>VOCs (g/l)</td>
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<td>Molecular Weight (g/mole)</td>
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<tr>
<td>Decomposition Temperature (C)</td>
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</tr>
</tbody>
</table>

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.
- 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. 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 All components listed on inventory or are exempt.
New Zealand Inventory of This product does not comply with NZIOC
Chemicals
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
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
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: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bentonite</td>
<td>1302-78-9</td>
<td>60 - 100%</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>TWA: 1 mg/m³</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>1 - 5%</td>
<td>TWA: 0.1 mg/m³</td>
<td>TWA: 0.2 mg/m³</td>
<td>TWA: 0.025 mg/m³</td>
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<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>0.1 - 1%</td>
<td>TWA: 0.1 mg/m³</td>
<td>TWA: 0.1 mg/m³</td>
<td>TWA: 0.025 mg/m³</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>0.1 - 1%</td>
<td>TWA: 0.1 mg/m³</td>
<td>TWA: 0.1 mg/m³</td>
<td>0.05 mg/m³</td>
</tr>
</tbody>
</table>

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
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.

<table>
<thead>
<tr>
<th>Toxicology data for the components</th>
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</thead>
<tbody>
<tr>
<td>Substances</td>
</tr>
<tr>
<td>CAS Number</td>
</tr>
<tr>
<td>Bentonite</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
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<tr>
<td>Crystalline silica, cristobalite</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
</tr>
</tbody>
</table>

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

Ecotoxicity Product

| Acute Fish Toxicity: | Not determined |
| Acute Crustaceans Toxicity: | Not determined |
| Acute Algae Toxicity: | Not determined |

Ecotoxicity Substance

<table>
<thead>
<tr>
<th>Substances</th>
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<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
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</table>

TUNED SPACER E+  
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### 12.2. Persistence and degradability

**Expected to be readily biodegradable**

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<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
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<tr>
<td>Crystalline silica, tridymite</td>
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<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
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### 12.3. Bioaccumulative potential

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<th>Log Pow</th>
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<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>No information available</td>
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<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
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### 12.4. Mobility in soil

No information available

### 12.5. Results of PBT and vPvB assessment

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<th>PBT and vPvB assessment</th>
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</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>No data available</td>
</tr>
</tbody>
</table>

### 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**
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
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***
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
New Zealand: 06-7559274

Fire, Police & Ambulance - Emergency Telephone

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

Identification of Substances or Preparation

<table>
<thead>
<tr>
<th>Product Trade Name:</th>
<th>TUNED® SPACER III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms:</td>
<td>None</td>
</tr>
<tr>
<td>Chemical Family:</td>
<td>Blend</td>
</tr>
<tr>
<td>UN Number:</td>
<td>None</td>
</tr>
<tr>
<td>Dangerous Goods Class:</td>
<td>None</td>
</tr>
<tr>
<td>Subsidiary Risk:</td>
<td>None</td>
</tr>
<tr>
<td>Hazchem Code:</td>
<td>None Allocated</td>
</tr>
<tr>
<td>Poisons Schedule:</td>
<td>None Allocated</td>
</tr>
<tr>
<td>Application:</td>
<td>Cement Spacer</td>
</tr>
</tbody>
</table>

Prepared By

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

2. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>60 - 100%</td>
<td>TWA: 0.1 mg/m³</td>
<td>TWA: 0.2 mg/m³</td>
<td>TWA: 0.025 mg/m³</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State:</td>
<td>Powder</td>
</tr>
<tr>
<td>Color:</td>
<td>Dark gray</td>
</tr>
<tr>
<td>Odor:</td>
<td>Odorless</td>
</tr>
<tr>
<td>pH:</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Specific Gravity @ 20 C (Water=1):</td>
<td>2.51</td>
</tr>
<tr>
<td>Density @ 20 C (kg/l):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Bulk Density @ 20 C (kg/M3):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Boiling Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Freezing Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Pour Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flash Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flash Point Method:</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Autoignition Temperature (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Lower (g/m³):</td>
<td>Not Determined</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Toxicology data for the components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Substances</strong></td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
</tr>
</tbody>
</table>

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

**Ecotoxicity Product**
- Acute Fish Toxicity: Not determined
- Acute Crustaceans Toxicity: Not determined
- Acute Algae Toxicity: Not determined

**Ecotoxicity Substance**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Daphnia Magna (Water Flea)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>7440-44-0</td>
<td>60 - 100%</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>10 mg/m$^3$</td>
</tr>
</tbody>
</table>

WellLife™ 684
Page 1 of 6
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
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: 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
<table>
<thead>
<tr>
<th>Conditions to Avoid</th>
<th>None known</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incompatibility (Materials to Avoid)</td>
<td>Strong oxidizers.</td>
</tr>
<tr>
<td>Hazardous Decomposition Products</td>
<td>Carbon monoxide and carbon dioxide.</td>
</tr>
<tr>
<td>Additional Guidelines</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

### 11. TOXICOLOGICAL INFORMATION

<table>
<thead>
<tr>
<th>Principle Route of Exposure</th>
<th>Eye or skin contact, inhalation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms related to exposure</td>
<td></td>
</tr>
<tr>
<td>Inhalation</td>
<td>May cause mild respiratory irritation.</td>
</tr>
<tr>
<td>Skin Contact</td>
<td>May cause mild skin irritation.</td>
</tr>
<tr>
<td>Eye Contact</td>
<td>May cause mild eye irritation.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>May cause mild gastric distress.</td>
</tr>
<tr>
<td><strong>Aggravated Medical Conditions</strong></td>
<td>Skin disorders.</td>
</tr>
<tr>
<td><strong>Chronic Effects/Carcinogenicity</strong></td>
<td>Prolonged, excessive exposure to dust may cause pneumoconiosis, a lung disease caused by inhaling dust particles less than 0.5 micrometers into the lungs.</td>
</tr>
<tr>
<td><strong>Other Information</strong></td>
<td>None known.</td>
</tr>
<tr>
<td><strong>Toxicity Tests</strong></td>
<td></td>
</tr>
<tr>
<td>Oral Toxicity:</td>
<td>Not determined</td>
</tr>
<tr>
<td>Dermal Toxicity:</td>
<td>Not determined</td>
</tr>
<tr>
<td>Inhalation Toxicity:</td>
<td>Not determined</td>
</tr>
<tr>
<td>Primary Irritation Effect:</td>
<td>Not determined</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Not determined</td>
</tr>
<tr>
<td>Genotoxicity:</td>
<td>Not determined</td>
</tr>
<tr>
<td>Reproductive / Developmental Toxicity:</td>
<td>Not determined</td>
</tr>
</tbody>
</table>

### 12. ECOLOGICAL INFORMATION

<table>
<thead>
<tr>
<th>Mobility (Water/Soil/Air)</th>
<th>Not determined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistence/Degradability</td>
<td>Not determined</td>
</tr>
<tr>
<td>Bio-accumulation</td>
<td>Not determined</td>
</tr>
</tbody>
</table>

Ecotoxicological Information

<table>
<thead>
<tr>
<th>Acute Fish Toxicity:</th>
<th>Not determined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Crustaceans Toxicity:</td>
<td>Not determined</td>
</tr>
<tr>
<td>Acute Algae Toxicity:</td>
<td>Not determined</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous</td>
<td>Mixture</td>
<td>60 - 100%</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

WellLife™ 734
Page 1 of 6
3. HAZARDS IDENTIFICATION

<table>
<thead>
<tr>
<th>Hazard Overview</th>
<th>No significant hazards expected.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Phrases</td>
<td>None</td>
</tr>
<tr>
<td>HSNO Classification</td>
<td>Non-hazardous</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

<table>
<thead>
<tr>
<th>Inhalation</th>
<th>Under normal conditions, first aid procedures are not required.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Under normal conditions, first aid procedures are not required.</td>
</tr>
<tr>
<td>Eyes</td>
<td>In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>Under normal conditions, first aid procedures are not required.</td>
</tr>
<tr>
<td>Notes to Physician</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

5. FIRE FIGHTING MEASURES

<table>
<thead>
<tr>
<th>Suitable Extinguishing Media</th>
<th>All standard fire fighting media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extinguishing media which must not be used for safety reasons</td>
<td>None known.</td>
</tr>
<tr>
<td>Special Exposure Hazards</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Special Protective Equipment for Fire-Fighters</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

6. ACCIDENTAL RELEASE MEASURES

<table>
<thead>
<tr>
<th>Personal Precautionary Measures</th>
<th>Use appropriate protective equipment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Precautionary Measures</td>
<td>None known.</td>
</tr>
<tr>
<td>Procedure for Cleaning / Absorption</td>
<td>Scoop up and remove.</td>
</tr>
</tbody>
</table>

7. HANDLING AND STORAGE

<table>
<thead>
<tr>
<th>Handling Precautions</th>
<th>Material is slippery underfoot. Keep floors clean of spills.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Information</td>
<td>Store in a dry location. Product has a shelf life of 60 months.</td>
</tr>
</tbody>
</table>

