Biocide Addition Bridging Document to the Varanus Island Hub Operations Environment Plan Summary

PROJECT / FACILITY	Varanus Island Hub
REVIEW INTERVAL (MONTHS)	No Review Required
SAFETY CRITICAL DOCUMENT	YES

Rev	Rev Date	Author / Editor	Amendment
0	11-Mar-19	A McGovern / M Ranaldi	Issued to DMIRS
1	11-Apr-19	A McGovern / M Ranaldi	Issued to DMIRS
	Click here to enter a date.		
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1 Introduction

On 27 November 2018, Santos completed its acquisition of Quadrant Energy. This has the effect that Santos Limited is now the ultimate holding company of Quadrant Energy Holdings Pty Ltd and its subsidiaries (which includes the operator in respect of this bridging document, Quadrant Energy Australia Limited). It has also resulted in most of the Quadrant group of entities changing their name. Quadrant Energy Australia Limited has changed its name to Santos WA Energy Limited (Santos WA). Its ABN (ABN 39 009 301 964) has remained the same. Santos WA (as operator in respect of this bridging document (BD) and associated environment plan (EP)) will be responsible for all commitments and obligations in this BD. The title was transferred on 21/12/2018.

Over the coming months, we will develop a transition plan to integrate the Quadrant assets into Santos' management systems. As this has not been done yet, this BD reflects the existing Quadrant policies, management systems, contracts and arrangements.

Santos WA continues to evaluate its chemical usage and continues to select and trial best in class chemical applications for use in hydrocarbon production systems. The activities undertaken which may utilise corrosion inhibitors are further described in the Varanus Island Hub Operations Environment Plan (EA-60-RI-186), Revision 6 and chemical disclosure is provided in **Appendix A**. Santos WA proposes to add a new biocide chemical which is proposed to potentially have an improved compatibility and better performance.

Section 3.2.1 of the VI Hub Ops EP lists those operational activities covered by the EP which may require further acceptance from DMIRS by way of a Bridging Document.

Santos WA proposes to start using a new biocide chemical (XC24359) on the Harriet Bravo 8" crude oil line within pipeline licences, TPL/01 and PL12. This product, based on manufacturer information has a better potential biocide performance than the product currently used. Santos WA propose to start using the new biocide XC24359 during Q2 of 2019.

The biocide will be used from an injection skid on the Harriet Bravo facility, either directly into the pipeline (batch dosing) and/or into the pig launcher (during cleaning/batching pig run).

1.1 Compliance

The *Biocide Addition BD* (QE-91-RI-20037) was prepared to meet the requirements of Regulation 11(1) of the Petroleum (Submerged Lands) (Environment) Regulations 2012 (P(SL)(E) Regulations). The biocide injection activities will be conducted in accordance with all applicable legislation and regulations and specifically to meet the requirements of the Petroleum (Submerged Lands) Act 1982 (WA) and its regulations.

The proposed chemical disclosure will be managed in accordance with the accepted *Varanus Island Hub Operations EP* (EA-60-RI-186) and the *Biocide Addition BD* (QE-91-RI-20037) as they cover the expected environmental risks and control measures to be undertaken.

2 Location

The operational area in the EP for the VI hub operations includes areas within 250m from pipelines, 500 m from platforms and subsea infrastructure and 500m from Varanus and Airlie Islands. VI is part of the Lowendal group of islands located on the North West Shelf of Western Australia in the Shire of Ashburton, off the Pilbara Coast. All activities described in this document occur on the Harriet Bravo 8" crude oil pipline, at the location shown in **Figure 2-1** and between the co-ordinates in **Table 2-1**.

Table 2-1: Harriet Bravo 8" Pipeline Coordinates

Latitude	Longitude
20° 34' 30.858" S,	115° 38' 15.259" E

20° 39' 3.110" S,	115° 34' 44.897" E

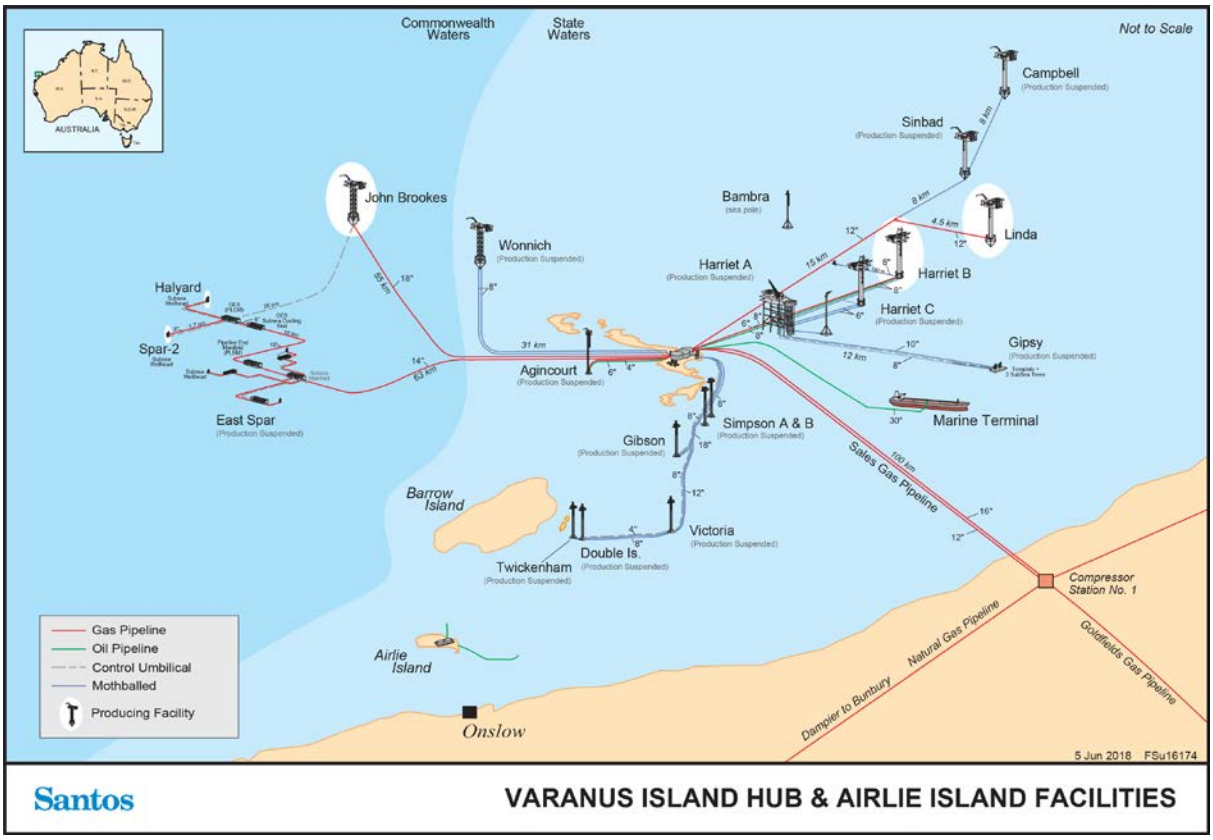

Figure 2-1: Proposed location of chemical usage

3 Description of the environment

3.1 Physical and biological environment

VI is located in the North-West Marine Region (DEWHA, 2008) which lies primarily on the continental shelf between North West Cape and Cape Bougainville. The area has a dynamic oceanographic environment, influenced by strong tides, cyclonic storms, long-period swell and internal tides. Regional surveys on the NWS indicate the seafloor composition is uniform throughout the area, but with spatial variation in the grain size and origin of the surface sediments. Regionally, the seafloor tends to be flat, unconsolidated and sedimentary with occasional calcarenite rock outcrops.

