Title: Harmonised REACH Exposure Scenario Mapping for the Oilfield Chemicals Industry

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Abstract:

The second tranche of substances to be registered for REACH, deadline June 2013, will include many substances used in oilfield applications. Under REACH, many substances require a chemical safety report (CSR) to be submitted as part of the registration dossier. Part of the CSR involves defining and assessing exposure scenarios (ESs) which are used to communicate safe operating conditions for identified uses. Use descriptor codes are a shorthand form of communicating the broad application of ESs, which can then be used to model specific scenarios for specific substances. These use descriptor codes will also appear on the Safety Data Sheet and form the initial step for Downstream Users (DUs) checking that their use is covered by their supplier under REACH.

A generic set of REACH use codes are presented to allow the oilfield chemical industry to have a single set of aligned use codes to describe the main exposure scenarios both on- and off-shore, thus simplifying communication up and down the supply chain. These generic use codes are presented in, the now standard, Downstream Users of Chemicals Co-ordination (DUCC) group format, and can be transferred from the DUCC spreadsheet to EOSCA's EGEST model which implements the secondary step of performing a quantitative, substance specific assessment for a given scenario.

The intention is that these standard use codes and scenarios be used within the oilfield industry and throughout the supply chain to ensure that scenarios are harmonised and standardised, and aligned within the industry. This will also benefit registrants of substances under REACH as it should reduce as far as possible unnecessary communication within the supply chain and the potential situation where different DUs are requesting different use codes to be supported for the same applications.

EU REACH Regulation

The EU Regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) 1907/2006 [1], came into force on 1st June 2007. Since that time the chemical industry has worked through a pre-registration phase, the first phase-in deadline for existing chemicals on 1st December 2010, and more recently the second phase-in deadline of 1st June 2013.

Two of the main aims of REACH are:

- The purpose of this Regulation is to ensure a high level of protection of human health and the environment (Article 1.1)

- This Regulation is based on the principle that it is for manufacturers, importers and downstream users to ensure that they manufacture, place on the market or use such substances that do not adversely affect human health or the environment (Article 1.3)

These aims are realised through Articles 14 of REACH, which require a chemical safety assessment (CSA) to be performed and this to be recorded in a chemical safety report (CSR) for all substances manufactured or imported in quantities of >10 tonnes per year. Also Article 31 of REACH requires the hazards, exposure scenarios detailed in the CSA & CSR and the resulting risk management measures (RMM) and operational conditions (OC) to be communicated via the Safety Data Sheet for a material.

In practice registrants define uses for their substances as such or in mixtures that they have identified for their customers, or their customers have identified to them and create Exposure Scenarios (ESs) for these intended uses. An ES is defined in REACH Article 3.37 as " the set of conditions, including operational conditions and risk management measures, that describe how the substance is manufactured or used during its life-cycle and how the manufacturer or importer controls, or recommends downstream users to control, exposures of humans and the environment."

ESs are summarised using a sets of Use Descriptor Codes detailed in Part D and Chapter R12 and R16 of the Information Requirements & Chemical Safety Assessment guidance. These comprise the Sector of Use (SU code), a Process Category (PROC code) for workers, and Environmental Release Category (ERC code) for the environment. There are also codes for Product Category (PC code) which are mainly intended for professional and consumers uses, and Article Category (AC code) which is used to define different articles.

Generic Exposure Scenarios

A Generic Exposure Scenario (GES) is applicable for a group of substances with a similar risk profile and aggregates individual Exposure Scenarios for a particular area of application such as a process chemical. In The European Chemical Industry Council, Cefic's own guidance [3] they state that "GESs are recognised as having particular value when they relate to the uses of chemicals (whether as substances or preparations) within a specific sector of downstream industry. Under such circumstances, the GES is able to communicate [Risk Mitigation Measures] RMM advice in a manner that addresses the requirements of REACH".

In an attempt to standardise a format for GESs, the "Downstream Users of Chemicals Co-ordination Group" (DUCC) created a platform quite early on in the implementation of REACH, comprising European trade associations which themselves represent "downstream user" industries ranging from cosmetics and detergents to speciality chemicals and chemical distribution. One particular tool that the DUCC group has produced and has been generally well adopted is the "UseR" or Use Reporting template, the purpose of which is "to provide a tool to DU Associations (and their members) for mapping and reporting uses for their respective sectors" [2].

