OSPAR COMMISSION

Assessment of the discharges, spills and emissions to air on the Norwegian Continental Shelf, 2009 — 2013

Offshore Industry Series

2015

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. The Contracting Parties are Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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.
Les Parties contractantes sont l'Allemagne, la Belgique, le Danemark, l’Espagne, 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, la Suisse et l’Union européenne

Contents

Executive Summary

This report presents the discharge, spill and emission data from offshore oil and gas operations on Norwegian Continental Shelf (NCS) over the period 2009–2013 and the assessment of the data. The annual data is provided in Annex 1.

Level of Activity

The Norwegian Continental Shelf is a mature petroleum region, and the production is declining. However, there is still a high activity level, with 254 wells drilled in 2013 and large discoveries made in the last few years.

Discharges & spills

The total quantity of *dispersed*[1] *oil (aliphatic oil)* discharged to sea from produced water and displacement water increased slightly during the 2009–2013 period.

Produced water and displacement water discharges are the main contributors to the oil discharges from the petroleum industry. The volume of produced water discharged decreased, while displacement water discharges remained stable between 2009 and 2013. The decline in produced water discharges was partly due to the successful implementation of injection strategies and partly due to a decline in the water production.

The annual average dispersed oil content in produced and displacement water increased over the period. A maximum of four installations on the NCS in any one year failed to meet the performance standard for oil content as an annual average. However, these installations had small discharge volumes as they reinjected most of their produced water. The total amount of oil discharged with water exceeding the performance standard was 3,3 tonnes in 2013.

The total number of oil spills to sea reduced on the NCS between 2009 and 2013. The quantity released showed larger variations, however, the annual volume spilled since 2011 has been much lower than previous years.

Chemicals

The total quantity of chemicals reported *used* offshore decreased up to 2012. However, in 2013 the amount increased due to increased drilling activity. 554 109 tonnes of chemicals were reported used in 2013. Of this, 6 kg were substances on the OSPAR List of Chemicals for Priority Action (LCPA).

The total quantity of chemicals *discharged* into the sea over the period 2009 – 2013 increased from 125 990 tonnes to 166 770 tonnes, due to increased drilling activity. 6 kg of the discharged chemicals contained LCPA substances (see explanation on page 15).

The number of chemical spills to sea was highly variable, and no clear temporal trend is observed. Over the 2009—2013 period, the total quantity of chemicals spilled to sea decreased. However, the

[1]. “Aliphatics” and “aromatics” are defined by the reference method set in OSPAR Agreement 1997—16 (Solvent extraction, Infra-Red measurement at 3 wavelengths). In that context, “aliphatics” and “dispersed oil” mean the same thing.

quantities spilled in 2009 and 2010 were exceptionally large, and looking at a longer time period we see no trend for volumes of chemicals spilled.

Atmospheric Emissions

Atmospheric emissions are not regulated by OSPAR measures, but they are reported annually to OSPAR. There was a general downwards trend between 2009 and 2013 for the atmospheric emissions of nmVOC and methane. The decrease for nmVOC may be accredited to *i.e*. implementation of vapour recovery units on the ships. The CO_2 emissions have remained relatively stable. The NOx emissions have increased slightly since 2011, while there was a leap in the emissions of SO_2 from 500 tonnes in 2009 to 914 tonnes in 2013. This can partly be contributed to new reporting routines on the Åsgard field (200 tonnes), as well as general increase in energy consumption and flaring on the NCS.

Récapitulatif

Le présent rapport présente les données sur les rejets, les déversements et les émissions pour les opérations pétrolières et gazières offshore sur le plateau continental norvégien (NCS) durant la période 2009–2013 et l'évaluation des données. Les données annuelles sont présentées dans l'Annexe 1.

Niveau d'activité

Le plateau continental norvégien est une région pétrolière parvenue au stade de la maturité, et la production est en déclin. On observe toutefois encore un niveau d'activité élevé, avec 254 puits forés en 2013 et des découvertes importantes au cours des quelques dernières années.

Rejets et déversements

La quantité totale d'hydrocarbures dispersés2 (hydrocarbures aliphatiques) rejetée en mer dans l'eau de production et l'eau de ballast a légèrement augmenté durant la période 2009–2013.

Ce sont les rejets d'eau de production et d'eau de ballast qui contribuent le plus aux rejets d'hydrocarbures de l'industrie pétrolière. Le volume d'eau de production rejeté a diminué, tandis que les rejets d'eau de ballast sont restés stables entre 2009 et 2013. Le déclin dans les rejets d'eau de production a été dû en partie à la réussite de la mise à exécution de stratégies d'injection et en partie à un déclin dans les quantités d'eau de production.

La quantité moyenne annuelle d'hydrocarbures dispersés présente dans l'eau de production et l'eau de ballast a augmenté durant la période. Au cours de n'importe quelle année, un maximum de quatre installations sur le NCS a manqué de satisfaire à la norme de performance pour la moyenne annuelle de la teneur en hydrocarbures. Toutefois, les volumes des rejets de ces installations étaient modestes, car elles réinjectaient la majeure partie de leur eau de production. La quantité totale d'hydrocarbures rejetée avec l'eau au-delà de la norme de performance a été de 3,3 tonnes en 2013.

[2]. Les composés « aliphatiques » et « aromatiques » sont définis par la méthode de référence énoncée dans l'Accord OSPAR 1997-16 (Extraction par solvant, mesure par infrarouges à 3 longueurs d'onde). Dans ce contexte, les termes « aliphatiques » et « hydrocarbures dispersés » ont le même sens.

Le nombre total de déversements d'hydrocarbures en mer a diminué sur le NCS entre 2009 et 2013. La quantité déversée a varié davantage, toutefois le volume annuel rejeté depuis 2011 a été beaucoup plus bas qu'au cours des années précédentes.

Substances chimiques

La quantité totale de substances chimiques dont l'utilisation offshore a été déclarée a diminué jusqu'en 2012. Toutefois, en 2013, la quantité a augmenté, dû à une intensification des activités de forage. On a déclaré l'utilisation de 554 109 tonnes de substances chimiques en 2013. Sur cette quantité, 6 kg étaient des substances figurant sur la Liste OSPAR de substances chimiques devant faire l'objet de mesures prioritaires (LPCA).

La quantité totale de substances chimiques rejetée en mer durant la période 2009 – 2013 a augmenté de 125 990 tonnes à 166 770 tonnes, dû à une intensification des activités de forage. Six kg des substances chimiques rejetées contenaient des substances LCPA (voir explication page 15).

Le nombre de déversements de substances chimiques en mer a varié considérablement, et on n'a pas observé de tendance temporelle évidente. Durant la période 2009 – 2013, la quantité totale de substances chimiques déversée en mer a diminué. Toutefois, les quantités déversées en 2009 et en 2010 étaient exceptionnellement importantes, et sur une période de temps plus longue, nous n'observons pas de tendance pour les volumes de substances chimiques déversés.

Émissions atmosphériques

Les émissions atmosphériques ne sont pas réglementées par des mesures OSPAR, mais elles sont déclarées une fois par an à OSPAR. On a observé une tendance générale à la baisse entre 2009 et 2013 pour les émissions atmosphériques de COVnm et de méthane. La diminution des COVnm peut être attribuée, par exemple, à la mise en place d'unités de récupération des vapeurs sur les navires. Les émissions de CO2 sont restées relativement stables. Les émissions de NOx ont légèrement augmenté depuis 2011, tandis que les émissions de SO2 ont connu une augmentation considérable, de 500 tonnes en 2009 à 914 tonnes en 2013. Cette situation peut être attribuée en partie à de nouvelles procédures de notification sur le champ d'Åsgard (200 tonnes), ainsi qu'à une augmentation générale de la consommation énergétique et de l'utilisation des torches sur le NCS.

1. Introduction

This report provides an assessment of the discharges, spills and emissions to the North Sea from offshore oil & gas installations on the Norwegian Continental Shelf (NCS) during the period 2009–2013. The purpose of the report is to assess trends related to the effectiveness of the OSPAR measures and the national regulation. Trends have been assessed using expert judgement and not by statistical analyses.

The assessment is based on data submitted by the operators on the NCS to the Norwegian authorities and reported by Norway in the annual OSPAR report on discharges, spills and emissions from offshore oil and gas installations. The assessment is based on the data available for the NCS at the time when the annual OSPAR report was submitted (Annex 1).