3.2 Potential environmental impacts

Given that the end fate of the biocide chemical is downhole into depleted oil/gas reservoirs via injection wells, there are no expected environmental or socio-economic impacts identified for this process. No discharges to State waters or land will occur during this activity.

4 Activity Description

4.1 Activities

Biocide XC24359 will be applied at the same rates/concentrations as the current biocide XC24380 as described in the accepted EP, therefore the 'product in system' % will be unchanged (<0.00120%%).

Full chemical disclosure is provided in **Appendix A**, and the SDS for XC24359 in **Appendix B** as per the DMP Chemical Disclosure Guideline (DMP, 2013). All other chemicals have previously been disclosed and SDS provided in the Varanus Island Hub Operations Environment Plan (EA-60-RI-186).

There will be no planned discharges of biocide chemical to the marine environment.

4.2 Schedule

Santos WA propose to start using the new biocide XC24359 during Q2 of 2019.

5 Chemical Disclosure

The downhole disposal of this alternative biocide chemical, containing previously undisclosed chemicals or increased volumes in chemicals compared to those disclosed in the VI Hub Ops EP, uses the same disposal approach as outlined in the existing Varanus Island Hub Operations Environment Plan (EA-60-RI-186).

6 Environmental Management

Chemical dosing will be managed under Santos WA's safety management system and the VI Hub Ops EP (EA-60-RI-186) Revision 6. Other relevant environmental management systems or procedures utilised are summarised below.

In the unlikely event that a chemical or hydrocarbon spill occurs during activities, Santos WA emergency response procedures are in place to cover such an occurrence. These include:

+ Varanus Island Hub Operations Oil Spill Contingency Plan (OSCP; EA-60-RI-186.2);
+ Varanus Island Hub Incident response plan (AE-00-ZF-044);
+ Incident Command and Management Manual (AE-00-ZF-025); and
+ Emergency response reported as per the Incident Reporting and Investigation Procedure (QE-91-IF-00002).

The proposed chemical addition is not considered a significant modification to the operational details described within the VI Hub Ops EP as it poses no significant new risks or significant increase in existing risks.

7 Stakeholder Consultation

Stakeholders are regularly updated on activities at the VI Hub through Santos WA's Quarterly Consultation Updates. These regular, non-project oriented updates detail Santos WA's ongoing and proposed activities on the NWS, looking out three to six months, including operating facilities. Information provided in this way is intended to afford stakeholders an opportunity to request additional information on specific activities or elements that may be of interest to them, and voice any concerns. Should stakeholders request additional information this can then be incorporated into the relevant documentation, and dialogue with Santos WA can continue should the concerns or issues require further consultation.

No additional consultation was undertaken for this BD as the activities are not significantly different from Santos WA's day to day activities on VI.

8 Contact details

Further information about the biocide injection activities can be obtained from Ashlee Crabbe on (08) 6218 7100 or email ashlee.crabbe@santos.com

Appendix A: Chemical Disclosure

A. SYSTEM DETAILS:

OPERATOR:	SANTOS
PROJECT / WELL:	VARANUS ISLAND HUB
SYSTEM:	PRODUCED WATER RE-INJECTION SYSTEM
TOTAL VOLUME OF SYSTEM:	8,337,545 L/d

