Department of Energy & Climate Change

THE UNITED KINGDOM RISK BASED APPROACH IMPLEMENTATION PROGRAMME

Version 2
July 2014

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Abbreviations

°C	Degrees celsius
BAT	Best available technique
BCF	Bio-concentration factor
BEP	Best environmental practice
Cefas	Centre for Environment, Fisheries & Aquaculture Science
CHARM	Chemical hazard assessment and risk management
CMR	Carcinogenic, mutagenic or reprotoxic
DECC	Department of Energy and Climate Change
DREAM	Dose related risks and effects assessment model
ECB	European Chemicals Bureau
ECHA	European Chemicals Agency
EIF	Environmental impact factor
Km	Kilometre
LC	Lethal effect concentration
M	Metre
m^3/day	Cubic metres per day
m^3/yr	Cubic meters per year
MEG	Monoethylene glycol
mg/l	Milligrammes per litre
NCIMB	National Collection of Industrial Food and Marine Bacteria
NOEC	No effect concentration
O&GUK	Oil and Gas UK
OIC	OSPAR Offshore Industry Committee
OSPAR	Oslo and Paris Commission
PBT	Persistent, bioaccumulative or toxic
PEC	Predicted environmental concentration
PLONOR	Poses little or no risk
PNEC	Predicted no effect concentration
Ppt	Parts Per thousand
PW	Produced water
RBA	Risk based approach
REACH	Registration, Evaluation, Authorisation and Restriction of Chemical Substances
TGD	Technical Guidance Document
UK	United Kingdom
vPvB	Very persistent and/or very bioaccumulative
WEA	Whole effluent assessment
WET	Whole effluent toxicity

1. Introduction

The Oslo and Paris Commission (OSPAR) Recommendation 2012/5 requires Contracting Parties to implement a risk-based approach (RBA) for the management of produced water (PW) discharges from offshore installations. General guidance relating to the Recommendation can be found in OSPAR Agreement 2012/7. It is up to individual Contracting Parties to develop implementation programmes within the framework described in the Recommendation and Agreement. Copies of the Recommendation and the Agreement are appended at Annex 1 and 2 respectively.

The RBA is based on the use of a standard method to calculate the predicted environmental concentration (PEC) and the predicted no effect concentration (PNEC) of the discharge, or components of the discharge, with an acceptance criterion of a PEC:PNEC ratio of ≤1 within a specified volume or area of water, which is taken to indicate that the discharge is unlikely to result in significant harm in the marine environment. This mirrors the current approach used to implement the OSPAR Harmonised Mandatory Control System for the use and discharge of offshore chemicals, using the Chemical Hazard Assessment and Risk Management (CHARM) model, the Dose Related Risks and Effects Assessment Model (DREAM) or any other approved dispersion model, and it is generally accepted that this approach is a good indicator of whether chemical discharges are likely to result in significant harm in the marine environment.

The UK implementation programme is based on the process summarised in Figure 1-1 (overleaf), involving six steps, covering four assessment tiers. Operators will be expected to complete all six steps for the initial assessments, but the ultimate aim is that, when repeat assessments are undertaken, operators will be able to screen out installations from further assessment if the test results confirm acceptance at a particular tier.

All installations on the UK Continental Shelf (UKCS) that have a permit to discharge produced water, or have a permit for the contingency discharge of produced water in the event of produced water re-injection downtime, have been included in the UK implementation programme. However, operators will be able to apply for an exemption for installations that have a confirmed cessation of production date during the period 2014 – 2018. Installations that re-inject all their produced water and halt production in the event of re-injection downtime, i.e. they do not have a permit for the contingency discharge of produced water, will not be included in the UK implementation programme.

A schedule for undertaking the assessments has been prepared, to spread the assessments over the period 2014 – 2018 and meet the Recommendation deadline of full implementation by the end of 2018. The schedule has taken a number of factors into consideration, including spreading the workload for operators with a number of assets, the scale of the discharges, the existing chemical sampling and analysis schedules, prior participation in the UK RBA trial (Genesis Oil and Gas 2013), installation–specific constraints such as scheduled maintenance shutdowns and the availability and capacity of toxicity testing facilities. Installations that have only recently been commissioned, or are commissioned during the period 2014 – 2018, will not be included in the implementation programme until there are stable and representative production levels and produced water discharges. A copy of the proposed schedule is appended at Annex 3, and operators are requested to contact the Department of Energy and Climate Change (DECC) via emt@decc.gsi.gov.uk to confirm whether the proposals are acceptable, or whether they wish to amend the schedule.

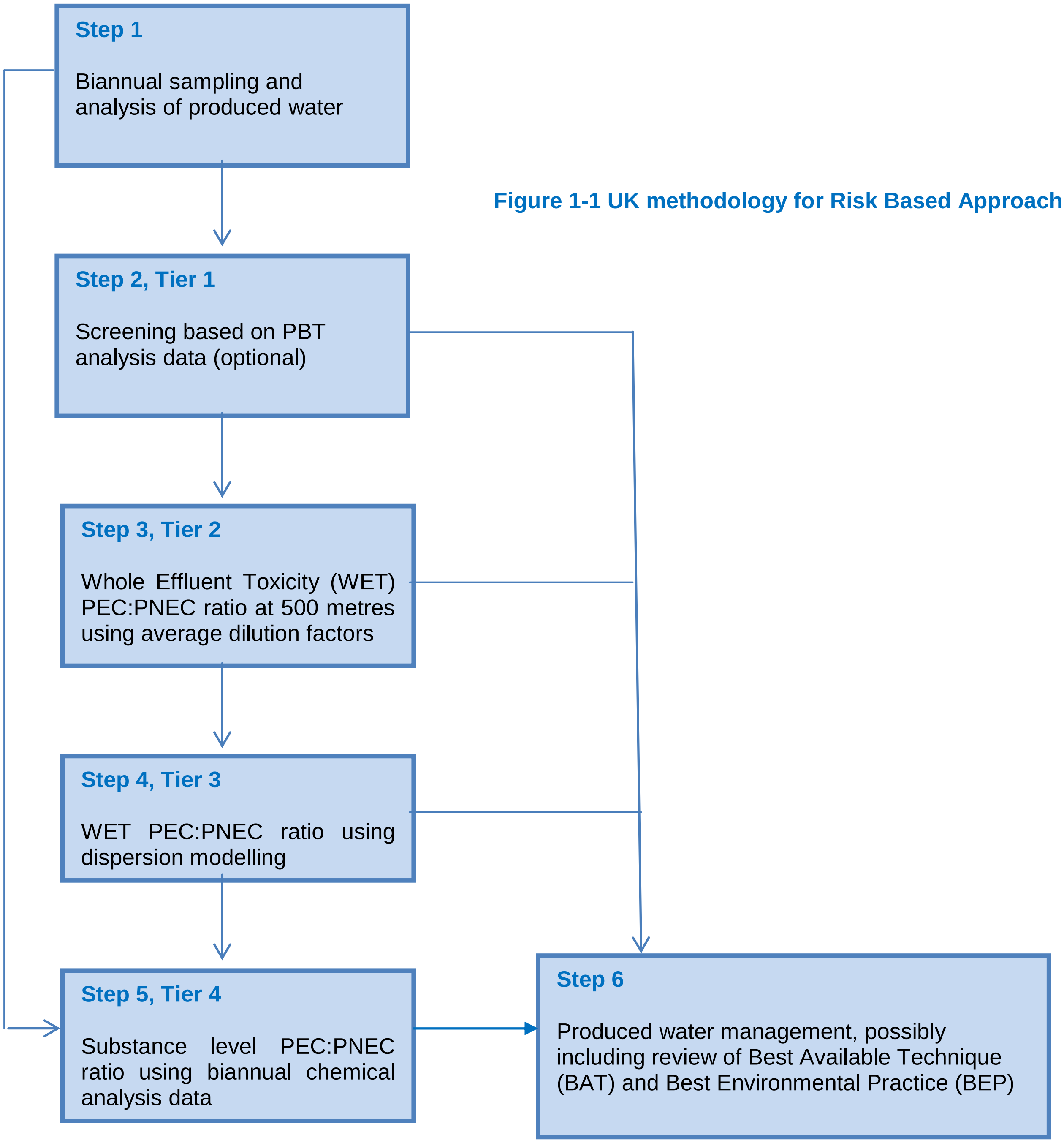

Figure 1-1 UK methodology for Risk Based Approach

2. UK Implementation of the Risk Based Approach

2.1 Step 1, Sampling and Analysis of Produced Water

Offshore sampling of the PW stream should be undertaken to collect samples for the determination of the concentrations of naturally occurring substances in the PW and the determination of the toxicity of the whole effluent. The chemical analyses are an existing requirement, as part of the bi-annual testing programme, but the toxicity testing is a new requirement that will only be required when undertaking RBA assessments. The samples for both testing programmes must be collected at the same time and if the installation has more than one treatment stream with separate post-treatment discharge facilities, sampling should be replicated for the separate discharge streams. Whether it is necessary to determine PEC:PNEC ratios or model the separate discharge streams will depend upon the results of the chemical analyses and toxicity testing and whether there are significant differences in the discharge arrangements (e.g. discharge depth), and subsequent steps in the process will only be necessary if the data indicates that there are material differences that could affect the risk assessment.

The collected samples should be shipped to shore as quickly as possible and transferred to the relevant laboratory or laboratories for chemical analysis and marine toxicity testing (the UK RBA trial indicated that the toxicity could increase if testing was delayed). As a minimum, representative samples should be analysed for the chemical determinands detailed in Section 11 of the DECC guidance notes for sampling and analysis of produced water (DECC 2014), and marine toxicity testing should be undertaken for three trophic levels. It is unnecessary to analyse the samples for any added chemicals, but general information relating to the PW discharge including volumes and details of the chemicals being added to the PW stream and their relevant dosage rates at the time of the sampling (including any batch treatments) should be recorded, as this information is required for subsequent steps in the process.

DECC does not intend to specify which species should be used for the toxicity tests, but would prefer the whole effluent testing to be undertaken using bacteria (MARA and LumiMARA), algae (*Skeletonema costatum*) and crustacea (*Acartia tonsa*), to mirror the testing regime used for the RBA trial undertaken in 2011 (NCIMB 2011). A meeting of the O&GUK RBA Working Group confirmed that the participants supported this standardised approach. MARA and LumiMARA are recommended in preference to the more conventional Microtox® bacterial test, as the trial study indicated that MARA and LumiMARA offered significant advantages over the single species Microtox® test. There are a number of commercial laboratories that are able to offer toxicity testing for three trophic levels, and the MARA and LumiMARA tests are available as standard kits that could be used by most laboratories.

Samples can also be collected for persistence and bioaccumulation testing if operators wish to investigate using the Tier 1 screening process detailed below. However, all operators are required to use the PEC:PNEC ratio methodology detailed in subsequent tiers for their first assessments, so that DECC can compile baseline data for all the participating installations.

Guidance in relation to sampling and analyses can be found in ECHA (2008), Deltares (2010) and NCIMB (2011).

2.2 Step 2, Tier 1: Screening based on PBT

Tier 1 involves screening out PW discharges that are not Persistent, Bio-accumulative and Toxic (PBT). The Technical Guidance Document (TGD) on Risk Assessment (ECB 2003) provides a methodology for deciding whether substances are PBT, or very Persistent and very Bio-accumulative (vPvB), and the criteria are summarised in Table 2-1.

Table 2-1 Criteria for identification of PBT and vPvB substances

Criterion	PBT criteria	vPvB-criteria
P	Half-life >60 days (d) in marine water or >40 d in freshwater*, or half-life >180 d in marine sediment or >120 d in freshwater sediment*	Half-life >60 d in marine water or freshwater, or >180 d in marine sediment or freshwater sediment
B	Bio-Concentration Factor (BCF) >2,000	BCF >5,000
T	Chronic NOEC <0.01 mg/l or CMR or endocrine disrupting effects	Not applicable
* For the purpose of marine environmental risk assessment, where marine half-life data is available it is used in preference to freshwater data.		

To be screened out at this stage, Whole Effluent Assay (WEA) would be required to assess all the PBT parameters, to demonstrate that the PW is not PBT. However, the UK implementation programme will initially concentrate on using Whole Effluent Testing (WET) to determine the marine toxicity, and subsequent steps will be based on assessment of PEC:PNEC ratios. Operators are therefore not obliged to assess samples for the PBT parameters for the initial assessments, but they may wish to investigate the Tier 1 approach for future assessments. If WEA is undertaken to investigate the Tier 1 approach, the results should be included in the assessment report.

2.3 Step 3, Tier 2: Determination of Whole Effluent PEC:PNEC Ratio at 500 metres using an Average Dilution Factor

Tier 2 involves screening out PW discharges if the whole effluent PEC:PNEC ratio at 500 m from the discharge point is ≤1, using generic dilution factors derived from the RBA trial or average dilution factors derived for specific installations using site specific data. There are a number of ways the average dilution factor for an installation could be determined, and the UK methodology will allow the operator to select and justify the method used for their assessments.

The RBA trial involved the use of outputs from dispersion modelling undertaken using DREAM, but there are a number of available dispersion models that could be used instead of DREAM. Monoethylene glycol (MEG) was selected as a tracer substance and the discharge of ‘neat’ MEG was modelled. The concentrations achieved at four points approximately 500 m from the discharge points (due north, south, east and west) were then manually derived from the model outputs, and the average PEC calculated. The original MEG concentration of 1,000,000 ppm (1,115,000 mg/l) was then divided by the average PEC to determine the average dilution factor for the individual installations.

This approach was found to be problematic given the highly transient location of many plumes. A more comprehensive approach has therefore been trialled involving calculating the minimum dilution at all points within a 1 km radius by compiling the results of modelling of the plume over a time series of 30 days using high time-resolution under conservative metocean conditions. The minimum dilution at 500 m is then reported. Using this approach, it was noted that dilution at 500 m is highly dependent on the discharge rate, and somewhat dependent on the water depth, and that other factors have a lower degree of influence. By applying this approach to all the installations modelled during the RBA trial, it was possible to derive worst-case dilution factors related to the discharge rate and water depth that could be used for all the installations included in the trial. These generic dilution factors can therefore be used for all UK installation assessments, and are detailed in Table 2-2.

Table 2-2 Derivation of dilution factors

	Annual produced water discharge (m^3)			
Water Depth (m)	**<100,000**	**100,000 – 1,000,000**	**1,000,000 – 8,000,000**	**> 8,000,000**
< 50	10,000	1,000	400	100
50 – 125	10,000	4,000	400	100
> 125	20,000	8,000	400	100

The lowest marine toxicity value should be used to determine the PNEC using an assessment factor of 1,000, as set out in relevant guidance (ECB 2003 and ECHA 2008). An assessment factor is necessary to take into account uncertainties in relation to the representative nature of laboratory toxicity tests undertaken using a limited number of test species. The lower the number of test species, the higher the assessment factor. The lowest toxicity value is divided by the appropriate assessment factor to derive the PNEC.

The RBA trial compared assessment factors of 1,000 and 10,000, to strengthen the procedure currently used for CHARM risk assessments, which involves the use of an assessment factor of 100, and to compare the strengthened procedure with the maximum assessment factor that would result from applying the REACH guidelines (ECHA 2008). It was concluded that an assessment factor of 10,000 would have a profound effect on the modelling results, and that it was likely that most produced water discharges would be identified as posing an unacceptable risk, which is not supported by the results of monitoring studies. Following discussions at the OSPAR Offshore Industry Committeee (OIC), it was therefore decided that an assessment factor of 1,000 should be used for the UK implementation programme, as the ECHA guidance was developed for near-coastal waters and it was considered that a factor of 10,000 was too conservative for offshore waters and the RBA.