Where relevant, the performance on the NCS has been compared to the overall performance in the OSPAR area, using the following sources:

- "OSPAR report on discharges, spills and emissions from offshore oil and gas activity in 2013" (OSPAR Commission 2015);
- "Assessment of the OSPAR report on discharges, spills and emissions to air from offshore oil and gas 2010—2012" (OSPAR Commission 2014).

It should be noted that as Norway is the largest oil and gas producer in the OSPAR region, emissions and discharges on the NCS contribute significantly to the total emissions and discharges in the OSPAR area. OSPAR trends may therefore to a certain degree be driven by trends on the NCS, making a comparison of performance challenging.

The operators have used procedures for sampling and analysis given by the Norwegian Environment Agency (NEA), and quality assurance procedures described by NEA and the Norwegian Oil & Gas Association. Certified laboratories have been used.

2. Setting the scene

Norway is the largest producer of oil and gas in the OSPAR region, but the NCS is a maturing basin, and production in Norway has been declining since 2004. However, in recent years the petroleum exploration has moved north, in particular to the Barent Sea, at the same time as several large discoveries have been made in mature areas in the North Sea.

Figure 1 shows the official Norwegian production data in millions of standard cubic meters of oil equivalents (sm^3 o.e.). The data presented in the OSPAR reports are in millions sm^3 o.e. up until 2011. The last two years the data have been given in millions tonnes o.e..

The number of installations with discharges has remained quite stable since 2009. Some of the changes shown in Figure 2 are due to changes in the way the installations are counted.

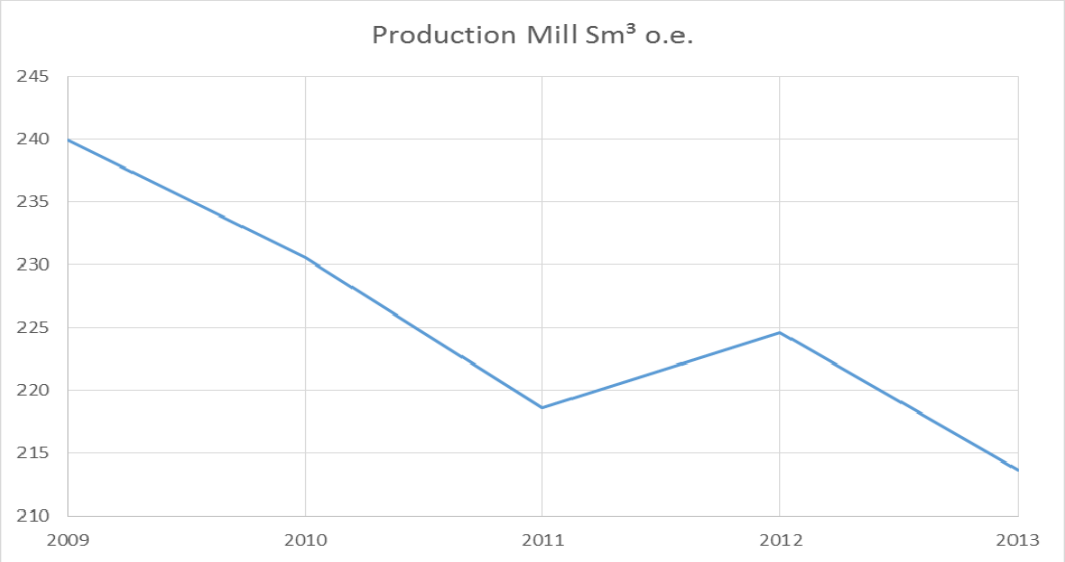

Figure 1: *Annual total production of oil equivalents on the Norwegian Continental Shelf*

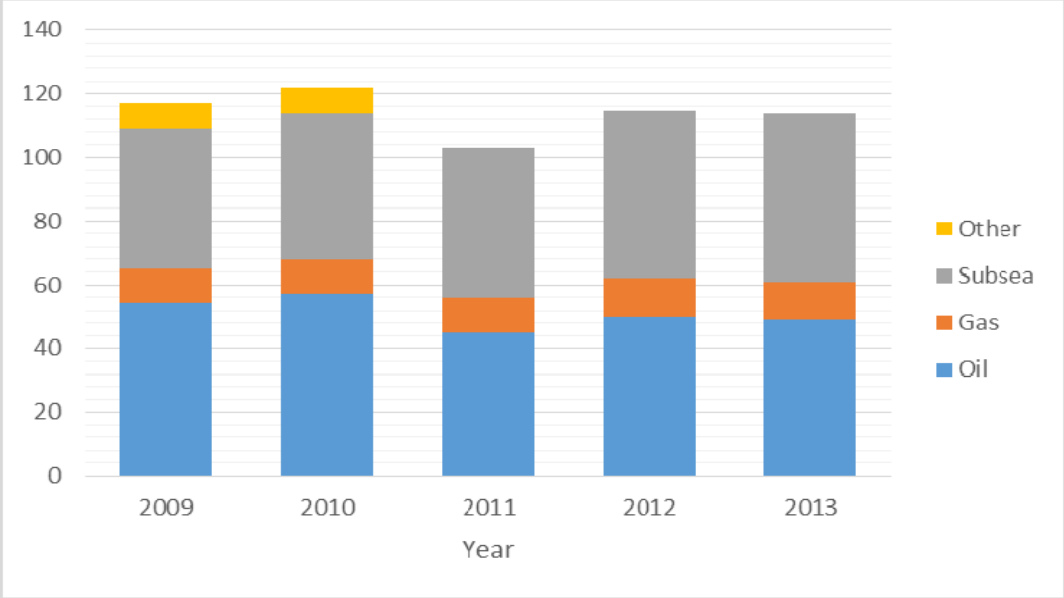

Figure 2: *Number of installations on the Norwegian Continental Shelf*

The way in which OSPAR recorded and reported drilling activity changed in 2010. Before 2010, 'drilling years' were determined based on the time the rig spent offshore. Since 2011, the number of wells drilled in each calendar year has been reported to better reflect drilling activity.

On the NCS, wells are reported the year drilling is finalized only. Sidetracks are reported as separate wells when the aim of the sidetrack is to reach new targets or explore new geological areas. Change of well path due to difficulties during drilling are not counted as separate wells.

The reported drilling activity on the NCS increased between 2012 and 2013, as shown in Figure 3.

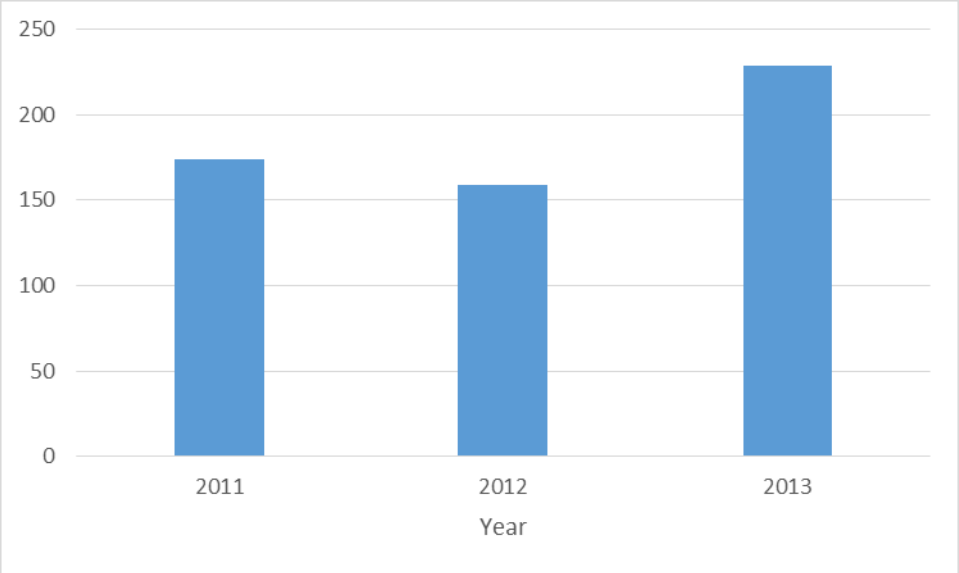

Figure 3: *Number of wells drilled on the Norwegian Continental Shelf*

3. Environmental Management

As required in OSPAR Recommendation 2003/5 to Promote the Use and Implementation of Environmental Management Systems (EMS), Norwegian legislation requires the industry to have an EMS (Framework HSE regulation, Section 17, Duty to establish, follow up and further develop a management system). Operators may either have a certified EMS (ISO 14001 or EMAS) or an EMS that is in accordance with the principles of such a standard. The authorities do not issue formal approval related to their EMS. However, all audits examine parts of the EMS system, and failing to have one will have grave consequences for the operator, including withdrawal of the licence.