B. PRODUCT LIST:

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
PFW	Not applicable	Injection fluid	99.86%	N/A – as per components below	N/A
CRO24009	Baker Hughes	Corrosion Inhibitor	0.00030%	Acute Mammalian Toxicity *Glycol ether* LD_{50} Dermal 2700 mg/kg (Rabbit) LD_{50} Oral 4500 mg/kg (Rat) *Organic sulfonic acid amine salt* LC_{50} (4 hours) Inhalation Vapour Rat 310 mg/m^3 LD_{50} Oral 438 mg/kg (Rat) *Distillates (petroleum),straight-run middle* LC_{50} (4 hours) Inhalation Vapour Rat 1700 mg/m^3 Aquatic Toxicity *Organic sulfonic acid amine salt* EC_{50} (48 hours) 5.88 ppm *Daphnia magna* LC_{50} (96 hours) 1.18 ppm *Lepomis macrochirus* *Glycol ether* LC_{50} (96 hours) 1300000 µg/L *Lepomis macrochirus* - 33 to 75 mm Chronic Toxicity No known carcinogenic (R40, R45, R49), mutagenic (R46) or reproductive (R60, R61, R62, R64) effects are associated with this product. Chronic effects – once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels. Biodegradation / bioaccumulation Biodegradability in 28 days (OECD 306) - 10 to 30% (seawater – indigenous microbes Octanol/Water Partition Coefficient (OECD117 – HPLC) ~90% of product Log $_{Pow}$ >3.0	Y
CRO24055	Baker Hughes	Corrosion Inhibitor	0.00036%	Acute Mammalian Toxicity *2-(2-butoxyethoxy)ethanol* LD_{50} Dermal Rabbit 2700 mg/kg LD_{50} Oral Rat 4500 mg/kg Aquatic Toxicity *2-(2-butoxyethoxy)ethanol* LC_{50} (96 hours) 1300000 µg/L *Lepomis macrochirus* – 33 to 75 mm *Solvent naphtha (petroleum), heavy aromatic* LC_{50} (96 hours) 1 to 10 mg/l Fish The manufacturer reports that the typical aquatic toxicity data for this type of product 10-100 mg/L marine fish. Chronic Toxicity No known carcinogenic (R40, R45, R49), chronic (R33, R48, R68), mutagenic (R46) or	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				reproductive (R60, R61, R62, R63, R64) effects for this product. <u>Biodegradation / bioaccumulation</u> Not available.	
CRW24006	Baker Hughes	Corrosion Inhibitor	0.00102%	<u>Acute Mammalian Toxicity*</u> *Component 1 (10-30% concentration)* LC_{50} (14 days) >4000 mg/kg bw (Rat) *Component 2 (10-30%)* LC_{50} (14 days) 2410 mg/kg bw (Mouse) *Component 3 (5-10%)* LC_{50} 3530 mg/kg bw (Rat) *Component 4 (1-5%)* Not available *Component 5 (1-5%)* LC_{50} (14 days) 73 mg/kg bw (Rat) *Component 6 (0.1-1%)* LC_{50} (14 days) 5840 mg/kg bw (Rat) *Component 7 (0.1-1%)* LC_{50} (14 days) 1553 mg/kg bw (Rat) *Component 8 (30-60%)* Not applicable - exempted under the 'Chemical Disclosure Guidelines' *All mammalian toxicity values are based upon 100% active material <u>Chronic Toxicity</u> No known carcinogenic (R40, R45, R49), chronic (R33, R36, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects for this product. <u>Aquatic Toxicity</u> *Component 1 (10-30% concentration)* LC_{50} (48 hours) 0.67 mg/L (*Acartia tonsa*) NOEC (48 hours) 0.12 mg/L (*Acartia tonsa*) EC_{50} (72 hours) 0.17 mg/L (*Skeletonema costatum*) NOEC (72 hours) 0.10 mg/L (*Skeletonema costatum*) LC_{50} (96 hours) 1.27 mg/L (Sheepshead minnow) NOEC (96 hours) 0.96 mg/L (Sheepshead minnow) *Component 2 (10-30%)* LC_{50} (48 hours) 2850 mg/L (*Daphnia magna*) EC_{50} (72 hours) 500 to 5000 mg/L (*Skeletonema costatum*) LC_{50} (96 hours) 1300 mg/L (Bluegill sunfish) *Component 3 (5-10%)* OSPAR PLONOR Listed *Component 4 (1-5%)* LC_{50} (48 hours) 0.3 mg/L (*Acartia tonsa*)	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				NOEC (48 hours) 0.05 mg/L (*Acartia tonsa*) EC_{50} (72 hours) 0.1 mg/L (*Skeletonema costatum*) NOEC (72 hours) 0.03 mg/L(*Skeletonema costatum*) LC_{50} (10 days) 38 mg/kg (*Corophium volutator*) NOEC (10 days) 25 mg/kg (*Corophium volutator*) LC_{50} (96 hours) 1.1 mg/L (Sheepshead minnow) NOEC (96 hours) 0.5 mg/L (Sheepshead minnow) *Component 5 (1-5%)* EC50 (96 hours) 30 mg/L Fathead minnow *Component 6 (0.1-1.0%)* OSPAR PLONOR listed *Component 7 (0.1-1%)* EC50 (72 hours) >20 mg/L (*Skeletonema costatum*) *Component 8 (30-60%)* Not applicable - exempted under the 'Chemical Disclosure Guidelines' <u>Biodegradation / bioaccumulation</u> Ready Biodegradability Biodegradability 28 days (*Component 1*) 47% Biodegradability 28 days (*Component 2*) 69% Biodegradability 28 days *(Component 3*) PLONOR Biodegradability 28 days (*Component 4*) 100% Biodegradability 28 days (*Component 5*) Not available Biodegradability 28 days (*Component 6*) PLONOR Biodegradability 28 days (*Component 7*) Not available Biodegradability 28 days (*Component 8*) Not applicable - exempted under the 'Chemical Disclosure Guidelines' <u>Octanol/Water Partition Coefficient</u> Log Pow (*Component 1*) 2.29 Log Pow (*Component 2*) 0.20 Log Pow (*Component 3*) PLONOR Log Pow (*Component 4*) Surfactant Log Pow (*Component 5*) 0.09 Log Pow (*Component 6*) PLONOR Log Pow (*Component 7*) -2.13 Log Pow (*Component 8*) Not applicable - exempted under the 'Chemical Disclosure Guidelines'	
CRW24053	Baker Hughes	Corrosion Inhibitor	0.00054%	<u>Acute Mammalian Toxicity</u> Not available <u>Aquatic Toxicity</u> (assessment of CRW24053 – data from similar chemistry/components) LC_{50} (96 hours) 10 – 50 mg/L Marine Fish (Sheepshead minnow) LC_{50} (48 hours) 50 – 100 mg/L Marine invertebrate (Mystid shrimp, *Acartia*) EC_{50} (72 hours) 1 – 5 mg/L Marine Algae (*Skeletonema costatum*)	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Chronic Toxicity No known carcinogenic (R40, R45, R49), chronic (R33, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects for this product. Biodegradation / bioaccumulation Biodegradability (28 Day OECD 306) 50 – 70% seawater – indigenous microbes Octanol/Water Partition Coefficient (HPLC – OECD 117) Log $_{Pow}$ 0 to 5	
CRW24200	Baker Hughes	Packing Fluid Corrosion Inhibitor	0.00060%	Acute Mammalian Toxicity *2-(2-butoxyethoxy)ethanol* LD_{50} Dermal 2700 mg/kg (Rabbit) LD_{50} Oral 4500 mg/kg (Rat) *Cyclohexylamine* LC_{50} Inhalation Vapour 1070 mg/m^3 (Mouse) LC_{50} Inhalation Vapour (4 hours) 2.3 mg/L (Rat) LC_{50} Inhalation Vapour (4 hours) 7500 mg/m^3 (Rat) LD50 Oral (4 hours) 426 mg/kg (Rat) *Quaternary Ammonium Compounds, Benzyl-C8-18-Alkyldimethyl, Chlorides* LD_{50} Oral 426 mg/kg (Rat) Chronic Toxicity No known carcinogenic (R40, R45, R49), chronic (R33, R39, R48, R68) or mutagenic (R46) effects for this product. *Cyclohexylamine* Fertility effects – may impair fertility, based on animal data (R62) Aquatic Toxicity *Amine compound* EC_{50} (48 hours) 1 to 10 mg/L Daphnia LC_{50} (96 hours) 1 to 10 mg/L Fish *2-(2-butoxyethoxy)ethanol* LC_{50} (96 hours) 1300000 µg/L *Lepomis macrochirus* (33 to 75 mm) *Cyclohexylamine* LC50 (96 hours) 44000 µg/L *Oncorhynchus mykiss* Biodegradation / bioaccumulation Ready Biodegradability *Amine compound* Not readily biodegradable in 28 days <60 % (OECD) *quaternary ammonium compounds, benzyl-C8-18-alkyldimethyl, chlorides* readily biodegrades *Cyclohexylamine* Log $_{Pow}$ 1.2	Y
CRW24830	Baker Hughes	Corrosion & Biocide Inhibitor	0.00060%	Acute Mammalian Toxicity *Component 1 (5-10% concentration)* LC_{50} (14 days) Rat 1110 mg/kg bw	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Component 2 (5-10%) Not available *Component 3 (5-10%)* LC_{50} (14 days) Rat 1110 mg/kg bw *Component 4 (1-5%)* Not available *Component 5 (10-15%)* Not available *Component 6 (30-50%)* Not applicable - exempted under the 'Chemical Disclosure Guidelines' *Component 7 (<1%)* Not available <u>Aquatic Toxicity</u> *Component 1 (5-10% concentration)* LC_{50} (48 hours) 2.7 mg/L *Acartia tonsa* NOEC (48 hours) 0.5 mg/L *Acartia tonsa* EC_{50} (72 hours) 1.1 mg/L *Skeletonema costatum* NOEC (72 hours) 1.0 mg/L *Skeletonema costatum* LC_{50} (10 days) 2723 mg/L *Corophium volutator* NOEC (10 days) 251 mg/kg *Corophium volutator* LC_{50} (96 hours) 5 mg/L Sheepshead minnow NOEC (96 hours) 3 mg/L Sheepshead minnow *Component 2 (5-10%)* OSPAR PLONOR Listed *Component 3 (5-10%)* LC_{50} (48 hours) 2850 mg/L *Daphnia magna* EC_{50} (72 hours) 500 to 5000 mg/L *Skeletonema costatum* LC_{50} (96 hours) 1300 mg/L Bluegill sunfish *Component 4 (1-5%)* LC_{50} (48 hours) 0.08 mg/L *Daphnia magna* NOEC (48 hours) 0.025 mg/L *Daphnia magna* *Component 5 (10-15%)* OSPAR PLONOR Listed *Component 6 (30-50%)* Not applicable - exempted under the 'Chemical Disclosure Guidelines' *Component 7(<1%)* Not available <u>Chronic Toxicity</u> No known carcinogenic (R40, R45, R49), chronic (R33, R39, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects, for any components in this product. <u>Biodegradation / bioaccumulation</u> Readily Biodegradability (seawater OECD 306) Biodegradability, 28 days (*Component 1*) 62% Biodegradability, 20 days (*Component 2*) PLONOR Biodegradability, 28 days (*Component 3*) 75%	