It should be noted that, for future assessments, if the PEC:PNEC ratio at 500 m is >1, operators will still be able to confirm that a PEC:PNEC ratio of ≤1 would be achieved at a specified distance greater than 500 m, and to seek confirmation whether DECC considers this to a reasonable and acceptable distance.

Further information in relation to DREAM, PECs, PNECs and PEC:PNEC ratios is appended at Annex 4.

2.4 Step 4, Tier 3: Determination of Whole Effluent PEC:PNEC Ratio using Dispersion Modelling

Tier 3 involves screening out PW discharges if the whole effluent PEC:PNEC ratio is ≤1 in a specific volume and/or area of water, based on site specific dispersion modelling. This approach is more rigorous than the Tier 2 assessment, and identifies whether the PEC:PNEC ratio is >1 within the modelled volume and/or area. Whereas the Tier 2 assessment derives a single PEC:PNEC ratio based on a generic or average dilution factor at 500 m, the Tier 3 modelling indicates whether the maximum or time-averaged PEC:PNEC ratio for the whole effluent has been >1 within the selected volume and/or area during the modelling period. The results therefore reflect the worst-case scenario.

The RBA trial involved the use of DREAM, and confirmed that dispersion is not always radial, and can be strongly aligned along a single axis as a consequence of the local flow regime. The site specific data used for the modelling were obtained from the installation operators, and examples of the data are summarised in Table 2-2.

Table 2-3 Modelling input data

Input Data	Installation 1	Installation 2
Discharge depth below water surface (m)	5	16.5
Temperature produced water (°C)	40	40[1.]
Salinity of produced water (ppt)	129	37
Duration of model run (days)	31	31
Diameter of discharge pipe[2.] (m)	0.508	0.508
Orientation of discharge pipe, angle from vertical (°)	180	180
Discharge volume[3.] (m^3/year)	328,627	14,444,044
Discharge rate[3.] (m^3/day)	958	41,506
Average concentration of dispersed oil[3.] (mg/l)	16	10.35
Produced water discharge frequency[3.] (days/year)	343	348

Notes:
1. The temperature of the PW was assumed
2. The diameter of the discharge pipe was not provided, and was selected based on the diameters provided for other UK installations with similar discharge volumes
3. The discharge volumes, rates and frequencies and dispersed oil concentrations were based on reported data

There are a number of suitable models that could be used for the Tier 3 assessment, and the UK methodology will allow the operator to select and justify the model used.

For future assessments, operators will be able to confirm that a PEC:PNEC ratio of ≤1 would be achieved within a specified volume and/or area, and to seek confirmation whether DECC considers this to be acceptable.

Further information in relation to dispersion modelling is appended at Annex 4.

2.5 Step 5, Tier 4: Determination of PEC:PNEC Ratio at the Substance Level

Tier 4 involves dispersion modelling to determine the PEC:PNEC ratio within a specific volume and/or area of water for the individual naturally occurring substances in the PW, and/or for both the naturally occurring substances and the added chemicals discharged with the PW. Whether it is necessary to include the added chemicals will depend upon the nature and quantity of the added chemicals. If they are included and it is found that added chemicals dominate the predicted risk, it will be informative to present the results with and without the added chemicals, as the management options for natural components and added chemicals will normally be very different.

This approach is more rigorous than the Tier 3 assessment, and involves modelling individual components of the PW discharge to determine the fate and contribution to the total risk of specific components in the produced water stream. Although the use and discharge of offshore chemicals is separately assessed within the OSPAR framework, the inclusion of added chemicals in a Tier 4 assessment is important from the point of view of identifying the dominant contributors to any unacceptable level of risk.

The RBA trial involved the use of DREAM, but there are a number of available models and the UK methodology will allow the operator to select and justify the model used for their assessments. Two options were modelled. The first option involved modelling based on the concentrations of naturally occurring substances in the PW. The second option involved modelling based on the concentrations of both naturally occurring substances and the added production chemicals likely to be present in the PW discharge. Information relating to the naturally occurring substances was obtained from the contemporary bi-annual sampling and analysis, and information relating to the added chemicals was obtained from the current chemical permit. The purpose of this approach was to identify the change in the total risk following inclusion of the added chemicals, and the results of both assessments were summarised in a diagram showing the level of risk within the selected area and as a pie chart showing the major contributions to the risk.

Further information in relation to dispersion modelling at the substance level, including information relating to the added chemicals that should be included in the modelling, is appended at Annex 4.

2.6 Step 6, Produced Water Management

The results obtained for every step in the assessment should be detailed in an RBA Assessment Report. In addition to detailing the results, the report should include a commentary on the risks in relation to the environmental sensitivities. This should refer to information already provided in the UK Oil Portal Production Operations MAT, or in any related and relevant SAT seeking an EIA Direction, a Chemical Permit or an Oil (hydrocarbon) Discharge Permit. The assessment report should also include details of the main uncertainties, and their potential impact on the conclusions of the report, and details of any anticipated changes to the PW discharge that could impact the risk profile in the future. The assessment report should be submitted to DECC as a separate document, via emt@decc.gsi.gov.uk, within six months of completion of the PW sampling and three months of completion of the dispersion modelling, and should not be submitted via the UK Oil Portal.

Following receipt and review of the report, DECC will initiate discussions with the operator. Where there are concerns in relation to the assessment, a management plan will be agreed and operators may be requested to collect additional samples or to undertake additional studies to verify the initial assessment, or to identify measures to reduce the risk. However, there are a number of assumptions associated with both the modelling and the data used to assess the individual substances that will need to be taken into consideration before considering options such as chemical substitution or amending the PW treatment process.

Although the selected default assessment factor of 1,000 is lower than the recommended ECHA value, its use is still a more conservative approach than is currently employed for the assessment of some offshore chemicals using CHARM. Some chemicals that have an acceptable risk assessment using CHARM may therefore be highlighted as a potential risk, but the primary purpose of the initial

RBA assessments will be to facilitate comparison of the contributions of all the added chemicals (and naturally occurring substances) and DECC does not intend to use the RBA data for specific added chemicals to change the certification rankings or the risk assessments included in chemical permit applications. Nevertheless, if the more conservative approach identifies a particular concern, operators may wish to encourage chemical suppliers to undertake additional toxicity tests to justify reducing the recommended assessment factor. Providing the additional tests do not significantly change the lowest toxicity value, this would reduce the uncertainty and allow the use of a lower assessment factor. Further information in relation to assessment factors is appended at Annex 4.

The PNEC values are also critical to the assessment of risk. Although OSPAR has addressed this issue for naturally occurring substances, and developed a common set of PNEC values based on good evidence and expert judgement that will be used by all Contracting Parties, the PNEC values for added chemicals obtained from data on the Cefas certification templates will be very conservative for offshore chemicals that consist of a mixture of substances, because the data provided relates to the most toxic component and that component may only be present in small quantities. Whilst this conservative approach may be justified when using CHARM with an assessment factor of 100, the contribution to the total risk predicted using dispersion modelling may be significantly greater than the contribution that would be predicted if the component substances were separately modelled using substance-specific toxicity data. Although the UK does not publish the formulation or toxicity data that would be needed to separately model the component substances, operators may wish to request this data from their chemical suppliers to repeat the modelling if a particular added chemical is identified as posing a significant risk in the marine environment.

The modelling of the added chemicals also ignores the possibility that some chemicals may be subject to a chemical reaction during the treatment process, and some may undergo physical processes that affect the concentration in the discharge. In many cases, it is therefore likely that the assumptions relating to the discharge of added chemicals in the produced water are very conservative, and laboratory tests and additional PW chemical analyses may be useful to improve the discharge data used in the model.

Finally it is necessary to consider that the methods available for the management of naturally occurring substances and added production chemicals will be very different. Whereas there may be scope for replacing production chemicals, or reducing their dosage, many naturally occurring substances cannot currently be removed, or it would require significant expenditure with no guarantee that the benefits in terms of risk reduction would justify the cost.

The Tier 4 modelling is therefore a very useful site-specific assessment process that can be used to inform decisions on risk reduction measures, but the initial results should be treated with caution and further studies, including additional modelling, may be desirable prior to making those decisions and implementing the measures. DECC remains confident that the UK implementation programme will significantly enhance our knowledge of the most important risks associated with PW discharges and that, as more installations complete their initial assessments, it will be better able to assess the value of individual steps in the process and to make informed decisions in relation to the frequency of repeat assessments for individual installations.

2.7 Demonstration of Best Available Technique and Best Environmental Practice

In addition to implementing the RBA, the demonstration and review of Best Available Technique (BAT) and Best Environmental Practice (BEP) remains a requirement for all PW discharges, as detailed in OSPAR Recommendation 2001/1 (as amended). Operators are routinely required to review the application of BAT and BEP, as part of the oil discharge permit review process, and this requirement may form part of any discussions initiated under Step 6, Produced Water Management, However, the results of a Tier 4 assessment would need to be carefully considered in the context of any current or proposed review of BAT and BEP, because of the significant assumptions associated with both the modelling and the data used to assess the added chemicals.

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2.8 Repeat Assessments

The frequency of repeat assessments will depend upon a number of factors, including the outcome of the initial assessments and any management measures implemented to reduce the risk; significant changes in the quality or quantity of produced water discharges (e.g. the addition of a new tie-back); significant changes in the results of the biannual analyses; and significant changes in the added production chemicals. DECC will review the results obtained and prepare a proposal during the course of the initial assessment programme.

3. References

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Annex 1

OSPAR Recommendation 2012/5

(Source: OSPAR 12/22/1, Annex 18)

OSPAR COMMISSION

Protecting and conserving the North-East Atlantic and its resources

OSPAR Recommendation 2012/5 for a risk-based approach to the Management of Produced Water Discharges from Offshore Installations

Preamble

RECALLING Article 2(3) of the Convention for the Protection of the Marine Environment of the North-East Atlantic ("OSPAR Convention"), which, *inter alia*, requires Contracting Parties to take full account of the use of the latest technological developments and practices designed to prevent and eliminate pollution fully, when adopting programmes and measures; and to this end requires Contracting Parties to define with respect to programmes and measures the application of best available techniques (BAT) and best environmental practice (BEP), including, where appropriate, clean technology,

RECALLING Article 5 of the OSPAR Convention, which requires the Contracting Parties to take all possible steps to prevent and eliminate pollution from offshore sources in accordance with the provisions of the Convention, in particular as provided for in Annex III,

RECALLING Article 2(2) of Annex III which requires Contracting Parties to use the criteria in Appendix 2 of the OSPAR Convention when setting priorities and assessing the nature and extent of the programmes and measures and their time scales,

RECALLING Article 2(1) of Annex III which requires

Recommandation OSPAR 2012/5 sur une approche basée sur le risque pour la gestion des rejets d'eau de production provenant des installations offshore

Préambule

RAPPELANT l'alinéa 3 de l'article 2 de la Convention pour la protection du milieu marin de l'Atlantique du Nord-Est (dite «Convention OSPAR »), qui, entre autres, demande que les Parties contractantes, lorsqu'elles adoptent des programmes et mesures, tiennent pleinement compte de l'utilisation des derniers progrès techniques réalisés et des méthodes conçues afin de prévenir et de supprimer intégralement la pollution ; et à cette fin demande que les Parties contractantes définissent, en ce qui concerne les programmes et mesures, l'application des meilleures techniques disponibles et de la meilleure pratique environnementale y compris, si cela est approprié, des techniques propres,

RAPPELANT l'article 5 de la Convention OSPAR, qui demande que les Parties contractantes prennent toutes les mesures possibles afin de prévenir et de supprimer la pollution provenant de sources offshore, conformément aux dispositions de la Convention, en particulier aux conditions prévues à l'annexe III,

RAPPELANT l'alinéa 2 de l'article 2 de l'annexe III qui demande aux Parties contractantes d'appliquer les critères visés à l'appendice 2 à la Convention OSPAR pour fixer les priorités et évaluer la nature et l'ampleur des programmes et mesures, ainsi que les calendriers correspondants,

RAPPELANT l'Article 2(1) de l'Annexe III qui demande

Contracting Parties when adopting programmes and measures, to use 'best available techniques' (BAT) and 'best environmental practice' (BEP) as defined in Appendix 1 of the OSPAR Convention,

que les Parties contractantes, lorsqu'elles adoptent des programmes et mesures, à utiliser les « meilleures techniques disponibles » (BAT) et la « meilleure pratique environnementale» (BEP) telles que définies à l'appendice 1 à la Convention OSPAR,

RECALLING OSPAR Decision 2000/2 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals as amended by Decision 2005/1, OSPAR Recommendation 2010/4 on a Harmonised Pre-screening Scheme for Offshore Chemicals and OSPAR Recommendation 2010/3 on a Harmonised Offshore Chemical Notification Format (HOCNF),

RAPPELANT la Décision OSPAR 2000/2 relative à un système obligatoire et harmonisé de contrôle de l'utilisation des produits chimiques en offshore et de réduction de leurs rejets, telle qu'amendée par la Décision 2005/1, la Recommandation OSPAR 2010/4 relative à un système harmonisé de présélection des produits chimiques d'offshore et la Recommandation OSPAR 2010/3 relative à un système harmonisé de notification des produits chimiques offshore (HOCNF),

RECALLING OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations as amended,

RAPPELANT la Recommandation OSPAR 2001/1 relative à la gestion de l'eau de production des installations offshore, telle qu'amendée,

RECALLING the strategic objective of the Offshore Oil and Gas Industry Strategy 2010-2020 and its timeframe that requires implementation of the Strategy progressively through appropriate actions and measures with the target, *inter alia*, to achieve by 2020 a reduction of oil in produced water discharged into the sea to a level which will adequately ensure that each of those discharges will present no harm to the marine environment,

RAPPELANT l'objectif stratégique de la Stratégie industrie pétrolière et gazière offshore 2010-2020 et son calendrier qui exige la mise en œuvre progressive de la stratégie, grâce à des mesures et actions appropriées ayant pour cible, entre autres, de parvenir, en 2020, à une réduction des hydrocarbures dans l'eau de production rejetée à la mer pour les ramener à des niveaux permettant d'assurer qu'aucun de ces rejets ne porte atteinte au milieu marin,

RECALLING the strategic objective of the Hazardous Substances Strategy 2010-2020 and its timeframe that requires implementation of the Strategy progressively by making every endeavour through appropriate actions and measures to, *inter alia*, move towards the target of cessation of discharges, emissions and losses of hazardous substances by the year 2020,

RAPPELANT l'objectif stratégique de la Stratégie substances dangereuses 2010-2020 et son calendrier qui exige la mise en œuvre progressive de la Stratégie en s'efforçant au mieux, grâce à des mesures et actions appropriées, entre autres, de se rapprocher des cibles de cessation des rejets, émissions et pertes de substances dangereuses, en 2020,

RECALLING the conclusions of the Quality Status Report 2010 on the impacts of produced water discharges to the maritime area and its advice that OSPAR Contracting Parties should continue to cooperate in their efforts to reduce discharges of oil through the application of a risk-based approach to management of produced water,