Requirements to document such management systems are stated in the HSE regulations, Framework regulation §23 and Management regulation §§24 and 42.

4 Oil discharges

4.1 Discharges of oil to sea

Discharges of dispersed oil are regulated in accordance with OSPAR Recommendation 2001/1 (as amended). Norwegian regulations state that the oil content shall be *as low as possible*. In addition, it is required that the oil content should not exceed 30 mg dispersed oil per litre.

Produced water and displacement water

Produced water discharges on the NCS decreased by about 6% from 2009 to 2013 (Figure 4). The decrease was small, but seems consistent. Discharges of displacement water varied, and about the same amount was discharged in 2009 and 2013. Volume of injected produced water varied, but there was a 6% increase between 2009 and 2013, which seems to be part of a positive trend in the period.

The decline in produced water discharges can partly be attributed to the increase in produced water injection. This indicates the successful implementation of measures to reach OSPAR goals. However, a larger proportion of the decline may be explained by a decline in the water production on the NCS.

Comparing this with OSPAR overall figures, shows that:

- The produced water discharges in Norway and in the OSPAR area reduced between 2009 and 2013 (by 6% and 17%, respectively). The reductions both on the NCS and in the OSPAR area are partly due to increased amounts of water injected and partly due to declines in water production;
- The discharges of displacement water reduced in the OSPAR region (5%), while remaining stable on the NCS.

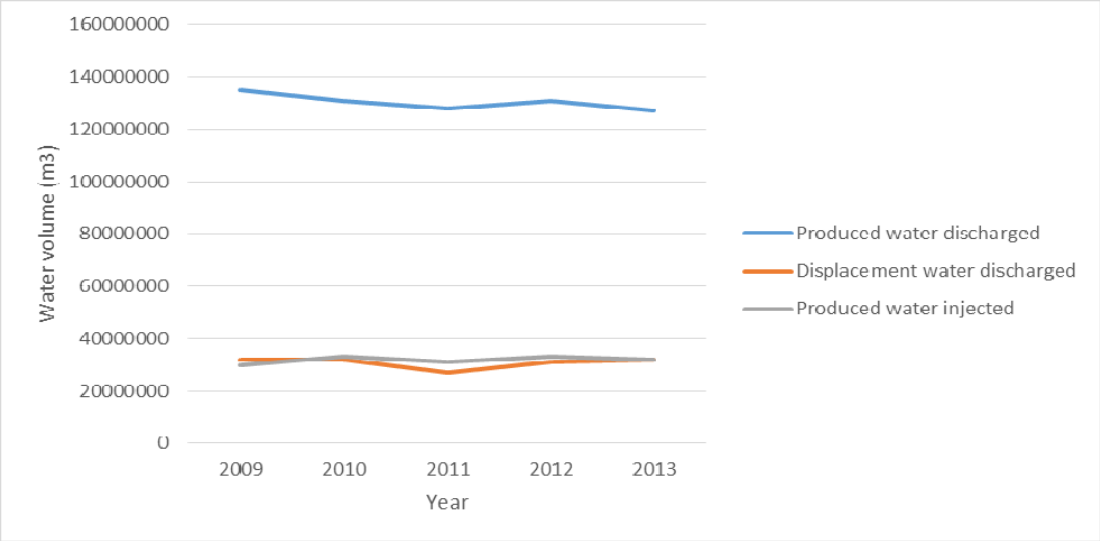

Figure 4: *Discharges and injection of produced water and displacement water on the NCS 2009—2013*

Dispersed oil discharged

The total quantity of dispersed oil discharged with *produced water and displacement water* varied between 1 490 and 1 595 tons (Figure 5). However, since 2010, there seems to be an increasing trend. The increase in discharges between 2009 and 2013 was approximately 3%. There has been also been an increase in the average dispersed oil concentration in *produced water and displacement water*, from 9.2 mg/l in 2009 to 10.0 mg/l in 2013 (Figure 5).

The figures for dispersed oil concentration in produced and displacement water in the OSPAR area vary, and no temporal trend can be observed over the 2009—2013 period. The average concentration on the NCS was slightly lower than the average concentration in the OSPAR area in 2013 (10.0 mg/L and 11.8 mg/L, respectively).

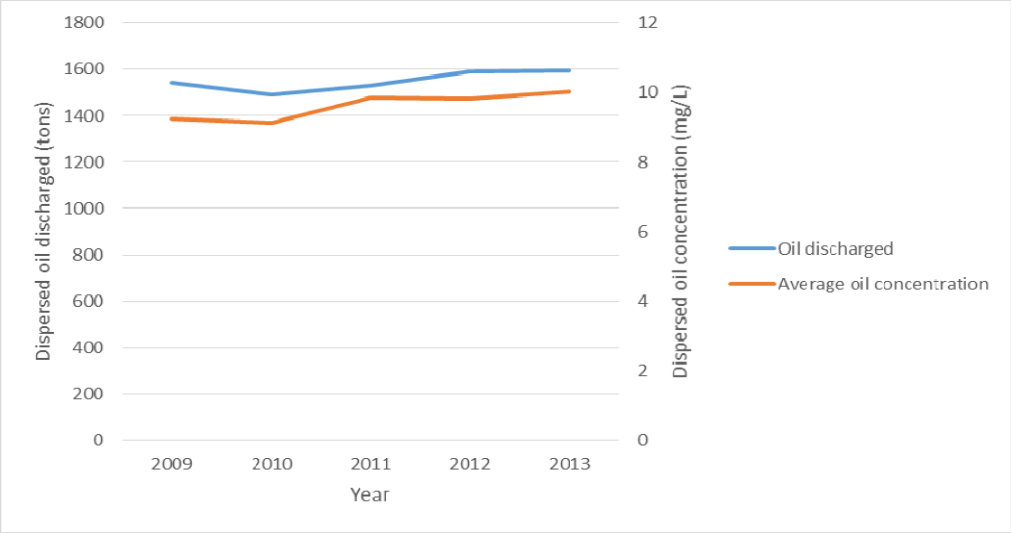

Figure 5: *Quantity and concentration of dispersed oil discharges 2009—2013*

The performance standard in Recommendation 2001/1 has been 30 mg/l calculated as a monthly average since 2007. Very few installations failed to meet this limit, only 3 in 2013 (Figure 6). Their reason for not reaching the goal was mainly that they rely on produced water injection, and when the injection falls out, small quantities of water with high concentrations of dispersed oil is discharged. These installations could discharge produced water over a longer period in order to stabilise the water cleaning process, and thereby reducing the average oil concentration, but Norwegian authorities have rather decided to accept higher concentrations of oil for very short periods in order to minimize the total discharge of oil.

The quantity of oil discharged with this water increased from 0 tonnes in 2009 to 3.3 tonnes in 2013 (Figure 6). During the same period, there was a reduction from 340 tonnes to 244 tonnes in the OSPAR area.

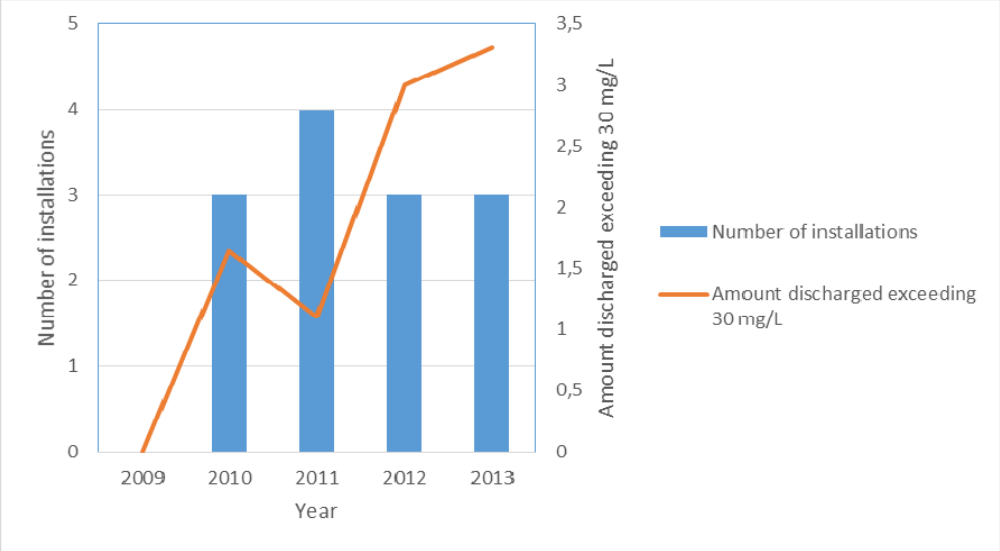

Figure 6: *Installations failing to meet performance standards for concentration of oil in water discharged and amount oil discharged because of the excess in concentration*

Norway also reports the dissolved oil content (as represented by BTEX components) in produced water discharges. OSPAR has not issued recommended discharge levels for these components as they rapidly biodegrade in seawater once discharged. The discharge of dissolved oil[3] (BTEX) in produced water over the 2009 to 2013 period has been between 1 675 and 1 954 tonnes per year. The discharges on the NCS remained stable in the period, compared to a 12% increase in the OSPAR area.