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Biodegradability, 28 days (*Component 4*) Not available Biodegradability, 28 days (*Component 5*) PLONOR Biodegradability, 28 days (*Component 6*) Not applicable - exempted under the 'Chemical Disclosure Guidelines' Biodegradability, 28 days (*Component 7*) Not available Octanol/Water Partition Coefficient (OECD 117) Log Pow (*Component 1*) MW > 700 Log Pow (*Component 2*) PLONOR Log Pow (*Component 3*) 0.2 Log Pow (*Component 4*) Surfactant Log Pow (*Component 5*) PLONOR Log Pow (*Component 6*) Not applicable - exempted under the 'Chemical Disclosure Guidelines' Log Pow (*Component 7*) Not available	
DFO24986	Baker Hughes	Defoamer	<0.00001%	Acute Mammalian Toxicity LC_{50} (14 days) >300 < 2000 mg/kg bw (Rat) Chronic Toxicity No known carcinogenic (R40, R45, R49), chronic (R33, R39, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects are associated with this product. Aquatic Toxicity LC_{50} (48 hours) >100 mg/L *Daphnia magna* EC_{50} (72 hours) = 112 mg/L *Selenastrum capricornutum* LC_{50} (96 hours) = 104 mg/L Zebrafish (*B. rerio*) Biodegradation / bioaccumulation Ready Biodegradability (Method OECD 301F) Biodegradability 28 days 79% Octanol/Water Partition Coefficient (Method OECD 117 (HPLC)) Log $_{Pow}$ = 1.18 to 4.37	Y
SRN6023	Nalco Champion	Corrosion Inhibitor	0.00162%	Acute Mammalian Toxicity *Component 1 (30-60%)* LD50 (Oral) Rat: 7712 mg/kg LC50 (Inhalation) Rat: >2.5 mg/L air LD50 (Dermal) Mouse: >3500 mg/kg Skin irritation Rabbit: Not irritating Eye irritation Rabbit: Not irritating Sensitisation Guinea pig: Not sensitising Aquatic Toxicity *Component 1 (30-60%)* PLONOR Fish LC50(96hr): 72,860 mg/L (Pimephales promelas) Crustacean LC50(48hr): >100 mg/L (Daphnia magna (fresh water) Algae EC50(96hr): 6500 mg/L (Selenastrum capricornutum) *Component 2 (1-10%)* Fish LC50(96hr):1.34mg/L (Scophthalmus maximus) Crustacean LC50(48hr):0.21 mg/L (Acartia tonsa)	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Algae EC50(72hr):0.0009 mg/L (Skeletonema costatum) *Component 3 (1-10%)* Fish LC50(96hr): 1-10 mg/L* Crustacean LC50(48hr): <1 mg/L* Algae EC50(72hr): <1 mg/L* **Estimated data based on structural analogue* *Component 4 (1-10%)* Fish LC50(96hr):>0.2 mg/L (Limit test, *Sheepshead minnow)* Crustacean LC50(48hr): 1.23 mg/L (Acartia tonsa) Algae EC50(72hr): 0.19 mg/L (Skeletonema costatum) *Component 5 (1-10%)* Fish LC50(96hr): 4.35 mg/L Crustacean LC50(48hr): 43.51 mg/L Algae EC50(72hr): 4.36 mg/L *(Component 5 data based on WAF test)* *Component 6 (1-10%)* Fish LC50(96hr):>18 mg/L (Limit test, *Sheepshead minnow)* Crustacean LC50(48hr): 32.6 mg/L (Acartia tonsa) Algae EC50(72hr): 98.58 mg/L (Skeletonema costatum) *Component 7 (1-10%)* Fish LC50(96hr): 6.1 mg/L (Zebra fish)* **Based on supplier data, no other data available.* *Component 8 (1-10%)* Fish LC50(96hr): 2100 mg/L (*Sheepshead minnow)* Crustacean LC50(48hr): 1195 mg/L (Acartia tonsa) Algae EC50(72hr): 1100 mg/L (Skeletonema costatum) *Component 9 (<1%)* PLONOR *Component 10 (<0.1%)* Fish LC50(96hr): 52 mg/L Crustacean LC50(48hr): 439 mg/L Algae EC50(72hr): 375 mg/L *(Component 10 data based on WAF test)* *Component 11 (<0.01%)* Fish LC50(96hr): 174 mg/L Crustacean LC50(48hr): 562 mg/L Algae EC50(72hr): 710 mg/L *(Component 11 data based on WAF test)* *Component 12 (<0.01%)* Fish LC50(96hr): 7.72 mg/L (Fathead minnow) Crustacean LC50(48hr): 17 mg/L ((Cancer magister, Dungeness or edible crab) Algae EC50(72hr): Not available *(Literature data from NZ HSNO CCID)*	

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Component 13 (<0.01%) Fish LC50(96hr): 1.2 mg/L (Pink salmon) Crustacean LC50(48hr): 2.16 mg/L (*Daphnia magna)* Algae EC50(72hr): ~0.4 mg/L (*Skeletonema costatum*) *(Literature data from NZ HSNO CCID)* *Component 14 (<0.01%)* Fish LC50(96hr): 4.2 mg/L *(Oncorhynchus mykiss)* Crustacean LC50(48hr): 2.16 mg/L (*Daphnia magna)* Algae EC50(72hr): 4.6 mg/L (*Selenastrum capricornutum)* *(Literature data from NZ HSNO CCID)* <u>Chronic Toxicity</u> Risk of cancer and heritable genetic damage. Sensitization due to skin contact. <u>Biodegradation / Bioaccumulation</u> *Component 1 (30-60%)* PLONOR *Component 2 (1-10%)* Log Pow:6.0 Biodegradation (28d): 38% (Marine BODIS) *Component 3 (1-10%)* Log Pow:6.0 Biodegradation (28d): ~40% *(Estimate based on structural analogue)* *Component 4 (1-10%)* Log Pow: Not applicable, surface active Biodegradation (28d): 41% (OECD 306) *Component 5 (1-10%)* Log Pow: Not applicable, surface active Biodegradation (28d): 23% (OECD 306) *Component 6 (1-10%)* Log Pow: -0.8 Biodegradation (28d): 21% (OECD 306) *Component 7 (1-10%)* Log Pow: 2.67 Biodegradation (28d): 56.6% **Based on supplier data* *Component 8 (1-10%)* Log Pow: 1.6 Biodegradation (28d): 68% (OECD 306) *Component 9 (<1%)* PLONOR *Component 10 (<0.1%)* Log Pow: 4.6 Biodegradation (28d): 86% (OECD 306) *Component 11 (<0.01%)* Log Pow: 3.4 Biodegradation (28d): 71% (OECD 306) *Component 12 (<0.01%)*	

