OSPAR COMMISSION

Overview assessment of the implementation of OSPAR Recommendation 2001/1 for the management of produced water from offshore installations

2010

Offshore Industry Series

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR Convention”) was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Community and Spain.

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, la Finlande, la France, l’Irlande, l’Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d’Irlande du Nord, la Suède et la Suisse et approuvée par la Communauté européenne et l’Espagne.

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Executive Summary

The overall goal is to prevent and eliminate pollution from offshore sources

In accordance with the overall objectives of the OSPAR Commission for the Offshore Oil and Gas Industry, the purpose of Recommendation 2001/1 as amended by Recommendation 2006/4 is to prevent and eliminate pollution by oil and other substances caused by discharges of produced water into the sea. This report presents an overview assessment of the implementation of OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations as amended by Recommendation 2006/4.

Produced water is the main source of oil discharges

The main source of oil discharge from routine production is produced water. This is the water that comes from the reservoir along with the oil. Produced water contains oil, in addition to chemicals and hazardous substances occurring naturally in the reservoir, such as heavy metals, aromatic hydrocarbons, alkyl phenols and radionuclides.

OSPAR has set a performance standard for oil in produced water and an overall reduction target

In order to reduce discharges of oil in produced water, the OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations defined a performance standard of 40 mg dispersed oil per litre of produced water. This limit was later reduced to 30 mg of dispersed oil per litre of produced water with effect from 2007. Furthermore, Contracting Parties agreed that by 2006 they should have achieved a minimum of 15% reduction in the total quantity of oil in produced water discharged into the sea compared to the year 2000.

Most countries have met or partly exceeded the 15% reduction target in the total amount of oil in produced water

Most of the Contracting Parties have achieved or partly exceeded the 15% reduction target as required by the Recommendation for dispersed oil discharges in produced water. The increase in number of offshore installations, where injection of produced water is taking place, has led to a considerable increase of volume of produced water injected. OSPAR Contracting Parties are continuing their efforts in cooperation with the offshore industry to comply with the performance standard of 30 mg of dispersed oil per litre of produced water.

Récapitulatif

Le but général est la prévention et l'élimination de la pollution provenant de sources offshore

Conformément aux objectifs généraux de la Commission OSPAR au sujet des Industries pétrolière et gazière offshore, le but de la Recommandation 2001/1 telle qu'amendée par la Recommandation 2006/4 est de prévenir et d'éliminer la pollution causée par les hydrocarbures et autres substances résultant des rejets d'eau de production en mer. Le présent rapport donne une évaluation récapitulative de la mise en oeuvre de la Recommandation 2001/1 pour la Gestion de l'eau de production provenant des installations offshore, tel qu'amendée par la Recommandation 2006/4.

Les eaux de production sont la source principale des rejets d'hydrocarbures

L'eau de production représente la source principale des rejets d'hydrocarbures de la production de routine. Il s'agit de l'eau qui arrive du réservoir avec l'hydrocarbure. L'eau de production contient des hydrocarbures, en plus des produits chimiques et des substances dangereuses se trouvant naturellement dans le réservoir, telles que métaux lourds, hydrocarbures aromatiques, phénols alkylés et radionuclides.

OSPAR a fixé une norme d'émission pour les hydrocarbures dans les eaux de production ainsi qu'une cible en tant que réduction générale

Afin de réduire les rejets d'hydrocarbures dans les eaux de production, la Recommandation OSPAR 2001/1 relative à la Gestion de l'eau de production des installations offshore définit une norme d'émission de 40 mg d'hydrocarbures dispersés par litre d'eau de production. Cette limite fut réduite plus tard à 30 mg d'hydrocarbures dispersés par litre d'eau de production à partir de 2007. De plus, les Parties contractantes ont convenu qu'au plus tard en 2006 ils auraient atteint un minimum de 15% de réduction de la quantité totale d'hydrocarbures dans l'eau de production rejetée dans la mer, comparée à l'année 2000.

La plupart des pays ont atteint ou même dépassé en partie la cible de 15% de réduction de la quantité totale d'hydrocarbures dans l'eau de production

La plupart des Parties contractantes ont atteint ou dépassé en partie la cible de 15% de réduction, telle que requise dans la Recommandation relative aux rejets d'hydrocarbures dispersés dans l'eau de production. L'augmentation du nombre d'installations offshore où se produit l'injection d'eau de production a entraîné une augmentation considérable du volume d'eau de production injectée. Les Parties contractantes d'OSPAR continuent leurs efforts, en coopération avec l'industrie offshore, afin de respecter la norme d'émission de 30 mg d'hydrocarbures dispersés par litre d'eau de production.