RAPPELANT les conclusions du Bilan de Santé 2010 sur les impacts des rejets d'eau de production dans la zone maritime et ses conseils, à savoir que les Parties contractantes OSPAR devraient continuer à coopérer dans leurs efforts de réduire les rejets d'hydrocarbures grâce à l'application d'une approche basée sur le risque pour la gestion de l'eau de production,

RECOGNISING that measures to prevent or mitigate risks to the marine environment by produced water discharges should not lead to

RECONNAISSANT que les mesures de prévention et d'atténuation des risques que présentent pour le milieu marin les rejets d'eau de production ne unacceptable risk in other areas and/or other environmental compartments,

NOTING the OSPAR agreement on Further Guidance on the Role of Marine Risk Assessment within the Framework of the OSPAR Strategy with regard to Hazardous Substances (Agreement 2002/19) which contains provisions relating to the identification of the most appropriate measures, the urgency of these measures and who is best placed to carry them out,

NOTING the relevant legislation within the European Union, in particular Regulation EC 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) and corresponding legislation of other Contracting Parties,

The Contracting Parties to the Convention for the Protection of the Marine Environment of the North-East Atlantic RECOMMEND:

1. Definitions

1.1 For the purpose of this Recommendation:

"offshore installation"	means any offshore installation as defined in the OSPAR Convention
"PEC"	PEC means Predicted Environmental Concentration; the concentration of a chemical or an effluent in the environment based on model calculations. PEC is expressed as concentration for individual substances or as dilution for the whole effluent,
"PNEC"	means Predicted No Effect Concentration; the concentration of a chemical or effluent below which adverse effects on the aquatic ecosystem and its organisms will most likely not occur during long-term or short term exposure,
"produced water"	means water which is produced in oil and/or gas production operations and includes formation water, condensation water and re-produced injection water; it also includes water used for desalting

devraient pas entraîner un danger intolérable dans d'autres zones et/ou d'autres compartiments environnementaux,

NOTANT l'Accord OSPAR sur d'autres indications relatives au rôle des évaluations des risques pour le milieu marin dans le cadre de la Stratégie OSPAR visant les substances dangereuses (Accord 2002/19), qui contient des dispositions relatives à l'identification des mesures les plus appropriées, leur urgence et qui peut les réaliser au mieux,

NOTANT la législation pertinente, au sein de l'Union européenne, en particulier le Règlement CE 1907/2006 concernant l'enregistrement, l'évaluation et l'autorisation des substances chimiques, ainsi que les restrictions applicables à ces substances (REACH) et la réglementation correspondante des autres Parties contractantes,

Les Parties contractantes à la Convention pour la protection du milieu marin de l'Atlantique du Nord-Est RECOMMANDENT:

1. Définitions

1.1 **Aux fins de la présente recommandation** :

«installation offshore»	désigne toute installation offshore telle que définie dans la Convention OSPAR.
«PEC»	PEC désigne la concentration environnementale prévue ; la concentration dans l'environnement d'un produit chimique ou d'un effluent, se fondant sur des calculs de modélisation. La PEC s'exprime sous forme de concentration de substances individuelles ou de dilution pour l'effluent entier,
"PNEC"	désigne la concentration prévue sans effet; la concentration d'un produit chimique ou d'un effluent au-dessous de laquelle il est fort peu probable que des effets préjudiciables sur les écosystèmes aquatiques et leurs organismes se produisent durant une exposition à long ou court terme,
"eau de production"	désigne l'eau produite pendant les opérations de production de pétrole et/ou de gaz, et comprenant l'eau du gisement, l'eau de condensation et l'eau injectée et reproduite. Elle comprend aussi l'eau utilisée pour dessaler les hydrocarbures,

oil,

“risk-based approach”	means an approach to managing produced water discharges - based on a characterization of the risk to the environment of a produced water discharge by examining both the exposure resulting from discharge of the produced water effluent and the sensitivity of the receiving environment to this exposure, - by taking appropriate measures to avoid or minimise exposure levels above the PNEC,
“substances” in the context of managing produced water discharges	means naturally occurring substances (including heavy metals, PAHs etc) and components of added chemicals present in the produced water,
“risk”	means the likelihood that adverse effects may occur, expressed as the PEC: PNEC ratio or the fraction of species potentially affected,
“WEA”	means Whole Effluent Assessment and is the characterisation of the persistence, bio-accumulative potential and toxicity of the entire effluent using a variety of physical, chemical and biological methods,
“WET”	means Whole Effluent Toxicity and is the characterisation of the toxicity of the entire effluent using biological methods.

2. Purpose and Scope

2.1 The purpose of this Recommendation is to:

- guide Contracting Parties in the application of a risk-based approach to assess the environmental risk posed by produced water discharges including naturally occurring substances,
- describe methods to characterise the risks and;
- guide Contracting Parties in the application of BAT and BEP to reduce those risks which are not adequately controlled.

2.2 The application of the risk-based approach will assist Contracting Parties in identifying,

«approche basée sur le risque	désigne une approche pour gérer les rejets dans l’eau de production, • basée sur la caractérisation du risque pour l’environnement d’un rejet d’eau de production en examinant aussi bien l’exposition résultant du rejet de l’effluent de l’eau de production que la sensibilité du milieu récepteur à cette exposition, • en prenant des mesures appropriées permettant d’éviter des niveaux d’exposition supérieurs à la PNEC,
« substances » dans le contexte de la gestion des rejets d’eau de production	désigne des substances présentes à l’état naturel (notamment les métaux lourds, les HAP, etc.) et des composants des produits chimiques ajoutés présents dans l’eau de production,
«risque»	signifie la probabilité de la présence d’effets préjudiciables, exprimée par le rapport PEC:PNEC ou la fraction des espèces potentiellement affectées,
«WEA»	désigne l’évaluation de l’effluent entier. C’est la caractérisation de la persistance, du potentiel de bioaccumulation et de la toxicité de l’effluent entier en utilisant diverses méthodes physiques, chimiques et biologiques,
«WET»	désigne la toxicité de l’effluent entier. C’est la caractérisation de la toxicité de l’effluent entier en utilisant des méthodes biologiques.

2. Objectif et champ d’application

2.1 La présente Recommandation a pour objectif:

a. d’orienter les Parties contractantes dans l’application d’une approche basée sur le risque pour évaluer le risque environnemental que posent les rejets d’eau de production, y compris les substances présentes à l’état naturel

b. de décrire des méthodes permettant de caractériser les risques; et

c. d’orienter les Parties contractantes dans l’application des BAT et BEP afin de réduire les risques qui ne sont pas contrôlés de manière adéquate.

2.2 L’application de l’approche basée sur le risque aidera les Parties contractantes à déterminer les prioritising and adopting measures that will reduce risks to the environment from discharges of produced water.

mesures de réduction des risques pour l'environnement provenant des rejets de l'eau de production, de classer ces mesures selon les priorités et de les adopter**.**

2.3 This Recommendation should be applied in addition to OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations as amended, OSPAR Decision 2000/2 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals, OSPAR Recommendation 2010/4 on a Harmonised Pre-screening Scheme for Offshore Chemicals and OSPAR Recommendation 2010/3 on a Harmonised Offshore Chemical Notification Format (HOCNF).

2.3 On devra appliquer la présente Recommandation de même que la Recommandation OSPAR 2001/1 relative à la gestion de l'eau de production, telle qu'amendée, la Décision OSPAR 2000/2 relative à un système obligatoire et harmonisé de contrôle de l'utilisation des produits chimiques en offshore et de réduction de leurs rejets, la Recommandation OSPAR 2010/4 relative à un système harmonisé de présélection des produits chimiques d'offshore et la Recommandation OSPAR 2010/3 relative à un système harmonisé de notification des produits chimiques offshore (HOCNF).

2.4 This Recommendation only applies to offshore installations that discharge produced water in the OSPAR maritime area. For the purpose of this Recommendation the term discharge does not include injection into the subsoil. Radioactive substances in produced water are excluded from the scope of this Recommendation.

2.4 La présente Recommandation ne s'applique qu'aux installations offshore qui rejettent de l'eau de production dans la zone maritime d'OSPAR. Dans le cadre de cette recommandation, le terme « rejet » n'inclut pas l'injection dans le sous-sol. Les substances radioactives dans l'eau de production sont exclues du champ d'application de la présente recommandation.

3. Programmes and Measures

3. Programmes et mesures

3.1 General Principles

3.1 Principes généraux

3.1.1 Contracting Parties should periodically conduct an environmental risk assessment for all produced water discharges from offshore installations into the marine environment.

3.1.1 Les Parties contractantes devraient entreprendre périodiquement une évaluation du risque environnemental pour tous les rejets d'eau de production, dans le milieu marin, provenant des installations offshore.

3.1.2 The method used to undertake the risk-based approach should be based on the determination of PEC:PNEC ratios or the fraction of species potentially affected as described in the OSPAR Guidelines in support of draft OSPAR Recommendation 2012/5 for a Risk-based Approach to the Management of Produced Water Discharges from Offshore Installations (OSPAR Agreement 2012-7) [add exact title when adopted by OSPAR 2012] (hereafter referred to as "the Guidelines").

3.1.2 La méthode utilisée pour l'approche basée sur le risque devrait se fonder sur la détermination des rapports PEC/PNEC ou de la fraction des espèces potentiellement affectée comme le décrivent les Lignes directrices étayant la Recommandation OSPAR 2012/5 sur une approche basée sur le risque appliquée à la gestion des rejets d'eau de production provenant des installations offshore (Accord OSPAR 2012-7) [citer le titre exact une fois les lignes directrices adoptées par OSPAR]) (appelées ci-après « les Lignes directrices »).

3.1.3 Contracting Parties should apply the

3.1.3 Les Parties contractantes devraient appliquer

Guidelines and the harmonised, structured procedure established therein. All the steps should be carried out as part of the procedure. The different steps are shown in Appendix 1 and are described in sections 3.2-3.7 below.

les Lignes directrices et la procédure harmonisée et structurée, élaborée dans les Lignes directrices. Toutes les étapes devraient être réalisées en tant qu'éléments constituants de la procédure. Les diverses étapes sont illustrées à l'appendice 1 et sont décrites dans les sections 3.2-3.7 ci-après.

3.1.4 Contracting Parties may elect to use a substance based approach or a whole effluent approach, or a combination of these approaches

3.1.4 Les parties contractantes peuvent décider d'utiliser une approche basée sur les substances ou une approche basée sur l'effluent entier, ou une combinaison de ces deux approches.

3.2 Data Collection

3.2.1 Contracting Parties should undertake a collection of all data that are relevant for the chosen risk assessment process. Depending on which approach is used (substance based or whole effluent based), this typically includes data from a combination of sources including, but not limited to:

a. bioassays of produced water effluents e.g. whole effluent toxicity (WET), whole effluent assessment (WEA);

b. naturally occurring substances: chemical analysis and substance based ecotoxicological information;

c. added chemicals discharged with produced water: including ecotoxicological information and other information;

d. substance physical and chemical properties;

e. produced water discharge information (volume, depth, temperature etc.); and

f. site/field-specific conditions e.g. hydrographic, oceanographic and meteorological data and vulnerability of the area where the discharges are taking place

3.2 Collecte des données

3.2.1 Les Parties contractantes devraient réaliser un recueil de toutes les données pertinentes pour le processus d'évaluation du risque sélectionné. En fonction de l'approche choisie (basée sur une substance ou sur un effluent entier), il s'agit typiquement des données provenant d'un certain nombre de sources incluant (liste non limitative) :

a. des analyses biologiques des effluents de l'eau de production, par exemple toxicité de l'effluent entier (WET), évaluation de l'effluent entier (WEA) ;

b. substances présentes à l'état naturel : analyses chimiques et informations écotoxicologiques relatives aux substances ;

c. produits chimiques ajoutés rejetés avec l'eau de production, il s'agit notamment d'informations écotoxicologiques et autres ;

d. des propriétés physiques et chimiques des substances ;

e. d'informations sur le rejet d'eau de production (volume, profondeur, température, etc.) ; et

f. des conditions propres à un site/domaine, par exemple données hydrographiques océanographiques et météorologiques et vulnérabilité de la zone où ont lieu les rejets

3.3 Hazard Assessment

3.3.1 Contracting Parties should assess the hazard related to the produced water discharge, i,e, the inherent properties of the discharge that may cause adverse effects.

3.3 Evaluation du danger

3.3.1 Les Parties contractantes devraient évaluer le danger lié au rejet d'eau de production, c'est-à-dire, les propriétés inhérentes du rejet risquant de provoquer des effets préjudiciables.

3.3.2 The hazard assessment should be based on data relating to the whole effluent or specific substances, or a combination of approaches, and should include the determination of Predicted No Effect Concentrations (PNECs).

3.3.2 L'évaluation du danger devrait se fonder sur les données portant sur l'effluent entier ou des substances spécifiques, ou sur la combinaison des deux approches et devrait inclure la détermination de la concentration prévue sans effet (PNEC).

3.4 Exposure Assessment

3.4 Evaluation de l'exposition

3.4.1 In order to estimate the exposure of the ecosystem to substances, expressed as the PEC, Contracting Parties should assess the exposure in the receiving environment, taking account of the fate of the produced water discharges (e.g. dispersion, dilution, degradation, volatilization etc.).

3.4.1 Afin d'estimer l'exposition des écosystèmes aux substances, exprimée par la PEC, les Parties contractantes devraient évaluer l'exposition dans le milieu récepteur, en prenant en compte le devenir des rejets d'eau de production (par exemple dispersion, dilution, dégradation, volatilisation, etc.).

3.4.2 The assessment should be based on data relating to the whole effluent or the specific substances, or a combination of these approaches, and should include the determination of Predicted Environmental Concentrations (PECs).

3.4.2 L'évaluation devrait se fonder sur les données portant sur l'effluent entier ou des substances spécifiques, ou sur la combinaison des deux approches et devrait inclure la détermination de la concentration prévue sans effet (PNEC).

3.5 Risk Characterisation

3.5 Caractérisation des risques

3.5.1 Contracting Parties should use the information gathered in the hazard and exposure assessments to estimate the potential of adverse effects that may occur in the marine environment based on the predicted exposure of the ecosystem to the produced water effluent and/or its specific substances.

3.5.1 Les Parties contractantes devraient utiliser les informations recueillies lors des évaluations du danger et de l'exposition afin d'évaluer le potentiel d'effets préjudiciables susceptibles de se produire dans le milieu marin en se fondant sur l'exposition prédite des écosystèmes à l'effluent d'eau de production et/ou de ses substances spécifiques.

3.5.2 The risk characterisation for produced water discharges in the receiving environment should be based on the PEC:PNEC ratio and/or the fraction of species potentially affected.

3.5.2 La caractérisation des risques que posent les rejets d'eau de production pour l'environnement récepteur devrait se fonder sur le rapport PEC/PNEC et/ou la fraction des espèces potentiellement affectées.

3.6 Risk Management

3.6 Gestion des risques

3.6.1 If the exposure level does not exceed the PNEC outside a column of water surrounding the installation, the radius of which is defined by a distance from the installation specified by the Contracting Party, or outside the volume of water directly impacted by the discharge (as determined by hydrographic modelling of dispersion of the discharge) that is specified by the Contracting Party, the risk should be considered to be adequately controlled.

3.6.1 On pourra considérer que le risque est contrôlé de manière adéquate si le niveau d'exposition ne dépasse pas la PNEC à l'extérieur d'une colonne d'eau entourant l'installation, dont le rayon correspond à la distance par rapport à l'installation déterminée par la Partie contractante, ou à l'extérieur du volume d'eau subissant directement l'impact du rejet (tel que déterminé par la modélisation hydrographique de la dispersion du rejet) déterminé par la Partie contractante.