4.2 Risk-based Approach (RBA)

In 2012, OSPAR adopted Recommendation 2012/5 for a risk-based approach to the management of produced water discharges from offshore installations. Norway has implemented the Recommendation by issuing specific requirements in the permits for the installations discharging produced water. These requirements will later be included in the HSE regulations for the petroleum industry. All operators discharging produced water have to perform and report new substance based risk assessments by March 2015, resulting in calculated field specific Environment Impact Factors (EIFs). One EIF refers to a volume of water of 100 000 m^3 where the PEC/PNEC ratio exceeds 1 for one or more components in the produced water. Installations with an EIF exceeding 10 are to perform whole effluent testing (WET) of the produced water by 2018.

The Norwegian operators have been performing risk assessments on an irregular basis since the introduction of a zero discharge approach in the late 1990s. The work was evaluated in 2003, 2005, 2006 and finally in 2010. One of the conclusions in 2010 was that, with regard to added chemicals, the goals were considered achieved, with over 90% reduction of the discharges of chemicals subject to OSPAR measures. With regards to produced water, cleaning technology and reinjection are among the zero discharge measures that have been implemented. The Norwegian Petroleum Directorate have estimated that investments in the various zero discharge measures implemented between 2002 and 2006 amounts to over NOK 6 billion (750 million Euro).

The overall risk reduction, expressed as the reduction of EIF on the NCS as a total, was 55% in the period 2002—2008.

4.3 Spills of oil to sea

The total number of oil spills to sea showed a steady reduction of almost 30% on the NCS between 2009 and 2013. The majority of the spills were smaller than 1 tonne. The reduction is most likely due to increased efforts by the industry.

The quantity of oil released has shown larger variations, as expected since it is mainly driven by the small and variable number of spills larger than 1 tonne. It should however be noted that the volume spilled since 2011 was much lower than the previous years, and this holds true also when looking at a longer time period.

[3] "Aliphatics" (or "dispersed oil") are regularly and frequently measured, while the sampling is much less frequent for "aromatics". Therefore data on "aromatics" may be less reliable.

Comparing figures from NCS to overall figures from OSPAR indicates the following:

- Between 2009 and 2013 there was a reduction in the number of total spills on the NCS. A similar trend was observed in the OSPAR area until 2012, but in 2013 there was a marked increase;

- Between 2009 and 2013, there was a reduction in the total volume spilled both in the OSPAR region and on the NCS. The reduction was greater on the NCS, however large variations makes it difficult to interpret the difference further.

The amount of oil spilled on the NCS was between 1% and 8% (wt) of the amount of dispersed oil discharged with produced water in the same period.

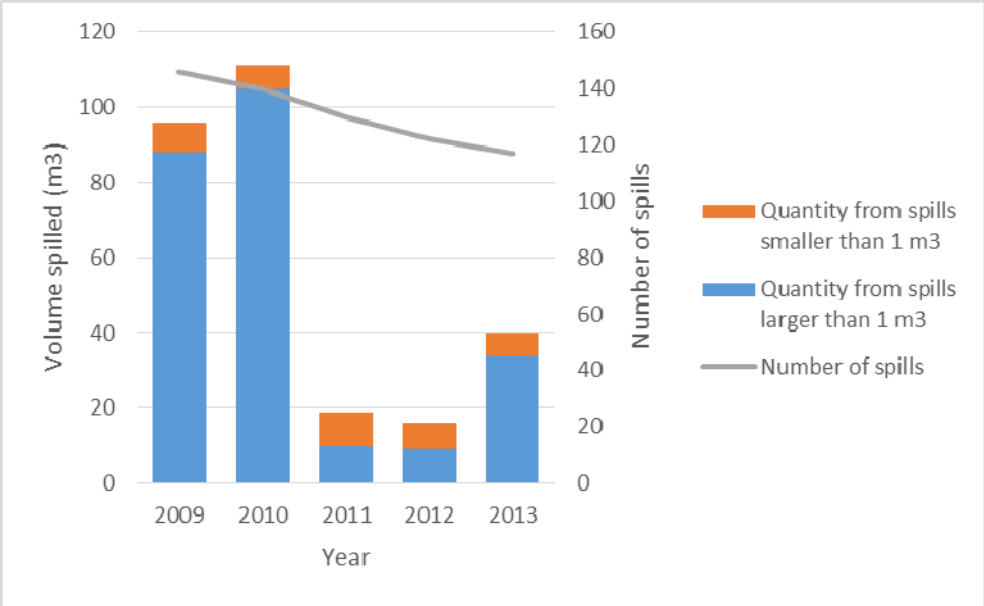

Figure 7: *Quantity and number of oil spills on the NCS 2009—2013*

4.4 Discharges of organic phase fluids

Discharge of cuttings contaminated with organic phase fluids (OPF) at a concentration greater than 1% by weight on cuttings is prohibited based on OSPAR Decision 2000/3. Norway regulates this under the Activities regulations section 68. Although some technologies are able to reduce the concentration of oil to below the 1% limit, no cuttings contaminated with OPF were discharged on the NCS between 2009 and 2013.

5. Chemicals

5.1 Chemical Use & Discharge

In this document, the following applies:

In this report, the term *substitution chemical* is short for *chemicals which contain one or more substances which are candidates for substitution*, according to OSPAR Recommendation 2010/4.This includes chemicals which are*:*

- on the OSPAR LCPA;
- inorganic with LC_{50} or EC_{50} less than 1 mg/l;
- have biodegradation less than 20%; or
- meets two of three criteria:
    - biodegradation less than 60%;
    - BCF larger than 100 or Log $P_{ow} \geq 3$; or
    - LC_{50}/EC_{50} less than 10 mg/L.

The goal of OSPAR Recommendation 2006/3 is for substitution chemicals to be phased out by 2017. In addition OSPAR Recommendation 2005/2 set a goal that Contracting Parties should have phased out the discharge of substitution chemicals on the OSPAR 2004 List of Chemicals for Priority Action (LCPA) by 1 January 2010. There are no OSPAR measures against the other categories of chemicals classified within HMCS, as these are deemed not to pose a significant risk to the environment. .

The Norwegian Pollution Control Act states that all pollution is illegal, and discharges and emissions from industry requires a permit. All use of chemicals (except for emergency use) needs a permit. The permit states the volume of chemicals allowed to be used, and the volume allowed to be discharged. Use of substitution chemicals is only permitted if they are necessary for safety or technical reasons.

In addition, the HSE regulations for the petroleum industry states that evaluation, ranking and choice of chemicals is the operator's responsibility. The authorities do not register individual chemicals, but the operators on the NCS run a common database where all chemicals are registered. The authorities have access to all information.

Total use and discharge of chemicals between 2009 and 2012 was stable (Figure 8). From 2012 to 2013, there was a marked increase, mainly due to higher drilling activity, resulting in an increased use of drilling chemicals. There was also an increase in chemicals discharged to sea between 2012 and 2013, though not as apparent as the increase in chemicals used, as a relatively large part of the drilling chemicals used were OPFs, and were not discharged. The bulk of the increase in discharges was non-substitution chemicals.