1. Introduction

1.1 Offshore oil and gas strategy

The objective of the 2003 OSPAR Offshore Oil and Gas Industry Strategy (Reference number: 2003-21) is to prevent and eliminate pollution from offshore sources and to protect the OSPAR maritime area against the adverse effects of offshore activities so as to safeguard human health and conserve the marine ecosystems. Accordingly, the goals of OSPAR Recommendation 2001/1 as amended, for the Management of Produced Water from Offshore Installations are:

- to reduce (and ultimately eliminate) the input of oil and other substances into the sea resulting from produced water from offshore installations, with the ultimate aim of eliminating pollution from those sources;
- to ensure that an integrated approach is adopted, so that reduction in oil discharge is not achieved in a way that causes pollution in other areas and/or other environmental compartments; and
- to ensure that effort is made to give priority to actions related to the most harmful components of produced water.

This report gives an overview of the implementation of the OSPAR Recommendation 2001/1 as amended Contracting Parties for the period up to 2007. Additional data on the discharges for 2008 are presented in the OSPAR Report on Discharges, spills and emissions from oil and gas installations offshore in 2008 (OSPAR, 2010).

1.2 Policy context, including link to international measures and EU

OSPAR is the key international governmental organisation specifically addressing environmental aspects of offshore oil and gas activities in the North-East Atlantic. In addition, other international organisations, such as the European Union, specifically the REACH Regulation (European Parliament and Council, 2006) and the Marine Strategy Framework Directive (European Parliament and Council, 2008), address aspects of the offshore oil and gas industry.

2. What is the problem?

Produced water is the water contained within the hydrocarbon reservoir that is separated and discharged during production. Produced water is the main source of oil discharges from the offshore industry and also contains a variety of naturally occurring hazardous substances such as heavy metals, aromatic hydrocarbons, alkyl phenols and radioactive substances (OSPAR 2010). Other sources are spills (BONN 2010).

The concentrations of heavy metals in produced water, so far measured, show to be generally close to background levels, with the exception of lead in produced water from gas platforms which is higher than that from oil installations. However, produced water volumes from gas installations are low. In addition, produced water may contain residues of chemicals which are used to assist drilling, maintenance and in the production of oil and gas.

3. What has been done so far?

OSPAR Measures implemented

The OSPAR Commission over time has developed a number of measures on produced water. As early as 1978, the Paris Commission (PARCOM), one of the predecessors of the OSPAR Commission, recommended a target of 40 mg/l oil-in-water. In 1986 this became the emission standard for platforms. In

1992 PARCOM developed a Recommendation advocating BAT (best available technology) for produced water management on offshore oil and gas installations.

Following the adoption in 1999 of the OSPAR Offshore Industry Strategy, OSPAR has adopted a range of programmes and measures addressing production phase activities, including OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations (as amended). This Recommendation has established *inter alia* a performance standard for dispersed oil of 30 mg/l discharge for produced water discharged into sea (§3.2) and the goal that each Contracting Party should ensure that the total quantity (*i.e.* dispersed and dissolved oil) of oil in produced water discharged into sea in the year 2006 from all offshore platforms under its jurisdiction has been reduced by a minimum of 15% compared to the equivalent discharge in the year 2000 (§4.2). OSPAR has also recommended a zero discharge "point of departure" for new installations; *i.e.* from 1 January 2002 each Contracting Party should ensure that new or substantially modified offshore installations should minimise discharges and, where appropriate, discharge no oil in produced water into the sea (§3.4).

By 2020, Contracting Parties are required to achieve 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 (§3.5a). In addition, Contracting Parties should, in accordance with the objective and timeframe of the OSPAR Strategy with regard to Hazardous Substances and the 1998 Ministerial Sintra Statement, achieve a continuous reduction in discharges of hazardous substances via produced water, by moving towards cessation of discharges of hazardous substances. The ultimate aim is to achieve near background concentrations in the marine environment for naturally occurring substances and close to zero concentrations of synthetic substances by 2020 (§3.5b). These objectives were confirmed in the 2010 North-East Atlantic Strategy, including the updated OSPAR Offshore Oil and Gas Industry Strategy and Strategy on Hazardous substances (OSPAR Agreement 2010-3).