3.6.2 Based on the risk characterisation,

3.6.2 Les Parties contractantes devraient continuer à revoir, en se fondant sur la caractérisation du risque, les options de gestion de l'eau de

Contracting Parties should continue to review the produced water management options and the application of BAT and BEP, as detailed in OSPAR Recommendation 2001/1 as amended, and implement site-specific actions as necessary to further reduce the risk. This may involve further data collection and input into the risk-based approach as shown in Appendix 1.

production et l'application de BAT et de BEP, comme l'explique dans le détail la Recommandation OSPAR 2001/1 telle qu'amendée, et mettre en œuvre des actions propres à des sites, en tant que de besoin, afin de réduire encore plus les risques. Cela peut impliquer de recueillir des données supplémentaires et de les appliquer à l'approche basée sur le risque comme le montre l'appendice 1.

3.7 Monitoring

3.7.1 Analysis of the effluent should be used to detect changes in the discharge and verify the effectiveness of the risk management measures.

3.7.2 Environmental monitoring should be carried out in order to detect changes in the receiving environment and to verify the impact hypothesis.

3.7 Surveillance

3.7.1 L'analyse de l'effluent devrait servir à détecter les modifications des rejets et/ou vérifier l'efficacité des mesures de gestion des risques.

3.7.2 La surveillance environnementale devrait être réalisée afin de détecter les modifications du milieu récepteur et/ou de vérifier l'hypothèse de l'impact.

4. Exchange of Information

4.1 Contracting Parties should regularly exchange information regarding, for example:

a. produced water sampling, analysis, and monitoring programmes;

b. whole effluent based risk assessment methodologies and results e.g. WEA, WET;

c. substance based risk assessment methodologies and modelling results;

d. substances identified in produced water likely to pose a risk to the marine environment;

e. field monitoring techniques;

f. the use of BAT and BEP in the context of risk-based approach as described in the Guidelines; and

g. the criteria used to assess whether risk is adequately controlled (e.g. distance and/or volume).

4. Echange d'information

4.1 Les Parties contractantes devraient échanger régulièrement des informations sur, par exemple:

a. l'échantillonnage de l'eau de production, leur analyse, et les programmes de surveillance ;

b. les méthodologies et les résultats de l'évaluation des risques basés sur l'effluent entier, par exemple, WEA, WET ;

c. les méthodologies d'évaluation du risque basée sur une substance et les résultats de la modélisation ;

d. les substances déterminées dans l'eau de production susceptibles de présenter un risque pour le milieu marin;

e. des techniques de surveillance sur le terrain ;

f. l'utilisation des BAT et BEP dans le contexte de l'approche basée sur le risque, telle que décrite dans les Lignes directrices ; et

g. les critères utilisés pour évaluer si le risque est contrôlé de manière adéquate (par exemple distance et/ou volume).

4.2 Les informations indiquées au paragraphe 4.1 ci-

4.2 The information referred to in paragraph 4.1 above should be submitted to OIC annually.

dessus devraient être communiquées à l'OIC tous les ans.

5. Entry into Force

5.1 This Recommendation has effect from 29 June 2012

5. Entrée en vigueur

5.1 La présente Recommandation prend effet à partir du 29 juin 2012.

6. Review and Periodic Evaluation

6.1 An implementation plan should be submitted by Contracting Parties to OIC 2013 with the aim of achieving full implementation by 31 December 2018.

6.2 Progress against the implementation plan should be submitted to OIC on an annual basis starting in 2014.

6.3 Contracting Parties should review and evaluate the effectiveness of the risk-based approach that they have adopted every five years as from 2018, in order to determine whether the purpose of this Recommendation is being achieved.

6. Revue et évaluation périodique

6.1 Un plan de mise en œuvre devrait être soumis par les Parties contractantes à l'OIC en 2013 dans le but d'une mise en application complète pour le 31 décembre 2018.

6.2 Les progrès réalisés par rapport au plan de mise en œuvre devraient être notifiés à l'OIC tous les ans à partir de 2014.

6.3 Tous les cinq ans à partir de 2018, les Parties contractantes devraient passer en revue et évaluer-l'efficacité de l'approche basée sur le risque qu'elles ont adoptée afin de déterminer si l'objectif et la portée de la présente Recommandation ont été atteints.

7. Implementation Reports

7.1 Reports on the implementation of this Recommendation should be submitted by Contracting Parties with offshore installations that discharge produced water in the OSPAR maritime area, using as far as possible the format set out in Appendix 2. The reports should be submitted to the appropriate OSPAR subsidiary body in accordance with OSPAR's Standard Implementation and Assessment Procedure.

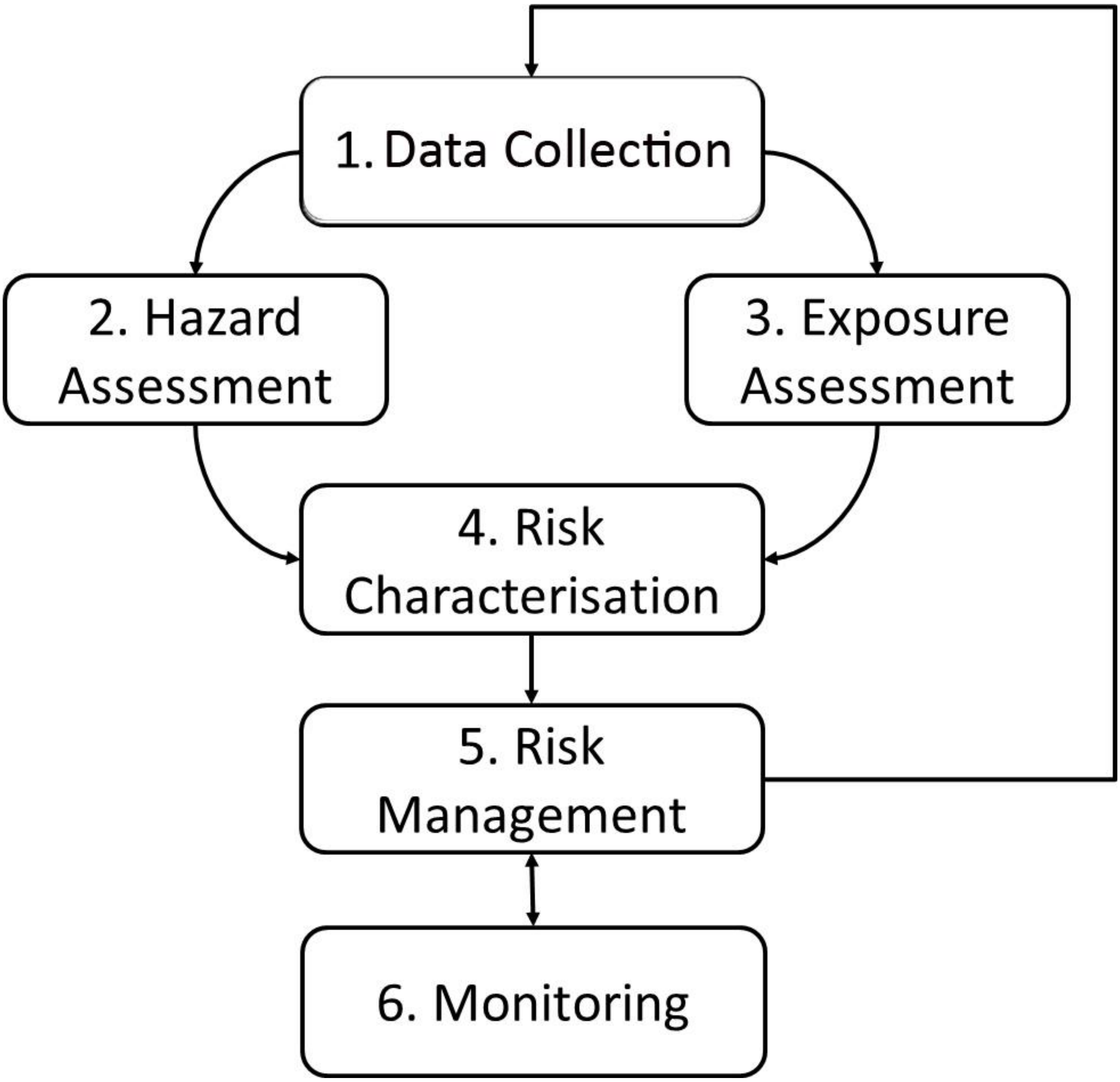
7. Rapports de mise en œuvre

7.1 Les Parties contractantes ayant des installations offshore qui rejettent de l'eau de production dans la zone maritime d'OSPAR, devraient rendre compte de la mise en œuvre de la présente Recommandation, ceci en ayant recours, dans toute la mesure du possible, au formulaire figurant en appendice 2. Les rapports devraient être remis à l'organe subsidiaire OSPAR compétent, conformément à la Procédure normalisée OSPAR de notification et d'évaluation de la mise en œuvre.

Appendix 1/Appendice 1

Figure 1: Diagram for the Risk-based Approach

All steps in the diagram should be carried out.



Appendix 2/Appendice 2

Format for implementation reports concerning OSPAR Recommendation 2012/5 for a Risk Based Approach to the Management of Produced Water Discharges from Offshore Installations.

(Note: In accordance with paragraph 6.1 of this Recommendation, this format should be used as far as possible in implementation reports)

I. Implementation Report on Compliance

Country:

Date submitted:

Contact person:

Reservation applies: *Yes/No*

Is measure applicable in your country: *Yes/No*

If not applicable, then state why not (e.g. no relevant installation):

…………………………………………………………..

…………………………………………………………..

Means of Implementation (delete whichever is not appropriate):

By legislation: Yes/No

Administrative agreement: Yes/No

By negotiated agreement: Yes/No

Please provide information on:

a. specific measures taken to give effect to this measure;

b. any special difficulties encountered, such as practical or legal problems, in the implementation of this measure;

c. the reasons for not having fully implemented this measure should be spelt out clearly and plans for full implementation should be reported;

d. if appropriate, progress towards being able to lift the reservation

Formulaire de mise en œuvre de la Recommandation OSPAR 2012/5 sur une approche basée sur le risque pour la gestion des rejets d'eau de production provenant des installations offshore

(Note: Conformément au paragraphe 6.1 de la présente recommandation, ce formulaire sera utilisé dans la mesure du possible pour rendre compte de la mise en œuvre)

I. Rapport de mise en œuvre

Pays :

Date de communication :

Point de contact :

Une réserve s'applique: *Oui/non*

La mesure est-elle applicable dans votre pays ? Oui/non

Dans le cas contraire, en indiquer les raisons (p.ex. il n'y a pas d'installation concernée):

…………………………………………………………..

…………………………………………………………..

Moyens de mise en œuvre (biffer la mention inutile)

Législation : Oui/non

Accord administratif : Oui/non

Accord négocié : Oui/non

Bien vouloir donner les renseignements suivants :

a. mesures prises spécifiquement afin de rendre la présente mesure effective ;

b. difficultés particulières qui se sont présentées, telles que problèmes pratiques ou juridiques, dans la mise en œuvre de la présente mesure ;

c. les raisons pour lesquelles la présente mesure n'a pas été pleinement appliquée doivent être clairement indiquées, de même que ce qui est prévu pour la mettre pleinement en œuvre.

d. si opportun, les progrès réalisés dans le sens de la levée de la réserve.

Department of Energy & Climate Change

Annex 2

OSPAR Agreement 2012/7

OSPAR COMMISSION

Protecting and conserving the North-East Atlantic and its resources

(Source: OSPAR 12/22/1, Annex 19)

OSPAR Guidelines in support of Recommendation 2012/5 for a Risk-based Approach to the Management of Produced Water Discharges from Offshore Installations

(OSPAR Agreement: 2012-7)

1. Scope of the guidelines

1. These OSPAR Guidelines relate to the provisions and requirements set out in §3 of OSPAR 2012/5 Recommendation for a Risk -based Approach to the Management of Produced Water Discharges from Offshore Installations. These Guidelines provide general guidance for Contracting Parties, when undertaking periodic environmental risk assessment for all produced water discharges offshore. They provide a description of each of the stages of the Risk -based Approach, as included in Appendix 1 to the *Recommendation 2012/5 for a Risk -based Approach to the Management of Produced Water Discharges from Offshore Installations.* For discharges in or in the vicinity of vulnerable areas, Contracting Parties may decide to deviate from the approach described in the Guidelines.

2. The basis for risk assessment is a PEC:PNEC and/or msPAF approach, which is valid only for substances causing direct effects. Substances that are both bioaccumulative and persistent might cause postponed effects after accumulation of a certain body burden (due to uptake of food), sometimes at great distance from the discharge point. The potential long-term effects of such substances will not be determined within the scope of the RBA, but need to be assessed separately.

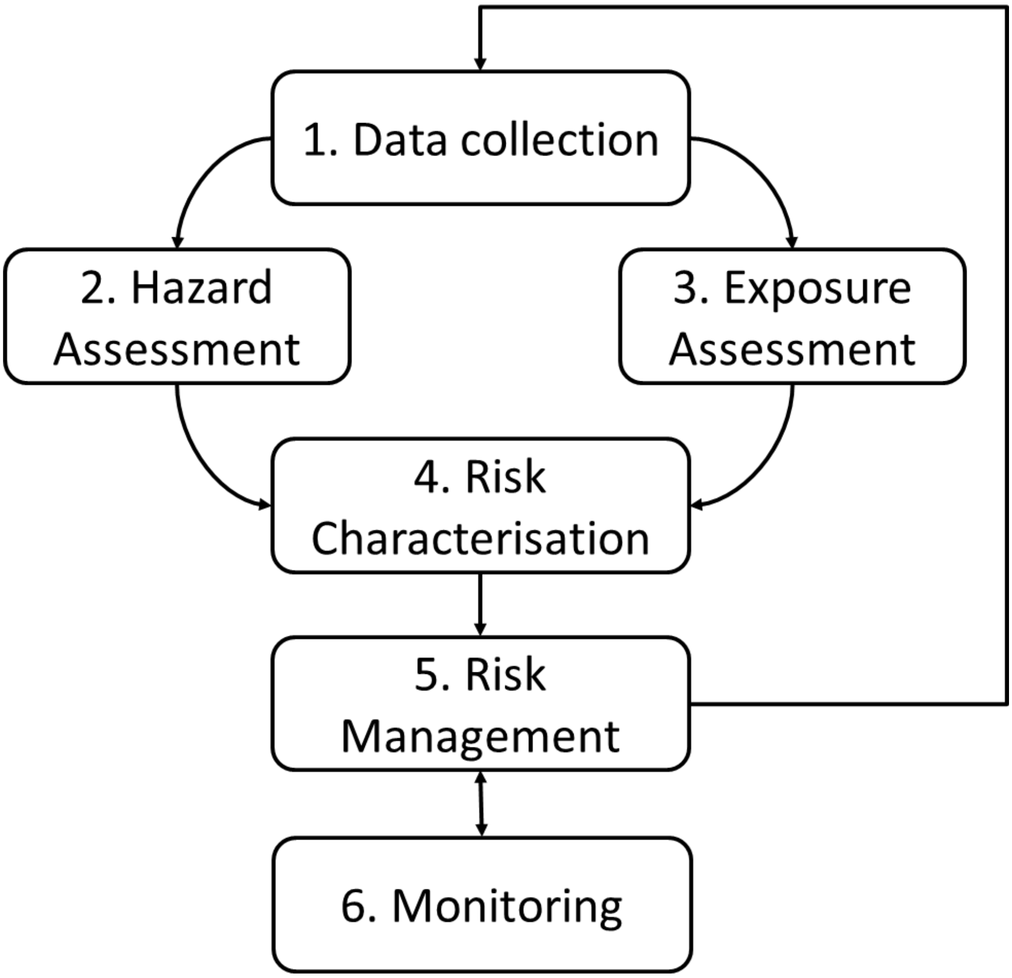
1. Overview of the Risk Based Approach

3. The RBA towards Produced Water Management is developed following a harmonised, structured procedure presented below (in Figure A2-1). This framework follows principles of environmental risk assessment already in use in, e.g. the EU (ECHA - Technical Guidance documents) and US (US-EPA Guidance on risk assessment). ECHA has published a series of guidance documents for environmental risk assessment of single substances; the RBA approach has as far as possible been aligned with these guidelines. The assessment of mixtures was developed according to the best scientific practice.