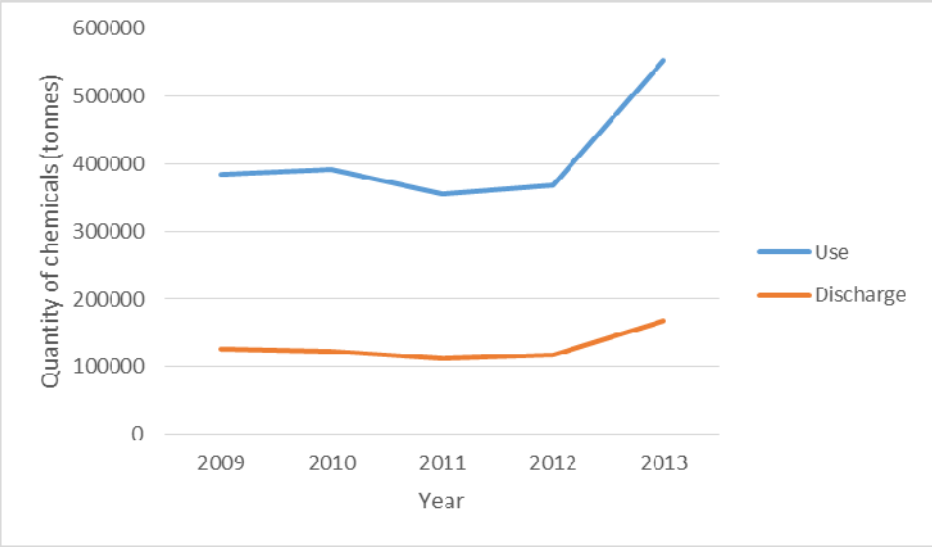

Figure 8: *Total quantity of chemicals used and discharged on the NCS 2009—2013*

Chemicals Used

The total quantity of chemicals *used* offshore in 2013 was 554 109 tonnes out of which almost 63% (wt.) were on the PLONOR list and nearly another 37% (wt.) were other non-substitution chemicals. Less than 1% of chemicals were on the List of Chemicals for Priority Action (LCPA-substances) or other substitution chemicals. Only 5,6 kg of the chemicals used were LCPA-substances (Figure 9). This was due to unauthorised use of cleaning chemicals, which has been addressed and stopped.

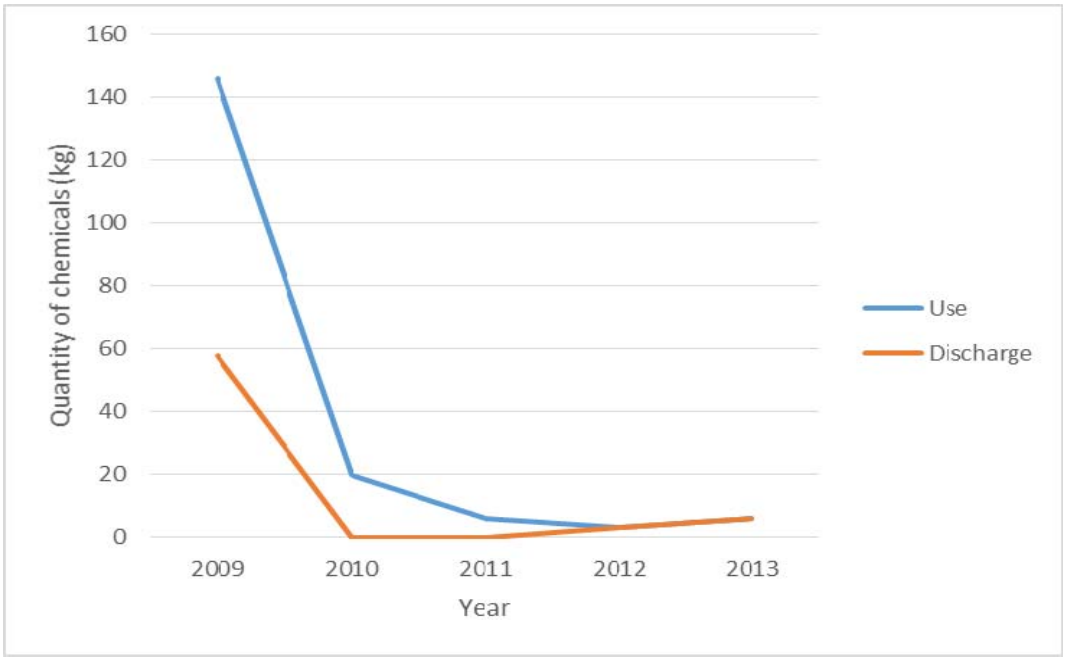

Figure 9: *Quantities of chemicals on the List of Chemicals for Priority Action (LCPA) used and discharged on the Norwegian Continental Shelf 2009—2013*

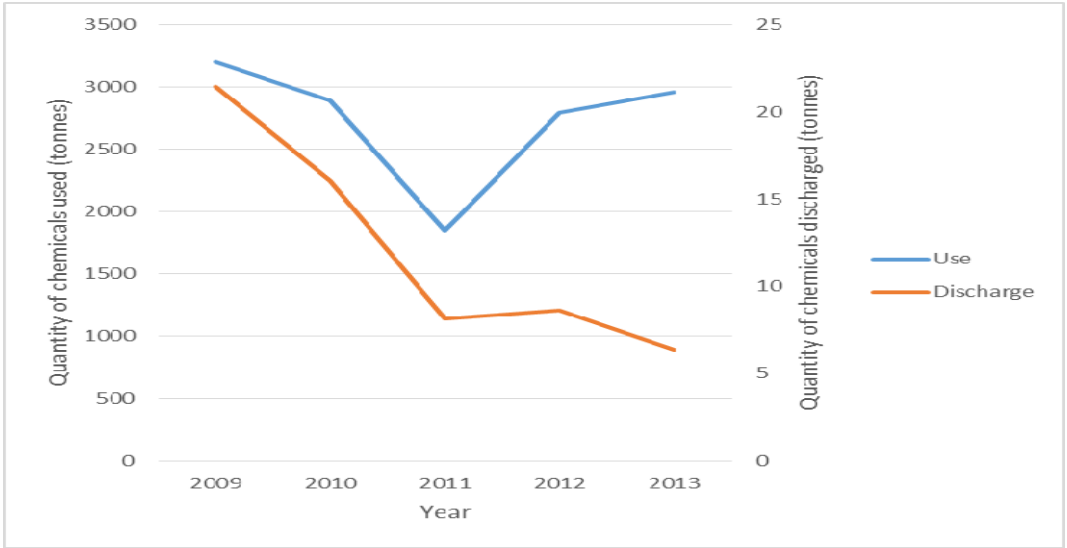

Figure 10: *Quantities of other substitution chemicals (exept LCPA chemicals) used and discharged 2009—2013*

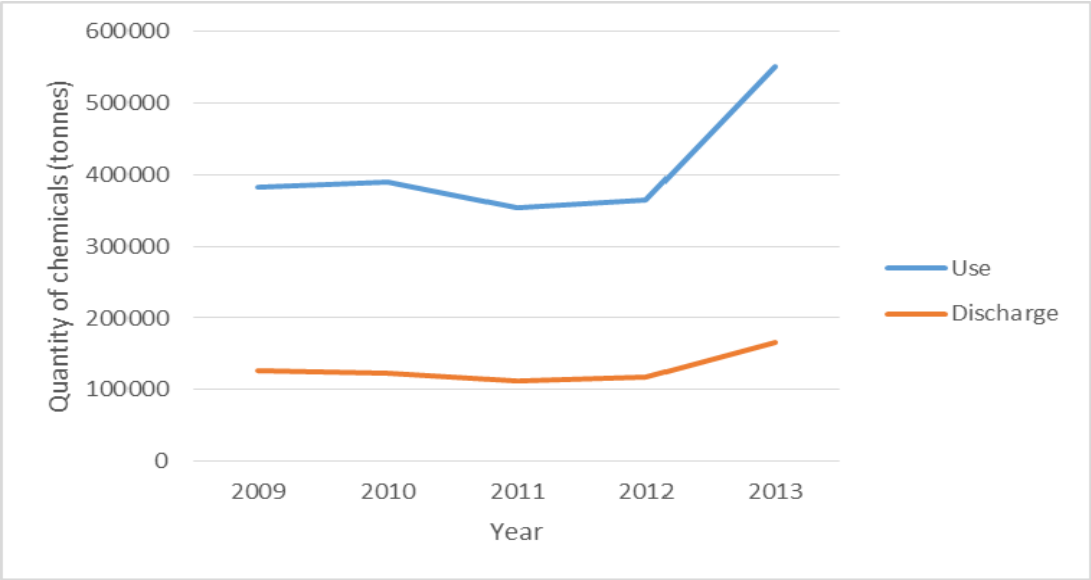

Figure 11: *Quantities of chemicals not containing substitution candidates used and discharged 2009—2013*

According to OSPAR documents, the figures for 2013 demonstrate that almost 66% of chemicals used were chemicals on the PLONOR list, almost 33% were other non-substitution chemicals and 1% were chemicals on the LCPA list or other substitution chemicals. Thus:

- the percentage of PLONOR chemicals used was slightly lower on the NCS in 2013 than the average in the OSPAR area in 2012; while
- the percentage of other non-substitution chemicals was higher; and
- the percentage of LCPA-chemicals and other substitution chemicals was less on the NCS than in the OSPAR area.