8. EXPOSURE CONTROLS/PERSOANL PROTECTION

<table>
<thead>
<tr>
<th>Engineering Controls</th>
<th>None known.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory Protection</td>
<td>Not normally necessary.</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
</tr>
<tr>
<td>Color</td>
<td>White to Variable</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>pH</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Specific Gravity @ 20 C (Water=1)</td>
<td>2.6</td>
</tr>
<tr>
<td>Density @ 20 C (kg/l)</td>
<td>2.48</td>
</tr>
<tr>
<td>Bulk Density @ 20 C (kg/m³):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Boiling Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Freezing Point/Range (C):</td>
<td>1200</td>
</tr>
<tr>
<td>Pour Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flash Point/Range (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flash Point Method</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Autoignition Temperature (C):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Lower (g/m³):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Lower (%):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Upper (g/m³):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flammability Limits in Air - Upper (%):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Vapor Pressure @ 20 C (mmHg):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Vapor Density (Air=1):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Percent Volatiles</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Evaporation Rate (Butyl Acetate=1):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Solubility in Water (g/100ml):</td>
<td>Insoluble</td>
</tr>
<tr>
<td>Solubility in Solvents (g/100ml):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>VOcs (g/l):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Viscosity, Dynamic @ 20 C (centipoise):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Viscosity, Kinematic @ 20 C (centistokes):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Partition Coefficient/n-Octanol/Water:</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Molecular Weight (g/mole):</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Decomposition Temperature (C):</td>
<td>Not Determined</td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability Data:</td>
<td>Stable</td>
</tr>
<tr>
<td>Hazardous Polymerization:</td>
<td>Will Not Occur</td>
</tr>
<tr>
<td>Conditions to Avoid</td>
<td>None known.</td>
</tr>
<tr>
<td>Incompatibility (Materials to Avoid)</td>
<td>None known.</td>
</tr>
<tr>
<td>Hazardous Decomposition Products</td>
<td>None known.</td>
</tr>
<tr>
<td>Additional Guidelines</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

11. TOXICOLOGICAL INFORMATION

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principle Route of Exposure</td>
<td>Eye or skin contact, inhalation.</td>
</tr>
</tbody>
</table>
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.
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

WellLife™ 734
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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***
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
New Zealand: +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: CAS Number
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).

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

3. Composition/information on Ingredients

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>0.1 - 1%</td>
<td>Carc. 2 (H351) STOT RE 1 (H372)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>TWA: 0.1 mg/m³</td>
<td>TWA: 0.025 mg/m³</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid Powder</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>pH</td>
<td>8-9</td>
</tr>
<tr>
<td>Freezing Point / Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting Point / Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Boiling Point / Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>2.7</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Insoluble in water</td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>&gt; 15000 mg/kg (human)</td>
<td>No information available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

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.
Interactions

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Non-irritating to the skin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Serious eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Mechanical irritation of the eyes is possible. No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Not regarded as mutagenic.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>EC50 (72 h) =440 mg/L (Selenastrum capricornutum)</td>
<td>LL0 (96 h) =10000 mg/L (Danio rerio)</td>
<td>No information available</td>
<td>LL50 (24 h) &gt;10000 mg/L (Daphnia magna)</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
</tbody>
</table>
12.3. Bioaccumulative potential
Does not bioaccumulate.

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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
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

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
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 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Odor</td>
<td>Slight</td>
</tr>
<tr>
<td>pH</td>
<td>5-9</td>
</tr>
<tr>
<td>Freezing Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>No data available</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Miscible with water</td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>
12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Inventory</th>
<th>Regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian AICS Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>New Zealand Inventory of Chemicals</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>EINECS Inventory</td>
<td>This product, and all its components, complies with EINECS</td>
</tr>
<tr>
<td>US TSCA Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>Canadian DSL Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
</tbody>
</table>

Poisons Schedule number
None Allocated

16. Other information

Date of preparation or review

Revision Date: 01-Oct-2015

Revision Note
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

CITRIC ACID ANHYDROUS

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>60 - 100%</td>
<td>Eye Irrit. 2A (H319)</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**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.
9. Physical and Chemical Properties

### 9.1. Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks/Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
<td></td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Freezing Point / Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Melting Point / Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Boiling Point / Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.66</td>
<td></td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Soluble in water</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>1000 °C / 1832 °F</td>
<td></td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

### 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)
<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>5400 mg/kg (Rat)</td>
<td>&gt; 2000 mg/kg</td>
<td>No data available</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5790 mg/kg (Mouse)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11,700 mg/kg (Rat)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>Not irritating to skin in rabbits.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Serious eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>Causes moderate eye irritation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>Patch test on human volunteers did not demonstrate sensitization properties</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>Did not show mutagenic effects in animal experiments</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>Did not show carcinogenic effects in animal experiments</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>No data of sufficient quality are available.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>No adverse health effects are expected from swallowing.</td>
</tr>
</tbody>
</table>

**12. Ecological Information**

**Ecotoxicity**
**Product Ecotoxicity Data**
No data available
12.2. Persistence and degradability

Biodegradable.

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>Readily biodegradable (97% @ 28d)</td>
</tr>
</tbody>
</table>

12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>-1.61 to -1.80</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid</td>
<td>77-92-9</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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
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

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
New Zealand: +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
NA
CAS Number
60 - 100%
PERCENT (w/w)
Not Applicable
GHS Classification - Australia

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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
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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks/ - Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State:</td>
<td>Solid</td>
<td></td>
</tr>
<tr>
<td>Odor:</td>
<td>Mild</td>
<td></td>
</tr>
<tr>
<td>pH:</td>
<td>6-8</td>
<td></td>
</tr>
<tr>
<td>Freezing Point / Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Melting Point / Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Boiling Point / Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Soluble in water</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

9.2. Other information

VOC Content (%)                          | No data available          |

Bulk Density                            | 40 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

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

Immediate, delayed and chronic health effects from exposure

<table>
<thead>
<tr>
<th>Exposure Route</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation</td>
<td>None known.</td>
</tr>
<tr>
<td>Eye Contact</td>
<td>May cause mild eye irritation.</td>
</tr>
<tr>
<td>Skin Contact</td>
<td>May cause mild skin irritation.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>None known.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability
12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values</td>
<td>NA</td>
<td>No information</td>
</tr>
<tr>
<td>according to the competent authority</td>
<td></td>
<td>available</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values</td>
<td>NA</td>
<td>No information</td>
</tr>
<tr>
<td>according to the competent authority</td>
<td></td>
<td>available</td>
</tr>
</tbody>
</table>

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
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: 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/m² – 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
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

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS Number</th>
<th>Percent</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyloxirane polymer with oxirane, monobutyl ether</td>
<td>9038-95-3</td>
<td>60 - 100%</td>
<td>Not determined</td>
<td>Not determined</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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.


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): 19
Viscosity, Kinematic @ 20 C (centistokes): Not Determined
Partition Coefficient/n-Octanol/Water: 0.353
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

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyloxirane polymer with oxirane, monobutyl ether</td>
<td>9038-95-3</td>
<td>12300 µL/kg (Rat) &gt; 4728 mg/kg (Rat)</td>
<td>20 mL/kg (Rabbit) &gt; 21140 mg/kg (Rat)</td>
<td>0.26 mg/L 4H</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyloxirane polymer with oxirane, monobutyl ether</td>
<td>9038-95-3</td>
<td>EC50: 465 mg/l (Skeletonema costatum)</td>
<td>LC50(96h): 3170 - 11900 mg/L (Pimephales promelas)</td>
<td>No information available</td>
<td>TLM48: 356 mg/l (Acartia tonsa) EC50(48h): 17000 - 19000 mg/L (Daphnia magna)</td>
</tr>
</tbody>
</table>

12.2 Persistence and degradability
Not readily biodegradable

12.3 Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substance</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyloxirane polymer with oxirane, monobutyl ether</td>
<td>0.353</td>
</tr>
</tbody>
</table>

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 category(ies):
- 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
Emergency telephone - §45 - (EC)1272/2008

<table>
<thead>
<tr>
<th>Country</th>
<th>Telephone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>112</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Bulgarian poison centre: +359 2 915-44-09 or +359 2 915-43-46</td>
</tr>
<tr>
<td>Croatia</td>
<td>Centar za kontrolu otrovanja (CKO): (+385 1) 23-48-342 (Poison Control Center (PCC) - Institute for Medical Research and Occupational Health)</td>
</tr>
<tr>
<td>Cyprus</td>
<td>+210 7793777</td>
</tr>
<tr>
<td>Denmark</td>
<td>Poison Control Hotline (DK): +45 82 12 12 12</td>
</tr>
<tr>
<td>France</td>
<td>ORFILA (FR): + 01 45 42 59 59</td>
</tr>
<tr>
<td>Germany</td>
<td>Poison Center Berlin (DE): +49 030 30686 790</td>
</tr>
<tr>
<td>Italy</td>
<td>Poison Center, Milan (IT): +39 02 6610 1029</td>
</tr>
<tr>
<td>Netherlands</td>
<td>National Poisons Information Center (NL): +31 30 274 88 88 (NB: this service is only available to health professionals)</td>
</tr>
</tbody>
</table>
SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Regulation (EC) No 1272/2008