Hazardous substances contained in produced water are also addressed by other OSPAR measures, including OSPAR Decision 2000/2 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals (as amended by OSPAR Decision 2005/1), OSPAR Recommendation 2008/1 Amending OSPAR Recommendation 2000/4 on a Harmonised Pre-screening Scheme for Offshore Chemicals and OSPAR Recommendation 2000/5 on a Harmonised Offshore Chemical Notification Format (HOCNF) (as amended by Recommendations 2005/3 and 2008/2).

4. Reporting obligations, data submission and reporting methods

4.1 Reporting obligations

OIC 2002 in Cadiz agreed on a format for the implementation of OSPAR Recommendation 2001/1 and that, for the first time, OIC 2005 should examine a draft review assessment of national implementation reports submitted on the basis of this format, and every 4 years later.

OIC 2003 adopted a first overview assessment of national plans towards the implementation of OSPAR Recommendation 2001/1 in document OIC 03/4/6 Rev.1. OIC 2003 also noted that there was currently no information on how Contracting Parties would set up baselines for 2000 in order to verify the achievement of the 15% reduction target by 2006 for the quantity of total oil in produced water.

A second overview assessment of implementation reports on OSPAR Recommendation 2001/1 was adopted in 2005, after agreement by OIC 2005 (OIC 05/4/1-E). The overview concluded that all relevant Contracting Parties had implemented the OSPAR Recommendation for the management of produced water and that the 30 mg/l performance standard would be implemented by them from 2006. Relevant Contracting Parties are making efforts to reach the 15% reduction target for 2006, although some of them have indicated that it would be difficult to reach that target.

By adopting the OSPAR Recommendation 2006/4 Amending OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations, Contracting Parties agreed in §9.1 of the Recommendation to continue to submit implementation reports, to begin by 31 December 2008 to the appropriate OSPAR subsidiary body and every four years thereafter unless otherwise specified by the Commission. Furthermore the Recommendation also includes §9.2 in which it is stated that where Contracting Parties intend to demonstrate compliance with paragraph 3.2 of the Recommendation (15% reduction target) solely on the basis of the analytical results of the application of the agreed reference method for dispersed oil (OSPAR Agreement 2006-6), the implementation report should include justification for such strategy.

4.2 Data submission

Most of the Contracting Parties with offshore oil and gas installations – Denmark, Germany, Ireland, Norway, the Netherlands and the United Kingdom – have submitted their implementation reports for inclusion in this assessment. No information was received from Spain. The implementation reports and the draft assessment were verified during meetings of the Expert Assessment Panel (EAP) established by the Offshore Industry Committee. The implementation reports were presented to OIC as meeting documents (as complied in OIC 10/4/2) and can be obtained from the OSPAR Secretariat (in agreement with the respective Contracting Party).

5. Results of the assessment

5.1 Implementation report on compliance

Recommendation 2001/1 as amended by Recommendation 2006/4 has been implemented as follows:

Contracting Party	Reservation applies?	Is measure applicable in your country?	By legislation?	By administration action?	By negotiated agreement?
Denmark	No	Yes	No	Yes	Yes
Germany	No	Yes	Yes	Yes	No
Ireland	No	Yes	No	Yes	Yes
Netherlands	No	Yes	Yes	No	Yes
Norway	No	Yes	Yes	Yes	No
United Kingdom	No	Yes	Yes	Yes	Yes
Spain	No	No	No	No info	No info

5.2 Implementation report on Effectiveness

Reports of discharges to the sea and emissions to air from offshore installations are submitted to the OSPAR Commission by the relevant Contracting Parties on annual basis (OSPAR, 2010). The effectiveness of the implementation of the Recommendation can be demonstrated by using these reports which have been validated by the EAP. The assessment has to take into account the development of offshore activities since 2001, i.e. the increasing number of offshore installations having discharges to the sea in the OSPAR maritime area together with the trend in quantity of produced water discharged and other factors like the quantity of produced water injected. These factors set the scene in establishing the effectiveness of the implementation of the Recommendation.