The February 2012 revision of the standard UseR Template format is shown in Figure 1, and the various sections of the table are detailed below:

The first column is obviously an incremental number as a key field to ease referencing.

A.   This Code is intended as an industry specific short and descriptive code

B.   The short title for the Exposure Scenario will be used in the CSR, dossier and on SDSs, so this should be a clear and concise description of the use/application.

C.   The short description gives more details on the scenario so that industry and DUs can determine whether it is broadly applicable to their use.

The Use Descriptors:

D.   The Sector of Use (SU), describes the broad industry area with three general categories SU3 (General Industrial), SU21 (Consumers) and SU22 (Professional). With later versions of the REACH dossier software IUCLID, these general Sus cannot be confused with the more specific ones, and where SU3 is used, this should be further specified by a specific SU for each use. The value is however not used for exposure estimation within the ECETOC-TRA model and rather specifies whether the sector of use is to be industrial/professional/consumer and the relevant branch of these categories.

E.   The Process Category (PROC), of which there may be more than one for a given ES, directly link to scenarios in the ECETOC-TRA (tier 1) model and drive exposure assessment for workers for industrial and professional uses. PROCs are not relevant for consumer uses.

F&G. The chemical Product Category (PC) codes are directly linked to scenarios in the ECETOC-TRA (tier 1) model and drive exposure assessments for consumers. The sub-category further defines product use for consumer use of preparations, also used in the ECETOC-TRA (tier 1) model, although the sub-category is not strictly speaking a Use Descriptor in itself.

H&I. The Article Category (AC) codes are directly linked to scenarios in the ECETOC-TRA (tier 1) model and drive exposure assessments for consumer use of articles. The Article sub-category further defines article use for consumers, and is also used in the ECETOC-TRA (tier 1) model, although the sub-category again, is not strictly speaking a Use Descriptor in itself.

J.   The Environmental Release Category (ERC) is directly linked to scenarios in the ECETOC-TRA (tier 1) model and drive exposure assessments for environmental compartments (soil, air, freshwater, marine water, etc.)

Life Cycle Stages

K.   The 6 columns for life-cycle stages act as a set of check boxes that are used to indicate the life-cycle stage(s) that a particular GES is relevant to.

Exposure Modifiers – These are parameters that can alter the level of exposure from a scenario, and the responses to these parameters are used directly in the ECETOC-TRA (tier 1) model. Each value for a parameter is related to a decimal value ≤1, and the mathematical product of these modifiers and the baseline exposure give a final exposure value.

L.   A measure of the duration and frequency, and hence exposure time for a use, default values from ECETOC-TRA are <15 mins, 15mins-1h, 1h-4h, >4h, the resulting modifier then ranges from 0.1-1 respectively.

M-O. These three columns allow the level of ventilation to be specified, a yes needs to be put under one of the three options: "Outdoors", "Indoor with LEV", "Indoor without LEV", the resulting modifier then varies for Indoors with LEV, but is 0.7 for Outdoor and 1 for Indoor without LEV.

P. The presence of respiratory protection and its effectiveness are captured, with the default values being, "No RPE", "90% RPE" and "95% RPE", with the resulting modifier ranging from 1-0.05 respectively.

Q. The concentration of substance in the mixture/preparation can be specified using the default values of: "<1%", "1-5%", "5-25%" and ">25%", with the resulting modifier ranging from 0.1-1 respectively.

R&S. The use of Personal Protective Equipment (PPE) as Risk Mitigation Measures (RMMs) can be identified here with a "Yes" or "No" against both eye-protection (goggles) and hand protection (gloves).

T. The last column is for SPERCs (Specific Environmental Release Categories), and for the current oilfield GESs the intention was to identify both onshore ERCs and the most relevant scenario from EGEST [5] a model made available by the European Oilfield Speciality Chemicals Association (EOSCA) that combines an ECETOC TRA type Tier 1 human health assessment with a CHARMs based offshore environmental assessment.