<table>
<thead>
<tr>
<th>Serious Eye Damage/Irritation</th>
<th>Category 1 - (H318)</th>
</tr>
</thead>
</table>

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
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9004-77-7</td>
<td>60 - 100%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substance</th>
<th>EINECS</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>EU - CLP Substance Classification</th>
<th>REACH Reg. No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>500-012-0</td>
<td>9004-77-7</td>
<td>60 - 100%</td>
<td>Eye Corr. 1 (H318)</td>
<td>01-2119484615-30</td>
</tr>
</tbody>
</table>

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
Other Guidelines
Please refer to the attached Annex for a listing of exposure scenarios.
No information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters
Exposure Limits

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>EU</th>
<th>UK</th>
<th>Netherlands</th>
<th>France</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Germany</th>
<th>Spain</th>
<th>Portugal</th>
<th>Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Austria</th>
<th>Ireland</th>
<th>Switzerland</th>
<th>Norway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
9.1. Information on basic physical and chemical properties

**Derived No Effect Level (DNEL)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>195 mg/m³</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
<td>60 mg/kg bw/day</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
</tr>
</tbody>
</table>

**General Population**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>117 mg/m³</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
<td>25 mg/kg bw/day</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
<td>2.5 mg/kg bw/day</td>
<td>Not available</td>
</tr>
</tbody>
</table>

**Predicted No Effect Concentration (PNEC)**

<table>
<thead>
<tr>
<th>Substances</th>
<th>Freshwater</th>
<th>Marine water</th>
<th>Intermittent release</th>
<th>Sewage treatment plant</th>
<th>Sediment (freshwater)</th>
<th>Sediment (marine water)</th>
<th>Air</th>
<th>Soil</th>
<th>Secondary poisoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>4.5 m/L</td>
<td>0.31 mg/L</td>
<td>24.9 mg/L</td>
<td>500 mg/L</td>
<td>6.6 mg/kg dw</td>
<td>0.66 mg/kg dw</td>
<td>Not available</td>
<td>1.32 mg/kg dw</td>
<td>333 mg/kg food</td>
</tr>
</tbody>
</table>

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.

Rubber apron.

**Skin Protection**

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 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**

**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**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>&gt; 5000 mg/kg (Rat) &gt; 2000 mg/kg (Rat)</td>
<td>6540 mg/kg (Rat) 3540 mg/kg (Rabbit) (similar substance) &gt; 2000 mg/kg (Rat) (similar substance)</td>
<td>&gt; 2.6 mg/L (Rat) 4h (similar substance) &gt; 2000 mg/L (Rat) 1h (similar substance)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Corrosion/Irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Non-irritating to the skin (Rabbit)</td>
</tr>
</tbody>
</table>
### Substances

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>EC50(72h): 391 mg/L (growth rate) (Skeletonema costatum)</td>
<td>EC50: 475 ppm (Abra alba)</td>
<td>IC50(16h): &gt; 5000 mg/L (Growth inhibition,</td>
<td>TLM48: 310 mg/L (Acartia tonsa)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LC50(96h): &gt;1800 mg/L (Scophthalmus maximus)</td>
<td>Activated sludge) (similar substance – 2-(2-butoxyethoxy)ethoxy)ethanol</td>
<td>EC50(48h): &gt; 3200 mg/L (Daphnia magna) (similar substance – ethanol, 2-butoxy-, manufacture of, by-products from)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EC10(30m): &gt; 1995 mg/L (respiration rate, activated sludge) (similar substance – 2-(2-butoxyethoxy)ethoxy)ethanol</td>
<td></td>
</tr>
</tbody>
</table>

### SECTION 12: Ecological information

#### 12.1. Toxicity

**Ecotoxicity effects**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>EC50(72h): 391 mg/L (growth rate) (Skeletonema costatum)</td>
<td>EC50: 475 ppm (Abra alba)</td>
<td>IC50(16h): &gt; 5000 mg/L (Growth inhibition,</td>
<td>TLM48: 310 mg/L (Acartia tonsa)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LC50(96h): &gt;1800 mg/L (Scophthalmus maximus)</td>
<td>Activated sludge) (similar substance – 2-(2-butoxyethoxy)ethoxy)ethanol</td>
<td>EC50(48h): &gt; 3200 mg/L (Daphnia magna) (similar substance – ethanol, 2-butoxy-, manufacture of, by-products from)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EC10(30m): &gt; 1995 mg/L (respiration rate, activated sludge) (similar substance – 2-(2-butoxyethoxy)ethoxy)ethanol</td>
<td></td>
</tr>
</tbody>
</table>

#### 12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td></td>
</tr>
</tbody>
</table>
12.3. Bioaccumulative potential
Does not bioaccumulate.

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>0.436</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Log Kow &lt; 4.5</td>
</tr>
</tbody>
</table>

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).

<table>
<thead>
<tr>
<th>Substances</th>
<th>PBT and vPvB assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>Not PBT/vPvB</td>
</tr>
</tbody>
</table>

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/NDSL - 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
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
ErC50 – Effective Concentration growth rate 50%
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL0 – Lethal Loading 0%
LL50 – Lethal Loading 50%
MARPOL – International Convention for the Prevention of Pollution from Ships
mg/kg – milligram/kilogram
mg/L – milligram/liter
NIOSH – National Institute for Occupational Safety and Health
NOEC – No Observed Effect Concentration
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
PC – Chemical Product category
PEL – Permissible Exposure Limit
ppm – parts per million
PROC – Process category
STEL – Short Term Exposure Limit
SU – Sector of Use category

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID
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
SU22 - 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.
<table>
<thead>
<tr>
<th>Substances</th>
<th>Assumed municipal sewage treatment plant flow m3/d</th>
<th>Wastewater Emission Removal Efficiency</th>
<th>Estimated product removal from wastewater via municipal sewage treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Conditions and measures related to treatment of waste (including article waste)**

<table>
<thead>
<tr>
<th>Substances</th>
<th>Conditions and measures related to treatment of waste (including article waste)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>No wastewater treatment required. Dispose of contents/container in accordance with local/regional/national/international regulations.</td>
</tr>
</tbody>
</table>

**Other conditions affecting environmental exposure**

<table>
<thead>
<tr>
<th>Substances</th>
<th>Receiving surface water flow m3/d</th>
<th>Degradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>-</td>
<td>68% @ 28d</td>
</tr>
</tbody>
</table>

**Control of Worker Exposure**

**Product (article) characteristics**

<table>
<thead>
<tr>
<th>Physical State:</th>
<th>Liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapor Pressure</td>
<td>0.002 mmHg</td>
</tr>
<tr>
<td>Dustiness</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>Limit the substance content in the product to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Amount used (or contained in articles), frequency and duration of use/exposure**

<table>
<thead>
<tr>
<th>Substances</th>
<th>Amounts used (daily)</th>
<th>Covers daily exposures up to (hours/day)</th>
<th>Frequency (days/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>-</td>
<td>8</td>
<td>-</td>
</tr>
</tbody>
</table>

**Technical and organisational conditions and measures**

<table>
<thead>
<tr>
<th>Substances</th>
<th>Technical and organisational conditions and measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>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.</td>
</tr>
</tbody>
</table>

**Conditions and measures related to personal protection, hygiene and health evaluation**

<table>
<thead>
<tr>
<th>Substances</th>
<th>Conditions and measures related to personal protection, hygiene and health evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>Use suitable eye protection. Wear suitable gloves tested to EN374. Refer to section 8 of the SDS.</td>
</tr>
</tbody>
</table>

**Other conditions affecting workers exposure**

<table>
<thead>
<tr>
<th>Substances</th>
<th>Other conditions affecting workers exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>Assumes a good basic standard of occupational hygiene is implemented. Assumes use at not more than 20°C above ambient temperature (unless stated differently).</td>
</tr>
</tbody>
</table>

**Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply**

<table>
<thead>
<tr>
<th>Substances</th>
<th>Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>Wash hands after use. Launder contaminated clothing before reuse.</td>
</tr>
</tbody>
</table>

### 3. Exposure estimation and reference to its source

**Environmental release and exposure**

<table>
<thead>
<tr>
<th>Substances</th>
<th>Release to Water</th>
<th>Release to Air</th>
<th>Release to Soil</th>
<th>Release estimation method</th>
<th>Local freshwater dilution factor</th>
<th>Local marine water dilution factor</th>
</tr>
</thead>
</table>
### Substances

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS Number</th>
<th>Protection Target</th>
<th>Exposure Estimate (based on: EUSES 2.1.2)</th>
<th>Unit</th>
<th>RCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>9004-77-7</td>
<td>Marine water</td>
<td>0.00749</td>
<td>mg/L</td>
<td>0.0242</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sediment (marine water)</td>
<td>&lt;0.0001</td>
<td>mg/kg dw</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

### Worker exposure

<table>
<thead>
<tr>
<th>Substance</th>
<th>Route of exposure and type of effects</th>
<th>Exposure estimate</th>
<th>Assessment Method</th>
<th>RCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene glycol butyl ether</td>
<td>Short-term exposure - local effects, Inhalation ppm</td>
<td>&lt;=7</td>
<td>No information available</td>
<td>&lt;=0.304</td>
</tr>
<tr>
<td></td>
<td>Short-term exposure - local effects, Dermal mg/kg bw/day</td>
<td>&lt;=13.71</td>
<td></td>
<td>&lt;=0.274</td>
</tr>
</tbody>
</table>

### 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Scaling method

For scaling see: http://www.ecetoc.org/tra, ECETOC TRA worker v2.3, modified version.