Chemicals Discharged

Total quantity of chemicals discharged into the sea in 2013 was 166 770 tonne. 69% of these were listed on the PLONOR list and another 31% (wt.) were other non-substitution chemicals. 0.004% were on the LCPA list or other substitution chemicals. 5,6 kg of the discharged chemicals were LCPA-chemicals (Figure 9).

According to OSPAR, the corresponding overall figures for 2013 were 75% chemicals on the PLONOR list, 24% other non-substitution chemicals and less than 1% chemicals on the LCPA list or other substitution chemicals. Thus:

- the percentage of PLONOR chemicals discharged was lower on the NCS in 2013 than the average in the OSPAR area in 2013; while
- the percentage of other non-substitution chemicals was higher on the NCS;
- the reported percentage of LCPA chemicals or other substitution chemicals was less than 1% both on the NCS and in the OSPAR area.

There were no LCPA chemicals used or discharged in 2010 and 2011. 3 and 5.6 kg of LCPA listed chemicals were used and discharged in 2012 and 2013 respectively. In 2013, this was due to unauthorised discharge of cleaning chemicals, which has been addressed and stopped. The discharge of substitution chemicals decreased 70%, from about 21 tonnes in 2009 to 6 tonnes in 2013.

5.2 Chemical Spills

The number of chemical spills to sea has been highly variable, and no clear temporal trend is observed. Over the 2009—2013 period, the total quantity of chemicals spilled to sea decreased from 13 080 m^3 in 2009 to 1 286 m^3 in 2013. However, the quantities spilled in 2009 and 2010 were exceptionally large, and looking at a longer time period we see no decreasing trend for volumes of chemicals spilled.

In the OSPAR area there seems to be an increase in the number of spills. There was a large reduction in the total volume spilled, but this again seems to be caused by the large spills on the NCS in 2009 and 2010 and seems not to represent a positive trend due to implementation of OSPAR measures.

Consequently:

- no clear trend is observed in the number of chemical spills on the NCS, while there was an increase in the OSPAR area;
- the observed reductions in quantities spilled both on the NCS and the OSPAR area over the 2009—2013 period, were due to exceptionally large spills on the NCS in 2009 and 2010.

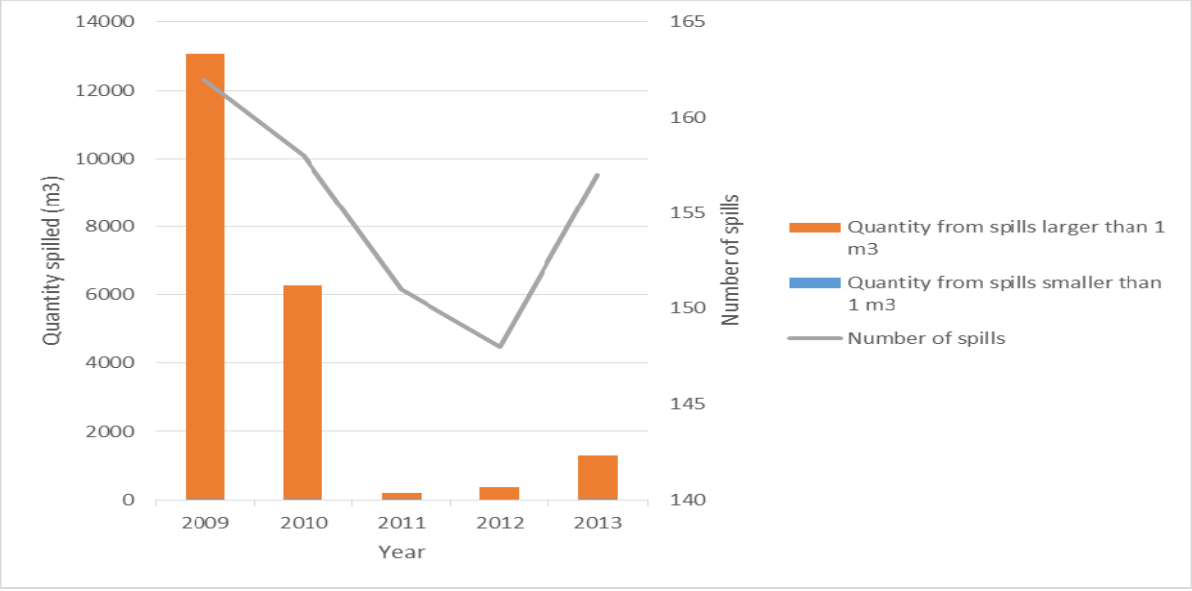

Figure 12: *Number and quantity of chemical spills on the Norwegian Continental Shelf 2009—2013*

6. Emissions to air

Atmospheric emissions are not covered by OSPAR measures or harmonised OSPAR measuring methodologies, but in Norway the atmospheric pollutants reported to OSPAR are regulated under Norwegian legislation. The atmospheric emissions from the Norwegian petroleum activities are reported annually to OSPAR.

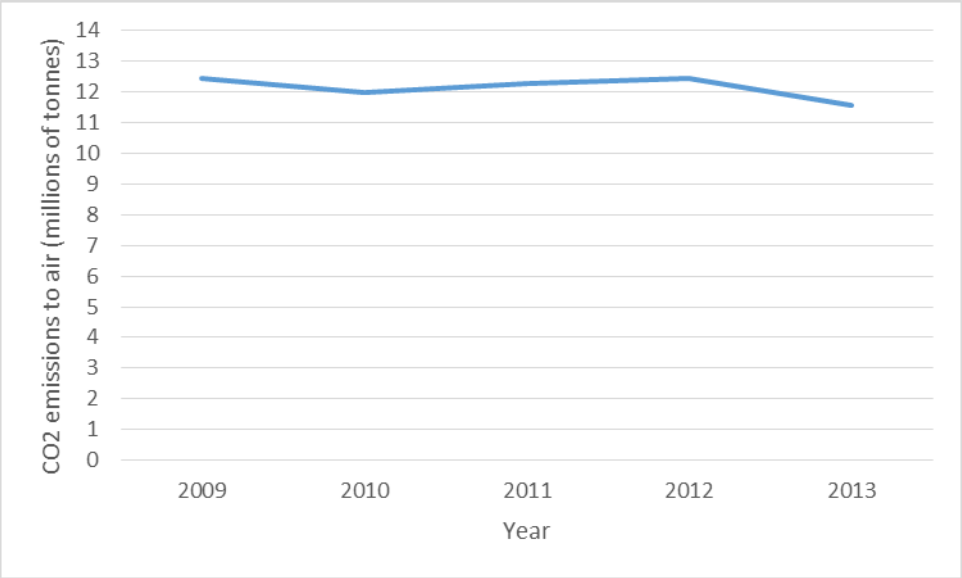

Figure 13: *Emissions of CO2 on the Norwegian Continental Shelf 2009—2013*

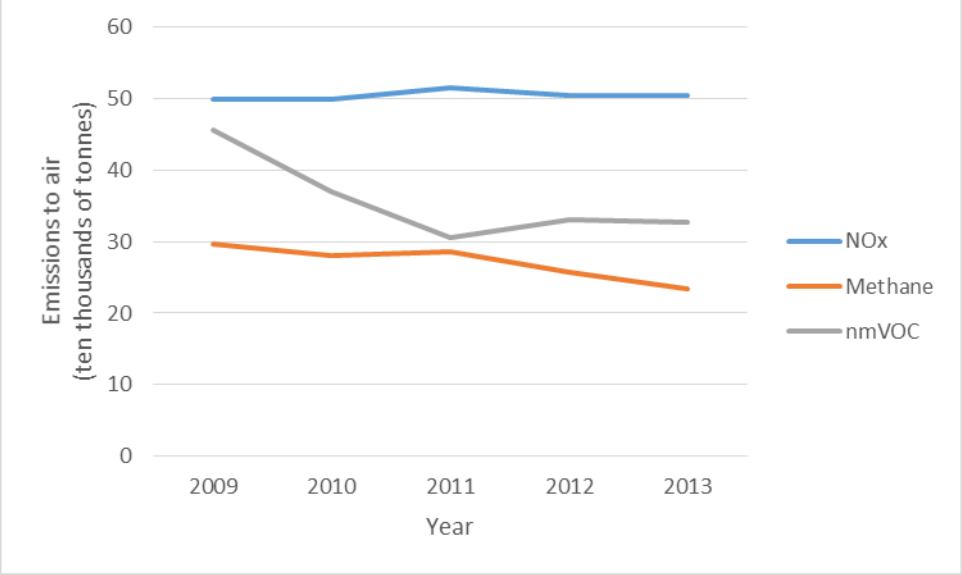

Figure 14: *Emissions of NOx, methane and nmVOC on the Norwegian Continental Shelf 2009—2013*