5.2.1 Increasing number of offshore installations with discharges to the sea

The number of offshore installations having discharges to the sea in the OSPAR maritime increased with about 50% from 2000 up to 2007. This increase is flattered by the fact that in 2000 the UK revised its criteria

for counting subsea installations and Norway started to report its subsea installations for the first time in 2004. Although the methodology for counting offshore installations has been questioned, it can still be concluded that a considerable increase occurred requiring extra efforts by the offshore industry to achieve the goals of the Recommendation (*i.e.* especially the 15% reduction target to be achieved by the end of 2006).

Table 1. Number of offshore installations with discharges to the sea 2000-2007

Country	2000	2001	2002	2003	2004	2005	2006	2007
Denmark	16	19	17	19	20	17	18	19
France	0	0	0	0,1	0	0	0	0
Germany	3	3	2	2	3	4	3	3
Ireland	2,5	4	4	NI	6	6	7	7
Netherlands	108	114	114	123	124	129	128	130
Norway	60	65	67	63	103	108	109	125
Spain	1	1	1	1	1	1	1	1
UK	298	332	381	383	396	407	416	444
Total	**488,5**	**538**	**586**	**592**	**653**	**671**	**683**	**730**

5.2.2 Quantity of displacement and produced water discharged daily to the sea (in m^3 per day), 2000 – 2007

The annual OSPAR report provides data for the quantity of produced water discharges to the sea, including displacement water discharges (the quantity of displacement water discharges contributes for about 10% of the total water discharges). Table 2 shows the trend in the quantity of water discharges which did not increase significantly in the period 2000 – 2007 but stabilised at about 1.2 million m^3 per day.

Table 2. Quantity of produced water and displacement water discharged to the sea (in m^3 per day), 2000 – 2007

Country	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Denmark	43 909	46 273	44 158	54 243	67 578	74 522	76 677	75 204
Germany	14	14	19	18	22	22	26	23
Ireland	6	7	8	NI	8	7	591	6
Netherlands	31 820	38 117	24 263	21 381	23 313	24 275	26 429	34 064
Norway	461 323	493 342	490 826	524 910	537 342	533 349	510 618	558 647
Spain	0	0	0	0	0	0	0	0
UK	652 188	696 482	738 082	719 950	690 481	642 967	603 112	553 139
Total	**1 189 260**	**1 274.236**	**1 297 356**	**1 320 502**	**1 318 745**	**1.275.143**	**1 217 453**	**1 221 082**

This, despite the fact that the oil and gas fields in the OSPAR Maritime area are considered to be mature fields, or are even in the 'end of life' period. The total quantity of displacement and produced water discharges to the sea per year was 434 million m^3 in 2000 while for 2007 this was 446 million m^3 per year, which is an increase of only about 3%. A possible explanation for this minor increase may be the fact that the volume of water injected has nearly tripled in the same period (see Table 4).

5.2.3 Number of offshore installations injecting produced water and quantity injected, 2001 – 2007

The following table gives an overview of the number of offshore installations where the injection of produced water is applied. The number nearly doubled in the period 2001 – 2007 (no data for 2000 available).

Table 3. Number of offshore installations injecting produced water, 2001 – 2007

Country	2001	2002	2003	2004	2005	2006	2007
Denmark	4	4	3	3	3	6	6
Germany	1	1	1	1	NA	1	1
Ireland	0	0	0	NI	0	0	0
Netherlands	2	3	4	5	4	4	5
Norway	13	16	18	20	19	18	17
Spain	1	1	1	1	1	1	1
UK	9	10	13	12	16	20	23
Total	**30**	**35**	**40**	**42**	**43**	**50**	**53**

In the same period the quantity of produced water injected per year increased from 30 million per year to about 88 million.

Table 4. Quantity of produced water injected per year (in m^3), 2001 - 2008

Country	2001	2002	2003	2004	2005	2006	2007
Denmark	8 024 636	10 157 548	10 325 765	10 697 293	12 225 001	11 701 580	12 655 105
Germany	84 469	69 992	122 836	185 489	NA	824 112	1 179 967
Ireland	0	0	0	0	0	0	0
Netherlands	328 062	5 679 617	6 640 917	6 376 580	7 050 010	5 296 785	6 685 848
Norway	13 153 719	16 636 508	21 286 897	29 794 046	32 569 423	31 693 056	26 665 258
Spain	760	476	799	3808	2926	770	992
United Kingdom	8 763 188	14 075 593	20 583 625	27 921 396	24 862 312	30 669 337	40 534 015
Total	**30 354 834**	**46 619 734**	**58 960 839**	**74 978 612**	**76 709 672**	**80 185 640**	**87 721 185**