Scaling parameters

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™

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

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks/Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
<td></td>
</tr>
<tr>
<td>Odor</td>
<td>Woody</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>9-10</td>
<td></td>
</tr>
<tr>
<td>Freezing Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>&gt; 93 °C</td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Partly soluble</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

9.2. Other information

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC Content (%)</td>
<td>No data available</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>22 lbs/ft³</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
### Substances

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### STOT - single exposure

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### STOT - repeated exposure

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### Aspiration hazard

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

## 12. Ecological Information

### Ecotoxicity

**Product Ecotoxicity Data**

No data available

### Substance Ecotoxicity Data

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

### 12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

### 12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

### 12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>
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
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

SODA ASH

Revision Date: 21-Jun-2016

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

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: Sodium carbonate

CAS Number: 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>60 - 100%</td>
<td>Eye Irrit. 2 (H319)</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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
SODA ASH

Revision Date: 21-Jun-2016

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Remarks/ Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>Freezing Point / Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Melting Point / Range</td>
<td>851 °C</td>
<td></td>
</tr>
<tr>
<td>Boiling Point / Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Partly soluble</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

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  Eye or skin contact, inhalation.

Symptoms related to exposure  None known.
Most Important Symptoms/Effects  None known.
Causes eye irritation

**Numerical measures of toxicity**

**Toxicology data for the components**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>4090 mg/kg (Rat)</td>
<td>2210 mg/kg (Mouse)</td>
<td>2.3 mg/L (Rat) 2h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2800 mg/kg (Rat)</td>
<td>&gt; 2000 mg/kg (Rabbit)</td>
<td></td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>Non-irritating to the skin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Serious eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>Irritating to eyes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>Not classified</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>In vivo tests did not show mutagenic effects.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>Did not show teratogenic effects in animal experiments.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**12. Ecological Information**

**Ecotoxicity**
Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>EC50 242 mg/L (Nitzschia)</td>
<td>TLM24 385 mg/L (Lepomis macrochirus)</td>
<td>No information available</td>
<td>EC50 265 mg/L (Daphnia magna)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LC50 310-1220 mg/L (Pimephales promelas)</td>
<td></td>
<td>EC50 (48h) 200 – 227 mg/L (Ceriodaphnia sp.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LC50 (96h) 300 mg/L (Lepomis macrochirus)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
</tbody>
</table>

12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>497-19-8</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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
- **Stockholm 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 abreviations 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
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

POTASSIUM CHLORIDE

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 (08) 9455 5300
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

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**Appropriate engineering controls**

**Engineering Controls**
Use in a well ventilated area.

**Personal protective equipment (PPE)**

<table>
<thead>
<tr>
<th>Respiratory Protection</th>
<th>Dust/mist respirator. (N95, P2/P3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Protection</td>
<td>Normal work gloves.</td>
</tr>
<tr>
<td>Skin Protection</td>
<td>Normal work coveralls.</td>
</tr>
<tr>
<td>Eye Protection</td>
<td>Dust proof goggles.</td>
</tr>
<tr>
<td>Other Precautions</td>
<td>None known.</td>
</tr>
<tr>
<td>Environmental Exposure Controls</td>
<td>No information available</td>
</tr>
</tbody>
</table>

## 9. Physical and Chemical Properties

---

**Revision Date:** 04-Sep-2015

**POTASSIUM CHLORIDE**

---

Page 3 / 8
9.1. Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks/Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>~7</td>
<td>~Method</td>
</tr>
<tr>
<td>Freezing Point/Range</td>
<td>771 °C</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.99</td>
<td></td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Soluble in water</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Partition coefficient:</td>
<td>n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

9.2. Other information

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Weight</td>
<td>74.55</td>
</tr>
<tr>
<td>VOC Content (%)</td>
<td>No data available</td>
</tr>
</tbody>
</table>

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
No significant hazards expected.

Numerical measures of toxicity

Toxicology data for the components

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>
Immediate, delayed and chronic health effects from exposure

<table>
<thead>
<tr>
<th>Exposure Path</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation</td>
<td>May cause mild respiratory irritation.</td>
</tr>
<tr>
<td>Eye Contact</td>
<td>May cause mild eye irritation.</td>
</tr>
<tr>
<td>Skin Contact</td>
<td>May cause mild skin irritation.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>May cause abdominal pain, vomiting, nausea, and diarrhea. Irritation of the mouth, throat, and stomach.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
</table>
Contains no hazardous substances in concentrations above cut-off values according to the competent authority

### 12. Ecological Information

#### Ecotoxicity

**Product Ecotoxicity Data**

No data available

**Substance Ecotoxicity Data**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

#### 12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

#### 12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

#### 12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

#### 12.6. Other adverse effects

---
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**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN Number:</td>
<td>Not restricted</td>
</tr>
<tr>
<td>UN Proper Shipping Name:</td>
<td>Not restricted</td>
</tr>
<tr>
<td>Transport Hazard Class(es):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Packing Group:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Environmental Hazards:</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**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
New Zealand: +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

<table>
<thead>
<tr>
<th>Hazard Category</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin Corrosion / irritation</td>
<td>Category 1 - H314</td>
</tr>
<tr>
<td>Serious Eye Damage / Eye Irritation</td>
<td>Category 1 - H318</td>
</tr>
<tr>
<td>Specific Target Organ Toxicity - (Single Exposure)</td>
<td>Category 3 - H335</td>
</tr>
<tr>
<td>Substances/mixtures corrosive to metal.</td>
<td>Category 1 - H290</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
</tr>
</tbody>
</table>

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.
CAUSTIC SODA

Revision Date: 22-Jan-2016

Risk Phrases
R35 Causes severe burns.
R37 Irritating to respiratory system.

3. Composition/information on Ingredients

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>2 mg/m³</td>
<td>2 mg/M³</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks/ Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
<td></td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>White to off white</td>
<td></td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

Page 4 / 9
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>No data available</td>
<td>1350 mg/kg (Rabbit)</td>
<td>No data available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>Causes severe burns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>Causes severe eye burns (Rabbit)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>Did not cause sensitization on laboratory animals (guinea pig)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>Did not show mutagenic effects in animal experiments In vitro tests did not show mutagenic effects.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>No data of sufficient quality are available.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>May cause respiratory irritation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification. Not applicable due to corrosivity of the substance.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### 12. Ecological Information

**Ecotoxicity**

**Product Ecotoxicity Data**
No data available

**Substance Ecotoxicity Data**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>No information available</td>
<td>LC50 (96h) 125 mg/L (Gambusia affinis) LC50 (48h) 189 mg/L (Leuciscus melanotus) LC50 (24h) 145 mg/L (Poecilia reticulate)</td>
<td>No information available</td>
<td>EC50 (48h) 40.4 mg/L (Ceriodaphnia sp.)</td>
</tr>
</tbody>
</table>

### 12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>The methods for determining biodegradability are</td>
</tr>
</tbody>
</table>
12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide</td>
<td>1310-73-2</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Transportation Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>UN Number:</td>
<td>UN1823</td>
</tr>
<tr>
<td>UN Proper Shipping Name:</td>
<td>Sodium Hydroxide, Solid</td>
</tr>
<tr>
<td>Transport Hazard Class(es):</td>
<td>8</td>
</tr>
<tr>
<td>Packing Group:</td>
<td>II</td>
</tr>
<tr>
<td>Environmental Hazards:</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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
Stockholm 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

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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

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>1 - 5%</td>
<td>Carc. 2 (H351) STOT RE 1 (H372)</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>0.1 - 1%</td>
<td>Carc. 2 (H351) STOT RE 1 (H372)</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>0.1 - 1%</td>
<td>Carc. 2 (H351) STOT RE 1 (H372)</td>
</tr>
</tbody>
</table>

### 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
9. Physical and Chemical Properties

### 9.1. Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks / Method</th>
<th>Color</th>
<th>Odor Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
<td></td>
<td>Various</td>
<td>No information available</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>9.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freezing Point / Range</td>
<td>No data available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melting Point / Range</td>
<td>No data available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiling Point / Range</td>
<td>No data available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>2.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Insoluble in water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
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<tr>
<td>Decomposition Temperature</td>
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<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>&gt; 15000 mg/kg (human)</td>
<td>No information available</td>
<td>No data available</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>&gt;15,000 mg/kg (Human)</td>
<td>No data available</td>
<td>No data available</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>&gt;15,000 mg/kg (Human)</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Non-irritating to the skin</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>Non-irritating to the skin</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>Non-irritating to the skin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Serious eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Mechanical irritation of the eyes is possible. No information available</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>Mechanical irritation of the eyes is possible.</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>Mechanical irritation of the eyes is possible.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available.</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>No information available.</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>No information available.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available.</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>No information available.</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>No information available.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Not regarded as mutagenic.</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>Not regarded as mutagenic.</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>Not regarded as mutagenic.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>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.</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>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.</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available.</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>No information available.</td>
</tr>
</tbody>
</table>
BENTONITE