Oilfield Speciality Chemicals Industry

The oilfield speciality chemicals industry is represented by EOSCA in Europe. EOSCA has been supporting its members and the industry with the challenges of REACH throughout the implementation of REACH. This has included guidance, discussions, conference papers and tools. From a human health assessment point of view the application, and hence worker exposure, of oilfield chemicals does not really change significantly between onshore and offshore operations. The potential for environmental exposure does however differ significantly between onshore and offshore applications and as such the EGEST model identifies the relevant CHARM model algorithms for different use and emission scenarios.

It is the intention of the present work to take this a step further and like other industries, present a set of GESs that cover the main processes and variables for oilfield product applications. This will provide industry with agreed, general definition of common processes and applications. Where possible these GESs should be used to reduce variability in ESs, complication and confusion, and to present Downstream Users (DUs) with clear ESs for common applications.

The GESs can be modified and/or scaled on a substance specific basis following the standard and accepted methods detailed in the ECHA guidance and other industry guidance on scaling. This departure from the standard GES should be noted and presented transparently to DUs so that the changes are noted and the scenario can be checked to ensure that it meets the DUs requirements.

Following consultation of draft GESs for the oilfield chemistry industry a DUCC UseR Template has been developed and was circulated within the EOSCA membership for comment. The summary of the spreadsheet is presented in Figure 2 and is available from EOSCA. A number of assumptions and conventions have been used in constructing this spreadsheet and are presented below:

1. The general SU code SU3 (general industrial) should be used in all cases, and then further specified in this case with SU2a (Mining including onshore oil and gas activities) and/or SU2b (Offshore industries) as appropriate.

2. There is a hierarchy of PROC codes, whereby a use that can be demonstrated as offering an acceptable level of risk implicitly also covers all other PROC codes for similar but more controlled processes. All GESs have been described as:
    PROC4 (Use in batch and other process (synthesis) where opportunity for exposure arises), but this GES would also implicitly cover:
    PROC3 (Use in closed batch process (synthesis or formulation));
    PROC2 (Use in closed, continuous process with occasional controlled exposure (e.g. sampling));
    PROC1 (Use in closed process, no likelihood of exposure).

3. The code PROC8b (Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities) has been included for all scenarios, because by definition the sites at which transfer may occur (production site, service vessel loading site, well site, platform/installation) are all industrial sites and dedicated to the transfer of the products.

4. For all scenarios PROC15 (Use as laboratory reagent) has also be included, whilst some argue that PROC2-5 also cover sampling and testing, to avoid confusion PROC15 has been included to cover testing of samples of both the product itself, and for the testing of samples of produced water or total fluids streams where the product may be present.

5. It has been assumed that the reasonable worst case scenario is for outdoor use with no LEV, where the use takes place indoors, or where LEV is available outdoors, scaling should be used to amend the scenario. (Is this correct GP? Should it not be indoor with no LEV)

6. The worst case assumption that the concentration of a substance in the product is >25% has been used – where the concentration is less than this scaling can be applied.

7. Due to the standard PPE requirements in oilfield operations appropriate eye protection (goggles) and hand protection (gloves) have been assumed.

The DUCC Template of Proposed GESs for the Oilfield Industry

The GESs for oilfield applications in the DUCC template format are presented in Figure 2. They present scenarios for liquid and solid products, in container sizes such as bulk (>5000L), Intermediate Bulk Containers (IBCs), and large (250L) and small (5-25L) drums.

The Sectors of Use have been specified as SU2a (onshore) and/or SU2b (offshore). The standard Process Codes of PROC 4 (batch processing), PROC8b (transfer at dedicated sites) and PROC 15 (laboratory use) have been included for all scenarios. The two most relevant ERCs, ERC4 (Industrial use of processing aids in processes and products, not becoming part of articles) and ERC7 (Industrial use of substances in closed systems) have also been included. Appropriate duration values have been given, as relevant to the size of container and type of operation.

The relevant ERCs for onshore application are detailed in the table (Figure 2) and EGEST SPERCs are suggested in Figure 3. This is an area that in many industries, including the oilfield industry, has still

not attained a great level of consensus to date. It is expected that through the process of reviewing 2013 REACH dossiers and the update of these dossiers, that agreement and consensus in the description of ERCs and SPERCs will become more apparent.