5.2.4 Quantity of oil discharged in produced water to the sea, 2001 – 2007

The following tables 5, 6 and 7 show the quantity of dispersed oil, dissolved oil and total oil discharges in produced to the sea in the period 2001 – 2007. The 2000 data, except for the dispersed oil discharges in table 5, are not shown, since some Contracting Parties did not have reliable data for dissolved oil discharged in that year. OIC 2005 agreed on the base line figures at Annex 8 to the Summary Record OIC 05/15/1-E. Except for Denmark, Germany and the Netherlands, other Contracting Parties stated that they did not have enough confidence in their national collected data on dissolved oil discharges in the base year 2000. Therefore the tables 6 and 7 only show the data for the period 2001 – 2007. Due the changing of the analysis method, 2007 data was not part of the assessment made for the years 2000 – 2006. Therefore a bold line in the tables 5 – 8 is drawn to separate the 2007 data from the other data.

Table 5. Quantity of dispersed oil discharges in produced water to the sea (in tonnes), 2000 - 2007

Country	2000	2001	2002	2003	2004	2005	2006	2007
Denmark	261	290	294	358	427	446	382	383
Germany	0	0.22	0.17	0.20	0.20	0	0	0
Ireland	0	0	0	0	0.12	0	0	0
Netherlands	189	252	148	114	119	108	114	146
Norway[1]	2738	3153	2827	2438	2495	2714	2246	1532
Spain	0	0	0	0	0	0	0	0
United Kingdom	5751	5694	5721	5276	5279	4970	4356	2959
Total	8939	9389	8990	8176	8320	8238	7098	5020

[1] * The numbers for Norwegian discharges in this table are slightly different from the numbers in the annual reports due to repeated examination of the reported data, followed by updating of the numbers.

As from 2007 the data is biased due to the changing of the analysis method by Denmark, Norway and the UK at the end of 2006. Due to this changing the 2007 data cannot be used for the assessment of the effectiveness of the Recommendation. Based on data for the period 2000 – 2006 a reduction of 20.6% of dispersed oil discharges in produced water can be calculated meaning that 15% reduction target have been achieved on the whole OSPAR maritime area for dispersed oil. Table 6 gives an overview for the discharges of dissolved oil in produced water.

Table 6. Quantity of dissolved oil discharged in produced water in the sea (in tonnes), 2001 - 2007

Country	2001	2002	2003	2004	2005	2006	2007
Denmark	205	192	265	292	348	360	353
Germany	0.32	0.42	0.50	0.80	0.76	1	1
Ireland	0	0	0	0.38	0.02	0	0
Netherlands	82	57	72	76	70	52	69
Norway	1101	1165	906	1547	1524	1711	1879
Spain	0	0	0	0	0	0	0
United Kingdom	3710	4260	3599	3276	3049	2756	2273
Total	5098	5674	4843	5192	4992	4880	4575

The decrease of dissolved oil discharges in produced water in the sea was in the period 2001 – 2006 for about 4%. However the EAP concluded in 2008 that the data for dissolved oil discharges in the period prior to 2004 are not reliable. Furthermore most of the techniques deployed to achieve the 15% reduction target as mentioned in the Recommendation are primarily focussing on the separation of dispersed oil; therefore this decrease of dissolved oil discharges is not expected to be significant as in the case for dispersed oil discharges.

Table 7 shows an overview of the total oil discharges in produced water in the sea for the period 2001 – 2007. Based on the data for dispersed oil discharges for the period 2001 – 2006 it was calculated that the reduction percentage achieved by 2006 was about 20.5%. Not taking into account the uncertainties in the data and having the data adapted to new data from Norway, the total oil discharged in produced water decreased for about 16.4% in the period 2001 – 2006.