Crystalline silica, tridymite 15468-32-3 No information available

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

12. Ecological Information

Ecotoxicity
Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>EC50 (72 h) =440 mg/L (Selenastrum capricornutum)</td>
<td>LL0 (96 h) =10000 mg/L (Danio rerio)</td>
<td>No information available</td>
<td>LL50 (24 h) &gt;10000 mg/L (Daphnia magna)</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>No information available</td>
<td>LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)</td>
<td>No information available</td>
<td>LL50 (24h) &gt; 10,000 mg/L (Daphnia magna) (similar substance)</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>No information available</td>
<td>LL0 (96h) 10,000 mg/L(Danio rerio) (similar substance)</td>
<td>No information available</td>
<td>LL50 (24h) &gt; 10,000 mg/L (Daphnia magna) (similar substance)</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
</tbody>
</table>

12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>No information available</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
<tr>
<td>Crystalline silica, cristobalite</td>
<td>14464-46-1</td>
<td>No information available</td>
</tr>
<tr>
<td>Crystalline silica, tridymite</td>
<td>15468-32-3</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

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
New Zealand: +64 800 451719

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

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Powder</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Color</td>
<td>White to off white</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>6.5-9 (1%)</td>
</tr>
<tr>
<td>Freezing Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Flash Point</td>
<td>221 °C / 430 °F</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.6</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Soluble in water</td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>400 °C / 752 °F</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
</tr>
</tbody>
</table>

#### 9.2. Other information

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC Content (%)</td>
<td>No data available</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>40-55 lbs/ft³</td>
</tr>
</tbody>
</table>

---

### 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>
**12. Ecological Information**

**Ecotoxicity**

**Product Ecotoxicity Data**

No data available

**Substance Ecotoxicity Data**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

**12.2. Persistence and degradability**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>
Contains no hazardous substances in concentrations above cut-off values according to the competent authority

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>NA</td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

### 12.3. Bioaccumulative potential

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

### 12.4. Mobility in soil

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

### 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**

<table>
<thead>
<tr>
<th>International Inventories</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian AICs Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>New Zealand Inventory of Chemicals</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>EINECS Inventory</td>
<td>This product, and all its components, complies with EINECS</td>
</tr>
<tr>
<td>US TSCA Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>Canadian DSL Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
</tbody>
</table>

**Poisons Schedule number**
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

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
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 CAS Number
Contains no hazardous substances in concentrations above NA cut-off values according to the competent authority

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>according to the competent authority</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks/Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State:</td>
<td>Powder</td>
<td></td>
</tr>
<tr>
<td>Odor:</td>
<td>Slight</td>
<td></td>
</tr>
<tr>
<td>Color:</td>
<td>White to off white</td>
<td></td>
</tr>
<tr>
<td>Odor Threshold:</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>pH:</td>
<td>7 (1%)</td>
<td></td>
</tr>
<tr>
<td>Freezing Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Specfic Gravity</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Soluble in water</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>204 °C / 400 °F</td>
<td></td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

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
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
<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
concentrations above cut-off values according to the competent authority

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil
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/m$^3$ – milligram/cubic meter  mm – millimeter  mmHg – millimeter mercury  w/w – weight/weight  d – day

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID
WHO/FAO

Disclaimer Statement
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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

<table>
<thead>
<tr>
<th>Classification of the Hazardous Chemical</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Oral Toxicity</td>
<td>Category 4 - H302</td>
</tr>
<tr>
<td>Acute inhalation toxicity - vapor</td>
<td>Category 3 - H331</td>
</tr>
<tr>
<td>Skin Corrosion/Irritation</td>
<td>Category 1 - H314</td>
</tr>
<tr>
<td>Serious Eye Damage/Irritation</td>
<td>Category 1 - H318</td>
</tr>
<tr>
<td>Respiratory Sensitization</td>
<td>Category 1 - H334</td>
</tr>
<tr>
<td>Skin Sensitization</td>
<td>Category 1 - H317</td>
</tr>
<tr>
<td>Reproductive Toxicity</td>
<td>Category 1B - H360</td>
</tr>
<tr>
<td>Specific Target Organ Toxicity - (Single Exposure)</td>
<td>Category 3 - H335</td>
</tr>
</tbody>
</table>
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  CAS Number
Glutaraldehyde  111-30-8
Methanol  67-56-1
Other hazards which do not result in classification
This mixture contains no substance considered to be persistent, bioaccumulating nor toxic (PBT).
This mixture contains no substance considered to be very persistent nor very bioaccumulating (vPvB).

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

### 3. Composition/information on Ingredients

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>10 - 30%</td>
<td>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)</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>0.1 - 1%</td>
<td>Acute Tox. 3 (H301) Acute Tox. 3 (H311) Acute Tox. 3 (H331) Repr. 1B (H360) STOT SE 1 (H370) Flam. Liq. 2 (H225)</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>0.1 ppm</td>
<td>0.05 ppm</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>TWA: 200 ppm</td>
<td>TWA: 200 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA: 262 mg/m³</td>
<td>STEL: 250 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEL: 328 mg/m³</td>
<td>STEL: 250 ppm</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Odor</td>
<td>Sharp</td>
</tr>
<tr>
<td>pH:</td>
<td>3.1-4.5</td>
</tr>
<tr>
<td>Freezing Point / Range</td>
<td>(-5) - (-10) °C</td>
</tr>
<tr>
<td>Melting Point / Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Boiling Point / Range</td>
<td>100.5 °C / 213 °F</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>0.9</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>0.2 mmHg</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>0.8</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.064</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Soluble in water</td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>-0.333</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>&gt; 275 °C / &gt; 527 °F</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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 acids. Strong alkalis.

10.6. Hazardous decomposition products
Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on routes 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**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>50 mg/kg (Guinea Pig)</td>
<td>560 µL/kg (Rabbit)</td>
<td>0.28-0.5 mg/L (Rat) 4h</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>&gt; 790 to 13,000 mg/kg (rat)</td>
<td>17,100 mg/kg (rabbit)</td>
<td>10 mg/L (human, vapor, 4h)</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>Causes severe skin irritation with tissue destruction. (Rabbit)</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>Non-irritating to the skin (Rabbit)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Serious eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>Causes severe eye irritation which may damage tissue. (Rabbit)</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>Non-irritating to the eye (Rabbit)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>Skin sensitizer in guinea pig.</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>Did not cause sensitization on laboratory animals (guinea pig)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>May cause sensitization by inhalation</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>In vivo tests did not show mutagenic effects.</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>The weight of evidence from available in vitro and in vivo studies indicates that this substance is not expected to be mutagenic.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>Did not show carcinogenic effects in animal experiments</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>No data of sufficient quality are available.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>Not a confirmed teratogen or embryotoxin.</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>Experiments have shown reproductive toxicity effects on laboratory animals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>No information available</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>May cause disorder and damage to the Central Nervous System (CNS)</td>
</tr>
</tbody>
</table>

| Substances     | CAS Number | STOT - repeated exposure |

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ALDACIDE® G ANTIMICROBIAL

Glutaraldehyde 111-30-8 May cause disorder and damage to the (Kidney)
Methanol 67-56-1 No data of sufficient quality are available.