If the oilfield industry use these proposed GESs as a standard then chemical suppliers and DU alike can be sure they are using the same language, and that the same assumptions have been made. Where it becomes apparent that modification may be required, if these are done through EOSCA, then the whole industry can be kept up to date with developments, rather than the GESs that have been proposed becoming divergent and resulting in lots of slightly modified versions. The adjustment of scenarios can come in the form of the scaling parameters for specific substances.

It is proposed that the of GESs for oilfield applications be distributed through the EOSCA website, with an email address being required before downloading the spreadsheet file. Then as and when updates to the GESs become available the distribution list can be used to update all interested users. It would also be useful if all comments and suggested amendments are directed to EOSCA so that these proposals can be collated, discussed and where relevant implemented for the benefit of the wider industry and DUS.   A preview of the EOSCA DUCC Template may be viewed at http://www.eosca.eu/regulation-update/.

Thus through the use of standard GESs where possible, the communication of uses within the industry should be simplified and efforts can be focused on those substances requiring a more detailed and application specific assessment.

Discussion

In conjunction with EOSCA a series of GESs have been proposed for the oilfield industry. The standard format and template as developed and distributed by DUCC has been adopted for this work to ensure that the resulting GESs are in a style and format that will be easily recognised by chemical suppliers and DUs alike. As such it is hoped that the proposed oilfield GESs will see wide-scale adoption throughout the oilfield industry for REACH within the EU.

The assumptions and thought processes behind the Use Descriptors selected, and scaling parameters used have been documented and presented in this paper so that these are transparent within the industry and the departures from these generic scenarios can be easily identified. It is anticipated that by using EOSCA as a focal point for the dissemination of the GESs and for receipt of feedback on these, that the GESs can be refined and added to as and when the requirement is identified, and through this process the GESs can be iteratively improved to ensure they reflect current knowledge and practice within the industry. The onus is however on the industry users and DUs to feedback to EOSCA their experiences in using the GESs as part of their REACH submissions.

Figure 1 – Standard format of DUCC UseR Template

				use descriptors						
Number	Code	Short ES title	Short description of process or activity	Sector of use (SU)	Process Category (PROC)	Product category (PC)	Product Sub-category	Article Category (AC)	Article Sub-category	Environmental Release Category (ERC)
1										
2	A	B	C	D	E	F	G	H	I	J
3										
4										

Life Cycle Stage(s)						Exposure Modifier						RMM		SPERC (later)
		end use			Service Life		Indoor							
Manufacture	Formulation	Industrial	Professional	Consumer		duration and frequency (exposure time)	Outdoor	with LEV	without LEV	respiratory protection	concentration of substance in the mixture (w/w)(optional)*	Eye protection (goggles)	protection of hands (gloves)	
K						L	M	N	O	P	Q	R	S	T