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Log Pow: <3 Biodegradation (28d): <60 *(Literature data from NZ HSNO CCID)* *Component 13 (<0.01%)* Log Pow: >3 Biodegradation (28d): >60 *(Literature data from NZ HSNO CCID)* *Component 14 (<0.01%)* Log Pow: <3 Biodegradation (28d): >60 *(Literature data from NZ HSNO CCID)*	
HSW24112	Baker Hughes	H2S Scavenger	0.00144%	Acute Mammalian Toxicity *2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl)triethanol* LC_{50} (4 hours) Inhalation Dusts and mists Rat 0.371 mg/l Aerosol. LD_{50} Dermal >2 g/kg (Rat) LD_{50} Oral >763 mg/kg (Rat) Aquatic Toxicity *2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl)triethanol* EC_{50} (48 hours) 26.1 to 34.5 ppm *Daphnia magna* - <24 hours LC_{50} (96 hours) >118 ppm *Cyprinodon variegatus* - 8 weeks Chronic Toxicity No known carcinogenic (R40, R45, R49), mutagenic (R46) or reproductive (R60, R61, R62, R64) effects are associated with this product. Chronic effects – once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels. Biodegradation / bioaccumulation Not available	Y
HSW24165	Baker Hughes	H2S Scavenger	0.00144%	Acute Mammalian Toxicity *2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl)triethanol* LC_{50} (4 hours) Inhalation Dusts and mists Rat 0.371 mg/l Aerosol LD_{50} Dermal Rat >2 g/kg LD_{50} Oral Rat >763 mg/kg *Quaternary Ammonium Compounds, Benzyl-C8-18-Alkyldimethyl, Chlorides* LD50 Oral 426 mg/kg (Rat) Aquatic Toxicity EC_{50} (48 hours) 26.1 to 34.5 ppm Fresh water, Daphnia - *Daphnia magna* - <24 hours, exposure LC_{50} (96 hours) >118 ppm Marine water Fish - *Cyprinodon variegatus* – 8 weeks, exposure Chronic Toxicity No known carcinogenic (R40, R45, R49), mutagenic (R46) or reproductive (R60, R61, R62, R64) effects are associated with this product. Chronic effects – once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels. Biodegradation / bioaccumulation *Quaternary Ammonium Compounds, Benzyl-C8-18-Alkyldimethyl, Chlorides* Readily biodegradable	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
HSW82185	Baker Hughes	H2S Scavenger	0.00144%	Acute Mammalian Toxicity* LC_{50} (14 days) >300 >2000 mg/kg bw *Oral toxicity based upon 100% active material. Chronic Toxicity No carcinogenic (R40, R45, R49), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects are known. HSW82185 does carry a chronic H373 phrase. May cause damage to organs through prolonged or repeated exposure if swallowed. Aquatic Toxicity LC_{50} (48 hours) 30 mg/L *Acartia tonsa* NOEC 12.5 mg/L *Acartia tonsa* EC_{50} (72 hours) 4 mg/L *Skeletonema costatum* LC_{50} (96 hours) 71 mg/L Sheepshead minnow NOEC (96 hours) 50 mg/L Sheepshead minnow Biodegradation / bioaccumulation Ready Biodegradability (Method OECD 306) Biodegradability 28 days, 84% Octanol/Water Partition Coefficient (Method OECD 117 (HPLC) Log $_{Pow}$ <0	Y
Jefftreat MP Amine	Huntsman	Gas treatment agent	<0.00001%	Acute Mammalian Toxicity *Amine compound* LD_{50} Dermal 11336 mg/kg (Rabbit – female) LD_{50} Dermal 10244 mg/kg (Rabbit – male) LC_{50} Oral 4680 mg/kg (Rat – male & female) LC_{50} Inhalation dusts and mists >6.5 mg/m^3 (Rat – male & female) *Piperazine* LD_{50} Dermal 8300 mg/kg (Rabbit – male & female) LD_{50} Oral 2600 mg/kg (Rat – male & female) Chronic Mammalian Toxicity *Amine compound* Sub-chronic NOAEL Dermal (90 days; 5 days per week) 750 mg/kg (Rat – male & female) *Piperazine* Sub-chronic NOAEL Oral (90 days; 7 days per week) 627 mg/kg/d (Rat – male & female) Sub-acute LOAEL Oral (7 days) 30 mg/kg/d (Human) No carcinogenic (R40, R45, R49) or mutagenic (R46) effects are known. Teratogenicity *toxicity* – May cause birth defects, based on animal data. *Amine compound* NOAEL Negative - Dermal >1000 mg/kg (9 days; 6 hours per day) (Rat – Male & Female) *Piperazine* NOAEL Negative – Oral 2100 mg/kg (10 days; 7days per week) (Rat – Male & Female) Reproductive *toxicity* – Oral 125 mg/kg NOAEL Rat male, female May impair fertility, based on animal data. R62 – Possible risk of impaired fertility	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				R63 – Possible risk of harm to the unborn child. Aquatic Toxicity *Amine compound* EC_{50} (17 hours) Bacteria 413.8 mg/L EC_{50} (48 hours) Daphnia 233 mg/L ErC_{50} (72 hours) Algae 176 mg/L LC_{50} (96 hours) Fish 1000 to 2200 mg/L *Piperazine* EC_{50} (48 hours) Daphnia 21 mg/L LC_{50} (96 hours) > 1800 mg/L Fish Chronic Aquatic Toxicity *Piperazine* NOEC (30 minute) 540 mg/L Bacteria NOEC (21 days) 12.5 mg/L Daphnia NOECr (72 hours) Algae >1000 mg/L Biodegradation / bioaccumulation *Amine compound* Ready Biodegradability (Method OECD 301A) 96% Readily biodegradable in 18 days (41 mg/L DOC) *Piperazine* Ready Biodegradability (Method OECD 301F) 70.2% Readily biodegradable in 28 days Bioaccumulative potential *Amine compound* Log $_{Pow}$ -1.08 BCF 3.16 Piperazine Log $_{Pow}$ -1.24	
RBW24136	Baker Hughes	Water Clarifier	0.00300%	Acute Mammalian Toxicity *Potassium Hydroxide* LD50 Oral 273 mg/kg (Rat) Aquatic Toxicity (assessment of RBW24136) EC_{50} (72 hours) (median) 1.6 mg/L *Skeletonema costatum* LC_{50} (48 hours) 1.7 mg/L *Acartia tonsa* LC_{50} (10 days) 575 mg/L *Corophium volutator* LC_{50} (96 hours) 357 mg/L *Scophthalamus maximus* juvenile Chronic Toxicity No known carcinogenic (R40, R25, R49), chronic (R33, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects are associated with this product. Biodegradation / bioaccumulation The product is inherently biodegradable. Ready Biodegradability (Method: OECD 306) Biodegradability, 0 days 0% Biodegradability, 5 days 31% Biodegradability, 15 days 20% Biodegradability, 28 days 29% Octanol/Water Partition Coefficient (OECD 117) Log $_{Pow}$ 2.6	Y