4. To allow for a consistent approach these OSPAR Guidelines refer to published documents, of which the ECHA Guidance on implementation of REACH (May 2008) is one of the key (series of) documents. This minimises the need for updating the Guidelines following a change in external documents.

5. The first step in the RBA process is data collation, in which information on the discharge is collected. The risk is determined using combined information from Hazard Assessment and Exposure Assessment. Contracting Parties should review management options, evaluate measures and develop and implement site-specific actions to reduce those risks which are not adequately controlled. This can involve further data collection and input into the risk-based approach as shown in Figure 1. Monitoring is used in order to verify the effectiveness of any risk management measures. It may also be used to detect changes in the discharge and in the receiving environment.

Figure 1



1.1 Data Collection – Step 1

6. Data collection involves the collation of relevant information for the level of assessment to be carried out, on the hazardous properties of individual substances and/or the produced water effluent, information on discharge characteristics and information on the local conditions in the receiving environment. This may include information from a combination of sources such as, but not limited to:

- bioassays of produced water effluents e.g. WET, WEA;
- naturally occurring substances: chemical analysis and substance based ecotoxicological information;

- added chemicals discharged with produced water: including ecotoxicological information and other information;
- substance physical and chemical properties;
- produced water discharge information (volume, depth, temperature etc.); and
- site/field-specific conditions e.g. hydrographic, oceanographic and meteorological data and vulnerability of the area where the discharges are taking place.

Bioassays of produced water effluents

7. The WET approach can be used to assess the toxicity of produced water. This approach assesses the combined toxicity from all substances in the produced water, including unknown substances. WET can be undertaken in its own right or at a more detailed level of assessment in conjunction with the substance-based approach. For this latter approach, produced water samples for bioassays and for chemical analysis should be collected in parallel. WET also determines the possible residual toxicity of substances already addressed by current BAT/BEP OSPAR measures, like dispersed oil (OSPAR Recommendation 2001/1 for the management of produced water from offshore installations, as amended) and offshore chemicals (OSPAR Decision 2000/2 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals, as amended).

8. When carrying out WET testing, it is recommended to follow the Practical Guidance Document on Whole Effluent Assessment for offshore Discharges (Roex 2010) or similar guidance. At least a minimum of three *in vivo* bioassays in line with standardized protocols (ECHA Guidance on information requirements and chemical safety assessment, R10.3.2) should be performed, representing three different trophic levels e.g. bacteria, algae and crustacean.

9. Immediate measurements of selected physical-chemical parameters (pH, ammonium, salinity, etc.), is recommended upon arrival of the bioassay samples in the laboratory. This is to allow for adjustment of the samples if considered necessary for performance of the bioassays.

10. WEA consists of a combination of tests for determining of the potential for bioaccumulation (B), persistency (P) and toxicity (T). Tests are available for detecting adverse effects of substances with specific mode of action. Practical guidance on tests and parameters regarding P and B are described in OSPAR Commission (2007) Practical Guidance Document on Whole Effluent Assessment and the Practical Guidance Document on Whole Effluent Assessment for offshore Discharges (Roex 2010)

Naturally occurring substances: chemical analysis and substance based ecotoxicological information

11. Samples of produced water should be collected for chemical analysis of naturally occurring substances. The produced water should be analysed on a minimum set consisting of at least the following groups of substances: heavy metals, BTEX, dispersed oil, 16 EPA PAHs, other PAHs and alkylphenols. Appendix 4 provides an example of substances for chemical analysis and analyses methods.

12. Examples of procedures for the sampling and analysis of substances in produced water are provided in the following documents (note: Available chemical analysis protocols for produced water in general do not include analysis of added chemicals):

- OSPAR Agreement 2006-06. Oil in produced water analysis. Guideline on criteria for alternative method acceptance and general guidelines on sample taking and handling;
- the ‘Methodology for the Sampling and Analysis of Produced Water and Other Hydrocarbon Discharges’ from the Department of Energy and Climate Change (DECC 2014) in the United Kingdom.

13. Substance based ecotoxicological information is an important source of data for input to the RBA process. This information is used to estimate PNECs and is described in the “Hazard

assessment" step. For the most common substances in the produced water OSPAR will establish and maintain a harmonised set of PNEC values (see Appendix 5).

Added chemicals discharged with produced water: including ecotoxicological information and other information

14. Information on added chemicals discharged with produced water is contained in Contracting Party databases generated through the application of the HMCS.

15. The minimum ecotoxicological information that should be collected includes short-term (acute) toxicity data for three trophic levels; invertebrates (e.g. crustacean, molluscs, echinoderms), algae (growth inhibition) and fish. For added chemicals short-term toxicity data are derived from the HOCNF. If data on the individual substances are not available, one could use the worst case toxicity values for the product.

16. Identification of potential hazardous substances in chemical products should be included and can be derived from regulatory submissions (such as REACH and OSPAR Decision 2000/2 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals, as amended), available for all non-PLONOR chemicals. Similar information on PLONOR chemicals discharged in large amounts (e.g. MEG, methanol) should also be included when available.

17. Since chemical analysis normally does not include analysis of added chemicals, an estimate of concentrations of added chemicals (preferably on substance level) must be determined. The most common practical method for the estimation of the quantity of added chemicals (except for surfactants) in produced water discharges is based on the octanol/water partition coefficients (log Pow) available on substance level from the HOCNF for all non-PLONOR production chemicals. For surfactants default values for the fraction released are provided in Thatcher et al. (2005).

Substance physical chemical properties

18. Physical-chemical properties may need to be collected for individual substances, such as state (liquid, solid, etc.), molecular weight, density, boiling point, solubility, melting point, vapour pressure and degradation rates. A list of useful sources of physico-chemical data is provided in ECHA Chapter R.7a: Endpoint specific guidance (Table R.7.1-2.). Relevant data is provided in the database of EU registered substances[1].

Produced water discharge information

19. The model selected for estimation of the dilution potential (described in step 3) will determine which discharge characteristic information and physicochemical information is necessary. The following information may typically be required to enable assessment of the dispersion of the produced water plume in the surrounding water:

- geographical position of discharge location;
- discharge volume/discharge rate;
- discharge depth;
- discharge arrangement (e.g. diameter and orientation of discharge pipe);
- salinity;
- temperature; and
- information regarding other discharges at the location (e.g. cooling water, ballast water discharge from the platform or discharges from neighbouring platforms).

Site/field specific conditions

20. In the exposure assessment (step 3) the predicted fate of produced water in the receiving environment is determined. For the purpose of modelling the dilution/dispersion in the receiving environment, information regarding the environmental parameters at the location/area is useful.

This could include:

- local/ ocean current data;

[1] http://apps.echa.europa.eu/registered/registered-sub.aspx

- hydrographical data;
- wind data;
- air temperature;
- water depth; and
- information on vulnerable areas (e.g. OSPAR Marine Protected Areas; OSPAR List of Threatened and or Declining Species and Habitats; Special Protection Areas (SPA's), and Special Areas of Conservation (SACs).

1.2 Hazard Assessment – Step 2

21.Hazard Assessment is the first evaluation step in the process, in which the hazard (i.e., the inherent capacity to cause adverse effects) of the discharge is evaluated, either on the basis of properties of the effluent or of the individual substances (both added and naturally occurring).

PNEC based on substance data

22.The hazard assessment requires derivation of PNECs derived from single species laboratory toxicity tests (preferably NOEC). Using already established PNEC values and following ECHA R10 (Characterisation of dose-response for the environment) where necessary, OSPAR will establish and maintain a harmonised set of PNEC values for the most common naturally occurring substances in the produced water (see Appendix 5). If other relevant substances are identified, dedicated PNEC values should be derived.

23.Since reliable PNECs are not available for all substances, some substances should be grouped. Grouping should be based on a combination of the chemical structure, toxic mode of action and toxicity. The toxicity of the group of substances will then be represented by the PNEC of selected single substance from that group (which will be available in the harmonised set of PNECs).

24.For added chemicals PNEC values should be derived from data provided in the HOCNF following ECHA R10, with a maximum assessment factor of 1000 as explained in Appendix 6. Similar approach should be followed for PLONOR chemicals discharged in large amounts (e.g. MEG, methanol).

PNEC based on WET data

25.Following the procedure described in ECHA R10, a PNEC for the whole produced water effluent can be calculated on the basis of the WET data that was collected as part of the Data Collection stage. Although the ECHA procedure was developed for single substances, the procedure can be applied to effluent toxicity tests (Cf. OSPAR Commission (2000) Background document concerning the elaboration of programmes and measures relating to Whole Effluent Assessment). A maximum assessment factor of 1000 is used (see Appendix 6).

1.3 Exposure Assessment – Step 3

26.Exposure assessment is carried out to determine the fate of discharged produced water. Again, a difference is made between an assessment based on the effluent as a whole and an assessment based on the combination of individual substances.

General principles of Exposure assessment

27. The purpose of the exposure estimation or assessment is to derive the PECs for the receiving environment around an offshore installation. The PEC can be determined by modelling the concentrations in the receiving environment. As a minimum, the PEC should be determined within the column of water the radius of which is defined by the distance from the installation (e.g. 500m zone) specified by the Contracting Party, or within the volume of water directly impacted by the discharge (as determined by hydrographic modelling of dispersion of the discharge), that is specified by the Contracting Party, taking into account local environmental conditions and sensitivies[2]

[2] Cf. ECHA-Guidance on information requirements and chemical safety assessment Chapter R.16: Envrionmental Exposure Estimation

28. The PEC may be predicted by use of a 1-, 2- or 3-dimensional dilution/dispersion model. It should be demonstrated that dilution is not overestimated by the model by use of (peer reviewed) field validation study(s). Furthermore, the model chosen should be well documented and its users should be well trained. If available, a model that takes account of different fate processes should be used (see also paragraphs 19 and 20). This will provide a more accurate PEC.

Exposure assessment following a substance based approach

29.The output from the substance based exposure assessment is the concentration of substances discharged with the produced water in the receiving environment (PEC).

Exposure assessment following a WET based approach

30.The output from the WET based exposure assessment is the concentration of produced water effluent (PEC) in the receiving environment, expressed as a percentage of the original effluent.

1.4 Risk Characterisation – Step 4

General principles of Risk characterization

31. Risk characterisation is the comparison of the predicted environmental concentration of the substance and/or the effluent (PEC) and the hazard (PNEC) at a given distance as a minimum.

32. The risk can be further characterised by identification of the contribution of the individual substances (both natural occurring and man-added substances) or groups of substances (e.g. through TIE/EDA) to the overall risk.

Risk characterisation following a WET based approach

33.The PNEC value calculated in the Hazard Assessment and the PEC value calculated in the Exposure Assessment are used to determine the PEC:PNEC ratio for the whole effluent.

Risk characterisation following a substance based approach

34.If risk estimates are calculated on a substance based approach, the PEC:PNEC ratios for the individual identified substances should be combined to calculate the overall risk estimate for the produced water. ECHA does not provide guidance for mixtures; therefore a combined approach based on species sensitivity distributions should be followed (msPAF, De Zwart and Posthuma 2005). Appendix 7 provides further guidance on how a combined approach may be carried out.

Using information from the combined WET- and Substance based approach

35. If both the WET and substance based approach is undertaken then it will be possible to use both sets of data to inform the risk assessment.

1.5 Risk Management – Step 5

Risk reduction

36. If the exposure level does not exceed the PNEC outside a column of water surrounding the installation, the radius of which is defined by a distance from the installation specified by the Contracting Party, or outside the volume of water directly impacted by the discharge (as determined by hydrographic modelling of dispersion of the discharge) that is specified by the Contracting Party, the risk should be considered to be adequately controlled. If this is not the case, Contracting Parties should then review management options and the application of BAT and BEP and implement site-specific actions to reduce the risks.

37. For effective risk reduction it is useful to have insight into the most important contributors to the risk. The intermediate results of the substance based risk characterisation may provide insight into those substances contributing most to the overall risk. Also TIE or equivalent methods may provide insight into those substances contributing most to the overall risk of the effluent (Sauer et al., 1997, Balaam et al. 2009, Thomas et al. 2009). The results may assist in identifying BAT and BEP.

Refinement of the risk characterisation

38. The risk characterisation can be dominated by uncertainty leading to high assessment factors in the derivation of the PNEC. Therefore, before looking at physical measures it may be prudent to

address uncertainty as reductions here can reduce the resultant PEC: PNEC ratio by factors of 10-100 (assessment factors generally drive the risk up as uncertainty increases). This may be achieved by, for instance, the collection of additional data and/or undertaking additional toxicity testing to obtain more reliable PNECs, more advanced dilution/fate modelling, review/additional of chemical analysis etc. to obtain more reliable PECs.

Measures

39. Risk reduction measures (OSPAR Commission publication on the Background Document concerning Techniques for the Management of Produced Water from Offshore Installations) may comprise some or all of the following:

- technical measures, such as abatement at the source by redesign of the applied processes (water shut off in the well);
- substitution of chemicals;
- application of closed systems (e.g. injection of produced water);
- end-of-pipe techniques such as separation or clarification techniques to treat produced water prior to discharge, and;
- organisational measures such as management systems in place (training, instructions, procedures and reporting).

40. The application of BAT and BEP should be demonstrated as described in Appendix 1 of the OSPAR Convention.

41. When setting priorities and in assessing the nature and extent of the measures and their time scales, Contracting Parties should use the criteria as mentioned in Appendix 2 of the OSPAR Convention.

42. Further explanation on the evaluation and implementation of Risk Management Measures is provided by ECHA (Chapter R13: Risk management measures and operational conditions)

Review and update of the environmental risk assessment

43. Each Contracting Party should determine how often the environmental risk assessment process should be undertaken. Typically, a review and update takes place when there is a significant change in the produced water discharge (characteristics) due to implementation of risk reduction measures or other modifications, such as:

- Implementation of new end-of-pipe technique;
- Substitution of added chemicals or new chemicals taken into use;
- Significant change in the discharge of added chemicals; and
- Tie-in of new produced water streams (satellites) and/or new wells.

44. An update of the environmental risk assessment would imply that the process should be restarted at step 1 (data collection) as shown in the flow diagram (Figure A2-1), and that the risk assessment process should be repeated with new and updated information.