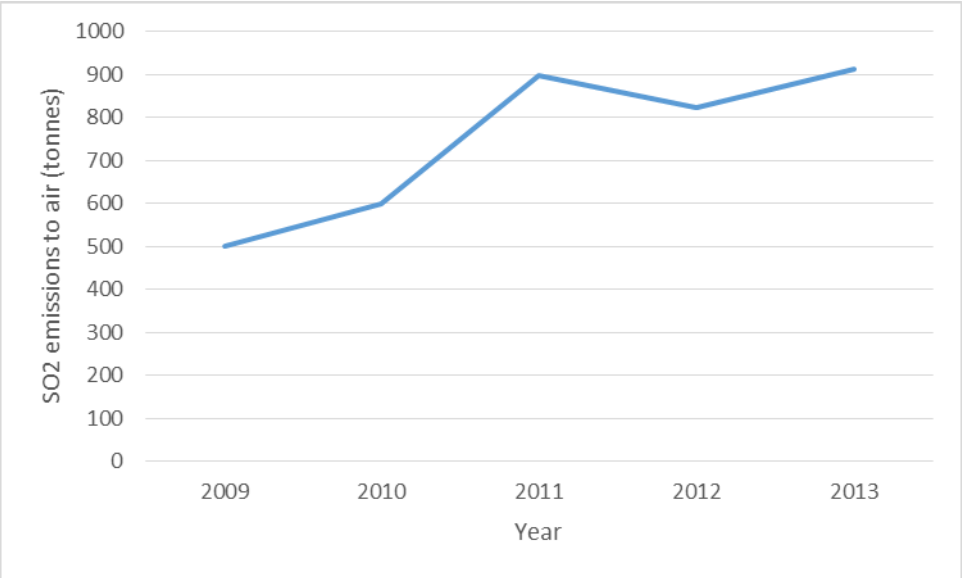

Figure 15: *Emissions of SO2 on the Norwegian Continental Shelf 2009—2013*

There was a general downwards trend between 2009 and 2013 for the atmospheric emissions of non-methane VOCs (nmVOCs) and methane (Figure 14), while the CO_2 emissions (Figure 13) and NOx emissions (Figure 14) remained relatively stable. There was a leap in the emissions of SO_2 from 500 tonnes in 2009 to 914 tonnes in 2013 (Figure 15). The increase of 400 tonnes of SO_2 can partly be contributed to a change in the reported emissions from Åsgard due to new reporting routines (200 tonnes), and a general increase in energy consumption and flaring on the NCS.

For nmVOC, the decrease seen from 2009 to 2011 is the latter part of a trend from 2001, in which the reported nmVOC emissions have been reduced due to regulation of emissions from offshore loading, resulting in *i.e*. implementation of vapour recovery units on the ships.

Comparing Norwegian figures to OSPAR overall figures, we find:

- CO_2-emissions remain stable both on the NCS, and in the OSPAR area;
- NOx emissions remain stable both on the NCS and in the OSPAR area;
- Methane emissions have reduced by 21% on the NCS, while they remain stable in the OSPAR area;
- Non-methane VOCs have reduced by 28% on the NCS and by 17% in the OSPAR area;
- SO_2 emissions have increased by 83% on the NCS and by 26% in the OSPAR area. The increase in Norway represents a clear temporal trend, whilst the OSPAR overall figures are more variable, and the trend is less clear.

7. Counting of installations & QA procedures in Norway

7.1 Counting of installations

In OSPAR, the number of installations is detailed in the "Inventory of oil and gas offshore installations in the OSPAR maritime area ". However, since the number does not only include drilling and production installations, but also for example concrete foundations for bridges and gangways, the number does not clearly indicate the level of drilling and production activity.

Therefore, in the annual reports to OIC from Norway, the number of installations are counted in the following way:

One installation with discharges to water and air may be a fixed or floating drilling and/or production installations ("mother installations") including sub sea wellhead templates with wells transferring oil and gas to the mother installations. The operator of the mother installation may or may not be the operator of the templates. Normally, the discharges are covered by one permit from the Norwegian Environment Agency. The mother installation may consist of more than one structure. An example is Statoil's Norne field, which consists of the Norne FPSO, 6 Norne templates, three Urd templates (covering the Svale and Star reservoirs), one Alve template and one Marulk template belonging to Eni (not shown on the picture).

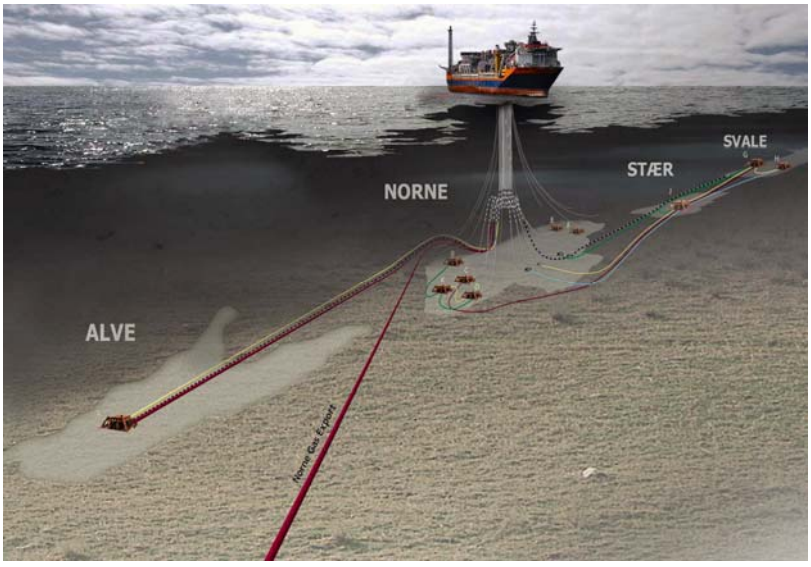

Figure 16: *The Norne field*

One field may have more than one installation which due to their size, complexity and integrity are counted individually. An example is the Statfjord field, which with three concrete base installations, and including the sub sea fields Statfjord East, Statfjord North and Sygna, are counted as 3.

A third example may be the Ekofisk field, with about 32 installations above the sea surface, counted as 6 installations in OIC context. Discharges from drilling and from water treatment plants are done

from these 6, and other discharges such as hydraulic fluids may be discharges from other installations, but these discharges also reported.

Figure 17: *The Ekofisk field*

In other cases, a field may be developed by drilling all wells from one single installation, in which case it is counted as one.

The intention is that the change in number of installations shall reflect the change in activity. The decommissioning of installations and development of new fields will be commented upon in future assessment reports.

7.2 Reporting requirements and quality assessment

The operators are required to report annually according to specifications from the Norwegian Environment Agency. Data related to drilling, production, discharges of water and oil, energy production and emissions to air, the use and discharge of chemicals, waste production and handling, *etc*, is entered into a common database. This database has been developed by the Norwegian Oil and Gas Association and is paid for by the industry, themselves.

The quality of data submitted is the responsibility of each operator. They are required to carry out systematic review of their own data. In addition, each operator has access to most data from the other operators. This enables them to compare and contrast their data to data from the other operators, and to relate them to data for previous years. The Norwegian Oil and Gas Association also carries out some quality assurance, but do not have any formal requirement from the authorities to do so.

Sampling and analysis have to be done according to national or international standards. The standards will be specific for each type of sample and each analysis. The operators have to include details related to this in their management systems. The authorities may any time request to see the documentation.

The operators have a requirement to evaluate uncertainties in the reported numbers, and the results shall be included in the annual report. However, this is a difficult task, and we do not yet have a good procedure for how to assess the operators' conclusions, and act upon them. We need more experience, and we have cooperation with the parts of our organisation which deal with reporting from land based industry to find a way forward.