RBW24362	Baker Hughes	Water Clarifier	0.00300%	Acute Mammalian Toxicity No data available	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Aquatic Toxicity *Component 1* LC_{50} (48 hours) 1440 mg/L *Acartia tonsa* NOEC (48 hours) 1138 mg/L *Acartia tonsa* EC_{50} (72 hours) 1130 mg/L *Skeletonema costatum* NOEC (72 hours) 800 mg/L *Skeletonema costatum* LC_{50} (96 hours) >1139 mg/L Sheepshead minnow *Component 2* Not applicable - exempted under the 'Chemical Disclosure Guidelines' Chronic Toxicity No known carcinogenic (R40, R25, R49), chronic (R33, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects are associated with this product. Biodegradation / bioaccumulation Ready Biodegradability Biodegradability in 28 days (*Component 1*) 34% (Method: OECD306) Biodegradability in 28 days (*Component 2*) (Method: OECD306) Not applicable - exempted under the 'Chemical Disclosure Guidelines' Octanol/Water Partition Coefficient Log $_{Pow}$ (*Component 1*) MW > 700 (Method: OECD 117) Log $_{Pow}$ (*Component 2*) Not applicable - exempted under the 'Chemical Disclosure Guidelines'	
SCW24024	Baker Hughes	Scale Inhibitor	0.00500%	Acute Mammalian Toxicity No data available *All mammalian toxicity values are based upon 100% active material Chronic Toxicity No carcinogenic (R40, R45, R49), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects are known. Aquatic Toxicity *Component 1 (30 – 60%)* EC_{50} (48 hours) = 242.2 mg/L *Daphnia magna* NOEC (48 hours) = 125 mg/L *Daphnia magna* EC_{50} (14 days) = 8.68 mg/L *Selenastrum capricornutum* NOEC (72 hours) = 5 mg/L *Selenastrum capricornutum* LC_{50} (96 hours) = 5377 mg/L *Cyprinodon variegantus* *Component 2 (>60%)* Not applicable - exempted under the 'Chemical Disclosure Guidelines' Biodegradation / bioaccumulation *Component 1 (30 – 60%)*	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Ready Biodegradability (Method OECD 301E) Biodegradability, 28 days 0% Octanol/Water Partition Coefficient (Method OECD 117) Log $_{Pow}$ = -8.22 *Component 2 (>60%)* Not applicable - exempted under the 'Chemical Disclosure Guidelines'	
SCW24526	Baker Hughes	Scale Inhibitor	0.00500%	<u>Acute Mammalian Toxicity*</u> *Component 1 (5-10% concentration)* LD_{50} 3550 mg/kg bw (rat, female) *Component 2 (5-10%)* LD_{50} 1750 mg/kg bw (Rat) *Component 3 (60-100%)* Not applicable - exempted under the 'Chemical Disclosure Guidelines' *All mammalian toxicity values are based upon 100% active material <u>Chronic Toxicity</u> No known carcinogenic (R40, R45, R49), chronic (R33, R39, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects for this product. <u>Aquatic Toxicity</u> *Component 1 (5-10%)* EC_{50} (48 hours) 527 mg/L (*Daphnia magna*) NOEC (48 hour) 400 mg/L (*Daphnia magna*) EC_{50} (96 hours) 7.23 mg/L (*Selenastrum capricornutm*) LC_{50} (96 hours) 360 mg/L (*Oncorhynchus mykiss*) NOEC (96 hours) 180 mg/L (*Oncorhynchus mykiss*) *Component 2 (5-10%)* LC_{50} (48 hours) >350 mg/L (*Acartia tonsa*) EC_{50} (72 hours) 168 mg/L (*Skeletonema costatum*) LC_{50} (96 hours) >70 mg/L (*Brachdanio rerio*) *Component 3 (60-100%)* Not applicable - exempted under the 'Chemical Disclosure Guidelines' <u>Biodegradation / bioaccumulation</u> Ready Biodegradability *Component 1* Biodegradability in 28 days 10% (Method: OECD 301) *Component 2* Biodegradability in 28 days 0% (Method: OECD 302B) *Component 3* Biodegradability in 28 days (Method OECD306) Not applicable - exempted under the 'Chemical Disclosure Guidelines' <u>Octanol/Water Partition Coefficient</u> *Component 1* Log $_{Pow}$ -0.81 *Component 2* Log $_{Pow}$ Not available	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Component 3 Log $_{Pow}$ Not applicable - exempted under the 'Chemical Disclosure Guidelines'	
WAO24026	Baker Hughes	Antifoulant	0.00018%	Acute Mammalian Toxicity *Solvent naphtha (petroleum)*, heavy aromatic LD_{50} Oral 3200 mg/kg (Rat) *2-(2-butoxyethoxy)ethanol* LD_{50} Dermal 2700 mg/kg (Rabbit) LD_{50} Oral 4500 mg/kg (Rat) *1,2,4-trimethylbenzene* LC_{50} (4 hours) Inhalation vapour 18000 mg/m^3 Aquatic Toxicity *Solvent naphtha (petroleum)* LC_{50} (96 hours) 1 to 10 mg/L Fish *2-(2-butoxyethoxy)ethanol* LC_{50} (96 hours) 1300000 µg/L *Lepomis macrochius* 22-75 mm *Naphthalene* EC_{50} (48 hours) 1.96 mg/L *Daphnia magna* LC_{50} (96 hours) 315 µg/L *Melanotaenia fluviatilis* – Larvae – 1 day *Nonylphenolethoxylate* LC_{50} (48 hours) 1 to 2 µg/L *Thamnocephalus platyurus*. Nauplii 24 hours LC_{50} (48 hours) 4800 µg/L *Daphnia pulex*. Larvae <24 hours LC_{50} (96 hours) 1300 µg/L *Lepmois macrochirus* – 1 g Chronic Toxicity *Naphthalene* Carcinogenic Cat. 3.; R40 No known mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects for this product. Chronic effects – prolonged or repeated contact can defeat the skin and lead to irritation, cracking and/or dermatitis. Biodegradation / bioaccumulation *Solvent naphtha* (petroleum), heavy arom: Not readily biodegradable *naphthalene*: Not readily biodegradable *1,2,4-trimethylbenzene*: Not readily biodegradable *naphthalene* Log $_{Pow}$ = 3.01	Y
WCW24063	Baker Hughes	Corrosion & Scale Inhibitor	0.00642%	Acute Mammalian Toxicity *2-(2-butoxyethoxy)ethanol* LD_{50} Dermal 2700 mg/kg (Rabbit) LD_{50} Oral 4500 mg/kg (Rat) *Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides* LD_{50} Oral Rat 426 mg/kg *2-mercaptoethanol* LD_{50} Oral Rat 244 mg/kg *Etidronic acid*	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				LD_{50} Oral Rat 2400 mg/kg *Acetic acid* LC_{50} (4 hours) Inhalation Vapour 11000 mg/m^3 (Rat) LD_{50} Dermal 1060 mg/kg (Rabbit) LD_{50} Oral 3310 mg/kg (Rat) <u>Aquatic Toxicity</u> *2-(2-butoxyethoxy)ethanol* LC_{50} (96 hours) 1300000 µg/L *Lepomis macrochirus* – 33 to 75 mm *Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides* EC_{50} (48 hours) 5.9 ppb *Daphnia magna* - <24 hours, LC_{50} (96 hours) 0.28 ppm *Pimephales promelas* *Acetic acid* EC_{50} (48 hours) 65000 µg/L Daphnia - *Daphnia magna*. Neonate - <24 hours. LC_{50} (48 hours) 50.1 µl/L *Artemia* sp. LC_{50} (96 hours) 75000 µg/L *Lepomis macrochirus* - 5.3 to 7.2 cm - 3.5 to 3.9 g <u>Chronic Toxicity</u> No known carcinogenic (R40, R45, R49), chronic (R33, R39, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects for this product. <u>Biodegradation / bioaccumulation</u> *Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides* Readily biodegradable	