1.6 Monitoring -Step 6

45. Monitoring is a key element in the verification of the effectiveness of measures adopted for the reduction of the risk. Monitoring refers to the monitoring of produced water effluents (effluent monitoring), the monitoring of the receiving environment (field monitoring) and the monitoring of changes which may require additional assessment (system monitoring). Monitoring is an on-going, iterative process, that is performed on a periodical basis, or when significant changes have been made to the installation that might affect the discharge. The outcome of the monitoring process is used as additional information in the risk management process.

Effluent Monitoring

46. Effluent monitoring may include the gathering of information from chemical analysis and / or WET/WEA tests on produced water samples taken periodically.

Field monitoring

47. Field monitoring may be used to validate the risk characterized in the RBA process. It may include chemical analysis of seawater and chemical and biological analysis of biota samples (biological effect monitoring) collected from the vicinity of offshore installations. Relevant international standards, and OSPAR Agreement 2004-11 on "Guidelines for Monitoring the Environmental Impact of Offshore Oil and Gas Activities" should be taken into account before field monitoring of the water column is carried out.

48. The monitoring program needs to be designed to be fit for the purpose and to take account of specific field conditions, future field activities and discharges and existing knowledge of previous monitoring in similar or nearby area (Cf. OSPAR Guidelines for Monitoring the Environmental Impact of Offshore Oil and Gas Activities (OSPAR Agreement 2004-11)).

2. Documenting the risk assessment

49. With the objective of documenting the risk assessment process the following information may be reported in order to provide an audit trail of the assessment:

- produced water sampling and analysis monitoring programmes, techniques and results;
- whole effluent based risk assessment methodologies and results e.g. WEA, WET;
- substance based risk assessment methodologies and modelling results; together with any derived PNEC values which are not listed in Appendix 5
- substances identified in produced water likely to pose a risk to the marine environment;
- the criteria used to assess whether risk is adequately controlled (e.g., distance and/or volume); and
- field monitoring techniques;

Appendix 1

List of Abbreviations

Abbreviation	Full text	Explanation / definition/reference
BAT	Best Available Techniques	OSPAR Convention, Appendix 1
BEP	Best Environmental Practice	OSPAR Convention, Appendix. 1
BTEX	Benzene, Toluene, Ethyl Benzene and Xylene	Collection of the aforementioned substances
CP	Contracting Parties	Countries being a part of OSPAR
DECC	UK Department of Energy and Climate Change	http://www.decc.gov.uk/
EC	European Commission	http://ec.europa.eu/index_en.htm
EC50	Median effect concentration	Explained under Glossary, Appendix 2
ECHA	European Chemicals Agency	http://echa.europa.eu/
EPA	US Environmental Protection Agency	http://www.epa.gov/
EPA PAH	List of 16 PAHs with high priority assigned by the EPA	
GC/FID	Gas Chromatography with Flame Ionization Detection	Analytical device for separation and detection of chemicals
GC/MS	Gas Chromatography with Mass Spectrometry	Analytical device for separation and detection of chemicals
HC5	5% Hazardous concentration	Explained under Glossary, Appendix 2
HMCS	Harmonised Mandatory Control System	OSPAR Decision 2000/2
HOCNF	Harmonised Offshore Chemical Notification Format	OSPAR Guidelines 2010-5
IUCLID	International Uniform Chemical Information Database	http://iuclid.echa.europa.eu/
LC50	Median lethal concentration	Explained under Glossary, Appendix 2
MEG	Monoethylenglycol	Production chemical listed as PLONOR
msPAF	Multi-substance Potentially Affected Fraction	Explained under Glossary, Appendix 2
NOEC	No Observed Effect Concentration	Explained under Definitions
OIC	Offshore Industry Committee	http://www.ospar.org/html_documents/ospar/html/01-04e_terms_of_reference.pdf#nameddest=OIC
OLF	The Norwegian Oil Industry Association	http://www.olf.no/
OSPAR	OSlo-PARis Convention	http://www.ospar.org
PAF	Potentially Affected Fraction	Explained under Glossary, Appendix 2
PAH	Polycyclic Aromatic Hydrocarbons	A chemical class of substances that are present in produced water, some of which are carcinogenic
PBT	Persistance Bioaccumulation Toxicity	Explained under Glossary, Appendix 2
PEC	Predicted Environmental Concentration	Calculated or estimated concentration in the environment used in environmental risk assessment
PLONOR	Pose Little Or NO Risk	OSPAR list of substances / preparations used and discharged offshore which are considered to pose little or no risk to the environment
PNEC	Predicted No Effect Concentration	the concentration of a chemical or effluent below which adverse effects on the aquatic ecosystem and its organisms will most likely not occur during long-term or short term exposure
PW	Produced Water	By-product of oil and gas extraction
RBA	Risk -based Approach	Approach for the management of PW as proposed by the OIC (08/13/1-E)

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REACH	Registration, Evaluation, Authorisation and Restriction of Chemical substances	EC regulation for chemicals (EC 1907/2006)
SDS	Safety Data Sheet	Annex II of REACH
TIE	Toxicity Identification and Evaluation	Explained under Glossary, Appendix 2
TMA	Toxic Mode of Action	Explained under Glossary, Appendix 2
US-EPA	See EPA	
WEA	Whole Effluent Assessment	Explained under Glossary, Appendix 2
WET	Whole Effluent Toxicity	Explained under Glossary, Appendix 2

Appendix 2

Glossary

HC5: The 5% Hazardous Concentration (HC5) is the exposure concentration of a substance at which 5% of biota are exposed above their effect concentration (usually NOECs). In general, the HC5 level is extrapolated from a limited, but representative, set of NOECs by fitting a cumulative statistical distribution (log-normal in these guidelines) to the NOEC data.

LC50/EC50: The toxicity data are typically reported as the concentrations at which x % (e.g. 50%) mortality or inhibition of a function (e.g. growth) is observed and are expressed as the lethal concentration (LCx) or the effect concentration (ECx), e.g. LC50 or EC50. L/EC50-values are usually obtained from short term tests (duration in the range of hours to a few days, depending on the test organism).

msPAF: For a more detailed explanation of the single-substance Potentially Affected Fraction, see 'PAF'. The multi-substance PAF (msPAF) is the fraction or percentage of biota that are potentially affected when exposed to a specific mixture of substances.

NOEC: Results of long term tests exposed to a substance for a prolonged period in relation to the length of the life-cycle of the organism are most frequently reported as L/ECx (x being very often equal to 10) or as the NOEC (No Observed Effect Concentration) which corresponds to the highest tested concentration for which there are no statistical significant effect when compared to the control group. The endpoints most frequently used are growth inhibition and reproduction.

PAF: The Potentially Affected Fraction (PAF) is the fraction or percentage of biota that is exposed above their effect level (usually the NOEC level) at a specific exposure concentration of a substance. This fraction is extrapolated from a limited, but representative, set of NOECs for the substance, by fitting a cumulative statistical distribution (log-normal in these guidelines) to the NOEC data.

PBT: Three intrinsic properties of chemicals called Persistence, Bioaccumulation potential and Toxicity (PBT). Persistent substances are substances that are not readily (bio)degradable in the environment. Bioaccumulative substances are substances that have a potency to concentrate in biota along the food-chain. Toxic substances are substances with low effect concentrations (e.g. NOECs).

TIE: Toxicity Identification and Evaluation (TIE) is a cycle of procedures relying on combinations of physical/chemical manipulations and toxicity tests to characterize, identify, and confirm the causes of measured toxicity in a sample (for instance an effluent).

TMA: Toxic Mode of Action are classes of (molecular) mechanisms by which chemicals exert their adverse effect. These classes are used in the calculation of the msPAF. For chemicals with a similar mode of action, exposure levels should be summed, while for substances with different modes of actions, effect levels should be summed.

WEA: Whole Effluent Assessment is the assessment of the whole effluent in terms of all three PBT properties (or even more generic).

WET: Whole Effluent Toxicity is the toxicity of the whole effluent. For this purpose, the effect level of a biota to a dilution series of the effluent is tested in the laboratory and is expressed, for instance, a NOEC or LC50/EC50.

Appendix 3

List of References

Key References

DECC (Department of Energy and Climate Change) (2014). *Methodology for the Sampling and Analysis of Produced Water and Other Hydrocarbon Discharges.* Version 2.1

ECHA Technical Guidance Documents, to be found on the ECHA website: http://guidance.echa.europa.eu

ECHA Guidance on information requirements and chemical safety assessment Chapter R.16: *Environmental Exposure Estimation*
http://echa.europa.eu/documents/10162/17224/information_requirements_r16_en.pdf

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Thomas, K.V., K Langford, K Petersen, A J Smith & K E Tollefsen (2009). *Effect-directed identification of naphtenic acids as important in vitro xeno-estrogens and anti-andrgens in North Sea offshore produced water discharges*. Environmental Science Technology, 43, pp. 8066-8701.

US-EPA Guidance on Risk Assessment, to be found on the US-EPA website: http://www.epa.gov/risk_assessment/

Appendix 4

Example of a Norwegian Chemical analysis program of produced water

Table 1: Overview of produced water substances (naturally occurring) included in the analysis program, recommended analysis, methods and limits of quantification.

Main group	Substances	Method	Standards of analysis	Detection limit
Metals and metalloids	Arsenic	AAS/ICP-MS /DRC-ICP-MS /HR-ICP-MS	EPA 200.7/200.8	1 – 5
	Cadmium	AAS/ICP-MS /DRC-ICP-MS /HR-ICP-MS	EPA 200.7/200.8	0,05 – 6
	Chromium	AAS/ICP-MS /DRC-ICP-MS /HR-ICP-MS	EPA 200.7/200.8	0,1 - 1,5
	Copper	AAS/ICP-MS /DRC-ICP-MS /HR-ICP-MS	EPA 200.7/200.8	0,5 – 6
	Mercury	CV-AAS/ICP-MS/DRC-ICP-MS	EPA 200.7/200.8	0,002 - 0,1
	Lead	AAS/ICP-MS /DRC-ICP-MS /HR-ICP-MS	EPA 200.7/200.8	0,3 - 1,5
	Nickel	AAS/ICP-MS /DRC-ICP-MS /HR-ICP-MS	EPA 200.7/200.8	0,5 – 9
	Zinc	AAS/ICP-MS /DRC-ICP-MS /HR-ICP-MS	EPA 200.7/200.8	2 – 15
	(Iron)	AAS/ICP-MS/DRC-ICP-MS/ICP-AES	EPA 200.7/200.8	1 – 4
	(Barium)	AAS/ICP-MS/DRC-ICP-MS/ICP-AES	EPA 200.7/200.8	0,1 – 10
Mono Aromatic Hydrocarbons	Benzene	GC-MS or GC-FID Headspace or purge-and-trap	Internal method M-036	1 – 10
	Toluene	GC-MS or GC-FID Headspace or purge-and-trap	Internal method M-047	1 – 20
	Ethylbenzene	GC-MS or GC-FID Headspace or purge-and-trap		1 – 50

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	Xylene (p, m, o)	GC-MS or GC-FID Headspace or purge-and-trap		1 – 30
Dispersed oil	C7-C40	GC/FID	Mod. NS-EN ISO 9377-2/OSPAR 2005-15	0,2
Polycyclic Aromatic Hydrocarbons (16 EPA)	Naphthalene, acenaphthylene, acenaphthene, fluorine, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(a)anthracene, benzo (ghi)perylene, indeno(123cd)pyrene,	GC/MS	Internal method M-036	0,01 – 0,1
Other PAHs:	Dibenzothiophene1-methylnaphthalene, 2-methylnaphthalene, 9-methylnaphthalene, 4-methyldibenzo-thiophene, 2,6 dimethyl naphthalene, 9-ethyl-phenanthrene, 4-ethyl-dibenzothiophene, trimethylphenanthrene, 2-isopropylnaphtalene, 1,2,6 trimethyl-phenantrene	GC/MS	Internal method M-036	0,01 – 0,1
Alkylphenols	Sum C1-C3, C4-C5 and C6-C9 alkylphenols	GC-MS 2285	Method established by Battelle (US)	0,01 – 0,1

Appendix 5

Grouping and establishment of a list of PNECs for naturally occurring substances

If a substance based risk approach is followed, the hazard assessment (step 2) in the Risk Based Approach (RBA) requires derivation of Predicted No Effects Concentrations (PNECs) for all substances identified in the produced water. During the last decade Environmental Quality Standards (EQSs) and PNECs have been established for a number of substances under the Water Framework Directive (WFD) and the EU following the guidance of the ECHA documents (formerly Technical Guidance Document). Since reliable PNECs are not available for all substances identified, grouping of substances is an option. The toxicity of the group of substances will then be represented by the PNEC of a selected single substance, from that group.

Produced water contains many naturally occurring substances that vary in composition from field to field. In order to chemically and toxicologically characterise the complex mixture of produced water, this may be simplified by grouping of substances.

Grouping should be based on a combination of a substance's chemical structure, toxic mode of action, PBT properties and the concentration level in produced water.

The OSPAR RBA group has established a list of PNEC values for the most common naturally occurring substances in the produced water based on already existing EQSs and PNECs, where available. Furthermore grouping of substances has been carried out.

Harmonised use of the list of PNECs enables sharing of information and comparison of the risk assessment results among Contracting Parties. This list should be maintained by OSPAR and updated on a regular basis (e.g. every 5-10 years) or as new scientific data become available. The PNEC list does not include added chemicals. Derivation of PNECs for added chemicals is described separately in paragraph 24 and Appendix 6 of the Guidelines.

The selection of PNECs for the list was based on the following prioritisation:

1. Environmental Quality Standards (EQS) derived under the WFD established for Priority Substances

2. Reliable PNECs derived from EU RARs

3. Reliable PNECs or EQS from publicly available literature sources

More detailed information about the PNEC selection, including a list of PNECs for naturally occurring substances typically found in produced water, is contained in the background document on the 'Establishment of a list of Predicted No Effect Concentrations (PNECs) for naturally occurring substances in produced water' (OSPAR Agreement 2014-05), which was adopted by OSPAR in 2014.

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Appendix 6

Use of marine assessment factors

The practical programme highlighted the fact that the assessment factors set out in ECHA and the 2003 Technical Guidance (TGD) for Deriving Environmental Quality Standards[1,2] have the potential to have a negative impact on the RBA approach by masking the overall contribution to produced water toxicity from natural components. This is a consequence of the introduction of an additional factor of 10 to the assessment factors derived for the marine environment.

The purpose of the RBA recommendation is to provide data to inform sound decisions on measures to reduce the risk from the discharge of produced water. The effect of the additional factor may be implementation of the wrong measures.

In a review of the science behind the additional factor, the Scientific Committee on Health and Environmental Risks[3] (SCHER) commented (Comment 15) that they did not accept the additional safety factor of 10 as a default for marine ecosystems as being generally justified. In the opinion of SCHER, the use of different approaches for both freshwater and marine ecosystems should be scientifically justified on a case-by-case basis.

Given the potential impact on their work, the ICG-RBA group notes that:

- The TGD recognises that there is a harmonised mandatory control system for the use and discharge of offshore chemicals already agreed within OSPAR (OSPAR 2000a; 2000b) and that the methodology proposed by OSPAR can be taken into consideration in determining assessment factors.
- The assessment factors proposed for the development of environmental quality standards are not directly relevant to determining whether there has been adequate dilution of offshore discharges within a specified water volume or area immediately adjacent to an offshore installation, as dispersion outside that zone ensures that acceptable water quality standards are rapidly achieved and maintained.
- The assessment factors within TGD 1993 originally proposed for risk assessment have been used to control chemical discharges from offshore installations for a number of years, and monitoring studies have indicated that they provide an appropriate level of protection to the ecosystem function.
- Discharges under OSPAR 2001/1 and 2012/5 are subject to strict control including requirements for hazard/risk assessment before discharge and regular review of BAT.