Figure 2 – The EOSCA DUCC Template of GESs for oilfield applications

Number	State	Package	Code	Short ES title	Short description of process or activity	Sector of use (SU)	Process Category (PROC) [1]	Product category (PC)	Product Sub-category	Article Category (AC)	Article Sub-category	Environmental Release Category (ERC)	Manufacture	Formulation	Industrial	Professional	Consumer	Service Life	duration and frequency (exposure time)	Outdoor [2]	Indoor with LEV	Indoor without LEV	respiratory protection	concentration of substance in the mixture (w/w)(optional) [3]	Eye protection (goggles) [4]	protection of hands (gloves) [5]	SPERC (later)
Explanation of sections of the DUCC Table						not relevant for exposure estimation with ECETOC-TRA gives information regarding industrial/professional/consumer and the relevant branch	PROCs as link to ECETOC-TRA (tier 1) driver for workers exposure only for industrial and professional uses, no PROC for consumer use	PCs as link to ECETOC-TRA (tier 1) driver for consumer use of preparations	P-Sub-Cat as link to ECETOC-TRA (tier 1) driver for consumer exposure only for consumer use of preparations. Not a Use Descriptor strictly speaking	ACs as link to ECETOC-TRA (tier 1) driver for consumer exposure only for consumer use of articles	Article-Sub-Cat as link to ECETOC-TRA (tier 1) driver for consumer exposure only for consumer use of articles (service life). Not a Use Descriptor strictly speaking	ERCs as link to ECETOC-TRA driver for environmental exposure							default values from ECETOC-TRA (< 0.25h, 0.25h-1h, 1h-4h, 4h-8h)	yes or no if "outdoor": yes then "indoor": no	yes or no: if "indoor": yes then it should be specified if LEV yes or no	yes or no: if "indoor": yes then it should be specified if LEV yes or no	default values from ECETOC-TRA (not, efficiency 90 %, efficiency 95 %)	default values from ECETOC-TRA (<1%, 1-5%, 5-25%, >25%)	yes or no	yes or no	Specific ERCs (currently under development) and link to ECETOC-TRA, however plan to define oilfield SPERCs in terms of which CHARM algorithm / E-GEST Scenario to use.
1	Liquid	Bulk (20T) >5000L	L-BLK-1	Application of bulk onshore/offshore oilfield liquid process chemical	Use in batch process where opportunities for exposure arise [1]		PROC04	n/a		n/a					X				8h/d	Yes	No	No	No	>25%	Yes	Yes	
					Transfer from support vessel to installation, transfer from bulk to on-site storage, transfer to process	SU02a / SU2b	PROC08b	n/a		n/a		ERC4 / ERC7			X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
					On-site sampling and testing e.g. QC		PROC15	n/a		n/a					X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
2		IBC/OWC (500 - 5000L)	L-IBC-2	Application of onshore/offshore oilfield liquid process chemical in IBC/OWC	Use in batch process where opportunities for exposure arise		PROC04	n/a		n/a					X				8h/d	Yes	No	No	No	>25%	Yes	Yes	
					Transfer from support vessel to installation, transfer from IBC to on-site storage, transfer to process	SU02a / SU2b	PROC08b	n/a		n/a		ERC4 / ERC7			X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
					On-site sampling and testing e.g. QC		PROC15	n/a		n/a					X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
3		Large Drum (250L)	L-LDR-3	Application of onshore/offshore oilfield liquid process chemical in large drum(s)	Use in batch process where opportunities for exposure arise		PROC04	n/a		n/a					X				8h/d	Yes	No	No	No	>25%	Yes	Yes	
					Transfer from support vessel to installation, transfer from drum to on-site storage, transfer to process	SU02a / SU2b	PROC08b	n/a		n/a		ERC4 / ERC7			X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
					On-site sampling and testing e.g. QC		PROC15	n/a		n/a					X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
4		Small Drum (5-25kg)	L-SDR-4	Application of onshore/offshore oilfield liquid process chemical in small drum(s)	Use in batch process where opportunities for exposure arise		PROC04	n/a		n/a					X				8h/d	Yes	No	No	No	>25%	Yes	Yes	
					Transfer from support vessel to installation, transfer from drum to on-site storage, transfer to process	SU02a / SU2b	PROC08b	n/a		n/a		ERC4 / ERC7			X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
					On-site sampling and testing e.g. QC		PROC15	n/a		n/a					X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
5		Grease / paste	L-GOP-5	Application of onshore/offshore oilfield process greases and pastes	Use in batch process where opportunities for exposure arise		PROC04	n/a		n/a					X				8h/d	Yes	No	No	No	>25%	Yes	Yes	
					Transfer from support vessel to installation, transfer from pot/tin/tube to process	SU02a / SU2b	PROC08b	n/a		n/a		ERC4 / ERC7			X				<15min/d	Yes	No	No	No	>25%	Yes	Yes	
					On-site sampling and testing e.g. QC		PROC15	n/a		n/a					X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
6	Solid/ powder	Bulk (20T)	S-BLK-1	Application of bulk onshore/offshore oilfield solid/powder process chemical	Use in batch process where opportunities for exposure arise		PROC04	n/a		n/a					X				8h/d	Yes	No	No	No	>25%	Yes	Yes	
					Transfer from support vessel to installation, transfer from bulk to on-site storage, transfer to process	SU02a / SU2b	PROC08b	n/a		n/a		ERC4 / ERC7			X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
					On-site samplign and testing e.g. QC		PROC15	n/a		n/a					X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
7		Large Drum (250L)	S-LDR-2	Application of onshore/offshore oilfield solid/powder process chemical in large drum(s)	Use in batch process where opportunities for exposure arise		PROC04	n/a		n/a					X				8h/d	Yes	No	No	No	>25%	Yes	Yes	
					Transfer from support vessel to installation, transfer from IBC to on-site storage, transfer to process	SU02a / SU2b	PROC08b	n/a		n/a		ERC4 / ERC7			X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
					On-site sampling and testing e.g. QC		PROC15	n/a		n/a					X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
8		Small Drum (5-25kg)	S-SDR-3	Application of onshore/offshore oilfield solid/powder process chemical in small drum(s)	Use in batch process where opportunities for exposure arise		PROC04	n/a		n/a					X				8h/d	Yes	No	No	No	>25%	Yes	Yes	
					Transfer from support vessel to installation, transfer from drum to on-site storage, transfer to process	SU02a / SU2b	PROC08b	n/a		n/a		ERC4 / ERC7			X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
					On-site sampling and testing e.g. QC		PROC15	n/a		n/a					X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
9		Bags/ sacks (25kg)	S-BAG-4	Application of onshore/offshore oilfield solid/powder process chemical in bags/sacks	Use in batch process where opportunities for exposure arise		PROC04	n/a		n/a					X				8h/d	Yes	No	No	No	>25%	Yes	Yes	
					Transfer from support vessel to installation, transfer from drum to on-site storage, transfer to process	SU02a / SU2b	PROC08b	n/a		n/a		ERC4 / ERC7			X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
					On-site sampling and testing e.g. QC		PROC15	n/a		n/a					X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	
10		Tablets	S-TAB-5	Application of onshore/offshore oilfield solid/powder process chemical in tablet form	Use in batch process where opportunities for exposure arise		PROC04	n/a		n/a					X				8h/d	Yes	No	No	No	>25%	Yes	Yes	
					Transfer from support vessel to installation, transfer from drum to on-site storage, transfer to process	SU02a / SU2b	PROC08b	n/a		n/a		ERC4 / ERC7			X				<15min/d	Yes	No	No	No	>25%	Yes	Yes	
					On-site sampling and testing e.g. QC		PROC15	n/a		n/a					X				<1h/d	Yes	No	No	No	>25%	Yes	Yes	