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

12. Ecological Information

Ecotoxicity
Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>EC50 (72h) 0.61 mg/L (Desmodesmus subspicatus)</td>
<td>LC50 (96h) 10 mg/L (Lepomis macrochirus)</td>
<td>NOEC (97d) 1.6 mg/L (Oncorhynchus mykiss)</td>
<td>EC50 (17h) 6.65 mg/L (Pseudomonas putida)</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>EC50 (96 h) =22000 mg/L (Pseudokirchnerella subcapitata) NOEC (8 d) =8000 mg/L (Scenedesmus quadricauda)</td>
<td>LC50 (96 h) =15400 mg/L (Lepomis macrochirus)</td>
<td>EC50 (200 h) =14536 mg/L (Oryzias latipes)</td>
<td>IC50 (3h) &gt; 1000 mg/L (activated sludge)</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability
Readily biodegradable

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>Readily biodegradable (75% @ 28d)</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>(95-97% @ 20d)</td>
</tr>
</tbody>
</table>

12.3. Bioaccumulative potential
Does not bioaccumulate.

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>-0.36</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>-0.77</td>
</tr>
</tbody>
</table>

BCF = 1.0 – 4.5 (Cyprinus carpio)
BCF < 10 (Leuciscus idus melanotus)

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>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.</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Transportation Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>UN Number</td>
<td>UN3265</td>
</tr>
<tr>
<td>UN proper shipping name:</td>
<td>Corrosive Liquid, Acidic, Organic, N.O.S. (Contains Glutaraldehyde)</td>
</tr>
<tr>
<td>Transport Hazard Class(es):</td>
<td>8</td>
</tr>
<tr>
<td>Packing Group:</td>
<td>III</td>
</tr>
<tr>
<td>Environmental Hazards:</td>
<td>Marine Pollutant</td>
</tr>
</tbody>
</table>

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
Stockholm 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™

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
CAS Number
Contains no hazardous substances in concentrations above cut-off values according to the competent authority
NA

Other hazards which do not result in classification
This 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>according to the competent authority</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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.
9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks/Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid Powder</td>
<td></td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
<td></td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>5.5-8 (5%)</td>
<td>Method</td>
</tr>
<tr>
<td>Freezing Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>upper flammability limit</td>
<td>0.5 oz/ft³</td>
<td></td>
</tr>
<tr>
<td>lower flammability limit</td>
<td>0.28 oz/ft³</td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Soluble in water</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>640 °C / 1184 °F</td>
<td></td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

9.2. Other information

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC Content (%)</td>
<td>No data available</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>45-65 lbs/ft³</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

### Immediate, delayed and chronic health effects from exposure

**Immediate effects**
- **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

### Skin corrosion/irritation

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### Eye damage/irritation

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### Skin Sensitization

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### Respiratory Sensitization

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### Mutagenic Effects

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### Carcinogenic Effects

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

---

**OXYGON™**

**Revision Date:** 21-Sep-2015
concentrations above cut-off values according to the competent authority

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

12. Ecological Information

Ecotoxicity
Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil
Substances

<table>
<thead>
<tr>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

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

<table>
<thead>
<tr>
<th>UN Number:</th>
<th>Not restricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN Proper Shipping Name:</td>
<td>Not restricted</td>
</tr>
<tr>
<td>Transport Hazard Class(es):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Packing Group:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Environmental Hazards:</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Special precautions during transport
None

HazChem Code
None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product

International Inventories

<table>
<thead>
<tr>
<th>Australian AICS Inventory</th>
<th>All components listed on inventory or are exempt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand Inventory of Chemicals</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>EINECS Inventory</td>
<td>This product, and all its components, complies with EINECS</td>
</tr>
<tr>
<td>US TSCA Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>Canadian DSL Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
</tbody>
</table>

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/m^3 – milligram/cubic meter  
mm – millimeter  
mmHg – millimeter mercury  
w/w – weight/weight  
d – day

**Key literature references and sources for data**

www.ChemADVISOR.com/  
NZ CCID

**Disclaimer Statement**

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet
SAFETY DATA SHEET

BARITE

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

<table>
<thead>
<tr>
<th>Carcinogenicity</th>
<th>Category 2 - H351</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Target Organ Toxicity - (Repeated Exposure)</td>
<td>Category 2 - H373</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>60 - 100%</td>
<td>Carc. 2 (H351)</td>
</tr>
<tr>
<td>Crystalline silica,</td>
<td>14808-60-7</td>
<td>1 - 5%</td>
<td>STOT RE 1 (H372)</td>
</tr>
</tbody>
</table>

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
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
8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>TWA: 10 mg/m³</td>
<td>TWA: 10 mg/m³</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>TWA: 0.1 mg/m³</td>
<td>TWA: 0.025 mg/m³</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Color</td>
<td>Pink to tan to gray</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No data available</td>
</tr>
<tr>
<td>Freezing Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>4.23</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Insoluble in water</td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
</tr>
</tbody>
</table>

9.2. Other information

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Weight</td>
<td>233.4</td>
</tr>
<tr>
<td>VOC Content (%)</td>
<td>No data available</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>&gt; 5000 mg/kg (Rat)</td>
<td>No data available</td>
<td>&gt;1.1 mg/L (rat, aerosol, 4hr) (similar substance)</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>&gt;15,000 mg/kg (Human)</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

Immediate, delayed and chronic health effects from exposure

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>Non-irritating to the skin (in vitro) (similar substances)</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Non-irritating to the skin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>Non-irritating to the eye (similar substances)</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Mechanical irritation of the eyes is possible.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>Did not cause sensitization on laboratory animals (mouse) (similar substances)</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>No information available</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>In vitro tests did not show mutagenic effects (similar substances)</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>Not regarded as mutagenic.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>Did not show carcinogenic effects in animal experiments (similar substances)</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>No information available</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
</tbody>
</table>
12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>No information available</td>
<td>LC50 (96h) 3.5 mg/L (Danio rerio)</td>
<td>No information available</td>
<td>NOEC (7d) 100 mg/L (Cancer anthonyi)</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
<td>LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)</td>
<td>No information available</td>
<td>LL50 (24h) &gt; 10,000 mg/L (Daphnia magna) (similar substance)</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability
The methods for determining biodegradability are not applicable to inorganic substances.

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>The methods for determining biodegradability are not applicable to inorganic substances.</td>
</tr>
</tbody>
</table>

12.3. Bioaccumulative potential
Does not bioaccumulate

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>No information available</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium sulfate</td>
<td>7727-43-7</td>
<td>No information available</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>14808-60-7</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

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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

## 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  
New Zealand: +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. |
CALCIUM CHLORIDE, ANHYDROUS POWDER

Classification of the hazardous chemical

| Serious Eye Damage/Irritation | Category 2 - H319 |

Label elements, including precautionary statements

Hazard pictograms

![Exclamation Mark]

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>60 - 100%</td>
<td>Eye Irrit. 2A (H319)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Appropriate engineering controls
Engineering Controls Use in a well ventilated area.
Personal protective equipment (PPE)

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 prevent excessive exposure, 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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>10</td>
</tr>
<tr>
<td>Freezing Point / Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting Point / Range</td>
<td>782 °C / 1439.6 °F</td>
</tr>
<tr>
<td>Boiling Point / Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>2.15</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Soluble in water</td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
</tr>
</tbody>
</table>

9.2. Other information

Molecular Weight 110.986

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>&gt; 1000 mg/kg (Rat)</td>
<td>5000 mg/kg (Rabbit)</td>
<td>No data available</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2301 mg/kg (Rat)</td>
<td>2240 mg/kg (Rat)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 2000 mg/kg (Rat)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>Causes mild skin irritation (Rabbit)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Serious eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>Causes moderate eye irritation (Rabbit)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>Did not show mutagenic effects in animal experiments</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>Animal testing did not show any effects on fertility.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
</tbody>
</table>
12. Ecological Information

Ecotoxicity
Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium chloride</td>
<td>10043-52-4</td>
<td>ErC50 (72h) 2900 mg/L (Pseudokirchnerella subcapitata)</td>
<td>LC50 (96h) 4630 mg/L (Pimephales promelas)</td>
<td>No information available</td>
<td>EC50 (48h) 2400 mg/L (Daphnia magna)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ErC50 (72h) 4000 mg/L (Pseudokirchnerella subcapitata)</td>
<td>LC50 (48h) &gt;6560 mg/L (Pimephales promelas)</td>
<td></td>
<td>EC50 (21d) 810 mg/L (reproduction) (Daphnia magna)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LC50 (24h) &gt;6660 mg/L (Pimephales promelas)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No information available</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 | No information available
---|------------|---------|
Calcium chloride | 10043-52-4 |         |

12.4. Mobility in soil

Substances | CAS Number | Mobility | No information available
---|------------|----------|
Calcium chloride | 10043-52-4 |         |

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
CALCIUM CHLORIDE, ANHYDROUS POWDER

Revision Date: 27-Apr-2016

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
Stokhomb 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
CALCIUM CHLORIDE, ANHYDROUS POWDER

Revision Date: 27-Apr-2016

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

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
1. Product Identifier & Identity for the Chemical

<table>
<thead>
<tr>
<th>Statement of Hazardous Nature</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1. Product Identifier</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Product Name</strong></td>
<td>SODIUM BICARBONATE</td>
</tr>
<tr>
<td><strong>Other means of Identification</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Synonyms:</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Product Code:</strong></td>
<td>HM001824</td>
</tr>
<tr>
<td><strong>Recommended use of the chemical and restrictions on use</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Recommended Use</strong></td>
<td>Buffer</td>
</tr>
<tr>
<td><strong>Uses Advised Against</strong></td>
<td>No information available</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Statement of Hazardous Nature</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Classification of the hazardous chemical</strong></td>
<td>Not classified</td>
</tr>
<tr>
<td><strong>Label elements, including precautionary statements</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Hazard Pictograms</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Signal Word</strong></td>
<td>Not Hazardous</td>
</tr>
</tbody>
</table>
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

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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.
9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks/ - Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
<td>Method</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Freezing Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>2.16</td>
<td></td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Soluble in water</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
<td></td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

9.2. Other information

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC Content (%)</td>
<td>No data available</td>
</tr>
</tbody>
</table>

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
No significant hazards expected.