Given the existing safeguards, the aims of the ICG-RBA and the implementation of BAT and BEP, the ICG-RBA therefore proposes to continue to use the assessment factors set out in the 1996 Technical Guidance Document on Risk Assessment[5].

References

1. ECHA (2008) *Guidance on information requirements and chemical safety assessment. Chapter R.10: Characterisation of dose [concentration] - response for environment*, May 2008. http://echa.europa.eu/web/guest/guidance-documents/guidance-on-information-requirements-and-chemical-safety-assessment

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4. Mathijs G., D Smit, T K Frost & S Johnsen. *Achievements of risk based produced water management on the Norwegian Continental Shelf (2002-2008)*. In Integrated Environmental Assessment and Management, 7, No. 4, pp 668-677.

5. EC (1996). *Technical Guidance Document in support of the Commission Directive 93/67/EEC on Risk Assessment for New Notified Substances and Commission Regulation (EC) No 1488/94 on Risk Assessment for Existing Substances. Parts 1-4*. Office for Official Publications of the EC, Luxembourg

Appendix 7

Example methods for calculating an overall risk estimate for produced water for the substance based approach

In the Risk Assessment step, for all substances and/or groups of substances a PEC:PNEC ratio is calculated. In order to arrive at single risk indicator that represents the overall risk of the produced water, these individual PEC:PNEC ratios should be combined. There are several methods available for this, ranging from straightforward summation of the PEC:PNEC ratios to more comprehensive methods that are scientifically more correct. This appendix describes two methods for calculating an overall risk estimate from individual PEC:PNEC ratios including their scientific validity. The two methods presented only serve as examples. More methods are available and new methods will be developed when science evolves.

The simplest way of calculating an indicator for the overall risk of the produced water is by summing all individual PEC:PNEC ratios. This ΣPEC:PNEC, for instance at a certain distance from the discharge source, can serve as an indicator for the overall risk, subject to risk reduction.

Method 1.
Summation of PEC:PNEC ratios (concentration addition)

$\Sigma PEC:PNEC = PEC:PNEC_1 + PEC:PNEC_2 + \ldots..PEC:PNEC_n$

Backhaus et al. (2003) provides two mechanisms to calculate chemical mixtures, which are a concentration addition for similar acting substances and for dissimilar acting substances an independent action as a main mechanism. This defends the selection of a simple method like summing up PEC:PNEC ratios to establish a risk indicator for the produced water. However, if the mixture contains dissimilar acting chemicals, independent action is probably scientifically the better choice, since the relation between the risk (i.e. the likelihood of adverse effects to occur) and the PEC:PNEC ratio might not be equal for all substances and/or substances groups.

Species Sensitivity Distributions (SSDs) describe the relationship between the PEC and risk. For these distributions the risk (likelihood of adverse effects to occur) is expressed as the potentially affected fraction (PAF) of species, or, in other words, the likelihood of a randomly selected species to be affected above a defined effect level (e.g. NOEC or EC50 level, depending on what toxicity metric is used to establish this distribution).

When based on chronic NOECs, the 5% risk level (PAF) from an SSD corresponds to an exposure level that is equal to the PNEC (in line with the HC5 definition for PNEC, Van Straalen en Denneman, 1989). A SSD based on chronic NOECs can therefore easily be transformed into a PEC:PNEC to risk curve by dividing the measure of exposure on the x-axis by the PNEC. After this transformation the x-axis becomes unit free and the value of 1 on the x-axis (PEC:PNEC ratio) then corresponds with the 5% PAF (See figure A for an example). PEC:PNEC to risk curves can be developed for different Toxic Modes of Action and are equal for all substances and/or substance groups with the same Toxic Mode of Action.

The only parameter needed to establish a PEC:PNEC to risk curve for a specific Toxic Mode of Action is a measure of interspecies variation (the slope of the SSD describing how the risk changes on increasing exposure). When PEC:PNEC to risk curves have been established for the different Toxic Modes of Action, PEC:PNEC ratios can be calculated into PAF. Finally the different PAF values can be combined in the overall risk indicator msPAF.

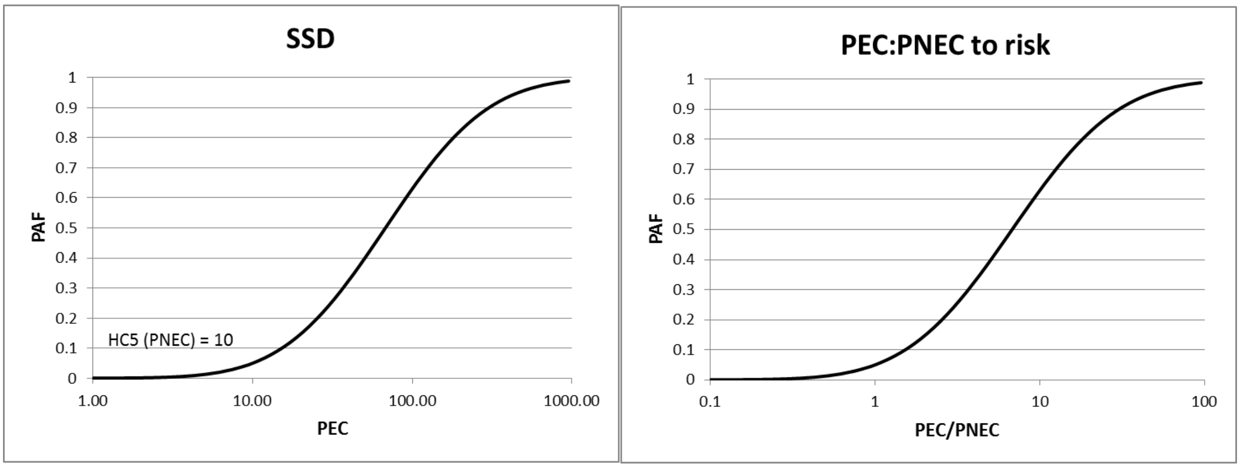

Figure A. Transformation of an SSD to a PEC:PNEC to risk curve by dividing the x-axis of the SSD (PEC) by the value of the PNEC (10 in this example).

Method 2.
Calculation of the multi-substance Potential Affected Fraction (msPAF) of species - independent action.

1. Sum PEC:PNEC ratios for substances and/or groups of substances with the same Toxic Mode of Action

   $\Sigma PEC:PNEC_{TMA1} = PEC:PNEC_1 + PEC:PNEC_2 + \ldots PEC:PNEC_n$
   $\Sigma PEC:PNEC_{TMA2} = PEC:PNEC_1 + PEC:PNEC_2 + \ldots PEC:PNEC_n$
   Etc. for all Toxic Modes of Action

2. Derive a PEC:PNEC to risk curve for each Toxic Mode of Action

   A PEC:PNEC to risk curve can be described by a lognormal distribution (often with 10 as base) using two parameters.
   Xm: the mean of the distribution
   SD: the standard deviation

   The SD of the PEC:PNEC to risk curve is equal to the slope of the Species Sensitivity Distribution. Harbers et al. (2006) published generic SSD slope values for several Toxic Modes of Action.

   If LOG10 is used as a base the Xm of the PEC:PNEC to risk curve can be derived with: $Xm = LOG(1) + (1.6449 \times SD)$

3. Calculate PAF for each $\Sigma PEC:PNEC_{TMA}$ by using the PEC:PNEC to risk curves

4. The overall risk value (msPAF) is calculated by combining the PAF related to each TMA, using the formula: $msPAF_{TMA1+2} = PAF_{TMA1} + PAF_{TMA2} - PAF_{TMA1} \times PAF_{TMA2}$.

Background information for the method described is provided in Smit et al. (2005).

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Annex 3

RBA Implementation Schedule

Table A3-1 RBA Implementation Schedule

2014			2015	
H1	**H2**		**H1**	**H2**
Forties D	Beryl B		Andrew	Forties B
Magnus	Lomond		Triton	North Everest
GP III	Bruce		Buzzard	Tiffany
Scott	Ninian South		Thames	Janice
Galahad	Northern Producer		Waveney	Neptune
Cleeton	Excalibur		Nelson	Curlew
Brent B	Solepit Clipper		Piper	Buchan
Clyde	Fulmar		Harding	Rough A
North Cormorant	Kittiwake		Alwyn	Douglas OSI
North Sea Producer	Kilmar		Athena	Dunlin
East Brae	Voyageur Spirit		Wingate	
2016			**2017**	
H1	**H2**		**H1**	**H2**
Forties C	Armada		Beryl A	Forties A
Foinaven	Babbage		BP Quad 204	Ninian North
Aoka Mizu	Banff		Apollo Spirit	Morecombe CPP
Hyde	Thistle		Gryphon	West Sole
Tyne	Lancelot		Golden Eagle	Leman
Leman	Anasuria		Trent	Pierce
Saltire	Gannet		Guinevere	Tartan
Tern Alpha	Montrose		Sean P	Rough B
Alba North	Millom West		Claymore	Burlington
Brae Bravo	Hewett 48/29		Eider	Cormorant A
	Balmoral		Elgin	
2018	**2018**			
H1	**H2**			
Beatrice Alpha	Murchison		Installations included in UK Trial	
Clair Phase 1	Douglas		Installations yet to come on stream	
Ravenspurn North	Brent C			
Ninian Central	Sevan Hummingbird			
Shearwater	Judy Platform			
Alba FSU	Brae Alpha			
Bleo Holm	Heather Alpha			
Britannia	Auk			
Hewett 52/5	Inde			
Malory	Clair Phase 2			

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Annex 4

Modelling, DREAM, PECs, PNECs and PEC:PNEC Ratios

This annex provides guidance on the minimum level of information and analysis required to undertake a risk based approach assessment. There may be site-specific reasons why a greater level of information and analysis is appropriate.

Acceptable Dispersion Models

A significant component of the risk-based approach is the examination of risks in the context of the location of the installation and under relevant metocean conditions. Three-dimensional dispersion models should therefore be used that are proven for use in this field and used internationally for regulatory purposes, such as DREAM, PROTEUS and MIKE. A recognised method for the calculation of risk for multiple substances shall be used and guidance is provided in Appendix 7 of the OSPAR 2012/7 Guidelines (see Annex 2). This method may be an intrinsic part of a recognised model for which the calculation basis is stated, or it may be a separate calculation. If it is the latter, DECC will expect to be provided with evidence that the calculation has been undertaken correctly.

The model should be capable of resolving volumes of $10^5 m^3$ which is typically reflected in the choice of grid size used in the model. If a particle tracking (Lagrangian) model is used, an appropriate combination of the number of particles and the time steps should be employed to simulate an unbroken produced water plume. Smoothing functions may be used for presentational purposes but not for risk calculation.

Temperature and salinity of the discharge proved to be significant aspects during the exploratory modelling undertaken to support the RBA trial, and the model should therefore also be capable of modelling density / buoyancy effects due to temperature and salinity.

The model outputs should include a graphical plan showing the typical extent of the maximum risk at any depth, along with a time-series graph of the volume affected above the 5% risk, demonstrating that the ‘typical’ time chosen is indeed reflective of the time-average. The maximum risk at any time at any location during the modelling period should also be shown, demonstrating that the area above the 5% risk has been captured in the modelled area. Cross sections of both these outputs should also be presented, which intersect the highest area of risk and show the full depth of the water column. Risk levels down to at most 0.1% should be shown in multiple steps, to add context to the overall behaviour of the plume. A 5% risk threshold should be adopted, but risk values greater than 5% can also be used to add context to the behaviour of the plume and the areas that are most at risk. The relative contributions of individual components to the overall risk, where it is >5%, should also be quantified and shown graphically.

It is expected that operators will apply reasonable skill and care in their use of modelling techniques and that this will include using trained and experienced personnel and robust input parameters. If DECC is not satisfied with the account of the modelling process in the final report of the assessment, or has doubts about the process, they may reject the results and/or commission further modelling to obtain comparative data. DECC may also request copies of input and output files for the model runs, and operators should therefore retain these files.

Metocean Data

The metocean data used for the modeling must come from a reputable source and may be measured or modelled. The origins of the data must be clearly described. It must be 3-dimensional with a spatial and time resolution that is appropriate to the area in which the installation is situated. For example, time intervals for currents of greater than 3 hours are likely to introduce anomalies because the tidal cycle will be poorly reproduced, whereas time intervals for wind of 6 hours would normally be considered acceptable. Operators can use their own metocean data, particularly if this has a higher degree of validation, but an explanation of the origins of the data and the protocols used to arrive at the model inputs will be required. The data shall be depth-resolved in as many layers as reflects the nature of the water column, and the operator shall provide evidence that the number of layers used is an appropriate representation of the dynamics of the water column.

Thermocline and halocline shall be incorporated into the model unless it can be demonstrated that these characteristics are uniform at all times, and the data used must be appropriate to the season of the modelling period.

It is recognized that the range of possible metocean conditions is very large. Whilst it is within the capability of available models to run scenarios over extended periods, the risk-based approach aims to identify significant contributors to risk that can then be considered in terms of risk reduction, and significant contributors can often be identified by modelling based on a subset of the available metocean data. It is also important to note that if a continuous discharge is being modelled it may take around two model-weeks for the discharge plume to reach a relatively stable state in the water column, and taking account of changes in tidal cycle, the minimum time for which results should be extracted is 28 days. It is therefore expected that operators with a continuous discharge will model the discharge for a period of at least 6 weeks. When calculating an annual time-averaged value for the volume of water above a risk level of 5%, the first two weeks of outputs should therefore be disregarded. However, the full 6 weeks may be included in calculating contributions to overall risk.

When undertaking modelling for the minimum 6-week period, it is expected that operators will choose metocean data that conservatively assesses risks to the environment, i.e. represents a minimum degree of dispersion, which is expected to be achieved in relatively calm conditions with low current velocities. In some cases, analysis of metocean data from commonly used sources may already have been undertaken and, where conservative modelling periods have been identified, these may continue to be used. Operators using alternative datasets should provide a justification for selecting specific modelling periods.

Modelling of the discharge over multiple representative periods of metocean data is acceptable and results from multiple periods may be combined to obtain representative annual average results, thereby reducing the conservatism in the assessment. It is understood that modelling multiple time periods is readily available using batch methods in existing applications and operators are encouraged to investigate modelling produced water over an annual range of conditions to minimize conservatism in the assessment and to identify seasonal variations.

Minimum Physical Parameters

Based on the experience of exploratory modelling undertaken during the RBA trial, the model must be capable of representing the processes of initial turbulent / momentum plume dynamics as well as regional transport and dispersion. To enable this, the model input data shall include, as a minimum:

- Discharge outlet diameter
- Discharge outlet orientation
- Discharge outlet depth
- Discharge flow rate
- Discharge temperature
- Discharge salinity

Representative Flow Scenarios

Actual predicted flow rates during representative periods of normal operation should be used for the modelling rather than averaged flows. If the predicted flow rates or discharge properties will vary significantly over the modelling period, as a minimum the highest representative flow rates should be used for the modelling purposes, and it will be informative to additionally model the main alternative flow rates or properties.