WCW24160	Baker Hughes	Corrosion & Scale Inhibitor	0.00642%	<u>Acute Mammalian Toxicity</u> *2-(2-butoxyethoxy)ethanol* LD_{50} Dermal 2700 mg/kg (Rabbit) LD_{50} Oral 4500 mg/kg (Rat) *Ethanediol* LD_{50} Dermal 9530 µL/kg (Rabbit) LD_{50} Oral 4700 mg/kg (Rat) *Glycerol* LD50 Intraperitoneal 4420 mg/kg (Rat) TDLo Intramuscular >5000 mg/kg (Rat) *Quaternary ammonium compounds, alkylbenzyldimethyl, chlorides* LD50 Oral 240 mg/kg (Rat) <u>Aquatic Toxicity</u> *2-(2-butoxyethoxy)ethanol* LC_{50} (96 hours) 1300000 µg/L *Lepomis macrochirus* - 33 to 75 mm *Ethanediol* LC_{50} (96 hours) >18500 mg/L *Oncorhynchus mykiss* *Glycerol* LC_{50} (96 hours) 54 to 57 ml/L *Oncorhynchus mykiss* -0.9 g	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Quaternary ammonium compounds, alkylbenzyldimethyl, chlorides EC_{50} (48 hours) 18 µg/L *Daphnia magna* - <24 hours LC_{50} (96 hours) 320 to 460 µg/L - *Lepomis macrochirus* - 0.3g <u>Chronic Toxicity</u> No known carcinogenic (R40, R45, R49), chronic (R33, R39, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects for this product. <u>Biodegradation / bioaccumulation</u> Not available.	
XC24117	Baker Hughes	Biocide (Glut/Quat)	0.00052%	<u>Acute Mammalian Toxicity</u> *Component 1 (10-30% concentration)* LC_{50} (14 days) Rat 159 mg/kg bw *Component 2 (1-5%)* LC_{50} (14 days) Rat 426 mg/kg bw *Component 3 (0.1-1.0%)* LC_{50} (14 days) Rat 5600 mg/kg bw *Component 4 (30-60%)* Not applicable - exempted under the 'Chemical Disclosure Guidelines' <u>Aquatic Toxicity</u> *Component 1 (10-30 concentration)* LC_{50} (48 hours) 2.8 mg/L *Acartia tonsa* NOEC (48 hours) 0.5 mg/L *Acartia tonsa* EC_{50} (72 hours) 0.35 mg/L *Skeletonema costatum* NOEC (96 hours) 0.11 mg/L *Skeletonema costatum* *Component 2 (1-5%)* LC50 (48 hours) 0.04 mg/L *Daphnia magna* NOEC (48 hours) 0.013 mg/L *Daphnia magna* *Component 3 (0.1-1.0%)* OSPAR PLONOR Listed *Component 4 (30-60%)* Not applicable - exempted under the 'Chemical Disclosure Guidelines' <u>Chronic Toxicity</u> No known carcinogenic (R40, R45, R49), chronic (R33, R39, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects, for this product. <u>Biodegradation / bioaccumulation</u> Ready Biodegradability Method: OECD306 Biodegradability 28 days (*Component 1*) 73% Method: OECD301B Biodegradability 28 days (*Component 2*) 95% Method: OECD306 Biodegradability 28 days (*Component 3*) PLONOR Method:OECD306 Biodegradability 28 days (*Component 4*) Not applicable - exempted under the 'Chemical Disclosure Guidelines' Octanol/Water Partition Coefficient	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Method: OECD117 (HPLC) Log $_{Pow}$ (*Component 1*) <0 Method: OECD 117 (HPLC) Log $_{Pow}$ (*Component 2*) Surfactant Method: OECD 117 (HPLC) Log $_{Pow}$ (*Component 3*) PLONOR Method: OECD 117 (HPLC) Log $_{Pow}$ (*Component 4*) Not applicable - exempted under the 'Chemical Disclosure Guidelines'	
XC24380	Baker Hughes	Biocide (THPS)	0.00120%	Acute Mammalian Toxicity ***Component 1 (60-100%)*** LD50 (oral): 575 mg/kg ***Component 2 (10-30%)*** Natural product – exempted under the Chemical Disclosure Guidelines Aquatic Toxicity Component 1 (60-100%) LC_{50} (96 hours) 72.5 mg/L *Scophthalmus maximus* EC_{50} (72 hours) 0.16 mg/L *Skeletonema costatum* LC_{50} (48 hours) 0.60 mg/L *Acartia tonsa* *Component 2 (10-30%)* *Natural product – exempted under the Chemical Disclosure Guidelines* Chronic Toxicity No known carcinogenic (H350, H351), chronic (H341, H370, H371, H373), mutagenic (H40) or reproductive (H360, H362) effects for this product. A component of this product does carry the following Hazard statement: H3161 – Suspected of damaging the unborn child. Biodegradation / bioaccumulation Ready Biodegradability Test Component 1 (60-100%) Ready Biodegradability (Method OPPTS 835.4300) Biodegradability, 7 days 60% Component 2 (10-30%) Natural product – exempted under the Chemical Disclosure Guidelines Octanol/Water Partition Coefficient (Log $_{Pow}$) Component 1 (60-100%) Method: OECD 117 (HPLC) Log $_{Pow}$ < 0 Component 2) 10-30%) Natural product – exempted under the Chemical Disclosure Guidelines.	Y
MEG Water (90:10)	Baker Hughes	Hydrate Inhibitor	<0.00001%	Aquatic Mammalian Toxicity *Ethanediol (60-100%)* OSPAR PLONOR Listed LD_{50} Dermal 9530 µL/kg LD_{50} Oral Rat 4700 mg/kg Chronic Toxicity	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				No known carcinogenic (R40, R45, R49), chronic (R33, R39, R48, R68), mutagenic (R46) or reproductive (R60, R61, R62, R63, R64) effects, for this product. Aquatic Toxicity *Ethanediol (60-100%)* OSPAR PLONOR Listed LC_{50} (96 hours) >18500 mg/L (*Oncorhynchus mykiss*) Biodegradation/bioaccumulation potential *Ethanediol (60-100%)* Not applicable - PLONOR	
XC24359	Baker Hughes	Biocide	0.00120%	Aquatic Mammalian Toxicity ***Component 1 (60-100%)*** Natural product – exempted under the Chemical Disclosure Guidelines ***Component 2 (10-30%)*** Specie: Rat LD50 (oral): 575 mg/kg ***Component 3 (1-5%)*** Specie: Rat LD50 (oral): 1002 mg/kg Chronic Toxicity This product does carry the following H phrase: H361 – Suspected of damaging unborn child. This product does not carry any of the following H phrases for carcinogenic (H350, H351), chronic (H341, H370, H371, H373), mutagenic (H340) reproductive (H360, H362) effects. Aquatic Toxicity ***Component 1 (60-100%)*** Natural product – exempted under the Chemical Disclosure Guidelines ***Component 2 (10-30%)*** Specie: *Skeletonema costatum* (marine algae) EC50 (72 hours) 0.16 mg/L Specie: *Acartia tonsa* (marine invertebrate) LC50 (48 hours) 0.60 mg/L Specie: *Cyprinodon variegatus* (marine fish) LC50 (96 hours) 72 mg/L ***Component 3 (1-5%)*** Specie: *Selenastrum capricarnutum* (freshwater algae) EC50 (72 hour) 0.019 mg/L Specie: Daphnia magna (freshwater invertebrate) LC50 (48 hours) 0.025 mg/L Specie: *Lepomis macrochirus* (freshwater fish) LC50 (96 hours) 0.059 mg/L Biodegradation/Bioaccumulation Potential Ready Biodegradability ***Component 1 (60-100%)*** Natural product – exempted under the Chemical Disclosure Guidelines ***Component 2 (10-30%)*** Method: USEPA 164-2. Biodegradability 30 days: 67% **Component 3 (1-5%)** Method: Die-away test with radiolabelled. Biodegradability 7 days: > 98% Octanol/Water Partition Coefficient ***Component 1 (60-100%)*** Natural product – exempted under the Chemical Disclosure Guidelines ***Component 2 (10-30%)***	Y