Table 7. Quantity of total oil discharged in produced water in the sea (in tonnes), 2001 - 2007

Country	2001	2002	2003	2004	2005	2006	2007
Denmark	495	486	623	723	793	741	737
Germany	1	1	1	1	1	1	1
Ireland	0	0	0	1	0	0	0
Netherlands	334	205	186	195	178	166	215
Norway	4254	3992	3491	4200	4357	4090	3505
Spain	0	0	0	0	0	0	0
United Kingdom	9404	9981	8875	8555	8019	7112	5232
Total	14 488	14 664	13 176	13 675	13 348	12 110	9 690

5.2.5 Number of offshore installations exceeding the performance standard of 30 mg/l

Table 8 shows the continuous effort by the offshore industry to comply with the performance target on all offshore installations. Up to 2006 the performance standard was 40 mg/l and from the 1January 2007 the new performance standard of 30 mg/l came into effect.

Table 8. Number of offshore installations exceeding the performance standard of 40 mg/l (until 2006) or 30 mg/l (from 1 January 2007)

	2000	2001	2002	2003	2004	2005	2006	2007
Total number of installations with discharges in the Convention Area	489	537	586	623	648	671	671	730
Number of installations exceeding 40 or 30 mg/l (from 2007)	15	23	20	22	28	25	14	22
Quantity of dispersed oil discharged	365	312	216	217	737	1044	469	319

So far only the Netherlands, Norway and the UK reported to have offshore installations exceeding the performance standard of 30 mg/l in 2007 on annual basis. All three Contracting Parties reported to have evaluated BAT and BEP for each offshore installation exceeding the performance standard.

5.3 Methods of analysis, approved by competent authority

Contracting Parties reported about their national experiences with the new OSPAR Reference (GC) method compared to the old one (IR). The Netherlands and Germany reported to have implemented the new OSPAR Reference method in June 2009.

The following experiences by CPs at the EAP meetings have been shared:

- Denmark: An increase of 10% has been experienced due to the changing to the new OSPAR Reference method compared to former IR method. Comprehensive reports by Denmark have been sent to the Netherlands containing results of the implementation of the new OSPAR reference method (GC-FID) correlated against alternative offshore measuring IR method for most Danish offshore installations. Average correction factors have been determined to be in a range of 0.75 – 1.66 meaning in a range of minus 25% up to plus 66% in oil concentrations measured when both analysis methods are compared;
- The Netherlands: parallel samples taken by government inspectors offshore have been analysed by applying the new OSPAR Reference method (GC-FID) and the former IR method. Results showed to be comparable for oil concentrations in produced water samples taken from oil production installations and higher for those from gas production installations. Some operators having gas production installations offshore the Netherlands reported analysis results with significant deviations. In June 2009 the new OSPAR Reference method (GC-FID) will be implemented;
- Norway: an overview was reported showing a decrease in oil discharges with produced water between 34 to 47.4% in the period 2003 to 2007. The following figure 1 shows this Norwegian experience for the period 2003 – 2007. From 2007 the OSPAR Reference method (GC-FID) was used.

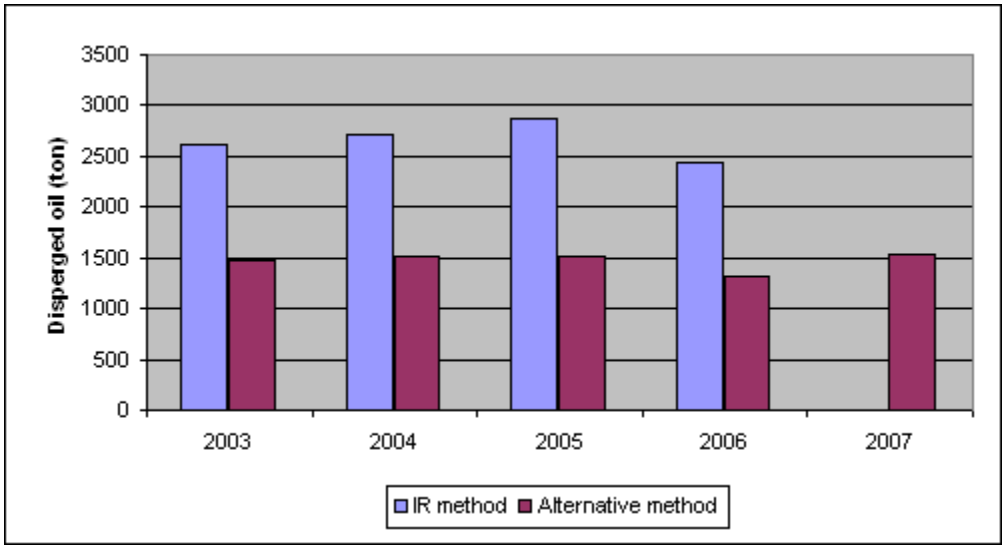

Figure 1 *Total dispersed oil discharges offshore Norway for the period 2003 – 2007, using the old IR method compared with the OSPAR Reference method (GC-FID).*