Periods of different discharge conditions, including periods of zero discharge should be taken into account in the overall annual average figure for the volume of water above a 5% risk level using the following formula, with T1 being the duration of discharge period 1 in days, $V1_{>5\%}$ being the corresponding average volume of water in m^3 above a risk level of 5%, etc.:

$$\text{Annual average volume above 5\% risk level} = \frac{V1_{>5\%} \times T1 + V2_{>5\%} \times T2 + [\text{etc.}]}{365.25}$$

Scenarios for Contingency Discharges during Re-injection Downtime

The contingency discharge of produced water from installations that rely on re-injection should, whenever possible, be modelled using discharge scenarios based on historic performance. As a minimum, it should be modelled for a period of a single month, ignoring the first two weeks of the output, but if the duration of the downtime could be up to 6 weeks per year then it should be modelled for that period.

The overall annual average volume of water reported as being above a 5% risk level should be calculated using the following formula, with T1 being the duration of the discharge period in days, $V1_{>5\%}$ being the average volume of water in m^3 above a risk level of 5%:

$$\text{Annual average volume above 5\% risk level} = \frac{V1_{>5\%} \times T1}{365.25}$$

Modelling of Natural Components

The components listed in Appendix 5 of the OSPAR 2012/7 Guidelines must be modelled. Operators should use the contemporary bi-annual analysis data as the inputs for the modelling. The assessment report should include details of the data and comments on whether they are representative, e.g. the extent to which the data aligns with historical analyses. Outlying data may be excluded from consideration where sufficient data exists for a statistical analysis and where the operator justifies the exclusion on a statistical basis, e.g. a 95% confidence interval, and should be replaced by averaged historical data that are considered the most representative, providing the assumptions and method underlying the choice are clearly stated.

It should be noted that the components to be modelled includes non-alkylated phenol (C0, i.e. non-alkylated C_6H_5OH), which is included in the DECC bi-annual sampling guidance but is not included in the EEMS returns. The levels of C0 should be included in the modelling for the C0-C3 grouping, and operators should therefore consult their produced water analysts to confirm that C0 is included. Where a breakdown of phenol and alkylated phenols is available to match the OSPAR 2012/7 PNEC categories, this should be used. It is also acceptable, and conservative, to use the EEMS reporting groupings as detailed below:

OSPAR 2012/7 PNEC Categories	EEMS Reporting Categories
Phenol (representing C0-C3 phenols)	'C1-C3 Alkyl Phenols' plus 'Other C1-C3 Alkyl Phenols' (check C0 is analysed and included)
Butylphenol (C4 alkyl phenols)	Included with C5 Alkyl Phenols as they have lower PNEC
Pentylphenol (C5 alkyl phenols)	'C4-C5 Alkyl Phenols' plus 'Other C4-C5 Alkyl Phenols'
Octylphenol (representing C6-C8 alkyl phenols)	'C6-C9 Alkyl Phenols' plus 'Other C6-C9 Alkyl Phenols'
Nonylphenol (C9 alkyl phenols)	Included with C6-C8 Alkyl Phenols as they have lower PNEC

Where insufficient EEMS data exists to confirm that the inputs are representative, e.g. for a new field, the operator should discuss delaying the assessment with DECC until stable operating conditions have been achieved and the results of at least two sampling and analysis programmes are available.

Modelling of Added Chemicals

Added chemicals that could contribute to the risk relating to the discharge must be included in the modelling, using the toxicity, biodegradation and LogPow data provided on the CEFAS template or in the original HOCNF application. Where only toxicity data is available, operators should use conservative assumptions regarding biodegradation (none), evaporation (none, or zero vapour pressure) and sediment partitioning (K_{OC} 0.001).

Chemical inputs to the modelling should be consistent with production chemical permit use and discharge assumptions. Where multiple chemicals are included in a permit for the same purpose, but only one chemical is applied at any time, the chemical presenting the highest potential risk should be included in the modelling.

Routine batch treatment chemicals, e.g. chemicals used for periodic biocide treatments, should be included if they are considered to represent a significant risk or are being administered at the time of the sampling. ‘Routine’ is interpreted as typically at least once per month. Non-routine batch treatment chemicals, e.g. chemicals used for periodic maintenance activities, do not have to be included. Non-routine operating conditions, e.g. field shutdowns and start-ups, should also be excluded from the modelling.

PLONOR chemicals that are not expected to significantly contribute to the risk need not be included, and all excluded chemicals, and chemicals with limited data, should be described in the assessment report.

If it is found that added chemicals dominate the predicted risk, it will informative to present results with and without the added chemicals, as the management options for natural components and added chemicals will normally be very different.

Predicted Environmental Concentration (PEC)

The PEC is the three-dimensional and time variable concentration of the discharge or discharge components in the receiving environment. The PEC can be calculated for all components input to the model that are considered to have the potential to result in harmful impact in marine organisms. The selected model should, whenever possible, calculate the fate of the discharge, or each component of the discharge, taking account of:

- Currents (tidal, residual, meteorological forcing);
- Turbulent mixing (horizontal and vertical);
- Density (differences in salinity and temperature);
- Evaporation at the sea surface, and
- Reduction of the concentration due to biodegradation.

Predicted No Effect Concentration (PNEC)

The PNEC is the estimated lower limit that could have effects on the biota, as determined for a single component or component group. The PNEC value can be derived from the EC_{50}, the LC_{50} or the No Observed Effect Concentration (NOEC) data obtained from laboratory toxicity testing of the whole effluent or the individual components, by dividing the EC_{50}, LC_{50} or NOEC by an assessment factor to provide an estimate of the chronic PNEC. The assessment factor is applied to take into account the uncertainty associated with extrapolation of laboratory test results to derive a measure of effects in the marine environment. Where there is limited available data, a higher assessment factor is applied, which generates a lower PNEC.

An assessment factor of 100 is currently used for most offshore oil and gas chemical risk assessments where there is a minimum level of testing to cover three trophic levels, which can include bacteria. More recent ECHA guidance (2008) recommends an assessment factor of 10,000. However, that guidance was primarily developed for near-coastal waters, and greater dispersion and dilution is expected in offshore waters. It is also relevant that the current assessment factor of 100 has been use for chemical discharges associated with offshore oil and gas activities for a number of years, and monitoring studies suggest that it provides appropriate protection. For the purpose of the RBA trial, assessment factors of 1,000 and 10,000 were compared but, following discussions at OSPAR OIC, an assessment factor of 1,000 was selected as an appropriate compromise for offshore discharges.

The ECHA recommended assessment factors are detailed Table A4-1.

Table A4-1 Assessment factors used to derive a PNEC for saltwater for different data sets (ECHA, 2008)

Available Data	Assessment Factor
Lowest short-term result (e.g. EC_{50} or LC_{50}) for three freshwater or saltwater taxonomic groups representing three trophic levels (usually algae, crustaceans and fish).	10,000
Lowest short-term result (e.g. EC_{50} or LC_{50}) for three freshwater or saltwater taxonomic groups representing three trophic levels (usually algae, crustaceans and fish) and two additional marine taxonomic groups (e.g. echinoderms and molluscs).	1,000
One long-term test result (e.g. EC_{10} or NOEC) for freshwater or saltwater species (e.g. crustacean reproduction or fish growth studies).	1,000
Lower long-term result (e.g. EC10 or NOEC) for two freshwater or saltwater species representing two trophic levels (e.g. algae and/or crustaceans and/or fish).	500
Lowest long-term result (e.g. EC_{10} or NOEC) for three freshwater or saltwater species representing three trophic levels (usually algae, crustaceans and fish).	100
Lowest long-term result (e.g. EC_{10} or NOEC) for two freshwater or saltwater species representing two trophic levels (algae and/or crustaceans and/or fish) and one additional marine taxonomic group (e.g. echinoderms or molluscs)	50
Lowest long-term result (e.g. EC_{10} or NOEC) for three freshwater or saltwater species representing three trophic levels (usually algae, crustaceans and fish) and two additional marine taxonomic groups (e.g. echinoderms and molluscs).	10

PNECs for Natural Components

The PNECs listed in the OSPAR 2012/7 Guidelines must be used, but operators may provide commentary on the PNECs in the assessment report if this is considered to be relevant to the results obtained. Where the PNECs are designated as a value above the background level (cadmium, chromium, mercury and zinc), the operator should provide a reputable scientific source for any local background level. If a local level cannot be identified, risks may be assessed using the background levels included in the OSPAR Agreement on Background Concentrations for Contaminants in Seawater, Biota and Sediment (OSPAR Agreement 2005-6). The relevant table is reproduced below:

Table A4-2 Ranges of background concentrations of dissolved trace metals[ng/kg] in specific regions of the Convention Area.

Element	Atlantic Ocean	Northern North Sea	English Channel Southern North Sea	Celtic Sea
Cd	5-25	8-25	9-12	4-12
Cu	50-100	50-90	140-360	60-80
Co			6-24	3-5
Cr (VI)	90-120			
Fe	25-150	200-600		
Pb	5-20	10-20	10-17	10-20
Mn	10-25	60-150		
Hg	0,1-0,4	0.2-0.5		
Ni	160-250	200-250	180-260	120-160
Se (IV)	2-20			
V	1250-1450	1250-1450	900-1050	
U	3000-3500	3000-3500		
Zn	30-200	250-450	170-280	120

It should be noted that the PNECs listed in the OSPAR 2012/7 Guidelines are currently being reviewed, and a revised list will be submitted to the OSPAR Offshore |Industry Committee (OIC) in March 2014 for potential adoption by OSPAR. DECC will therefore advise operators when any new list should be used for RBA assessments.

Where a known natural component is not included in the list of PNECs in the OSPAR 2012/7 Guidelines, or any replacement list, it does not have to be included in the assessment.

PNECs for Added Chemicals

Worst-case aquatic toxicity data included in the Cefas template or the HOCNF application should be used to generate a PNEC using an assessment factor of 1,000.

PNECs less than the Lowest Acceptable Value

Some models may have a lower limit for the PNEC threshold, e.g. 1 part per trillion. Where this is the case, it is permissible to increase the PNEC by a factor of 100 and to simultaneously increase the concentration in the discharge by a factor of 100. This will result in an acceptable risk calculation. (Note: The latest version of DREAM (6.5.1) issued at the end of 2013 no longer has a limitation on the use of very low PNEC values).

Use of DREAM

DREAM was developed by SINTEF in collaboration with a number of major operators, including ConocoPhillips, Total, Eni, Statoil, Shell, Norsk Hydro, ExxonMobil and BP. The DREAM Environmental Impact Factor (EIF) concept is the accepted method for assessing produced water and chemical discharges in Norway, and the model has a strong scientific basis. It is described in more detail at www.sintef.no/erms and the computational guidelines are provided in Utvik, et al. (2003).

DREAM is a dispersion model based on wind and 3D current data that can be used for whole effluent or component-specific fate assessments, based on the physicochemical properties of the effluent or its components in addition to relevant toxicity and biodegradation data. It can be used for a variety of effluents, and components such as hydrocarbons, heavy metals and added offshore chemicals, and the output includes an assessment of the overall risk to the environment.

It should be noted that the PNEC values for a number of natural occurring substances in PW are already built into the DREAM model, and it will therefore be necessary to check whether these align with the values included in the OSPAR 2012/7 Guidelines. If there are differences, the values included in the model should be substituted with the values included in the guidance.

Environmental Impact Factor

The EIF is a quantified measure of the environmental risk that is most commonly used for the assessment of discharges of PW and associated chemicals resulting from offshore oil and gas production. The EIF is based on a comparison of the modelled concentrations of the components in the receiving water column (i.e. the PEC) and the lowest theoretical concentrations of the same components that would be expected to result in harmful effects in marine organisms (i.e. the PNEC). Where the PEC is greater than the PNEC there is considered to be a risk to 5% of the most sensitive species. The model can be used to determine the specific volume and/or area of water in which the PEC is greater than the PNEC, where harmful effects might occur as a result of the PW discharge. The methodology is described in ECB (2003), and is commonly used for the assessment of discharges of offshore chemicals under the OSPAR Harmonised Mandatory Control System.

An EIF of 1 indicates that the PEC:PNEC ratio in a 100 m x 100 m x 10 m (10^5 m^3) volume of water is >1, i.e. there is considered to be a risk to 5% of the most sensitive species). The risks relating to individual components in the release are summed to derive a total risk using the probability formula described by deZwart and Posthuma (2005). If the EIF is <1, it indicates that the PEC:PNEC ratio is >1 in a smaller volume of water, and if the EIF is >1, it indicates that PEC:PNEC ratio is >1 in a larger volume of water.

DREAM predicts the PEC of the release, or the components in the release, within any given area, in terms of the volume of water within that area where the PEC:PNEC ratio is >1. When assessing components, the model sums each volume of water where the PEC:PNEC ratio of individual components is >1 to derive the EIF for the release. The relative contribution of the components to the total risk, as described by the EIF, is also predicted. The principle underlying the methodology is documented in the EU Technical Guidance Document on chemical risk assessment (ECB, 2003). The EIF concept is illustrated in Figure 2-1.

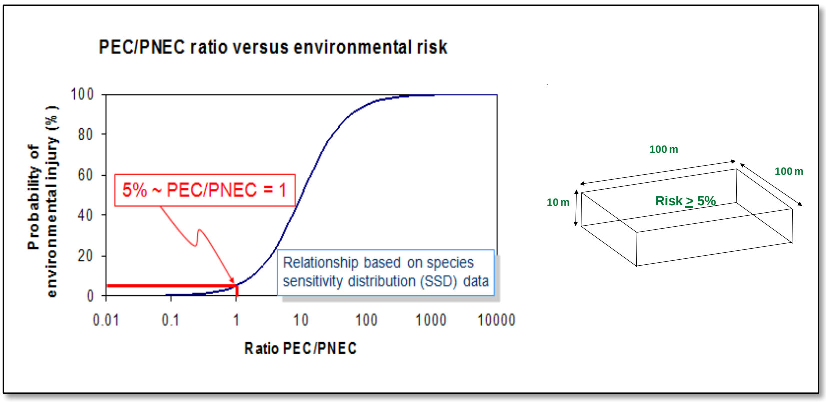

Figure A4-1 Illustration of the Environmental Impact Factor concept

The model is typically run for a period of 30 days, using relatively quiescent conditions, as sensitivity studies indicate that equilibrium in terms of risk would be reached within this time.

Two EIFs can be derived for each discharge scenario, the maximum EIF and the time-averaged EIF. The maximum EIF is an instantaneous maximum value, i.e. the highest EIF derived during the 30 day period, and is sensitive to small changes in environmental inputs, such as wind and currents, during the 30 day period. The time-averaged EIF is more stable, and is the average during the 30 day period reflecting the establishment of stable conditions. The maximum EIF was used for the RBA trial, to address the worst-case scenario.

The EIF does not define an “acceptable” limit, and comparing installations is not advisable because of the different nature and scale of the discharges and the different environmental conditions. The primary purpose is to evaluate whether further measures are justified to minimise the impact of the PW discharge, and to compare the potential benefits of different risk reduction options.

As the use of DREAM is relatively new for the UKCS, there is very little published EIF data for UK installations. However, in 2002 Statoil published EIF data for the discharge of PW from 25 fields in the North Sea. The values ranged from 0 (zero) to 15,000, with an EIF of 100 or less for seven fields, and EIF of approximately 1,000 for the majority of the fields and an EIF of >5,000 for three fields (StatoilHydro, 2008).