Product Name	Supplier	Purpose	Product in system (%)	Toxicity & Ecotoxicity Info	SDS Attached
				Method: OECD 117 (HPLC). Log (Pow): <0 ***Component 3 (1-5%)*** Method: OECD 107 (Shake Flask Method). Log (Pow) 2.45	

C. CHEMICAL LIST

Chemicals within produced water re-injection system	CAS number	Mass fraction (%)
WATER	7732-18-5	99.99999%
PHOSPHONIC ACID, SODIUM SALT	22042-96-2	0.00301%
2-(2-BUTOXYETHOXY)ETHANOL	112-34-5	0.00234%
ETHANEDIOL	107-21-1	0.00200%
2,2',2''-(HEXAHYDRO-1,3,5-TRIAZINE-1,3,5-TRIYL)TRIETHANOL	4719-04-4	0.00146%
TETRAKIS(HYDROXYMETHYL)PHOSPHONIUM SULPHATE	55566-30-8	0.00126%
DIPHOSPHONIC ACID	2809-21-4	0.00080%
GLYCEROL	56-81-5	0.00078%
AMINES, N-TALLOW ALKYLTRIMETHYLENEDI-, ETHOXYLATED	61790-85-0	0.00070%
1,3,5 TRIALKYLHEXAHYDRO TRIAZINE	108-74-7	0.00065%
DITHIOCARBAMATE	204079-86-7	0.00060%
AMIDE/IMIDAZOLINES	68910-93-0	0.00058%
POTASSIUM HYDROXIDE	1310-58-3	0.00047%
ALKYL (C3-5) BENZENES	64742-94-5	0.00036%
AMINE FATTY ACID CONDENSATE	68953-36-6	0.00032%
C12-16 ALKYLBENZYLDIMETHYLAMMONIUM CHLORIDE	68424-85-1	0.00032%
FATTY ACIDS, TALL OIL, REACTION PRODUCTS WITH DIETHYLENETRIAMINE	61790-69-0	0.00027%
POLYCARBOXYLATE, SODIUM SALT	9003-04-7	0.00026%
THIOALCOHOL	60-24-2	0.00026%
DISTILLATES (PETROLEUM), STRAIGHT-RUN MIDDLE	64741-44-2	0.00025%
ACETIC ACID	64-19-7	0.00023%
ETHOXYLATED AMINE	61791-26-2	0.00023%
FATTY ACIDS	67762-38-3	0.00023%
BENZYL ALKYL DIMETHYL AMMONIUM CHLORIDE	8001-54-5	0.00018%
2-AMINOETHANOL	141-43-5	0.00016%
2-PROPENOIC ACID, POLYMER WITH METHYL 2-PROPENOATE	25302-81-2	0.00015%
SODIUM THIOSULPHATE	10102-17-7	0.00014%
2-BUTOXYEHTANOL	111-76-2	0.00013%
AMINE DERIVATIVE	64754-93-4	0.00011%
GLUTARALDEHYDE	111-30-8	0.00009%
AMMONIUM BISULPHITE	10192-30-0	0.00009%
AMINE, COCO ALKYL PROPIONATES	91995-05-0	0.00009%
PYRIDINE, ALKYL DERIVATIVES, CRUDE TAR BASES	68391-11-7	0.00006%
2-PROPENOIC ACID, HOMOPOLYMER	9003-01-4	0.00004%
QUATERNARY AMMONIUM COMPOUND	68391-01-5	0.00004%
NAPHTHALENE	91-20-3	0.00004%
CYCLOHEXYLAMINE	108-91-8	0.00004%
ALKYL AMINE	61788-46-3	0.00004%
DIPROPYLENE GLYCOL	110-98-5	0.00003%
THIOGLYCOLIC ACID	68-11-1	0.00003%
1 2 4-TRIMETHYLBENZENE	95-63-6	0.00002%
FATTY ACIDS, C18-UNSATURATED, DIMERS	61788-89-4	0.00002%
ISOPROPANOL	67-63-0	0.00001%
2-PROPENOIC ACID, POLYMER WITH 2-PROPANOL	114033-68-0	0.00001%
NONYL PHENOL ETHOXYLATE	9016-45-9	0.00001%
TRIBUTYLTETRADECYLPHOSPHONIUM CHLORIDE	81741-28-8	0.00001%
MESITYLENE	108-67-8	<0.00001%
OXYALKYLATED RESINS	63428-92-2	<0.00001%
BENZENESULFONIC ACID, 4-C10-13-SEC-ALKYL DERIVATIVES	85536-14-7	<0.00001%
DIETHYLENETRIAMINE	111-40-0	<0.00001%

Chemicals within produced water re-injection system	CAS number	Mass fraction (%)
DODECYL BENZENE SULPHONIC ACID, LINEAR	68584-22-5	<0.00001%
BENZENESULPHONIC ACID, DODECYL-, AMINE SALT	25155-30-0	<0.00001%
FLUORESCEIN SODIUM SALT	518-47-8	<0.00001%
METHANOL	67-56-1	<0.00001%
XYLENE	1330-20-7	<0.00001%
POLYDIMETHYLSILOXANE	63428-62-9	<0.00001%
SODIUM ACRYLATE	7446-81-3	<0.00001%
SULPHURIC ACID	7664-93-9	<0.00001%
METHYLDIETHANOLAMINE	105-59-9	<0.00001%
PIPERAZINE	110-85-0	<0.00001%
ETHYLBENZENE	100-41-4	<0.00001%
Total		**~100%**

Appendix B: Safety Data Sheets