Numerical measures of toxicity

Toxicology data for the components

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>
**Immediate, delayed and chronic health effects from exposure**

<table>
<thead>
<tr>
<th>Exposure Type</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation</td>
<td>May cause mild respiratory irritation.</td>
</tr>
<tr>
<td>Eye Contact</td>
<td>May cause mild eye irritation.</td>
</tr>
<tr>
<td>Skin Contact</td>
<td>May cause mild skin irritation.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>None known.</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
Contains no hazardous substances in concentrations above cut-off values according to the competent authority

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Contains no hazardous substances in concentrations above cut-off values according to the competent authority

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### 12. Ecological Information

#### Ecotoxicity

**Product Ecotoxicity Data**

No data available

**Substance Ecotoxicity Data**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

#### 12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

#### 12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

#### 12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

#### 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
<table>
<thead>
<tr>
<th>UN Number:</th>
<th>Not restricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN Proper Shipping Name:</td>
<td>Not restricted</td>
</tr>
<tr>
<td>Transport Hazard Class(es):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Packing Group:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Environmental Hazards:</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Special precautions during transport
None

HazChem Code
None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product

International Inventories
<table>
<thead>
<tr>
<th>Australian AICS Inventory</th>
<th>All components listed on inventory or are exempt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand Inventory of Chemicals</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>EINECS Inventory</td>
<td>This product, and all its components, complies with EINECS</td>
</tr>
<tr>
<td>US TSCA Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>Canadian DSL Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
</tbody>
</table>

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
SODIUM BICARBONATE

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

STEELSEAL®

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
New Zealand: +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

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>according to the competent authority</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>pH</td>
<td>No data available</td>
</tr>
<tr>
<td>Freezing Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>4200 °C / 7592 °F</td>
</tr>
<tr>
<td>Flash Point</td>
<td>&gt; 356 °C / &gt; 673 °F</td>
</tr>
<tr>
<td>lower flammability limit</td>
<td>0.07-0.12 oz/ft³</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>1</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>0.4</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.75</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Insoluble in water</td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
</tr>
</tbody>
</table>

9.2. Other information

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC Content (%)</td>
<td>No data available</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>38-45 lbs/ft³</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
</table>
12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

### 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**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>UN Number:</td>
<td>Not restricted</td>
</tr>
<tr>
<td>UN Proper Shipping Name:</td>
<td>Not restricted</td>
</tr>
<tr>
<td>Transport Hazard Class(es):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Packing Group:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Environmental Hazards:</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**Special precautions during transport**
None

**HazChem Code**
None Allocated

### 15. Regulatory Information

**Safety, health and environmental regulations specific for the product**

<table>
<thead>
<tr>
<th>International Inventories</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian AICS Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>New Zealand Inventory of Chemicals</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>EINECS Inventory</td>
<td>This product, and all its components, complies with EINECS</td>
</tr>
<tr>
<td>US TSCA Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>Canadian DSL Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
</tbody>
</table>

**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

Key literature references and sources for data
www.ChemADVISOR.com/  NZ CCID

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End of Safety Data Sheet
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  Acutely Toxic Substances
6.1D  Acutely Toxic Substances
6.1D  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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>Australia NOHSC</th>
<th>New Zealand WES</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethylene glycol monobutyl ether</td>
<td>111-76-2</td>
<td>30 - 60%</td>
<td>TWA: 20 ppm</td>
<td>TWA: 25 ppm</td>
<td>TWA: 20 ppm</td>
</tr>
<tr>
<td>Alcohols, C9-11, ethoxylated</td>
<td>68439-46-3</td>
<td>10 - 30%</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Color</td>
<td>Clear</td>
</tr>
<tr>
<td>Odor</td>
<td>Characteristic</td>
</tr>
<tr>
<td>pH</td>
<td>4 (10%)</td>
</tr>
<tr>
<td>Specific Gravity @ 20 C (Water=1)</td>
<td>0.97</td>
</tr>
<tr>
<td>Density @ 20 C (kg/l)</td>
<td>0.944</td>
</tr>
<tr>
<td>Bulk Density @ 20 C (kg/m3)</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Boiling Point/Range (C)</td>
<td>168-173</td>
</tr>
<tr>
<td>Freezing Point/Range (C)</td>
<td>-70</td>
</tr>
<tr>
<td>Pour Point/Range (C)</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Flash Point/Range (C)</td>
<td>68</td>
</tr>
</tbody>
</table>
Flash Point Method: CC
Autoignition Temperature (C): 240
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): .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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
</table>

BARAKLEAN® DUAL
Page 4 of 7
**12. ECOLOGICAL INFORMATION**

Ecotoxicological Information

**Ecotoxicity Product**

- **Acute Fish Toxicity:** Not determined
- **Acute Crustaceans Toxicity:** Not determined
- **Acute Algae Toxicity:** Not determined

**Ecotoxicity Substance**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethylene glycol monobutyl ether</td>
<td>111-76-2</td>
<td>EC50: 839.56 mg/l (Skeletonema costatum) EC50(72h): 911 mg/L (biomass) EC50: &gt; 500 mg/l (Scenedesmus subspicatus) NOEC(72h): 88 mg/L (biomass)(Pseudokirchnerella subcapitata) LC50: &gt; 1000 mg/l (Scaphthalmus maximus juvenile) LC50(96h): 1474 mg/L (Oncorhynchus mykiss) NOEC(21d): &gt; 100mg/L (Danio rerio)</td>
<td>LC50: &gt; 1000 mg/l (Scaphthalmus maximus juvenile) TT/EC3(48h): 463 mg/L (Uronema parduzci) TT/EC3(72h): 73 mg/L (Entosiphon sulcatum) TT/EC3(16h): 700 mg/L (Pseudomonas putida)</td>
<td>TT/EC3(48h): 463 mg/L (Uronema parduzci) EC50: &gt;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)</td>
<td></td>
</tr>
<tr>
<td>Alcohols, C9-11, ethoxylated</td>
<td>68439-46-3</td>
<td>EC50(96h): 0.26 mg/L (Selenastrum capricornutum) LC50(96h): 5.7 mg/L (Oncorhynchus mykiss) NOEC(30d): 0.28 mg/L (Pimephales promelas)</td>
<td>No information available</td>
<td>No information available</td>
<td>EC50(48h): 2.5 mg/L (Daphnia magna) NOEC(21d): 1.75 mg/L (Daphnia magna) (similar substance)</td>
</tr>
</tbody>
</table>

**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®

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®

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

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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
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

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
12. Ecological Information

Ecotoxicity
Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Transportation Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UN Number:</strong></td>
<td>Not restricted</td>
</tr>
<tr>
<td><strong>UN Proper Shipping Name:</strong></td>
<td>Not restricted</td>
</tr>
<tr>
<td><strong>Transport Hazard Class(es):</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Packing Group:</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Environmental Hazards:</strong></td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**Special precautions during transport**
None

**HazChem Code**
None Allocated

15. Regulatory Information

**Safety, health and environmental regulations specific for the product**

**International Inventories**

<table>
<thead>
<tr>
<th>Inventory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian AICS Inventory</td>
<td>Product contains one or more components not listed on inventory.</td>
</tr>
<tr>
<td>New Zealand Inventory of Chemicals</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>EINECS Inventory</td>
<td>This product, and all its components, complies with EINECS</td>
</tr>
<tr>
<td>US TSCA Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>Canadian DSL Inventory</td>
<td>Product contains one or more components not listed on the inventory.</td>
</tr>
</tbody>
</table>

**Poisons Schedule number**
None Allocated

16. Other information

**Date of preparation or review**

<table>
<thead>
<tr>
<th>Revision Date:</th>
<th>30-Sep-2015</th>
</tr>
</thead>
</table>

**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
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
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 (08) 9455 5300
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 | CAS Number
--- | ---
Sodium chloride | 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>60 - 100%</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>3000 mg/kg (Rat)</td>
<td>&gt;10000 mg/kg (Rabbit)</td>
<td>42 mg/L (Rat) 1h</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>Non-irritating to the skin (Rabbit)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>May cause mild eye irritation. (Rabbit)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>Did not show carcinogenic effects in animal experiments</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

---

### 12. Ecological Information

**Ecotoxicity**

**Product Ecotoxicity Data**
No data available

**Substance Ecotoxicity Data**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>EC50 (120h) 2430 mg/L (Nitzschia sp.)</td>
<td>TLM96 &gt; 1000 mg/L (Oncorhynchus mykiss) LC50 (96h) 5840 mg/L (Lepomis macrochirus) NOEC (33d) 252 mg/L (Pimephales promelas) NOEC 5000 – 8000 mg/L (Escherichia coli)</td>
<td>NOEC 292-584 mg/L (Daphnia magna) NOEC (21d) 314 mg/L (Daphnia pulex) TLM96 &gt; 1,000,000 ppm (Mysidopsis bahia) LC50 (48h) 874-4136 mg/L (Daphnia magna)</td>
<td></td>
</tr>
</tbody>
</table>

**12.2. Persistence and degradability**
<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>No information available</td>
</tr>
</tbody>
</table>