Figure 3 – Details of the relevant SPERCs for offshore oilfield chemicals from the EOSCA EGEST model

SPERC #	SPERC Description	Long Description	Charm Calc Alg	E-GEST Scenario
SS1	Subsea discharge	Subsea discharge, where CHARM model is not applicable - Osborne-Adams time to effect assessment approach taken	n/a	1
CWS2	Topside direct discharge	Topside direct discharge, using CWS algorithm. Based on batch discharge of products such as rigwashes that go overboard without entering the production process.	CWS	6
DR3	Drilling	Drilling discharge, using drilling algorithm. Based on continuous and batch discharge of drilling mud and associated chemicals.	DR	7
CM4	8 - CM	Cementing algorithm. Based on batch discharge of excess cement from mixing pits.	CM	8
PSC5	9 –PS-PU (cont)	Production algorithm. Based on continuous and batch discharges of production chemicals applied at any point in the production train where they could mix with total fluids.	PS/PU	9
PSB6	10 – PS-PU (batch)	Production algorithm. Models batch discharges only. This is for products that end up in total fluids having been used in subsea pipeline operations, and is assumes that the chemical will be discharged in a period of <24h.	PS/PU	10
CWO7	11 - CWO	Completion and Work-over algorithm. Based on discharge of products that are injected downhole for various purposes and are then returned and discharged in produced water on a batch basis.	CWO	11

References

[1]   Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC; Accessed online: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006R1907:EN:NOT, last accessed 15/07/13.

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[4]   Guidance on information requirements and chemical safety assessment Part D: Exposure Scenario Building, Version 1.2, October 2012; ECHA, Helsinki; Accessed online: http://echa.europa.eu/documents/10162/13632/information_requirements_part_d_en.pdf, last accessed 18/07/13.

[5]   EGEST, EOSCA Generic Exposure Scenario Tool; EOSCA, Aberdeen, UK; Accessed online: http://www.eosca.eu/software/egest/ last accessed 22/07/13.