- The UK reported its following experience: On 1 January 2007, the OSPAR Reference method (GC-FID) became the official method for the analysis of dispersed oil in produced water in the UK. From this date all UK dispersed oil in produced water data returns had to be submitted in terms of this method. Offshore operators could continue to use existing analysis techniques (e.g. IR) but had to correlate the 'old' oil in water analysis method with the OSPAR Reference method GC-FID). On changing the analysis methods, the UK dispersed oil in water figures in 2007 (14.66 mg/l) fell by 26% in comparison to the 2006 figures. Analysis undertaken during 2007 (using the majority of the 2006 and 2007 data) showed that approximately 70% of the discharging installations in the UK showed a reduction with a smaller number of discharging installations showing an increase (30%). Although these variations cannot be absolutely attributed to the change in analysis method (due to inherent variance of oil in water levels) it was noticeable that the majority of the installations where the mg/l increased were gas or condensate fields which generally have lower produced water discharge levels. In an earlier study in August 2007, UK operators were asked to supply correlation graphs that plotted the OSPAR Reference Method versus the DECC IR method. Survey results (90 platforms) at a fixed 30ppm dosage level indicated a 25% change (across the board) on going from the IR method to the OSPAR Reference method. The use of a fixed dose rate to assess the effect of the change in method is important as the percentage change can vary across the concentration range. On further analysis this showed a 27% reduction for oil platforms and a 22% reduction for gas platforms.

5.4 Contracting Parties' reporting under specific articles

Implementation reports from Contracting Parties on §3.2 and §4.2 included the following information:

- Germany, Ireland, the Netherlands, Norway and the UK have achieved the goal, *i.e.* at least 15% reduction of discharges of dispersed oil by the end of 2006 compared to the base year 2000.
- All relevant Contracting Parties expressed that in their view BAT and BEP are being applied in their countries in order to achieve the goals as recommended in the Recommendation.
- Denmark reported an increase of about 46% of discharges of dispersed oil by the end of 2006 compared to 2000. However Denmark presented a comprehensive report on its offshore action plan for 2008 – 2012 which will be undertaken in order to reduce the discharges of oil to around 280 tonnes per year which is just above the 15% reduction target as agreed by the Recommendation for 2006. Denmark also reported to have experience an increase of 10% in dispersed oil concentrations due to changing of the analysis method.

- The Netherlands: since the oil is still measured by the former Parcom Reference IR method, an increase in dispersed oil discharged in produced water of 28% compared to 2006 is reported in 2007 by the Netherlands. However, compared to the base year 2000 the reduction is still about 23% in 2007. The reason for this increase is due to injectivity loss at one of the oil producing installations. The trend in decrease was restored in 2008 which showed a decrease of 10% in 2008 compared to 2007. The Netherlands reported in 2007 to have four offshore installations exceeding the performance standard of 30 mg/l. All four offshore installations are gas producers. On two of these installations production were stopped in 2007 either to put extra BAT, *i.e*. a Twin filter or to take extra measures in 2008 to improve the performance. On the other two installations a ceramic cross membrane filter was installed in 2007 while on the other one the ceramic cross membrane filter was revamped and a coalescer vessel has been installed before the methanol recovery unit as pre-separation step for dispersed oil. In 2008 the Netherlands reported 7 offshore installations to fail to meet the performance standard of 30 mg/l. BAT and BEP evaluations have been carried out and measures have been taken in order to comply with the performance standard.
- Norway stated in its implementation report that by the 31December 2006 Norway has reduced the amount of discharged oil with 18% since base year 2000 and has reached the goal of 15% reduction target. In February 2009 some new and revised calculations have been reported which lead to the aforementioned new reduction number of 18%. At the 2009 EAP meeting, Norway stated that it also experienced a fall in the concentration of dispersed oil when changing to the analytical method. By Email dated 24th of February 2009 Norway presented updated figures on dispersed oil discharges for the years 2003 – 2007. Norway's implementation report is at OIC 09/4/2 Add.1. In its annual report to OSPAR Norway reported to have two offshore installations exceeding the performance standard of 30 mg/l. After the EAP meeting in January 2009, a new implementation report has been received showing three offshore installations to exceed the 30 mg/l performance standard. On two of those offshore installations produced water re-injection have taken place in 2007 however not for the full 100% of the time, which mean that part of the produced water discharged did not comply with the performance standard. On one offshore installation the installation of a new Epcon produced water treatment system is foreseen in the third quarter of 2008. In 2008 Norway reported 4 offshore installations exceeding the performance standard of 30 mg/l. Reports on the evaluation of BAT and BEP on these installations have been issued to the EAP 2010 and measures are planned in order to comply with the performance standard;
- The United Kingdom: an updated implementation report for the Recommendation has been issued to OIC 2009 (OIC 09/4/2 Add.2-E). From this report it is concluded that there were twelve offshore installations exceeding the performance standard of 30 mg/l in 2007.In 2008 the UK reported to have 20 offshore installations failing to meet the performance target of 30 mg/l. For all these offshore installations BAT and BEP evaluation reports have been issued and measures are planned to comply in due time with the performance target.