### 12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>No information available</td>
</tr>
</tbody>
</table>

### 12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>7647-14-5</td>
<td>No information available</td>
</tr>
</tbody>
</table>

### 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**
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®

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
New Zealand: +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 CAS Number
Contains no hazardous substances in concentrations above cut-off values according to the competent authority NA

Other hazards which do not result in classification
This 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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values</td>
<td>NA</td>
<td>60 - 100%</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>according to the competent authority</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid Powder</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>pH</td>
<td>4.9 (1%)</td>
</tr>
<tr>
<td>Freezing Point/Range</td>
<td>190 °C</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Flash Point</td>
<td>193 °C / 380 °F PMCC</td>
</tr>
<tr>
<td>lower flammability limit</td>
<td>0.29</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No data available</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.3</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Insoluble in water</td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No information available</td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No information available</td>
</tr>
</tbody>
</table>

9.2. Other information

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC Content (%)</td>
<td>No data available</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>24-31 lbs/ft3</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
### Substances

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### 12. Ecological Information

#### Ecotoxicity

**Product Ecotoxicity Data**
No data available

**Substance Ecotoxicity Data**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
</tr>
</tbody>
</table>

#### 12.2. Persistence and degradability

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>
12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains no hazardous substances in concentrations above cut-off values according to the competent authority</td>
<td>NA</td>
<td>No information available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>UN Number:</th>
<th>Not restricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN Proper Shipping Name:</td>
<td>Not restricted</td>
</tr>
<tr>
<td>Transport Hazard Class(es):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Packing Group:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Environmental Hazards:</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Special precautions during transport
None

HazChem Code
None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product

International Inventories

<table>
<thead>
<tr>
<th>Australian AICS Inventory</th>
<th>All components listed on inventory or are exempt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand Inventory of Chemicals</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>EINECS Inventory</td>
<td>This product, and all its components, complies with EINECS</td>
</tr>
<tr>
<td>US TSCA Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
<tr>
<td>Canadian DSL Inventory</td>
<td>All components listed on inventory or are exempt.</td>
</tr>
</tbody>
</table>

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
- LC50 – Lethal Concentration
- LD50 – Lethal Dose
- LL50 – Lethal Loading
- 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](http://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**
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
New Zealand:  +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

<table>
<thead>
<tr>
<th>Hazard Type</th>
<th>Category</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Oral Toxicity</td>
<td>Category 4</td>
<td>H302</td>
</tr>
<tr>
<td>Skin Corrosion / irritation</td>
<td>Category 2</td>
<td>H315</td>
</tr>
<tr>
<td>Serious Eye Damage / Eye Irritation</td>
<td>Category 1</td>
<td>H318</td>
</tr>
<tr>
<td>Skin Sensitization</td>
<td>Category 1</td>
<td>H317</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Category 2</td>
<td>H351</td>
</tr>
<tr>
<td>Reproductive Toxicity</td>
<td>Category 1B</td>
<td>H360</td>
</tr>
<tr>
<td>Specific Target Organ Toxicity - (Single Exposure)</td>
<td>Category 1</td>
<td>H370</td>
</tr>
<tr>
<td>Flammable liquids.</td>
<td>Category 3</td>
<td>H226</td>
</tr>
</tbody>
</table>

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  CAS Number
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues  68909-77-3
Methanol  67-56-1
Nitrilotriacetic acid, trisodium salt monohydrate  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.

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>PERCENT (w/w)</th>
<th>GHS Classification - Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>10 - 30%</td>
<td>Skin Irrit. 2 (H315)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Eye Corr. 1 (H318)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Skin Sens. 1 (H317)</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>10 - 30%</td>
<td>Acute Tox. 3 (H301)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acute Tox. 3 (H311)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acute Tox. 3 (H331)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Repr. 1B (H360)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>STOT SE 1 (H370)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Flam. Liq. 2 (H225)</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>1 - 5%</td>
<td>Acute Tox. 4 (H302)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Eye Irrit. 2A (H319)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Carc. 2 (H351)</td>
</tr>
</tbody>
</table>

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
8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Australia NOHSC</th>
<th>ACGIH TLV-TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>TWA: 200 ppm</td>
<td>TWA: 200 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA: 262 mg/m³</td>
<td>STEL: 250 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEL: 328 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State:</td>
<td>Liquid</td>
</tr>
<tr>
<td>Color:</td>
<td>Brown</td>
</tr>
<tr>
<td>Odor:</td>
<td>Alcohol</td>
</tr>
<tr>
<td>Odor Threshold:</td>
<td>No information available</td>
</tr>
<tr>
<td>pH:</td>
<td>9-11</td>
</tr>
<tr>
<td>Freezing Point/Range:</td>
<td>-23 °C</td>
</tr>
<tr>
<td>Melting Point/Range:</td>
<td>No data available</td>
</tr>
<tr>
<td>Boiling Point/Range:</td>
<td>100 °C / 212 °F</td>
</tr>
</tbody>
</table>
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

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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>3816 mg/kg-bw (rat)</td>
<td>&gt; 2000 mg/kg (Rat)</td>
<td>No toxicity at saturation (rat, 8 h, vapour)</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>&lt; 790 mg/kg (rat)</td>
<td>7300 mg/kg (mouse)</td>
<td>10 mg/L (Human) 4h (vapor)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14200 mg/kg (rabbit)</td>
<td>15800 mg/kg (Rabbit)</td>
<td>22,500 ppm (Rat) 8h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300 mg/kg (Human)</td>
<td>393 mg/kg bw (primates)</td>
<td>64,000 ppm (Rat) 4h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6200 mg/kg (Rat)</td>
<td>1000 mg/kg (Human)</td>
<td>83.2 mg/L (rat) 4h</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>1740 mg/kg (Rat)</td>
<td>&gt; 2000 mg/kg (Rabbit)</td>
<td>&gt; 5 mg/L (Rat, Aerosol, 4h)</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin corrosion/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>Causes moderate skin irritation. (Rabbit) Skin, rabbit:</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>Non-irritating to the skin (Rabbit)</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>Non-irritating to the skin (Rabbit) Not irritating to skin in rabbits. Skin, rabbit:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Eye damage/irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>Causes eye burns. Causes severe eye irritation. Will damage tissue.</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>Non-irritating to the eye (Rabbit)</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>Irritating to eyes. (Rabbit) Eye, rabbit: Causes moderate eye irritation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Skin Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>May cause sensitization by skin contact (mouse)</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>Did not cause sensitization on laboratory animals (guinea pig)</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>Did not cause sensitization on laboratory animals (guinea pig)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Respiratory Sensitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>No information available</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>No information available</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>No information available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mutagenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-</td>
<td>68909-77-3</td>
<td>In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects.</td>
</tr>
</tbody>
</table>
reaction products with ammonia, morpholine derivatives residues

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS Number</th>
<th>Carcinogenic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>The weight of evidence from available in vitro and in vivo studies indicates that this substance is not expected to be mutagenic.</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>Not regarded as mutagenic. In vivo tests did not show mutagenic effects. In vitro tests did not show mutagenic effects</td>
</tr>
</tbody>
</table>

**Substances**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Reproductive toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>Experiments have shown reproductive toxicity effects on laboratory animals</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.</td>
</tr>
</tbody>
</table>

**Substances**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - single exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>May cause disorder and damage to the Central Nervous System (CNS)</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
</tbody>
</table>

**Substances**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>STOT - repeated exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>No data of sufficient quality are available.</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>No significant toxicity observed in animal studies at concentration requiring classification.</td>
</tr>
</tbody>
</table>

**Substances**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Aspiration hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

---

### 12. Ecological Information

**Ecotoxicity**

**Product Ecotoxicity Data**

No data available

**Substance Ecotoxicity Data**

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Toxicity to Algae</th>
<th>Toxicity to Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Toxicity to Invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>EC50 (72 h) =100 mg/L</td>
<td>LC50 (96 h) &gt;100 mg/L</td>
<td>EC50 (3h) &gt; 1000 mg/L</td>
<td>LC50 (48 h) =287.2 mg/L</td>
</tr>
</tbody>
</table>
## 12.2. Persistence and degradability

Not readily biodegradable

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>No information available</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>(95-97% @ 20d)</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>Readily biodegradable (100 @ 14d)</td>
</tr>
</tbody>
</table>

## 12.3. Bioaccumulative potential

Does not bioaccumulate.

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>Log Pow &lt;1</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>-0.77</td>
</tr>
<tr>
<td>BCF = 1.0 – 4.5 (Cyprinus carpio)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCF &lt; 10 (Leuciscus idus melanotus)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>-2.62 (calculated)</td>
</tr>
</tbody>
</table>

## 12.4. Mobility in soil

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS Number</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues</td>
<td>68909-77-3</td>
<td>No information available</td>
</tr>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>No information available</td>
</tr>
<tr>
<td>Nitrilotriacetic acid, trisodium salt monohydrate</td>
<td>5064-31-3</td>
<td>No information available</td>
</tr>
</tbody>
</table>

## 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
Stockholm 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