Appendix 1: OSPAR Measures associated with Offshore Oil and Gas industry

Discharges contaminated with oil

PARCOM Recommendation 86/1 of a 40 mg/l Emission Standard for Platforms[4];

OSPAR Reference Method of Analysis for the Determination of the Dispersed Oil Content in Produced Water (OSPAR Agreement number: 2005—15);

OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations (as amended);

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

Use and discharge of drilling fluids and cuttings

OSPAR Decision 2000/3 on the Use of Organic-phase Drilling Fluids (OPF) and the Discharge of OPF-contaminated Cuttings;

Guidelines for the Consideration of the Best Environmental Option for the Management of OPF-Contaminated Cuttings Residue (OSPAR Agreement number: 2002—8);

Chemicals used and discharged offshore

OSPAR Decision 2000/2 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals (as amended);

OSPAR Recommendation 2010/4 on a Harmonised Pre-Screening Scheme for Offshore Chemicals;

OSPAR Recommendation 2010/3 on a Harmonised Offshore Chemical Notification Format (HOCNF) (as amended);

OSPAR Recommendation 2006/3 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that Are, or Which Contain Substances Identified as Candidates for Substitution;

OSPAR Recommendation 2005/2 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that Are, or Contain Added Substances, Listed in the OSPAR 2004 List of Chemicals for Priority Action.

[4] PARCOM Recommendation of a 40 mg/l Emission Standard for Platforms, 1986 was revoked for produced water only by OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations. However, this measure is still applicable in relation to ballast water, drainage water and displacement water from offshore installations.

Annex 1: Data Annexes

Table 1: Number of installations on the NCS with discharges to the sea, or emissions to the air 2009—2013

	2009	2010	2011	2012	2013
Oil	54	57	45	50	49
Gas	11	11	11	12	12
Subsea	44	46	47	53	53
Other	8	8			

Table 2: Oily aqueous discharges to the maritime area

Table 2a: Oil discharged in displacement and produced water (in tonnes), 2009—2013

2009 (GC-FID)	2010 (GC-FID)	2011 (GC-FID)	2012 (GC-FID)	2013 (GC-FID)
Dispersed	Dispersed	Dispersed	Dispersed	Dispersed
1 542	1 490	1 529	1 593	1 595

Table 2b: Dissolved oil discharged in displacement and produced water (in tonnes), 2009—2013

2009	2010	2011	2012	2012
Dissolved	Dissolved	BTEX	BTEX	BTEX
1 954	1 820	1 675	1 855	1 045

Table 2c: Total volume of produced water and displacement water discharged, and produced water injected (in m^3/year), 2009—2013

	2009	2010	2011	2012	2013
PW*	134 770 215	130 842 793	128 550 571	130 909 973	127 305 417.7
DPW**	31 567 044	31 953 823	27 025 783	31 491 555	32 227 733
IPW***	29 547 450	33 217 136	31 095 328	32 756 572	320 98 111.01
Total	195 884 709	196 013 752	186 671 682	195 158 100	191 631 262

* Produced water
** Displacement water
*** Injected produced and displacement water

Table 3: Installations which do not meet OSPAR performance standard for dispersed oil in aqueous discharges

Table 3b: Number of installations with discharges failing to meet the 30 mg oil/l performance standard, valid from 2007 onwards, and quantity of oil discharged by these installations (in tonnes)

	2009	2010	2011	2012	2013
Number of installations exceeding 30 mg/l	0	3	4	3	3
Quantity of dispersed oil discharged	0	1.64	1.1	3.0	3.3

Table 4: Use and discharges of organic-phase drilling fluids (OPF) and cuttings

Table 4a: Quantities of oil and other organic-phase fluids discharged via cuttings (in tonnes), 2003—2012

2009	2010	2011	2012	2013
Total OPF	Total OPF	Total OPF	Total OPF	Total OPF
0	0	0	0	0

Table 4b: Number of wells drilled with OPF, with discharge of contaminated cuttings to the maritime area, 2003—2012

2009		2010		2011		2012		2013	
OBF	non-OBF OPF	OBF	non-OBF OPF	OBF	Other OPF	OBF	Other OPF	OBF	Other OPF
0	0	0	0	0	0	0	0	0	0

Table 5: Spillage of oil and chemicals

Table 5a: Number of oil spills, 2009—2013 - Spills less than 1 m^3 (≤ 1 m^3) and spills above 1 m^3 (> 1 m^3)

2009		2010		2011		2012		2013	
≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3
142	4	133	7	129	1	118	4	112	5

Table 5b: Total quantity of oil spilled, in m^3, 2009—2013

2009		2010		2011		2012		2013	
≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> m^3
8	88	6	105	8.7	10	7.0	9	6.2	33.8

Table 5a: Number of chemical spills, 2009—2013 - Spills less than 1 m^3 (≤ 1 m^3) and spills above 1 m^3 (> 1 m^3)

2009		2010		2011		2012		2013	
≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3
119	43	126	32	123	28	110	38	126	5

Table 5b: Total quantity of chemicals spilled, in m^3, 2009—2013

2009		2010		2011		2012		2013	
≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> 1 m^3	≤ 1 m^3	> m^3
23	13 057	20	6 245	25.1	176	15.4	350	18.425	1 267.191

Table 6: Emissions to air, 2009—2013

CO_2 (in million of tonnes)

2009	2010	2011	2012	2013
12.44	12.00	12.28	12.44	11.57

NO_x (in thousand of tonnes)

2009	2010	2011	2012	2013
50.00	50.00	51.49	50.44	50.45

nmVOCs (in thousands of tonnes)

2009	2010	2011	2012	2013
45.61	37.00	30.58	33.02	32.76

CH_4 (in thousand of tonnes)

2009	2010	2011	2012	2013
29.63	28.04	28.58	25.66	23.47

SO_2 (in tonnes)

2009	2010	2011	2012	2013
500	600	899	822	914

Table 7: The use and discharge of offshore chemicals, 2009—2013

Table 7a: Quantity of offshore chemicals used in kg/year

Prescreening category	2009	2010	2011	2012	2013
PLONOR	289 681 616	286 277 021	273 273 649	282 848 186	346 516 261
Inorganic, LC50 or EC50 > 1 mg/l	0	0	0	0	0
Ranking Substances	92 409 851	103 061 375	80 140 722	82 880 656	204 629 459
List of Chemicals for Priority Action	146	20	6	3	6
Inorganic LC50 or EC50 < 1 mg/l	53	0	0	30	92
Biodegradation < 20%	2 144 671	2 386 670	1 493 063	1 287 072	1 636 733
Substance meets two of three criteria	1 061 115	506 942	348 519	1 506 167	1 326 315
Total	**385 297 452**	**392 232 028**	**355 255 959**	**368 522 114**	**554 108 866**

Table 7b: Quantity of offshore chemicals discharged in kg/year

Prescreening category	2009	2010	2011	2012	2013
PLONOR	111 268 937	111 268 937	99 503 072	104 495 858	114 256 578
Inorganic, LC50 or EC50 > 1 mg/l	0	0	0	0	0
Ranking Substances	14 700 303	11 727 338	12 304 885	13 532 911	52 507 255
List of Chemicals for Priority Action	58	0	0	3	6
Inorganic LC50 or EC50 < 1 mg/l	0	0	0	21	0
Biodegradation < 20%	16 318	14 455	6 403	3 600	2 957
Substance meets two of three criteria	5 152	1 584	1 710	5 018	3 399
Total	**125 990 768**	**123 012 314**	**111 816 070**	**118 037 411**	**166 770 195**

Table 7c: Chemicals spilled in kg per year

Prescreening category	**2009**	**2010**	**2011**	**2012**	2013
PLONOR	233 000	709 000	170 000	159 000	233 000
Inorganic, LC_{50} or EC_{50} > 1 mg/l	*		*	*	*
Ranking	38 600	111 000	51 700	10 060	38 600
List of Chemicals for Priority Action	0	0	0	0	0
Inorganic LC_{50} or EC_{50} < 1 mg/l	0	0		69	0
Biodegradation < 20%	130	1 390	500	900	130
Substance meets two of three criteria	160	50	330	82	160
Total	**38 890**	**112 440**	**52 530**	**11 111**	**38 890**

Table 8: Norway total production in oil equivalents (millions Sm^3)

2009	2010	2011	2012	2013
239.93	230.54	218.64	224.59	213.66

OSPAR COMMISSION

Victoria House
37-63 Southampton Row
London WC1B 4DA
United Kingdom

t: +44 (0)20 7430 5200
f: +44 (0)20 7242 3737
e: secretariat@ospar.org
www.ospar.org

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ISBN: 978-1-909159-93-8
Publication Number: 662/2015