6. Conclusions

6.1 Effectiveness of the implementation

In the context of the increasing offshore oil and gas activities in the OSPAR Maritime area and the maturing of the existing oil and gas fields, the following conclusions can be made on the effectiveness of the implementation of the OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations, as amended by OSPAR Recommendation 2006/4:

a. Most of the Contracting Parties have achieved or partly exceeded the 15% reduction target as required by §3.3 of the Recommendation for dispersed oil discharges in produced water[2]. By 2012 it is expected that also Denmark will comply with this goal;

b. The increase in number of offshore installations, where injection of produced water is taking place, lead to a considerable increase of volume of produced water injected. These efforts by Contracting Parties have minimised discharges of oil in produced water and have also lead to a reduction of discharges of other substances than oil (*i.e.* implementation of §3.5);

c. Continuous effort by the offshore industry and Contracting Parties are going on to comply with the performance standard of 30 mg/l, demonstrating the effectiveness of the measures described in § 4.1 and §4.2 of the Recommendation as amended.

It can therefore be concluded that the purpose and the scope of the OSPAR Recommendation 2001/1 as amended by OSPAR Recommendation 2006/4 have been met by most Contracting Parties and efforts continue to implement the Programmes and Measures described in the Recommendation. Although the 2020 goals as in §3.5 of the Recommendation have not been achieved yet it can be concluded that the Recommendation is being implemented effectively.

6.2 Lessons learned

Taking into account the experiences reported by the relevant Contracting Parties the following lessons have been learnt:

- Changing to the new OSPAR Reference method based on GC-FID principle in 2007 lead to a break in the trend for the discharges of dispersed oil in produced water in the sea compared to the years before. Besides that the new OSPAR Reference method only measures dispersed oil concentrations is not suitable for measuring concentrations of dissolved oil concentrations. Therefore a trend in the discharge of total oil in produced water cannot be presented in future;
- Overall goals and targets of measures should be SMART (Specific, Measurable, Achievable, Realistic and Time dependent) and criteria should be assessed prior the agreement of new measures;
- One technical measure, *i.e.* injection of produced water, not only lead to reduction of oil discharges but also the reduction of other substances than oil. Due to the lack of harmonisation on the sampling and analysis of these substances and also a lack in a reporting mechanism to OSPAR, the reduction of the discharges of other substance than oil cannot be quantified;
- Monitoring of the receiving environment is not carried out by the relevant Contracting Parties on a regular basis, so no assessment of the effectiveness of the Recommendation with regard to the reduction in environmental impact can be presented.

[2] The review of the 15% reduction target was hampered due to the fact that some statistical data for the base year are missing (*i.e.* figures for discharges of dissolved oil and discharge volumes of produced water per Contracting Party are not available). So the EAP was not in the position to present any trend for the discharges of total oil, *i.e*. the sum of dispersed and dissolved oil, for the period 2000 – 2005. Some Contracting Parties stated that they did not have enough confidence in their national collected data on the dissolved oil discharges for this period. OIC agreed on the baseline figures as presented at OIC 2005. Subsequently the EAP based its assessment of the 15% reduction target on the dispersed oil figures for the period 2000 – 2006.

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